Hazard Mitigation Plan

Erie County, New York

March 2022

Volume I

Prepared by:
Tetra Tech, Inc.
2000 Linglestown Road, Suite 203 | Harrisburg, PA 17110

EXECUTIVE SUMMARY

Hazard mitigation is an action to help reduce long-term risks caused by hazards or disasters, such as flooding, earthquakes, or wildfires. The purpose of hazard mitigation is to protect people and structures, and minimize the costs of disaster response and recovery. Hazard mitigation can take many forms: capital projects, policies, education, and environmental protection. A hazard mitigation plan (HMP) documents a local government's evaluation of hazards and the strategies to mitigate those hazards.

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

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

Erie County and 46 jurisdictions actively participated in the HMP update process. Table ES-1 lists the participating jurisdictions.

Table ES-1. Participating Jurisdictions in the 2022 Erie County HMP Update

Jurisdictions	
Erie County	Gowanda, Village of
Erie County Water Authority	Grand Island, Town of
Akron, Village of	Hamburg, Town of
Alden, Town of	Hamburg, Village of
Alden, Village of	Holland, Town of
Amherst, Town of	Kenmore, Village of
Angola, Village of	Lackawanna, City of
Aurora, Town of	Lancaster, Town of
Blasdell, Village of	Lancaster, Village of
Boston, Town of	Marilla, Town of
Brant, Town of	Newstead, Town of
Buffalo, City of	North Collins, Town of
Cheektowaga, Town of	North Collins, Village of
Clarence, Town of	Orchard Park, Town of
Colden, Town of	Orchard Park, Village of
Collins, Town of	Sardinia, Town of
Concord, Town of	Sloan, Village of
Depew, Village of	Springville, Village of
East Aurora, Village of	Tonawanda, City of
Eden, Town of	Tonawanda, Town of
Elma, Town of	Wales, Town of
Evans, Town of	West Seneca, Town of
Farnham, Village of	Williamsville, Village of

During the Erie County HMP planning process, the nation, the State of New York, and Erie County were facing the COVID-19 pandemic. The COVID-19 pandemic was declared a major disaster on March 20, 2020 (DR-4480). The Governor issued a stay-at-home Executive Order beginning March 22, 2020, which has since been revoked.

The Erie County Office of Emergency Services, Department of Public Works, the Steering Committee members, and the planning partners were addressing the COVID-19 pandemic concurrent with completing the update to the HMP. Erie County and all planning partners made their best effort to work through this unprecedented time to complete the HMP update and meet FEMA and state requirements. Unfortunately, in-person public meetings were canceled for the safety of residents and planning partners. However, Steering Committee, Planning Partnership, jurisdiction-specific, and public meetings continued virtually. More targeted stakeholder and public involvement was initiated to ensure a broad audience was reached, described further below.

During this HMP update process, Erie County and the participating jurisdictions accomplished the following:

- Developed a Steering Committee and Planning Partnership
- Reviewed and updated the hazards of concern
- Profiled and prioritized these hazards
- Estimated inventory at risk and potential losses associated with these hazards
- Reviewed and updated hazard mitigation goals and objectives
- Reviewed and updated County and local mitigation strategies to address identified risks and vulnerabilities

ERIE COUNTY MULTI-JURISDICTIONAL PLANNING PROCESS

Erie County developed and adopted the original Erie County HMP in 2007 and updated the plan in 2015. The DMA 2000 regulations require that local plans be formally updated and adopted every five (5) years, reassessing risk and updating local strategies to manage and mitigate those risks. To comply, Erie County and its inclusive jurisdictions actively participated in the 2022 update of the HMP. Extensive outreach efforts by the Erie County Department of Homeland Security and Emergency Services resulted in participation from all 46 jurisdictions. Upon completion and approval of the HMP, participating jurisdictions will continue to address and implement the findings and recommendations of this HMP.

As required by the DMA 2000, the participating jurisdictions and Erie County have informed the public about HMP update efforts and have provided opportunities for public comment and input regarding the planning process. In addition, numerous agencies and stakeholders have participated as core or support members to provide input and expertise to the planning process. This HMP documents the process and outcomes of the jurisdictions' mitigation planning efforts.

Erie County and the participating jurisdictions incorporate mitigation planning as an integral component of daily government operations through existing processes and programs. A public outreach campaign was initiated to commence the HMP update. A citizen survey to gauge hazard preparedness was developed. The survey asked quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. Stakeholder surveys across multiple sectors was distributed to obtain input. The citizen survey was posted on the County's mitigation plan website (https://www.eriecountynyhmp.com/). The stakeholder surveys were sent by the Erie County Department of Homeland Security and Emergency Services to applicable stakeholder groups. Updates to the HMP will be announced on the County website and via municipal outreach after annual plan reviews and 5-year updates. The County HMP Coordinator and local planning partnership representatives will be responsible for receiving, tracking, and filing public comments regarding this HMP when posted for draft public review and throughout the plan's period of performance.

ERIE COUNTY HAZARD MITIGATION PLAN ADOPTION

Following formal Federal Emergency Management Agency (FEMA) approval of this HMP update, Erie County and all participating jurisdictions will be required to formally adopt the updated HMP. A sample of an adoption resolution is included in Appendix A (Adoption Resolutions). Of the 46 participating planning partners listed in Table ES-1, all fully met the participation requirements specified by the Steering Committee.

ERIE COUNTY PROFILE

> Development increases population and structures and therefore can increase the impact of hazards on a community.
> For example, heavy development planned for a flood-prone area would likely increase the impact of the flood events as time progresses.

According to the 2018 American Community Survey (ACS) Census data, Erie County had a population of 919,355. Erie County is located in southwest New York State, north of the Commonwealth of Pennsylvania. The County is bordered by Chautauqua County to the west, Erie and Wyoming Counties to the north, Allegany County to the east, and the Commonwealth of Pennsylvania to the south.

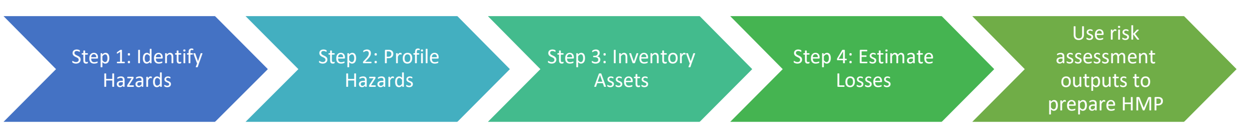
Erie County is located in the northwest portion of the Allegheny Plateau region of New York State. The northern part of the County is generally flat, while steeper slopes are found in the central and southern parts of the County. The southern region of the County – characterized by hills and valleys – is the only unglaciated portion of western New York State. Cuba Lake, Lime Lake, Crystal Lake, Quaker Lake, Rainbow Lake, Red House Lake, Science Lake, and Timber Lake are within the County.

Land use in Erie County is influenced by natural resources, topographic constraints, water lines, sewers, and roads. The county has a relatively compact development pattern and is made up of rural, suburban, and urban areas. Agriculture remains a large land use. Although the number of farms is decreasing slightly, the size of farms is increasing. This trend toward fewer but larger farm operations parallels statewide trends (Erie County Department of Economic Development, Planning & Tourism 2015).

The Erie County HMP provides a general overview of current and anticipated population and land use within the study area. This information provides a basis for making decisions regarding the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support decisions regarding future development in vulnerable areas. For potential increases in vulnerability, the County and jurisdictions can then plan ahead to mitigate those vulnerabilities early in the development process or can direct development to areas of lower risk. The Planning Partnership will revisit the HMP regularly to ensure that mitigation actions support sustainability to minimize increased risk, and to also ensure implementation and targeting of specific mitigation actions will address the potential impacts of development over time.

RISK ASSESSMENT

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



Step 1: Identify hazards of concern. Erie County considered the full range of natural and non-natural hazards that could impact the County and then identified and ranked hazards of greatest concern. The following list of 13 hazards of concern was selected for further evaluation in the HMP:

- Coastal Erosion
- Cyber Security
- Earthquake
- Expansive Soils
- Extreme Temperature
- Flood
- Hazardous Materials
- Landslide
- Pandemic
- Severe Storm
- Severe Winter Storm
- Utility Failure
- Wildfire

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

Steps 3 and 4: Evaluate assets of jurisdictions and identify assets exposed or vulnerable to the hazards of concern. Hazard profile information, combined with data regarding population, demographics, general building stock, and critical facilities at risk, prepares the community to develop risk scenarios and estimate potential damages and losses from each hazard.

Once the risk assessment was completed, the County and participating jurisdictions evaluated the risk and vulnerability to each hazard for their community. This served as a starting point in identifying and prioritizing mitigation strategies.

ERIE COUNTY MITIGATION STRATEGY

Outcomes of the risk assessment, supplemented by community input, provided a basis for reviewing past mitigation actions, future goals, and appropriate local mitigation actions.

Goals and Objectives

The 2015 HMP specified overarching mitigation goals with corresponding objectives that summarized hazard reduction outcomes the County and participating jurisdictions want to achieve. During the 2022 plan update process, the Steering Committee reviewed the goals and objectives established in the 2015 HMP. These goals and objectives were reviewed in consideration of the hazard events and losses since the 2015 plan; the updated hazard profiles and vulnerability assessment; the goals and objectives established in the 2019 NYS HMP, county and local risk management plans; and direct input from the County and jurisdictions for how to meet their needs to advance and best manage their hazard risk. Amendments include additions/edits to goals and objectives to express the planning partnership's interests in integrating this plan with other planning mechanisms/programs and to support mitigation through the protection and preservation of natural systems (refer to Section 6 – Mitigation Strategies). The following summarizes the three (3) updated goals for the 2022 HMP.

1. Protect life, property, and critical infrastructure from hazard impacts.
2. Educate the public, officials, and other stakeholders about the hazards they face and what can be done to mitigate hazard impacts.
3. Reduce the risk of hazards on life, property, and the environment.

Capability Assessment

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

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

- Types of mitigation actions that may be prohibited by law
- Limitations that may hinder mitigation actions
- The range of local and state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing their mitigation actions

Identification, Prioritization, Analysis, and Implementation of Mitigation Actions

As part of the planning process for this HMP update, all participating jurisdictions evaluated their risks and known or anticipated losses to the hazards of concern, assessed their capabilities to manage hazard risk, reviewed progress on past mitigation efforts, and identified a comprehensive range of mitigation alternatives and actions they endeavor to implement as resources are identified and available. The HMP identifies all proposed mitigation actions relevant to achievement of the goals and objectives presented above. The county and participating jurisdictions have identified appropriate local mitigation actions, along with hazards mitigated, goals and objectives met, lead agencies, estimated costs, potential funding sources, and proposed timeline. These actions are identified in Volume II, Section 9, which consists of annexes for the County and each participating jurisdiction.

PLAN MAINTENANCE PROCEDURES

Hazard mitigation planning is an ongoing process. Section 7 (Plan Maintenance) of this plan presents procedures for how the County will monitor, integrate, evaluate, and update the HMP over the next five years. The Planning Partnership will continue ongoing mitigation efforts to implement the HMP and revise and update the HMP, as necessary.

To monitor implementation of the HMP, Planning Partnership members will meet annually to discuss the status of HMP implementation and will prepare a report summarizing the status of the HMP and any needed updates. The mitigation evaluation will address changes as new hazard events occur, as the area develops, and as more is learned about hazards and their impacts. The evaluation will include an assessment of whether the planning process and actions have been effective, whether development or other issues warrant changes to the HMP or its priorities, progress toward achievement of the communities' goals, and whether changes are warranted. The HMP will be updated, at a minimum, within the 5-year cycle specified by the DMA 2000.

POINT OF CONTACT

To request information or provide comments regarding this HMP, please contact the Erie County HMP Coordinator:

Mailing Address:	Erie County Department of Homeland Security and Emergency Services 42 Elm Street Buffalo, NY 14203
Contact Name:	Greg Butcher, Deputy Commissioner
E-mail Address:	gregory.butcher@erie.gov
Telephone:	(716) 858-6578

TABLE OF CONTENTS

VOLUME I

APPENDICES

VOLUME II

SECTION 1. INTRODUCTION

1.1 PURPOSE

Erie County and its jurisdictions have prepared this multi-hazard mitigation plan to better protect the residents and property throughout the County from the effects of hazard events. This plan demonstrates the County's and each jurisdiction's commitment to reducing risk from hazards, increasing resilience overall, and provide a tool to help decision makers integrate mitigation in their day-to-day processes. This plan was also developed to position Erie County and its participating jurisdictions for eligibility of pre- and post-disaster Federal Emergency Management Agency (FEMA) grants, including: Hazard Mitigation Assistance grant programs (HMA), which include Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and Flood Mitigation Assistance (FMA). This plan also aligns with the planning elements of the National Flood Insurance Program's Community Rating System (CRS) which provides for lower flood insurance premiums in CRS communities.

1.2 BACKGROUND

A Hazard Mitigation Plan (HMP) is a living document that communities use to reduce their vulnerability to hazards. It forms the foundation for a community's long-term strategy to reduce disaster losses and creates a framework for decision making to reduce damages to lives, property, and the economy from future disasters. Examples of mitigation projects include home acquisitions or elevations to remove structures from high-risk areas, upgrades to critical public facilities, and infrastructure improvements. Ultimately, these actions reduce vulnerability, and communities are able to recover more quickly from disasters. Erie County has demonstrated its commitment to reducing disaster losses by initially developing its multi-jurisdictional HMP in 2005 and updating information upon which to base a successful mitigation strategy to reduce the impacts of natural disasters and to increase the resiliency of its communities.

In response to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), Erie County and the jurisdictions located therein have developed this hazard mitigation plan, which represents a regulatory update to the *2015 Erie County Multi-Jurisdictional All-Hazards Mitigation Plan* (HMP; also referred herein as the *Hazard Mitigation Plan* or *the plan*). The DMA 2000 amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) and is designed to improve planning for, response to, and recovery from disasters by requiring state and local entities to implement pre-disaster mitigation planning and develop HMPs. The Federal Emergency Management Agency (FEMA) has issued guidelines for HMPs. The New York State Division of Homeland Security and Emergency Services (NYS DHSES), formerly the New York State Office of Emergency Management (NYSOEM), also supports plan development for jurisdictions in New York and issued the NYS DHSES Hazard Mitigation Planning Standards for HMPs developed with NYS DHSES-administered funds.

> *Hazard Mitigation* is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from specific hazards.
>
> FEMA defines a *Hazard Mitigation Plan* as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

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

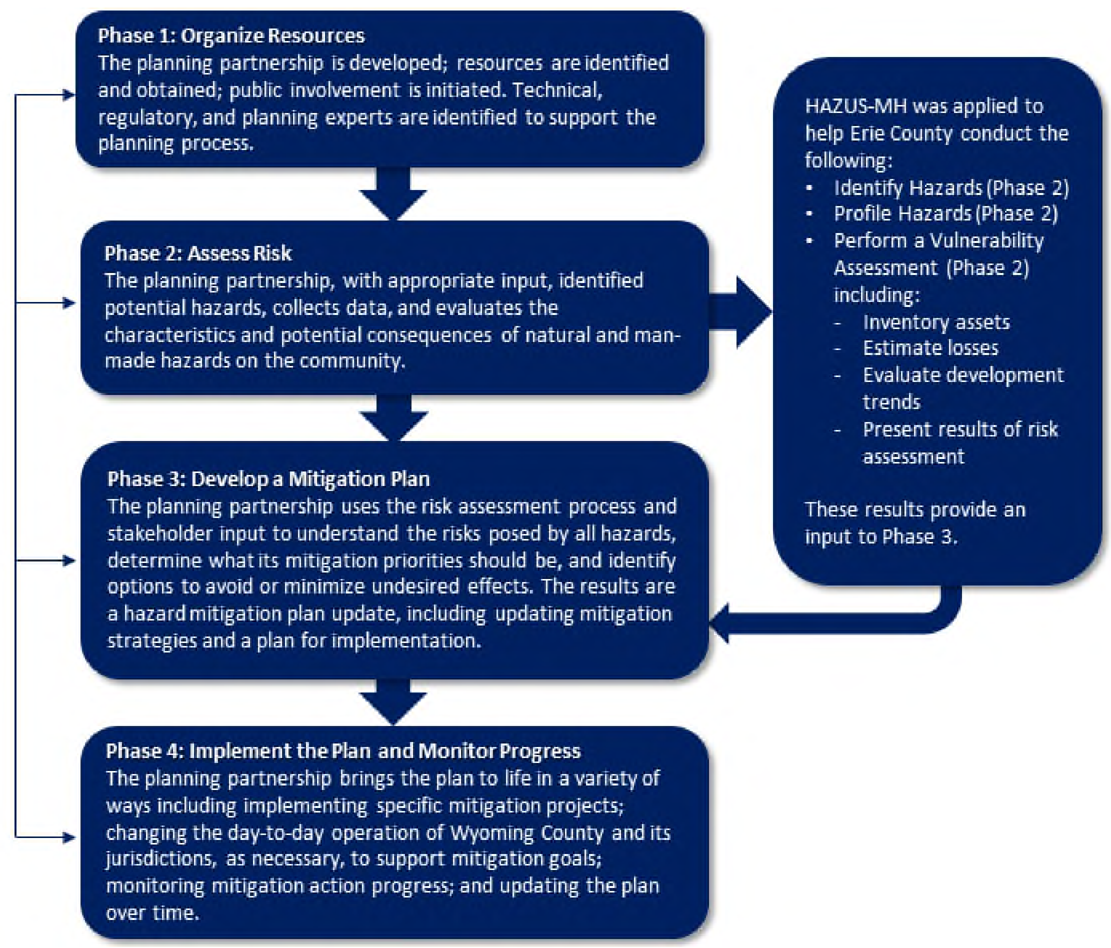
1.3 PLAN ORGANIZATION

The Erie County Hazard Mitigation Plan 2022 Update is organized as a two-volume plan and is in alignment with the DMA planning requirements, the 2013 FEMA *Local Mitigation Planning Handbook*, and the FEMA *Local Mitigation Plan Review Tool*.

Volume I provides information on the overall planning process and hazard profiling and vulnerability assessments, which serves as a basis for understanding risk and identifying mitigation actions. As such, Volume I is intended for use as a resource for on-going mitigation analysis.

Volume II provides an annex dedicated to each participating jurisdiction. Each annex summarizes the jurisdiction's legal, regulatory, and fiscal capabilities; identifies vulnerabilities to hazards; documents mitigation plan integration with other planning efforts; records status of past mitigation actions; and presents an individualized mitigation strategy. The annexes are intended to provide a useful resource for each jurisdiction for implementation of mitigation projects and future grant opportunities, as well as a place for each jurisdiction to record and maintain their local aspect of the countywide plan.

Figure 1-1. Erie County Hazard Mitigation Planning Process



The HMP is organized into two volumes: Volume I includes all information that applies to the entire planning area (Erie County) and Volume II includes participating jurisdiction-specific information.

Volume I of this plan includes the following sections:

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

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

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

Section 4: County Profile: Overview of Erie County, including: (1) general information, (2) economy, (3) land use trends, (4) population and demographics, (5) general building stock inventory, and (6) critical facilities.

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

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

Section 7: Plan Maintenance Procedures: System established by the Steering Committee to continue to monitor, evaluate, maintain, and update the HMP.

Volume II of this plan includes the following sections:

Section 8: Planning Partnership: Description of the planning partnership, their responsibilities, and description of jurisdictional annexes.

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

Appendices include the following:

Appendix A: Resolution of Plan Adoption: Resolutions from the county and each jurisdiction included as each formally adopts the HMP update.

Appendix B: Participation Matrix: Matrix to give a broad overview of who attended meetings and when input was provided to the HMP update, as well as Letters of Intent to Participate as described in Section 3.

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

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

Appendix E: Risk Assessment Supplementary Data: Expanded explanation of community lifelines; and the previous hazard events from the 2015 HMP.

Appendix F: Critical Facilities: Critical facilities included in the risk assessment.

Appendix G: Coastal Hazard Area maps

Appendix H: FEMA Plan Review Tools: Examples of plan review templates available to support annual plan review.

Appendix I: Plan Review Matrix: Summary of plans reviewed, including documentation of content relevant to the mitigation planning process.

1.4 THE UPDATED PLAN – WHAT IS DIFFERENT?

Due to the success of the 2015 plan, no major changes were made to the format or function of the 2022 update. The 2022 update has been enhanced using best available data and technology, especially in the risk assessment portion of the plan in Section 5 (Risk Assessment). The updated plan differs from the initial plan in a variety of ways:

- Updated NYS DHSES guidance existed at the time of its development. The 2017 New York State Hazard Mitigation Planning Standards and Guide were used to develop the 2022 update.
- Newly available data provided for a more detailed and accurate risk assessment. The updated plan is based on new data including FEMA's countywide Digital Flood Insurance Rate Maps (DFIRMs).
- User-friendly tone to cater to the strong desire for this plan to be understandable to the general public and not overly technical.
- Actions are identified, rather than strategies. Strategies provide direction, but actions are fundable under grant programs. The identified actions meet multiple measurable objectives so that each planning partner can measure the effectiveness of their mitigation actions.
- Identification and priority for numerous actions to be implemented by the planning partnership. The status of these actions will be monitored over the plan performance period by a plan maintenance strategy identified in Section 7 (Plan Maintenance) that included annual progress reporting.

Table 1-1 indicates the major changes between the two plans as they relate to 44 CFR planning requirements.

Table 1-1. Plan Changes Crosswalk

44 CFR Requirement	2015 Plan	2022 Updated Plan
Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: *(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* *(2) An opportunity for neighboring communities, local and regional*	The 2015 plan followed an outreach strategy utilizing multiple media developed and approved by the Steering Committee. This strategy involved the following: • Public participation on an oversight Steering Committee. • Establishment of a plan informational website. • Press releases.	Building upon the success of the 2015 plan, the 2022 planning effort deployed the same public engagement methodology. The plan included the following enhancements: • Using social media. • HMP project website. • Web-deployed survey. • Informational brochure.

44 CFR Requirement	2015 Plan	2022 Updated Plan
agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and *(3) Review and incorporation, if appropriate, of existing plans, studies, reports and technical information.*	Use of a public information survey. Stakeholders were identified and coordinated with throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.	As with the 2015 plan, the 2022 planning process identified key stakeholders and coordinated with them throughout the process. The planning team performed a comprehensive review of relevant plans and programs.
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	The 2015 plan included a comprehensive risk assessment of hazards of concern. Risk was defined as (probability x impact), where impact is the impact on people, property, and economy of the planning area. All planning partners ranked risk as it pertains to their jurisdiction. The potential impacts of climate change are discussed for each hazard.	The same methodology, using new, updated data, was deployed for the 2022 plan update.
§201.6(c)(2)(i): [The risk assessment] shall include a] description of the … location and extent of all-natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	The 2015 plan presented a risk assessment of each hazard of concern. Each section included the following: • Hazard profile, including maps of extent and location, previous occurrences, and probability of future events. • Climate change impacts on future probability. • Impact and vulnerability on life, health, safety, general building stock, critical facilities, and economy. • Impact on people, property, critical facilities, and environment. • Future growth and development. • Additional data and next steps. • Overall vulnerability assessment.	The same format, using new and updated data, was used for the 2022 plan update. Each section of the risk assessment includes the following: • Hazard profile, including maps of extent and location, previous occurrences, and probability of future events. • Climate change impacts on future probability using the best available data for New York State. • Vulnerability assessment includes: impact on life, safety, and health, general building stock, critical facilities, and the economy, as well as future changes that could impact vulnerability. • The vulnerability assessment also includes changes in vulnerability since the 2022 plan. • Identified issues have been documented in each hazard profile.
§201.6(c)(2)(ii): [The risk assessment] shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community.	Vulnerability was assessed for all hazards of concern. The HAZUS-MH-MH computer model was used for the severe storm, earthquake, and flood hazards. These were Level 2 analyses using county data. Site-specific data on county-identified critical facilities were entered into the HAZUS-MH model. HAZUS-MH outputs were generated for other hazards by applying an estimated damage function to an asset inventory extracted from HAZUS-MH-MH.	The same methodology was deployed for the 2022 plan update, using new and updated data. Additional hazards of concern include the following: • Cybersecurity (distinct from Terrorism hazard) • Hazardous Materials • Pandemic • Utility Failure

44 CFR Requirement	2015 Plan	2022 Updated Plan
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods.	A summary of NFIP insured properties including an analysis of repetitive loss property locations was included in the plan.	The same methodology was deployed for the 2022 plan update using new and updated data.
Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the identified hazard area.	A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Steering Committee defined "critical facilities" for the planning area, and these were inventoried by exposure. Each hazard chapter provides a discussion on future development trends.	The same methodology was deployed for the 2022 plan update using new and updated data.
Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Loss estimates were generated for all hazards of concern. These were generated by HAZUS-MH-MH for the severe storm, earthquake, and flood hazards. For the other hazards, loss estimates were generated by applying a regionally relevant damage function to the exposed inventory. In all cases, a damage function was applied to an asset inventory. The asset inventory was the same for all hazards and was generated in HAZUS-MH.	The same methodology was deployed for the 2022 plan update using new and updated data.
Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	There is a summary of anticipated development in the county profile, as well as in each individual annex.	The same methodology was deployed for the 2022 plan update using new and updated data.
§201.6(c)(3):[The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.]	The 2015 plan contained a mission statement, goals, objectives and actions. The guiding principal, goals and objectives were regional and covered all planning partners. Each planning partner identified actions that could be implemented within their capabilities. The actions were jurisdiction-specific and strove to meet multiple objectives. All objectives met multiple goals and stand alone as components of the plan. Each planning partner completed an assessment of its regulatory, technical, and financial capabilities.	The same methodology for setting goals, objectives, and actions was applied to the 2022 plan update. The Steering Committee reviewed and reconfirmed the mission statement, goals, and objectives for the plan. Each planning partner used the progress reporting from the plan maintenance and evaluated the status of actions identified in the 2015 plan. Actions that were completed or no longer considered to be feasible were removed. The balance of the actions was carried over to the 2022 plan, and in some cases, new actions were added to the action plan.
Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The Steering Committee identified a mission statement, goals, and objectives targeted specifically for this HMP. These planning components supported the actions identified in the plan.	The same methodology for setting goals, objectives, and actions was applied to the 2022 plan update. The Steering Committee reviewed and updated the mission statement, goals, and objectives for the plan to include a focus on increased resiliency. This resulted in the finalization of six goals and 30 objectives to frame the plan.
Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific	The 2015 plan includes a hazard mitigation catalog that was developed through a facilitated process. This catalog identifies actions that	The mitigation catalog was reviewed and updated by the Steering Committee for the 2022 update. As with the 2015 plan, the catalog has

44 CFR Requirement	2015 Plan	2022 Updated Plan
mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	manipulate the hazard, reduce exposure to the hazard, reduce vulnerability, or increase mitigation capability. The catalog further segregates actions by scale of implementation. A table in the action plan section analyzes each action by mitigation type to illustrate the range of actions selected.	been included in the 2022 plan to represent the comprehensive range of alternatives considered by each planning partner. The table with the analysis of mitigation actions was used in jurisdictional annexes to the plan.
Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	All municipal planning partners that participate in the National Flood Insurance Program identified an action stating their commitment to maintain compliance and good standing under the program.	The same methodology was deployed for the 2022 plan update, using new and updated data.
Requirement: §201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in section (c)(3)(ii) will be prioritized, implemented and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each recommended action was prioritized using a qualitative methodology based on the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project, and the costs of the project.	A revised methodology based on the STAPLEE criteria and using new and updated data was used for the 2022 plan update.
Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	The 2015 plan outlined a detailed maintenance strategy.	The 2022 plan details a plan maintenance strategy similar to that of the initial plan.
Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	The 2015 plan details recommendations for incorporating the plan into other planning mechanisms.	The 2022 plan details recommendations for incorporating the plan into other planning mechanisms such as the following: • Comprehensive Plan • Emergency Response Plan • Capital Improvement Programs • Municipal Code
Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	The 2015 plan details a strategy for continuing public involvement.	The 2015 plan maintenance strategy was carried over to the 2022 plan. In addition, the county will use a proprietary online tool to support the annual progress reporting of mitigation actions.
Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).	46 planning partners participated in the 2015 planning process.	The 2022 plan achieves DMA compliance for 46 planning partners. Resolutions for each partner adopting the plan can be found in Appendix A of this volume.

SECTION 2. PLAN ADOPTION

2.1 OVERVIEW

This section contains information regarding adoption of the plan by Erie County and each participating jurisdiction.

2.1.1 Plan Adoption by Local Governing Bodies

Adoption by the local governing bodies such as the County Legislature, City Council, or Town/Village Board demonstrates the commitment of Erie County and each participating jurisdiction to fulfill the mitigation goals and strategies outlined in the plan. Adoption of the plan via a municipal resolution legitimizes the Hazard Mitigation Plan (HMP) and authorizes responsible agencies to execute their responsibilities.

The County and all participating jurisdictions will proceed with formal adoption proceedings when the Federal Emergency Management Agency (FEMA) has completed review of the plan and provides conditional approval of this HMP update, known as Approval Pending Adoption (APA).

Following adoption or formal action on the plan, the jurisdiction must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the plan to the Erie County Hazard Mitigation Coordinator in the Erie County Department of Homeland Security and Emergency Services. Erie County will forward the executed resolutions to the New York State Division of Homeland Security & Emergency Services (NYS DHSES), after which they will be forwarded to FEMA for the record. The jurisdictions understand that FEMA will transmit acknowledgement of verification of formal plan adoption and the official approval of the plan to the Erie County Hazard Mitigation Plan Coordinator.

The resolutions issued by each jurisdiction to support adoption of the plan will be included in Appendix A.

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

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

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

SECTION 3. PLANNING PROCESS

3.1 INTRODUCTION

This section includes a description of the planning process used to update the 2015 Erie County Hazard Mitigation Plan (HMP), including how it was prepared, who was involved in the process, and how the public was included. To ensure that the plan meets requirements of the Disaster Mitigation Act (DMA) of 2000 and that the planning process would have the broad and effective support of the participating jurisdictions, regional and local stakeholders, and the public, an approach to the planning process and plan documentation was developed to achieve the following:

- The plan will be multi-jurisdictional, with the intention of including all municipalities in the county. Erie County invited all the towns and villages, and a variety of stakeholders, to join them in the planning process. The county, Erie County Water Authority, and all 44 local municipal governments in the county participated in the 2022 planning process, as indicated in Table 3-1. The plan considers ten natural hazards and three non-natural hazards of concern facing the county, thereby satisfying the natural hazard mitigation planning requirements specified in DMA 2000.
- The plan was developed following the process outlined by DMA 2000, Federal Emergency Management Agency (FEMA) regulations, prevailing FEMA guidance, and the 2017 New York State Division of Homeland Security and Emergency Services (NYS DHSES) hazard mitigation planning standard. Following this process ensured that all the requirements are met and support HMP review.

Table 3-1. Participating Erie County Jurisdictions

Jurisdictions			
Erie County	Cheektowaga, Town of	Grand Island, Town of	Orchard Park, Town of
Erie County Water Authority	Clarence, Town of	Hamburg, Town of	Orchard Park, Village of
Akron, Village of	Colden, Town of	Hamburg, Village of	Sardinia, Town of
Alden, Town of	Collins, Town of	Holland, Town of	Sloan, Village of
Alden, Village of	Concord, Town of	Kenmore, Village of	Springville, Village of
Amherst, Town of	Depew, Village of	Lackawanna, City of	Tonawanda, City of
Angola, Village of	East Aurora, Village of	Lancaster, Town of	Tonawanda, Town of
Aurora, Town of	Eden, Town of	Lancaster, Village of	Wales, Town of
Blasdell, Village of	Elma, Town of	Marilla, Town of	West Seneca, Town of
Boston, Town of	Evans, Town of	Newstead, Town of	Williamsville, Village of
Brant, Town of	Farnham, Village of	North Collins, Town of	
Buffalo, City of	Gowanda, Village of	North Collins, Village of	

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

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

This section of the plan describes the mitigation planning process, including (1) Organization of the Planning Process; (2) Stakeholder Outreach and Involvement; (3) Integration of Existing Data, Plans, and Technical

Information; (4) Integration with Existing Planning Mechanisms and Programs; and (5) Continued Public Involvement.

3.2 ORGANIZATION OF THE PLANNING PROCESS

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

3.2.1 Organization of Planning Partnership

Erie County applied for and was awarded a multi-jurisdictional planning grant under the FEMA Fiscal Year 2018 Pre-Disaster Mitigation Program, which supported the development of this multi-jurisdictional HMP update.

Project management and grant administration have been the responsibility of the Erie County Department of Planning and Development. A contract planning consultant (Tetra Tech, Inc., referred to herein as Tetra Tech) was selected to guide the county and participating jurisdictions through the HMP update process. A contract between Tetra Tech and Erie County was executed in November 2020. Specifically, Tetra Tech was tasked with the following:

- Assisting with the organization of a Steering Committee and the Planning Partnership
- Assisting with the development and implementation of a public and stakeholder outreach program
- Collecting data
- Facilitating and attending meetings (Steering Committee, Planning Partnership, municipal, stakeholder, public, and other)
- Reviewing and updating the hazards of concern, hazard profiling, and risk assessment
- Assisting with the review and update of mitigation planning goals and objectives
- Assisting with the review of past mitigation strategies progress
- Assisting with the screening of mitigation actions and the identification of appropriate actions
- Assisting with the prioritization of mitigation actions
- Authoring the draft and final plan documents

In February 2020, Erie County notified all municipalities within the county of the pending planning process and invited them to formally participate. Jurisdictions were asked to identify planning points of contact (POC) for facilitating municipal participation and representing the interests of their respective communities.

To facilitate plan development, Erie County developed a Steering Committee to provide guidance and direction to the HMP update effort and to ensure the resulting document will be embraced by the constituencies within the planning area (refer to Table 3-2). Specifically, the Steering Committee was charged with the following:

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

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

Table 3-2. Erie County Hazard Mitigation Steering Committee Members

Affiliation	Name	Title
Erie County Department of Homeland Security and Emergency Services (DHSES)	Greg Butcher	Deputy Commissioner
	Melissa Calhoun	Special Assistant
	Daniel Neaverth	Commissioner
	Ryan Sheedy	Senior Medical Emergency Radio System (MERS) Coordinator
Erie County Department of Environment and Planning	Josh Wilson	Coordinator - Pollution Prevention Program
	Daniel Castle	Deputy Commissioner
Erie County Water Authority	Matthew W. Barrett	Security Officer
City of Buffalo	Don Poleto	Senior Operations Engineer
New York State Division of Homeland Security and Emergency Services (NYS/DHSES)	Kevin Clapp	Planning Manager, Mitigation Programs
Village of Depew	R.J. Nieman	Emergency Manager
Town of Hamburg	Sean Crotty	Emergency Manager Chair, Erie County Emergency Managers Association

Table 3-3 lists the current municipal members of the Planning Partnership at the time of this HMP update. It is noted that the Steering Committee members also are part of the overall project Planning Partnership, fulfilling these responsibilities on behalf of Erie County. This Planning Partnership was charged with the following:

- Representing their jurisdiction throughout the planning process
- Ensuring participation of all departments and functions within their jurisdiction that have a stake in mitigation (e.g., planning, engineering, code enforcement, police and emergency services, public works)
- Assisting in gathering information for inclusion in the HMP update, including the use of previously developed reports and data
- Supporting and promoting the public involvement process
- Reporting on progress of mitigation actions identified in prior or existing HMPs, as applicable
- Identifying, developing, and prioritizing appropriate mitigation initiatives
- Reporting on progress of integration of prior or existing HMPs into other planning processes and municipal operations
- Supporting and developing a jurisdictional annex
- Reviewing, amending, and approving all sections of the plan update
- Adopting, implementing, and maintaining the plan update

Table 3-3. Erie County Hazard Mitigation Planning Partnership Members

Jurisdiction	Primary Point of Contact	Title	Alternate Point of Contact	Title
Erie County	Gregory Butcher	Deputy Commissioner Address: Department of Homeland Security and Emergency Services	Melissa Calhoun	Special Assistant, Department of Homeland Security and Emergency Services
Erie County Water Authority	Matt Barrett	Security	Russell Stoll	COO
Akron (V)	Carl Patterson	Mayor	Daniel Kowalik	Emergency Manager
Alden (T)	Dean Adamski	Town Supervisor	Colleen Rogers	Deputy Supervisor

Jurisdiction	Primary Point of Contact	Title	Alternate Point of Contact	Title
Alden (V)	Mark Pruitt	Office of Emergency Management Coordinator	Michael Manicki,	Mayor
Amherst (T)	James Zymanek	Director of Emergency Services and Safety	Dominic Creamer	Emergency Services and Safety
Angola (V)	Howard Frawley	Mayor	Nicole Milks	Clerk-Treasurer
Aurora (T)	James J Bach	Town Supervisor	Elizabeth Cassidy	Code Enforcement Officer
Blasdell (V)	Janet L. Plarr	Village Administrator	Joseph Fox Sr.	Emergency Manager
Boston (T)	Gene Wieckowski	Emergency Manager	Jason Keding	Supervisor
Brant (T)	Mark J. DeCarlo	Supervisor	Connie Miner	Grants Consultant
Buffalo (C)	Michael Tuberdyke	Buffalo Fire Department Division Chief	Michael Finn	Commissioner Department of Public Works
Cheektowaga (T)	Mike Mazurowski	Emergency Services Manager	Patrick Bowen	Town Engineer
Clarence (T)	David Bissonette	Emergency Manager	David Baumler	Deputy Emergency Manager
Colden (T)	James P. DePasquale	Supervisor	Patricia A. Zubrick	Deputy Town Supervisor
Collins (T)	Kenneth E. Martin	Supervisor	Ron Paluch	Emergency Manager
Concord (T)	Michael Willibey	Emergency Manager	Clyde Drake	Supervisor
Depew (V)	RJ Nieman	Emergency Manager	Kevin Patterson	Mayor
East Aurora (V)	Cathryn Thomas	Village Administrator	Matthew Hoeh	Supt. Public Works
Eden (T)	Brian Burgstahler	Emergency Manager	Melissa Hartman	Town Supervisor
Elma (T)	Wayne A. Clark	Supervisor	Michael Nolan	Deputy Supervisor/ Councilman
Evans (T)	William Smith	Director of Planning & Community Development	Corey Baskerville	Supervising Code Enforcement Officer & MS4 Officer
Farnham (V)	Jere R. Hoisington	Mayor	Jackie Hoisington	Clerk
Gowanda (V)	Carol Sheibley	Deputy Mayor	Nicholas Crassi	Disaster Coordinator
Grand Island (T)	John Whitney, P.E.	Town Supervisor	Richard Crawford	Highway Superintendent
Hamburg (T)	Sean Crotty	Emergency Manager	Nicholas Budney	Deputy Emergency Manager
Hamburg (V)	Ric Dimpfl Jr.	Emergency Manager	Sean Crotty	Emergency Manager
Holland (T)	Michael Kasprzyk	Supervisor	Geoff Hack	Councilman - disaster coordinator
Kenmore (V)	Kathleen Johnson	Clerk/Treasurer	AJ Kiefer	Captain, Kenmore Police
Lackawanna (C)	Annette Iafallo	Mayor	Anthony DeSantis	Public Works Commissioner
Lancaster (T)	Ronald Rozler	Disaster Coordinator	Ronald Ruffino Sr	Supervisor
Lancaster (V)	Scott M. Kuhlmey	Director of Emergency Management	Scott M. Robinson	Assistant Disaster Coordinator
Marilla (T)	Brian Nolan	Emergency Manager	Earl Gingerich, Jr	Supervisor
Newstead (T)	David Cummings	Supervisor	Dawn Izydorczak	Town Clerk
North Collins (T)	John M. Tobia	Supervisor	None identified	
North Collins (V)	Vincent George	Mayor	Jan Hutchinson	Clerk/Treasurer
Orchard Park (T)	Rich Murgalski	Emergency Manager	Wayne Bieler	Town Engineer
Orchard Park (V)	Rich Murgalski	Emergency Manager	John Gullo	Code and Building Inspector

Jurisdiction	Primary Point of Contact	Title	Alternate Point of Contact	Title
Sardinia (T)	Gerard Whittington	Emergency Manager	Beverly Gambino	Supervisor
Sloan (V)	Debra Smith	Clerk, Treasurer	Karen M. Gold	Deputy Clerk
Springville (V)	Liz Melock	Village Administrator	Bill Krebs	Mayor
Tonawanda (C)	Mark Banks	Deputy Director Office of Emergency Management	Chuck Stuart	Fire Chief and Co-Director of Emergency Management
Tonawanda (T)	Robert Lutz	Emergency Services Coordinator, Town Police Department	James Stauffiger	Chief of Police
Wales (T)	Walter Raichel	Emergency Manager	Ellen M. Bapst	Deputy Emergency Manager
West Seneca (T)	Eric Conley	Emergency Manager	James Unger	Captain West Seneca Police Department/ OEM
Williamsville (V)	James Zymanek	Director of Emergency Services and Safety	Dominic Creamer	Emergency Services and Safety

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

The jurisdictions in Erie County have differing levels of capabilities and resources available to apply to the plan update process, and further, have differing exposure and vulnerability to the hazards being considered in this plan. Erie County's intent was to encourage participation by all jurisdictions and to accommodate their specific needs and limitations while still meeting the intents and purpose of plan update participation. Such accommodations have included the establishment of a Steering Committee, engaging a contract consultant to assume certain elements of the plan update process on behalf of the jurisdictions, and the provision of additional and alternative mechanisms to meet the purposes and intent of mitigation planning.

Ultimately, jurisdictional participation is evidenced by a completed municipal annex to the HMP (Section 9) wherein jurisdictions have individually identified their planning POCs; evaluated their risk to the hazards of concern; identified their capabilities to provide effective mitigation in their community; identified and prioritized an appropriate suite of mitigation initiatives, actions, and projects to mitigate their hazard risk; and eventually, adopted the updated plan via resolution.

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

Neither the Town of North Collins nor the Village of North Collins participate in the National Flood Insurance Program (NFIP). As such, 42 of the county's 44 municipalities participate in the NFIP and have a designated NFIP Floodplain Administrator (FPA). All known FPAs were informed of the planning process, reviewed the plan documents, and provided direct input to the plan update. Local FPAs are identified in the Points of Contact and Administrative and Technical portions of Section 9 (Jurisdictional Annexes).

3.2.2 Planning Activities

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

A summary of Steering Committee and Planning Partnership meetings held and key milestones met during the development of the HMP update is included in Table 3-4, which also identifies the DMA 2000 requirements satisfied. Documentation of meetings (e.g., agendas, sign-in sheets, minutes) are provided in Appendix C (Meeting Documentation). Table 3-4 identifies only the formal meetings held during plan development and does not reflect the planning activities conducted by individuals and groups throughout the planning process. In addition to these meetings, a great deal of communication was conducted between the county, committee members, and the contract consultant through individual local meetings, electronic mail (email), and by phone.

After completion of the HMP update, implementation and ongoing maintenance will become a function of the Planning Partnership, as described in Section 7 (Plan Maintenance). The Planning Partnership will be responsible for reviewing the HMP and soliciting and considering public comment as part of the 5-year mitigation plan update.

The table below summarizes a list of mitigation planning activities and meetings and their respective participants. A more detailed list of participants for each meeting is provided in Appendix B (Participation Matrix) and Appendix C (Meeting Documentation). DMA 2000 (Public Law 106-390) includes details on each of the planning requirements.

Table 3-4. Summary of Mitigation Planning Activities/Efforts

Date	DMA 2000 Requirement	Description of Activity	Participants
November 2, 2020	1b, 2	Steering Committee Kick-Off Meeting (Data Collection, Review of Mission Statement and Goals, Hazards of Concern Identification, Public Outreach Strategy)	Erie County Department of Homeland Security and Emergency Services (DHSES), Erie County Department of Environment and Planning, Erie County Water Authority, City of Buffalo, New York State Division of Homeland Security and Emergency Services (NYS/DHSES), Village of Depew, Town of Hamburg; Chair, Erie County Emergency Managers Association
November 18, 2020	1b, 2, 3a	Planning Partnership Kick-Off Meeting (Municipal Kick-Off Meeting and Planning Overview)	Erie County Department of Environment and Planning, Erie County Department of Homeland Security and Emergency Services, Erie County Department of Public Works Division of Highways, Board of Cooperative Extension Services, Erie County Emergency Managers Association, Holland Central School District, New York State Department of Environmental Conservation Albert Cheverie, Hospital Emergency Preparedness Representative, New York State Department of Health; Department of Geography, State University at Buffalo/Erie County Local Emergency Planning Association, Town of Akron, Town of Newstead, Village of Blasdell, Town of Clarence, Town of Collins, Town of Eden, City of Tonawanda, Town of West Seneca

Date	DMA 2000 Requirement	Description of Activity	Participants
January and February 2021 (6 different meetings)	1b, 2, 3a, 4a, 4b, 4c	Municipal Support Meetings (Discuss information gathering worksheets, municipal problem areas, status of past mitigation actions)	Erie County Department of Homeland Security and Emergency Services, Buffalo Fire Department, Town of Cheektowaga, Town of Newstead, Village of North Collins, Village of North Collins, Town of Sardinia, City of Tonawanda, Town of Tonawanda, Erie County Water Authority, Town of Aurora, Village of Blasdell, Town of Boston, City of Buffalo Department of Public Works, Town of Concord, Village of East Aurora, Erie County Department of Public Works, Town of Aurora, Town of Amherst, Village of Williamsville, Village of Akron, Town of Aurora, Village of East Aurora, Town of Evans, Village of Farnham, Village of Hamburg, Town of Holland, Town of Lancaster, Village of Springville, Erie County Department of Environment and Planning, Town of Brant, Town of Collins, Town of Eden, Town of North Collins, Town of West Seneca, Village of Alden, Town of Colden, Village of Depew, Town of Hamburg, Village of Lancaster, Village of Orchard Park, Town Orchard Park, Village of Sloan, Town of West Seneca
January 25 and January 28, 2021	1b	Public Information Meetings (Offered to provide information on hazard mitigation, the planning process, and the Erie County HMP update)	Erie County Department of Homeland Security and Emergency Services, Erie County Department of Environment and Planning, WBFO, NYS Division of Homeland Security and Emergency Services
May 19, 2021	1b, 2, 3, 4am 4b, 2, 4a, 4b, 4c	Risk Assessment Review Meeting (Presentation of risk assessment overview, development of hazard problem statements by community) and Strengths, Weaknesses, Obstacles, and Opportunities (SWOO) Meeting	Erie County Department of Environment and Planning, Erie County Department of Homeland Security and Emergency Services, Erie County Water Authority, Village of Depew, Village of East Aurora, Village of Akron, Town of Newstead, Town of Orchard Park, Town Orchard Park, Village Orchard Park, Village of Springville, City of Tonawanda, Town of Tonawanda, Lake Erie Watershed Protection Alliance, National Fuel Gas, National Weather Service, Niagara Frontier Transportation Authority
June 9, 2021	1b, 2, 4a, 4b, 4c	Mitigation Strategy Workshops (Guidance on developing mitigation actions for inclusion in the HMP)	Erie County Department of Environment and Planning, Erie County Department of Homeland Security and Emergency Services, Erie County Department of Public Works, Erie County Water Authority, Village of Akron, Town of Amherst, Town of Aurora, Town of Cheektowaga, Town of Collins, Town of Concord, Village of East Aurora, Town of Eden, Town of Hamburg, Town of Holland, Town of Lancaster, Town of Newstead, Town of Orchard Park, Village of Springville, Town of Tonawanda, Town of West Seneca, Village of Williamsville
September 8, 2021	1b, 2, 3, 4, 5	Draft Plan Review Meeting (Receive comments from the public on the draft plan)	Erie County Department of Environment and Planning, Erie County Department of Homeland Security and Emergency Services, Town of Aurora, Town of Boston, Town of Cheektowaga, Town of Clarence, Town of Collins, Town of Concord, Village of East Aurora, Town of Grand Island, Town of Holland, City of Lackawanna, Town of Newstead, Town of North Collins, Town of Orchard Park, Village of Orchard Park, Town of Sardinia, City of Tonawanda, Town of Tonawanda, Town of West Seneca, National Fuel Gas, NYS DHSES

Date	DMA 2000 Requirement	Description of Activity	Participants
September 30, 2021	N/A	Submit draft to NYS DHSES for formal review	Erie County NYS DHSES
October 1 – November 22, 2021	1b, 2, 3, 4, 5	NYS DHSES Draft Plan Review	NYS DHSES
November 22 – December 20, 2021	N/A	Revise draft and submit to FEMA Region II for formal review	Erie County FEMA Region II
December 21, 2021 – February 2, 2022	1b, 2, 3, 4, 5	FEMA Review	FEMA Region II
February 2, 2022	1, 2, 3, 4, 5	Approvable Pending Adoption status granted	Erie County FEMA Region II

Notes:
Each number in column 2 identifies specific DMA 2000 requirements, as follows:
1a – Prerequisite – Adoption by the Local Governing Body
1b – Public Participation
2 – Planning Process – Documentation of the Planning Process
3a – Risk Assessment – Identifying Hazards
3b – Risk Assessment – Profiling Hazard Events
3c – Risk Assessment – Assessing Vulnerability: Identifying Assets
3d – Risk Assessment – Assessing Vulnerability: Estimating Potential Losses
3e – Risk Assessment – Assessing Vulnerability: Analyzing Development Trends
4a – Mitigation Strategy – Local Hazard Mitigation Goals
4b – Mitigation Strategy – Identification and Analysis of Mitigation Measures
4c – Mitigation Strategy – Implementation of Mitigation Measures
5a – Plan Maintenance Procedures – Monitoring, Evaluating, and Updating the Plan
5b – Plan Maintenance Procedures – Implementation through Existing Programs
5c – Plan Maintenance Procedures – Continued Public Involvement

3.3 STAKEHOLDER OUTREACH AND INVOLVEMENT

Stakeholders are the individuals, agencies, and jurisdictions with a vested interest in the recommendations of the HMP and include all planning partners.

Diligent efforts were made to ensure broad regional, county, and local representation in this planning process. To that end, a comprehensive list of stakeholders was developed with the support of the Steering Committee and Planning Partnership. Stakeholder outreach was performed early and throughout the planning process. This HMP includes information and input provided by these stakeholders, where appropriate, as identified in the references.

The following is a list of the various stakeholders that were invited to participate in the development of this plan, along with a summary of how t they participated and contributed. This summary listing does not represent every stakeholder that was aware of and contributed to this HMP update, as outreach efforts were being made, both formally and informally, throughout the process by the many planning partners involved in the effort, and documentation of all such efforts is impossible. Instead, this summary is intended to demonstrate the scope and breadth of the stakeholder outreach efforts made during the plan update process.

3.3.1 Federal Agencies

Cybersecurity and Infrastructure Security Agency: A representative of the Cybersecurity and Infrastructure Security Agency attended a Planning Partnership Kickoff Meeting.

FEMA Region II: Provided updated planning guidance, provided summary and detailed data from the NFIP (including repetitive loss information), and conducted plan review.

National Weather Service: Attended the Planning Partnership Kickoff Meeting.

Information regarding hazard identification and the risk assessment for this HMP update was requested and received or incorporated by reference from the following agencies and organizations:

- National Centers for Environmental Information (NCEI)
- National Hurricane Center (NHC)
- National Oceanic and Atmospheric Administration (NOAA)
- National Weather Service (NWS)
- Storm Prediction Center (SPC)
- U.S. Army Corps of Engineers (USACE)
- U.S. Census Bureau

3.3.2 State Agencies

NYS DHSES: Administered planning grant and facilitated FEMA review, provided updated planning guidance, attended meetings, and provided review of draft and final HMP.

New York State Department of Environmental Conservation (NYSDEC): Provided data and information, attended the Planning Partnership Kickoff Meetings. A representative of the Buffalo Regional Office Division of Water completed the stakeholder survey.

New York State Department of Health (NYS DOH): Attended the Planning Partnership Kickoff Meeting.

SUNY-Buffalo: Attended the Planning Partnership Kickoff Meeting.

SUNY-Erie: Provided information by completing the stakeholder survey.

3.3.3 Erie County Departments

Several county departments were represented on the Steering Committee and involved in the HMP update planning process. Appendix B (Participation Matrix) provides further details regarding regional and local stakeholder agencies.

Erie County Department of Homeland Security and Emergency Services: The Department's Deputy Commissioner served on the Steering Committee, attended all meetings, provided information and data, reviewed documents, and reached out to stakeholders. The Department assisted with distribution of project information via social media. Images of posts are included in Appendix D (Public and Stakeholder Outreach Documentation).

Erie County Department of Planning and Development: The Erie County Department of Environment and Planning was represented by its Deputy Director serving on the HMP Steering Committee and by other staff participating in the Planning Partnership meetings. Planning and Development provided critical data, assisted with the update of events and losses in the county, updated the previous mitigation strategy, facilitated outreach to jurisdictions and stakeholders, contributed to the county's capability assessment and updated mitigation strategy, and reviewed draft sections of the HMP.

Erie County Department of Public Health: Tracy Chalmers from the Department participated in the Planning Partnership.

Erie County Department of Public Works: A Senior Civil Engineer from the Department participated in the Planning Partnership.

Erie County Water Authority: The Water Authority's Security Officer participated in several meetings and provided important data about critical facilities.

3.3.4 Regional and Local Stakeholders

Appendix B (Participation Matrix) provides further details regarding regional and local stakeholder agencies. The stakeholders listed below were directly contacted by Erie County to provide information, identify specific mitigation strategies, and/or review the draft HMP. Results of information gathering surveys are provided in Appendix D (Public and Stakeholder Outreach Documentation). Feedback was reviewed by the Steering Committee and Planning Partnership and integrated, where appropriate, in the plan.

Academia

All school districts in the county were invited via email to provide input and attend meetings and were notified of the draft HMP review period. The Erie 1 BOCES and the Holland Central School were represented at the Planning Partnership Kickoff Meeting. The following academic organizations completed the stakeholder survey:

- Akron Central School District
- Alden Central School District
- Eden Central School District
- Iroquois Central School District
- Kenmore-Town of Tonawanda Union Free School District
- Lake Shore Central School District
- Springville-Griffith Institute Central School District
- Tonawanda City School District
- West Seneca Central School District

Business and Commercial Interests

Businesses and commercial industries in Erie County were invited to provide input on the draft HMP. National Fuel Gas attended the Planning Partnership Kickoff Meeting and the Risk Assessment Review Meeting. The following organizations completed the stakeholder survey:

- Akron Music Studios
- Alternative Care Services of WNY/ Alden's Meals on Wheels
- Boston Youth Soccer League
- DuPont
- Evonik
- Fiddlers Green Manor
- Greater Buffalo Niagara Regional Transportation Council
- Moog Incorporated
- Niagara Frontier Transportation Authority
- NOCO Energy Corporation
- Snap Fitness
- Sumitomo Rubber USA
- Unifrax

Emergency Services

All state, county, and local emergency service providers (police, fire, EMS) were notified of the planning process and invited to attend meetings and provide input on the draft HMP. Response organizations were contacted via email and telephone by the Erie County DHSES. The following organizations provided information through completing the stakeholder survey:

- Alden Fire Department
- AMR Walden Fire District (Cheektowaga)
- Brighton Fire Company
- Brighton Fire District No. 5
- Buffalo Police Department
- Chaffee-Sardinia Fire Company
- Cheektowaga Police Department
- City of Tonawanda Office of Emergency Management
- Clarence Center Fire Company
- East Concord Fire Department
- Elma Fire Company
- Erie Community College, EMT Department
- Harris Hill Volunteer Fire Company
- Marilla Fire Company
- North Amherst Fire Company
- Orchard Park Fire Company
- Orchard Park Fire District
- Orchard Park Fire District EMS
- Rescue Hose #1
- Sheridan Park Fire
- Spring Brook Fire District
- Swormville Fire
- Town of Lancaster OEM
- Town of Sardinia OEM
- Town of Tonawanda Paramedics
- Twin District Volunteer Fire Company
- Village of Hamburg Department of Emergency Services
- Windom Volunteer Fire Company

Highway and Public Works

All local highway and public works departments were invited to provide input on the draft HMP and attend all planning meetings. In addition, many of the participating municipalities had representatives from their highway and public works departments representing them on the Planning Partnership. The Town of Lancaster Highway Department, Town of Sardinia Highway Department, Town of Tonawanda Highway Department, and the Town of Tonawanda Water Plant completed the stakeholder survey.

Additional Stakeholders

Catholic Health, Chemical Distributors, Inc., the Erie County Medical Center, Kaleida Health, Mount Saint Mary's Hospital, the Sisters of Charity Hospital, the Niagara Frontier Transportation Authority, and the WNY Healthcare Association were represented at a Planning Partnership Kickoff Meeting.

3.3.5 Adjacent Counties

Erie County has tried to keep surrounding counties and municipalities apprised of the project and has given them the opportunity to provide input to this planning process. Specifically, the following adjoining and nearby county representatives were contacted via email in March 2020 to inform them about the availability of the project website, draft plan documents, and surveys, and to invite them to attend planning meetings or otherwise provide input to the planning process.

- Niagara County, New York
- Genesee County, New York
- Monroe County, New York

The neighboring counties of Niagara, Genesee, Wyoming, Cattaraugus, and Chautauqua were invited to all planning meetings. In addition, an electronic survey was distributed to officials in these counties in January 2021 to invite them to provide input into the planning process. No responses on this survey were received. Documentation of outreach to adjacent counties can be found in Appendix D.

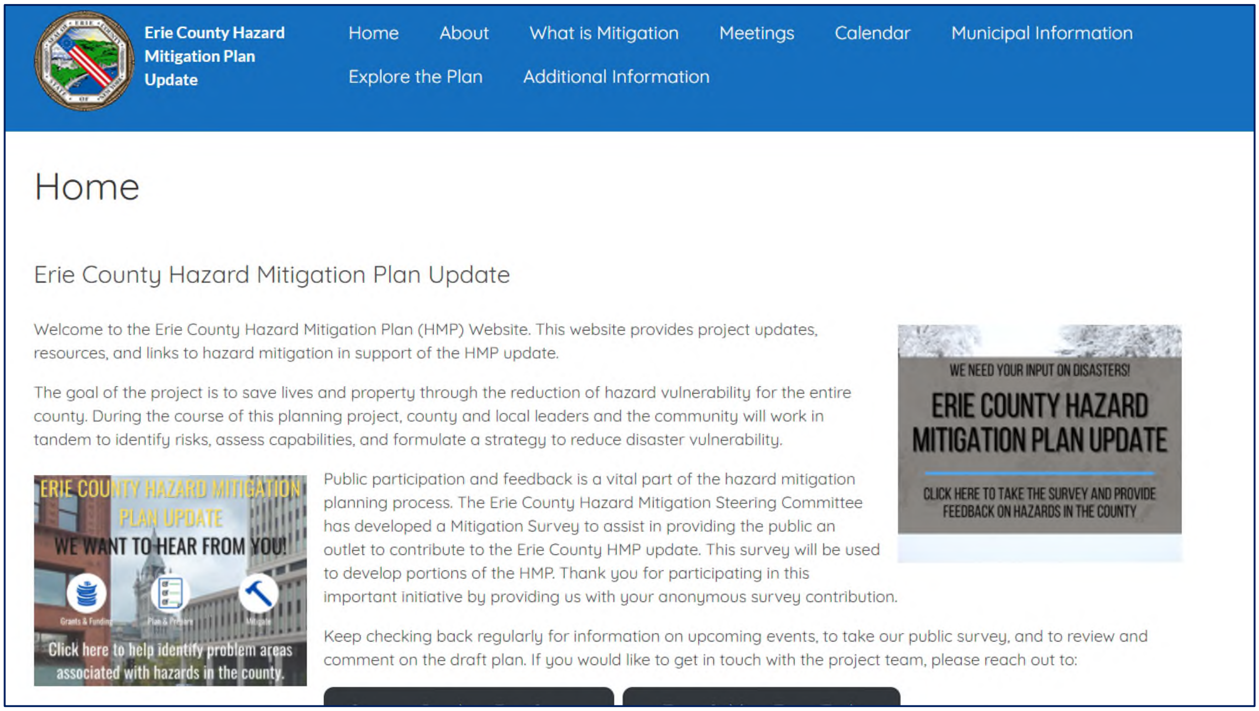
3.3.6 Public Outreach

The Steering Committee and Planning Partnership made the following efforts toward public participation in the development and review of the HMP:

- A public project website was developed and is being maintained to facilitate communication between the Steering Committee, Planning Partnership, public, and stakeholders. The public website provided a project overview, county and local contact information, access to the citizen's survey, and sections of the HMP for public review and comment. Figure 3-1 provides a screenshot of the current website homepage (https://www.eriecountynyhmp.com/). http://www.ongov.net/planning/haz.html
- A pair of public information webinars were conducted in January 2021. Two members of the general public, a reporter, and 17 representatives of other planning partners attended the webinars. Copies of meeting materials are provided in Appendix C.
- All hazard mitigation planning meetings open to the public were advertised on the Erie County Department of Homeland Security and Emergency Services website and the project website.
- A public online mapping tool to identify problem areas created by hazards was made available in January 2021. Fourteen people responded and identified problem areas. This information was incorporated into the jurisdictional annexes (in their lists of problem statements and mitigation actions developed to solve those problems) for the following municipalities:
    - City of Buffalo
    - Town of Hamburg
    - Town of Orchard Park
    - Village of Orchard Park
    - Village of Springville
    - Town of Tonawanda
- All participating municipalities were encouraged to post the links to the project webpage and citizen and stakeholder surveys. In addition, all participating municipalities were requested to advertise the availability of the project website via local homepage links, and other available public announcement methods (e.g., Facebook, Twitter, email blasts).

- Starting in April 2021, draft sections of the plan were posted on the project website for public review and comment. In addition, links were provided to the participating jurisdictions to post on their respective websites.
- Once approved by NYS DHSES/FEMA, the final HMP will be available on the county and municipal websites.

Figure 3-1. Erie County HMP Website Homepage



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

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

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

Plans, reports, and other technical information were identified and provided directly by the county, participating jurisdictions, and numerous stakeholders involved in the planning effort as well as through independent research by the planning consultant. The county and participating jurisdictions were tasked with updating the inventory of their planning and regulatory capabilities in Section 9 (Jurisdictional Annexes) and providing relevant planning and regulatory documents, as applicable. Relevant documents, including plans, reports, and ordinances, were reviewed to identify the following:

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

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

- New York State Standard Multi-Hazard Mitigation Plans of 2014 and 2019
- Erie County Comprehensive Emergency Management Plan (CEMP)
- Local plans and regulations (Appendix G includes a list and description of the local documents reviewed for each jurisdiction)
  - Comprehensive/Master Plans
  - Building Codes
  - Zoning and Subdivision Ordinances
  - NFIP Flood Damage Prevention Ordinances
  - Site Plan Requirements
  - Local Waterfront Revitalization Plans
  - Stormwater Management Plans
  - Emergency Management and Response Plans
  - Land Use and Open Space Plans
  - Capital Plans

3.5 INTEGRATION WITH EXISTING PLANNING MECHANISMS AND PROGRAMS

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within Erie County, many existing plans and programs support hazard risk management, and thus it is critical that this HMP integrates, coordinates with, and complements existing plans and programs.

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

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

3.6 CONTINUED PUBLIC INVOLVEMENT

Erie County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will be posted online at https://www2.erie.gov/disaster/index.php?q=The%20Plan and municipalities will be encouraged to maintain links to the plan website. The county will also make hard copies of the HMP available for review at public locations, as identified on the website.

A notice regarding updates of the plan and the location of plan copies will be publicized after the Planning Partnership's annual evaluation and posted on the public website at https://www2.erie.gov/disaster/index.php?q=The%20Plan.

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

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

Further details regarding continued public involvement are provided in Section 7 (Plan Maintenance).

After completion of this plan, implementation and ongoing maintenance will continue to be a function of the Planning Partnership. The Planning Partnership will review the plan and accept public comments as part of an annual review and as part of 5-year mitigation plan updates.

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

Mr. Gregory Butcher is identified as the Erie County HMP Coordinator in Section 7 (Plan Maintenance) and will be responsible for receiving, tracking, and filing public comments regarding this plan. Contact information is:

Greg Butcher, Deputy Commissioner
Erie County Department of Homeland Security and Emergency Services
716-858-2944
45 Elm Street
Buffalo, NY 14203
Email: Gregory.Butcher@erie.gov

SECTION 4 COUNTY PROFILE

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

4.1 GENERAL INFORMATION

Erie County is located in Western New York and is bordered by Niagara County on the north, Wyoming and Genesee counties to the east, Cattaraugus and Chautauqua county to the south and Lake Erie to the west. The county's area is 1,227 square miles. The County makes up part of the international border with Canada. Buffalo is the County seat.

Erie County is home to 44 incorporated municipalities (25 towns, 16 villages and three cities). They are the Towns of Alden, Amherst, Aurora, Boston, Brant, Cheektowaga, Clarence, Colden, Collins, Concord, Eden, Elma, Evans, Grand Island, Hamburg, Holland, Lancaster, Marilla, Newstead, North Collins, Orchard Park, Sardinia, Tonawanda, Wales and West Seneca; Villages of Akron, Alden, Angola, Blasdell, Depew, East Aurora, Farnham, Gowanda, Hamburg, Kenmore, Lancaster, North Collins, Orchard Park, Sloan, Springville and Williamsville; and Cities of Buffalo, Lackawanna, and Tonawanda.

The county is named after the early native group the Erie Indians. During French and then English colonial rule, Erie County was occupied by Iroquoian speaking peoples who succeeded the Erie. White settlers began to arrive in the area after the American Revolutionary War. Native peoples had been forced to cede most of their lands. Erie County was incorporated in 1821. The county included only two towns; Willink and Clarence, which, over time were split to form the current 42 towns, villages and cities within Erie County. The county also contains portions of the Cattaraugus and Tonawanda Indian Reservations. I-90 runs through the county and spur highways connect to urban centers. Four US Routes and 14 New York State Routes traverse the county. (Britannica online, accessed December 2020).

According to the U.S. Census, the 2010 population for Erie County was 919,040 The estimated 2019 population was 919,355, a nearly zero percent change from the 2010 Census. The total population of the county is projected to increase out to 2040 to 945,891 residents (Cornell University, 2017). Data from the 2019 U.S. Census American Community Survey indicate that 5.5 percent of the population is 5 years of age or younger and 17.6 percent is 65 years of age or older. Communities must deploy a support system that enables all populations to safely reach shelters or to quickly evacuate a hazard area.

According to the U.S. Census Bureau, Erie County is the seventh most populated county in New York State (U.S.

4.2 MAJOR PAST HAZARD EVENTS

Presidential disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Table 4-1 shows FEMA disaster declarations that included Erie County through 2020 (records date back to 1954).

Table 4-1. History of Hazard Events in Erie County, New York

Disaster Number	Date of Event	Declaration Date	Incident Type	Title
494	1976-03-19T00:00:00.000Z	1976	Severe Ice Storm	ICE STORM,SEVERE STORMS & FLOODING
3027	1977-01-29T00:00:00.000Z	1977	Snow	SNOWSTORMS
527	1977-02-05T00:00:00.000Z	1977	Snow	SNOWSTORMS
734	1985-03-22T00:00:00.000Z	1985	Snow	SNOW MELT & ICE JAMS
3107	1993-03-13T00:00:00.000Z	1993	Snow	SEVERE BLIZZARD
1233	1998-06-25T00:00:00.000Z	1998	Severe Storm(s)	SEVERE STORMS AND FLOODING
3136	1999-01-01T13:38:00.000Z	1999	Snow	SNOW
1335	2000-05-03T00:00:00.000Z	2000	Severe Storm(s)	SEVERE STORMS AND FLOODING
3155	2000-05-22T00:00:00.000Z	2001	Other	WEST NILE VIRUS
3157	2000-11-19T00:00:00.000Z	2001	Snow	SNOW
1391	2001-09-11T09:00:00.000Z	2001	Fire	FIRES AND EXPLOSIONS
3170	2001-12-24T00:00:00.000Z	2002	Snow	SNOW
1404	2001-12-24T00:00:00.000Z	2002	Snow	SEVERE WINTER STORM
3186	2003-08-14T16:10:56.000Z	2003	Other	POWER OUTAGE
1534	2004-05-13T00:00:00.000Z	2004	Severe Storm(s)	SEVERE STORMS AND FLOODING
3262	2005-08-29T00:00:00.000Z	2005	Hurricane	HURRICANE KATRINA EVACUATION
3268	2006-10-12T16:00:00.000Z	2007	Snow	LAKE EFFECT SNOWSTORM
1665	2006-10-12T18:00:00.000Z	2007	Severe Storm(s)	SEVERE STORMS AND FLOODING
1857	2009-08-08T00:20:00.000Z	2009	Severe Storm(s)	SEVERE STORMS AND FLOODING
3351	2012-10-27T00:00:00.000Z	2013	Hurricane	HURRICANE SANDY
4204	2014-11-17T12:00:00.000Z	2015	Snow	SEVERE WINTER STORM, SNOWSTORM, AND FLOODING
4472	2019-10-31T15:30:00.000Z	2020	Severe Storm(s)	SEVERE STORMS, STRAIGHT-LINE WINDS, AND FLOODING
4480	January 20, 2020 and continuing	January 20, 2020 and continuing	COVID-19 Pandemic	New York COVID-19 Pandemic

Source: FEMA 2021

4.3 PHYSICAL SETTING

This section presents topography and geology, hydrology and hydrography, and climate information for Erie County.

4.3.1 Topography and Geology

Erie County's northern half is relatively flat and rises gently up from Lake Erie. The Southtowns are much hillier, containing the northernmost foothills of the Appalachian Mountains. The county's highest point is at 1,940 feet above sea level in the Town of Sardinia. is located in two physiographic regions: the Allegany Plateau, characterized by the upland, sloping topography to the south and the Erie-Ontario Lowlands of lake plain to the north. Glaciers have covered this area several times leaving deposits of glacial till as they receded. (FEMA, Town of Orchard Park, 1982). Surface soils within the County are nonsorted rock materials; imbedded sand and gravel, as well as imbedded clay, silt and fine sand. They reflect the texture of the glacial till, outwash and lake deposits from which they come. Generally, soils are shallow and fairly well-drained (FEMA, Village of Depew, 1981). Soils for a thin mantle over the bedrock, which is generally found at depths greater than five feet. Heavy wooded areas can be found along steep hillsides and farming occurs on the gently rolling hilltop areas and n the broad valleys. Many farms are now overgrown, as a once agricultural area has rapidly become urbanized (FEMA, Town of West Seneca, 1992).

4.3.2 Hydrography and Hydrology

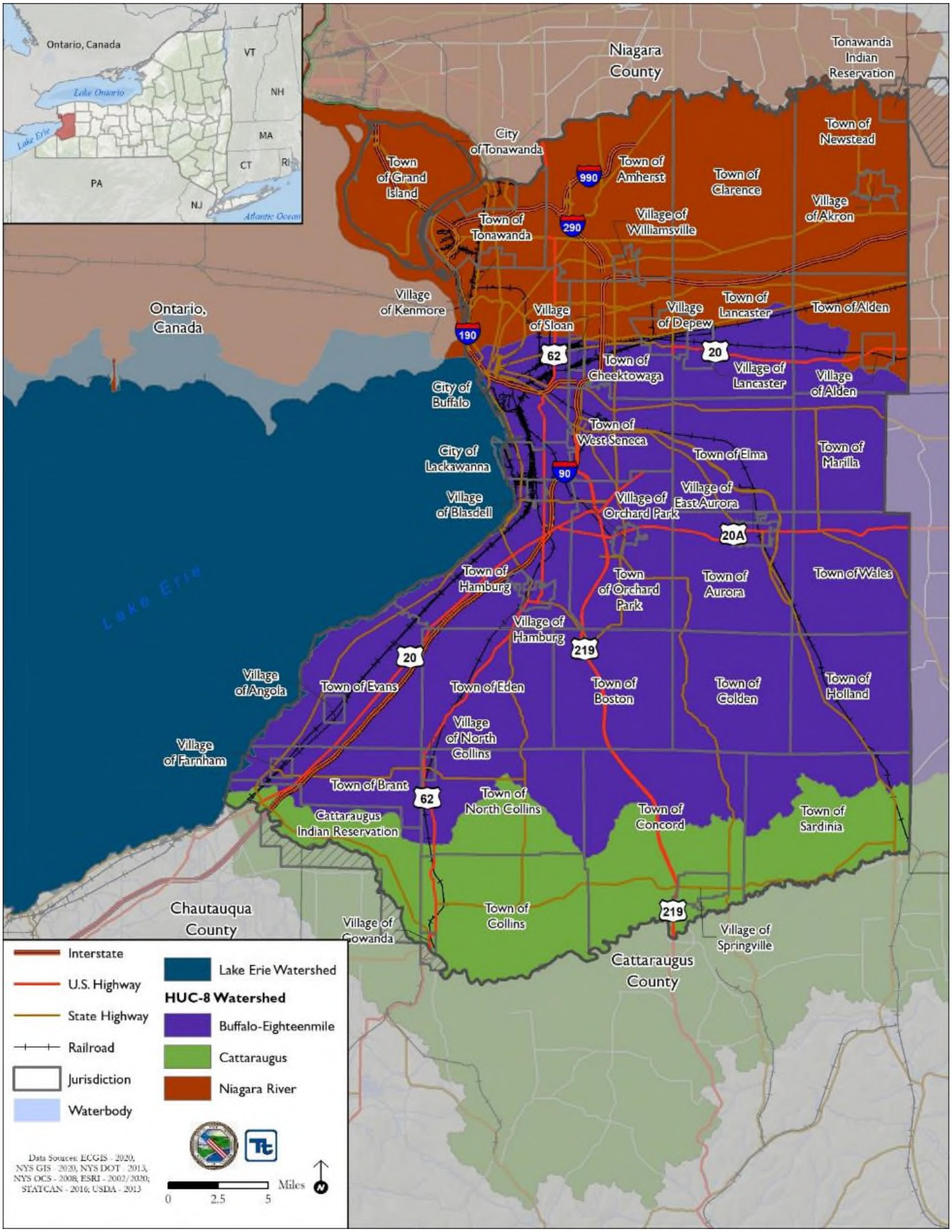
The county is bordered by large watercourses – the Cattaraugus and Tonawanda Creeks, the Erie Canal and the Niagara River. Large creeks that flow through the county include Ellicott, Cayuga, Buffalo, and Eighteenmile Creeks. The County contains Evangola, Beaver Island, and Buckhorn Island state parks.

Flooding can occur in Erie County during any season of the year, but it most likely occurs in the late winter – early spring months when melting snow may combine with intense rainfall to produce increased runoff. Ice jams and debris have often increased flood heights by impeding water flow at bridges and culverts. Floods can result from collusion over the watershed of a large mass of warm moisture-laden air from the north; from sharp rises in temperature in the spring that melt the snow cover of the basin and are followed by rains; and from localized thunderstorms

Drainage Basins and Watersheds

A watershed is the area of land that drains into a body of water, such as a river, lake, stream, or bay. It is separated from other systems by high points in the area, such as hills or slopes. It includes not only the waterway itself but also the entire land area that drains to it. For example, the watershed of a lake would include not only the streams entering the lake but also the land area that drains into those streams and eventually the lake. Drainage basins generally refer to large watersheds that encompass the watersheds of many smaller rivers and streams. Erie County is part of three drainage basins: the Niagara River basin, the Buffalo-Eighteenmile Creek basin and the Niagara River Basin and the Cattaraugus Creek basin.

Figure 4-1. Watersheds Located Within Erie County



4.3.3 Climate

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

The cool season (October through March) is characterized by large, low-pressure systems that move northeastward along the Atlantic coast or the western side of the Appalachian Mountains. Storms that form in these systems are characterized by long periods of steady precipitation in the form of rain, snow, or ice, and tend to produce less surface runoff and more recharge than the summer storms because they have a longer duration and occasionally result in snowmelt (NYS Hazard Mitigation Plan, 2019)

Erie County experiences a fairly humid, continental-type climate, but with a definite “maritime” flavor due to strong modification from the Great Lakes. Winters are generally cloudy, cold and snowy. The lake snow machine can start as early as mid-November. The average date of the last frost is near the end of April in the City of Buffalo and in midMay inland. Spring comes slowly to the Buffalo area; the ice pack on Lake Erie does not 14disappear until mid-April. Summers are pleasant, sunshine is plentiful, temperatures are warm and humidity levels are moderate. Autumn is pleasant, but rather brief. The first frost can be expected in late September inland and mid-October in the City of Buffalo (Erie County Flood Insurance Study, 2019).

4.4 POPULATION AND DEMOGRAPHICS

An understanding of the planning area population characteristics provides a foundation for deciphering the impacts of natural hazards in the county. As noted in Section 5 (Methodology) of this plan, modeling of the impacts of natural hazards on the population was performed using FEMA’s Hazards U.S. Multi-Hazard (Hazus) including the available population information from the 2010 U.S. Decennial Census data indicating a county population 919,040. However, according to U.S. Census Bureau, 2015-2019 American Community Survey 5-Year Population Estimates, the county contains a population of approximately of 919,355, or a slight increase in population (American Community Survey, 2021). A detailed population table for the 2019 American Community Survey population statistics is shown below in Table 4-2. Figure 4-2. shows the distribution of the general population density (persons per square mile) in 2019 by Census block. For the purposes of this plan, the best available data was referenced to support the analysis, i.e., 2015-2019 American Community Survey 5-Year Population Estimates.

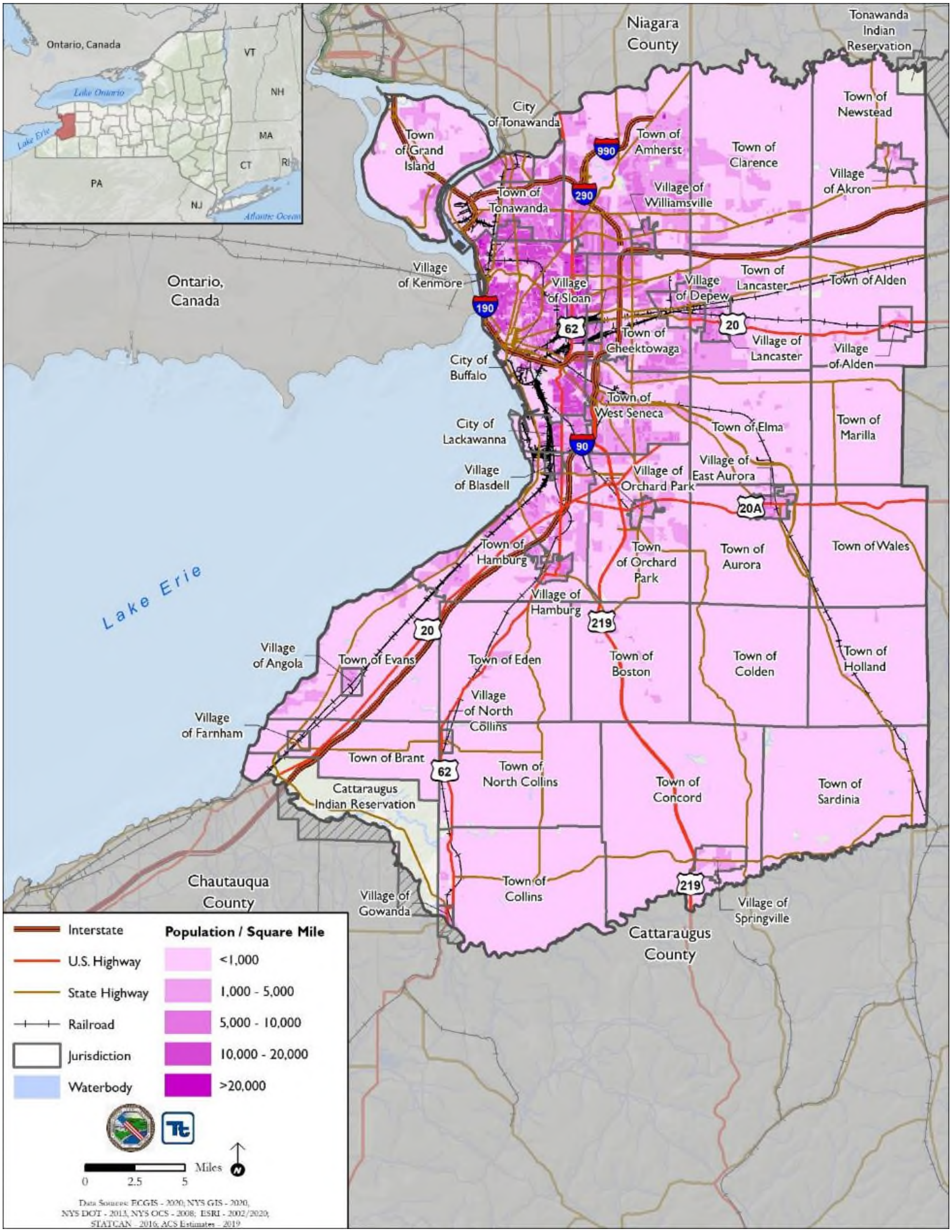
Table 4-2. Erie County Population Statistics (2019 American Community Survey 5-Year Estimates)

Jurisdiction	Population (2015-2019 American Community Survey Estimates)											
	Total	Percent of County Total	Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Non-English Speaking	Percent of Jurisdiction Total	Disability	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Akron (V)	2,871	0.3%	563	19.6%	172	6.0%	31	1.1%	331	11.5%	152	5.3%
Alden (T)	7,418	0.8%	1,249	16.8%	209	2.8%	58	0.8%	493	6.6%	233	3.1%
Alden (V)	2,577	0.3%	451	17.5%	121	4.7%	4	0.2%	392	15.2%	142	5.5%
Amherst (T)	120,276	13.1%	24,201	20.1%	5,976	5.0%	5,706	4.7%	12,332	10.3%	10,671	8.9%
Angola (V)	2,373	0.3%	390	16.4%	129	5.4%	0	0.0%	421	17.7%	297	12.5%
Aurora (T)	7,599	0.8%	1,383	18.2%	240	3.2%	24	0.3%	822	10.8%	351	4.6%
Blasdell (V)	2,645	0.3%	460	17.4%	167	6.3%	2	0.1%	309	11.7%	353	13.3%
Boston (T)	8,042	0.9%	1,716	21.3%	343	4.3%	66	0.8%	920	11.4%	366	4.6%
Brant (T)	1,541	0.2%	352	22.8%	39	2.5%	26	1.7%	216	14.0%	117	7.6%
Buffalo (C)	256,480	27.9%	31,818	12.4%	16,941	6.6%	19,369	7.6%	41,485	16.2%	74,552	29.1%
Cheektowaga (T)	73,129	8.0%	14,394	19.7%	3,737	5.1%	2,151	2.9%	9,838	13.5%	7,746	10.6%
Clarence (T)	32,440	3.5%	6,124	18.9%	1,651	5.1%	372	1.1%	2,989	9.2%	1,067	3.3%
Colden (T)	3,328	0.4%	633	19.0%	107	3.2%	6	0.2%	257	7.7%	60	1.8%
Collins (T)	5,418	0.6%	609	11.2%	180	3.3%	332	6.1%	487	9.0%	257	4.8%
Concord (T)	4,186	0.5%	728	17.4%	338	8.1%	5	0.1%	381	9.1%	297	7.1%
Depew (V)	15,102	1.6%	2,954	19.6%	910	6.0%	146	1.0%	1,919	12.7%	967	6.4%
East Aurora (V)	6,184	0.7%	1,446	23.4%	249	4.0%	22	0.4%	537	8.7%	342	5.5%
Eden (T)	7,631	0.8%	1,387	18.2%	430	5.6%	68	0.9%	847	11.1%	334	4.4%
Elma (T)	11,732	1.3%	2,719	23.2%	519	4.4%	65	0.6%	1,066	9.1%	483	4.1%
Evans (T)	13,782	1.5%	2,959	21.5%	574	4.2%	204	1.5%	2,473	17.9%	1,564	11.3%
Farnham (V)	459	0.0%	55	12.0%	32	7.0%	1	0.2%	67	14.6%	80	17.4%
Gowanda (V)	1,043	0.1%	193	18.5%	99	9.5%	21	2.0%	174	16.7%	184	17.6%
Grand Island (T)	21,047	2.3%	3,698	17.6%	1,143	5.4%	235	1.1%	1,732	8.2%	1,259	6.0%
Hamburg (T)	45,985	5.0%	9,136	19.9%	2,265	4.9%	369	0.8%	5,327	11.6%	3,113	6.8%
Hamburg (V)	9,636	1.0%	1,863	19.3%	653	6.8%	101	1.0%	955	9.9%	734	7.6%
Holland (T)	3,355	0.4%	540	16.1%	143	4.3%	8	0.2%	520	15.5%	263	7.8%
Kenmore (V)	15,132	1.6%	2,627	17.4%	491	3.2%	223	1.5%	2,003	13.2%	971	6.4%
Lackawanna (C)	17,831	1.9%	2,948	16.5%	1,479	8.3%	1,409	7.9%	3,006	16.9%	3,983	22.3%
Lancaster (T)	27,625	3.0%	4,907	17.8%	1,428	5.2%	200	0.7%	2,036	7.4%	743	2.7%
Lancaster (V)	10,144	1.1%	1,714	16.9%	683	6.7%	147	1.4%	1,150	11.3%	885	8.7%

Jurisdiction	Population (2015-2019 American Community Survey Estimates)											
	Total	Percent of County Total	Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Non-English Speaking	Percent of Jurisdiction Total	Disability	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Marilla (T)	5,378	0.6%	1,133	21.1%	221	4.1%	46	0.9%	542	10.1%	115	2.1%
Newstead (T)	5,804	0.6%	1,092	18.8%	201	3.5%	0	0.0%	1,087	18.7%	148	2.5%
North Collins (T)	2,130	0.2%	321	15.1%	110	5.2%	0	0.0%	258	12.1%	192	9.0%
North Collins (V)	1,370	0.1%	176	12.8%	113	8.2%	13	0.9%	218	15.9%	157	11.5%
Orchard Park (T)	26,361	2.9%	5,858	22.2%	1,289	4.9%	436	1.7%	2,731	10.4%	1,289	4.9%
Orchard Park (V)	3,148	0.3%	650	20.6%	100	3.2%	26	0.8%	357	11.3%	72	2.3%
Sardinia (T)	2,780	0.3%	549	19.7%	164	5.9%	22	0.8%	454	16.3%	267	9.6%
Sloan (V)	3,562	0.4%	549	15.4%	166	4.7%	126	3.5%	490	13.8%	476	13.4%
Springville (V)	4,298	0.5%	855	19.9%	225	5.2%	26	0.6%	898	20.9%	643	15.0%
Tonawanda (C)	14,830	1.6%	2,870	19.4%	736	5.0%	183	1.2%	2,375	16.0%	1,733	11.7%
Tonawanda (T)	57,027	6.2%	11,911	20.9%	2,944	5.2%	1,177	2.1%	8,290	14.5%	5,026	8.8%
Wales (T)	3,020	0.3%	495	16.4%	179	5.9%	0	0.0%	249	8.2%	131	4.3%
West Seneca (T)	45,344	4.9%	9,574	21.1%	1,974	4.4%	293	0.6%	5,992	13.2%	2,734	6.0%
Williamsville (V)	5,233	0.6%	1,248	23.8%	319	6.1%	106	2.0%	486	9.3%	492	9.4%
Cattaraugus Tribal Territory	2,045	0.2%	246	12.0%	161	7.9%	55	2.7%	332	16.2%	765	37.4%
Tonawanda Tribal Territory	14	0.0%	0	0.0%	0	0.0%	4	28.6%	2	14.3%	0	0.0%
Erie County Total	919,355	100.0%	161,744	17.6%	50,350	5.5%	33,884	3.7%	120,246	13.1%	126,806	13.8%

Source: American Community Survey 2019
Note: Individuals below poverty level (Census poverty threshold for a 3-person family unit is approximately $20,335). Refer to Poverty Thresholds by the Census Bureau of more information.
V = Village, T = Town, C = City, % - Percent
Cattaraugus Tribal Territory and Tonawanda Tribal Territory are included in the above population totals, but did not participate in this HMP update.

Figure 4-2. 2019 American Community Survey 5-Year Estimates Population Distribution and Density of General Population for Erie County, New York



4.4.1 Vulnerable Populations

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

Identifying concentrations of vulnerable populations can assist communities in targeting preparedness, response, and mitigation actions. Populations with a higher level of vulnerability may be more seriously affected during the course of an emergency or disaster. Vulnerable populations have unique needs that should be taken into consideration by public officials to help ensure the safety of demographics with a higher level of risk. For the purposes of this planning process, vulnerable populations in Erie County include children, elderly, low-income, the physically or mentally disabled, and non-English speakers.

Age

Children are considered vulnerable to hazard events because they are dependent on others to safely access resources during emergencies and may experience increased health risks from hazard exposure. The elderly are more apt to lack the physical and economic resources necessary to respond to hazard events and are more likely to suffer health-related consequences. Those living on their own may have more difficulty evacuating their homes. The elderly are also more likely to live in senior care and living facilities (described in Section 4.6.1) where emergency preparedness occurs at the discretion of facility operators.

According to the 2015-2019 American Community Survey 5-Year Estimates, the median age in Erie County was 42 years. Hazus-MH reports 5.5 percent of the 2018 Erie County population is under the age of 5. Of the 2019 population, 17.6 percent of the county's population is age 65 and older. Figure 4-3. shows the distribution of persons over age 65 and the distribution of population under 5 in Erie County.

Income

The 2015-2019 American Community Survey 5-Year Estimates indicate that median household income in Erie County was $58,121 and the poverty rate is 14.2% The U.S. Census Bureau identifies households with two adults and two children with an annual household income below $24,339 per year as "low income" (U.S. Census 2018). Figure 4-3 below illustrates the low-income population density in Erie County.

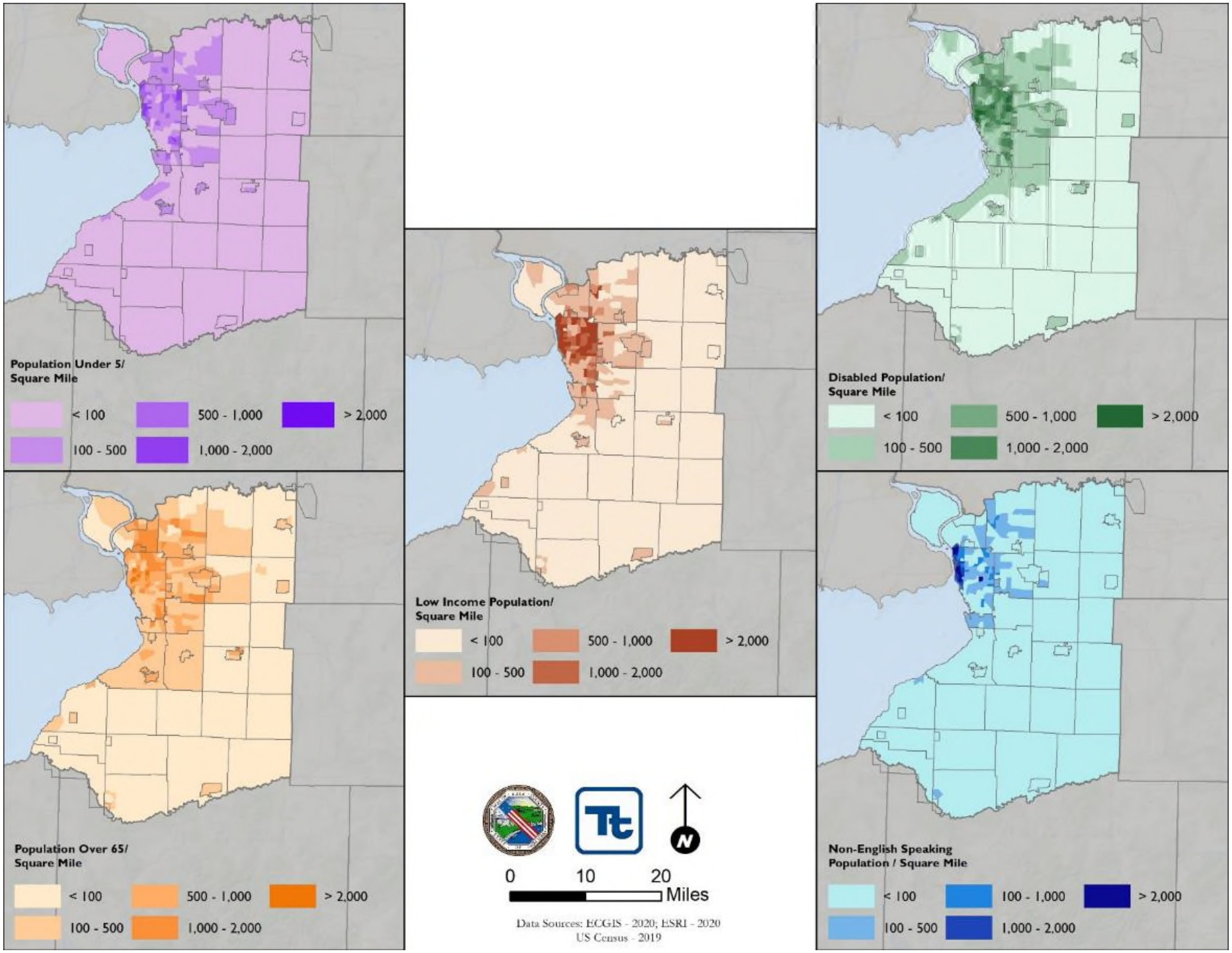
Physically or Mentally Disabled

"Persons with a disability include those who have physical, sensory, or cognitive impairment that might limit a major life activity (Center for Disease Control, 2015)." These impairments may increase the level of difficulty that individuals may face during an emergency. Cognitive impairments may reduce an individual's capacity to receive, process, and respond to emergency information or warnings. Individuals with a physical or sensory disability may face issues of mobility, sight, hearing, or reliance on specialized medical equipment. According to the 2014-2018 American Community Survey, 13.1 percent residents of Erie County are living with a disability. Figure 4-3 shows the geographic distribution of disabled individuals throughout Erie County, including individuals with: hearing, vision, cognitive, ambulatory, self-care, and independent living difficulties.

Non-English Speakers

Individuals who are not fluent or do not possess a working proficiency in English are vulnerable because they may have difficulty understanding information being conveyed to them. Cultural differences can also add complexity to how information is being conveyed to populations with limited proficiency of English (Centers for Disease Control, 2015). According to the 2014-2018 American Community Survey, 11 percent of residents over the age of 5 primarily speak a language other than English at home; of those 95,713 individuals who reported to speak English less than “very well”, 32,704 speak Spanish, 31,453 percent speak other Indo-European languages, 15,833 percent speak Asian and Pacific Island Languages, and 15,723 percent speak other languages. Figure 4-3 below shows the geographic distribution of individuals who speak English less than “very well.”

Figure 4-3. 2019 Distribution and Density of Persons - Vulnerable Populations in Erie County, New York

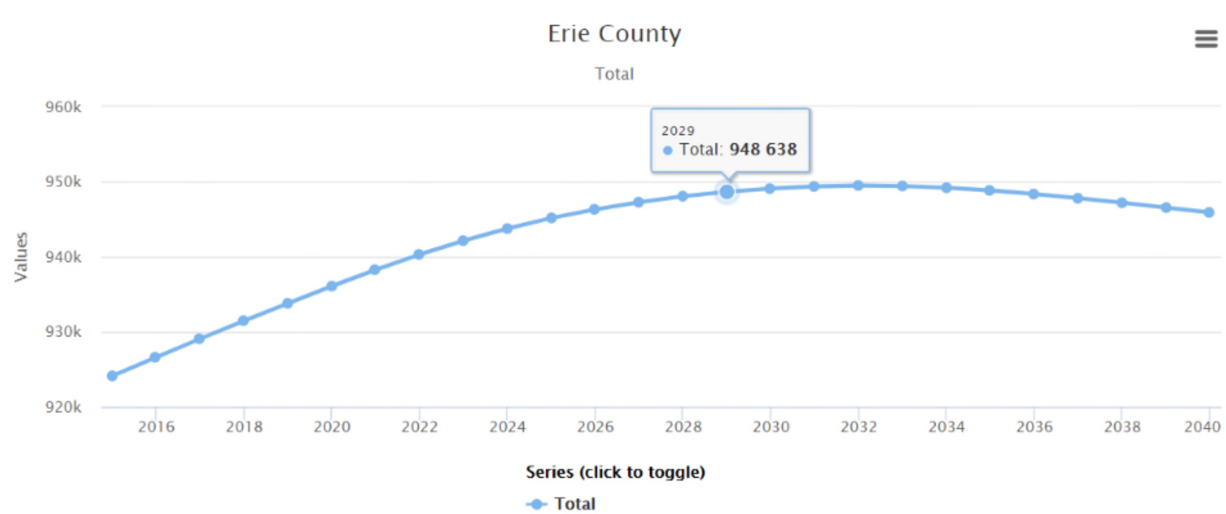


Population and Demographic Trends

This section discusses population trends to use as a basis for estimating future changes that could result from the seasonal character of the population and significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas. Various Census Bureau products were used as sources for the population trends section. The Decennial Census is the official population count taken every 10 years. American Community Survey 5-Year Estimates are used to show annual population changes, but it is not an official population count. 5-Year Estimates are used because they are the most accurate form of American Community Survey with the largest sample size which allows for greater accuracy at smaller geographic areas. The American Community Survey 5-Year Estimate products were used to establish annual changes in population. The numbers provided are not official census counts, but are official estimates provided to communities so that they may have a greater understanding in population changes within their jurisdictions.

Cornell University's Program on Applied Demographics produced population projections by county and by age and sex for New York State. The projections were completed in 2011 and are in 5-year intervals up to the year 2040. The projections are based upon rates of change estimated from historic data. The projections have been combined with historical census information to illustrate population trends within Erie County over a longer study period. Erie County experienced population growth from 1940 until 1980. There has been a slight decrease in population each decade since 1980. This population decrease is projected to continue through the year 2040. Figure 4-4 shows the observed and projected population change in Erie County from 1940 through 2040.

Figure 4-4. Erie County Population Change, 2014 to 2040



Source: U.S. Census Bureau, 2020; Cornell 2017

Population changes at the municipal level are also important to capture to better understand changing populations within the county and where the concentration of population resides. Section 9 (Jurisdictional Annexes) discusses recent changes in population for each municipality.

4.5 GENERAL BUILDING STOCK

The 2015-2019 American Community Survey 5-Year Estimates reported 430,732 housing units in Erie County The U.S. Census defines a household as all the persons who occupy a housing unit; and defines a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Therefore, you may have more than one household per housing unit. The median value of an owner-occupied housing unit in Erie County was estimated at $165,500 (U.S. Census 2019).

For this update, a custom-building inventory was created for Erie County. The general building stock was updated countywide with a custom-building inventory using the 2018 Microsoft building stock inventory data set. The building inventory attributes were updated using parcel tax assessor information provided by Erie County GIS. Attributes provided in the spatial files were used to further define each structure, such as year built, number of stories, basement type, occupancy class, and square footage. The centroid of each building footprint was used to estimate the building location. Structural and content replacement cost values (RCV) were calculated for each building using the available assessor data, the building footprint, and RS Means 2020 values. The updated building inventory (360,925 buildings with a total building replacement value [structure and content] of greater than $222.5 billion) was incorporated into Hazus at the structure and aggregate level. Approximately 92.7-percent of the buildings (334,595 buildings) and 57.6-percent of the building stock replacement value are associated with residential housing. Refer to Section 5.1 (Methodology and Tools) for a more detailed description of the general building stock inventory.

Generally, contents for residential structures are valued at about 50 percent of the building's value. For non-residential facilities, the value of the content is about equal to the building's structural value. Actual content value varies widely depending on the usage of the structure.

The 2014-2018 American Community Survey data identified that the majority of housing units (66.5 percent or 27,593 units) in Erie County are single-family detached units. The 2017 U.S. Census Bureau's County Business Patterns data identified 1,608 business establishments employing 21,775 people in Erie County. The retail trade industry has the highest number of establishments in the county, with 311 establishments. This is followed by the accommodation and food services industry with 209 establishments and the other services sector (except public administration) with 206 establishments (U.S. Census, 2017).

Figure 4-5, Figure 4-6, and Figure 4-7, show the distribution and exposure density of residential, commercial, and industrial buildings, respectively, in Erie County based on the aggregate custom-building stock values input into HAZUS-MH v4.2. Exposure density is the dollar value of structures per unit area, including building content value. The densities are shown in units of $1,000 ($K) per square mile.

Viewing exposure distribution maps, such as Figure 4-5, Figure 4-6 and Figure 4-7 can assist communities in visualizing areas of high exposure and in evaluating aspects of the study area in relation to the specific hazard risks.

Figure 4-5. Distribution of Residential Building Stock and Value Density in Erie County

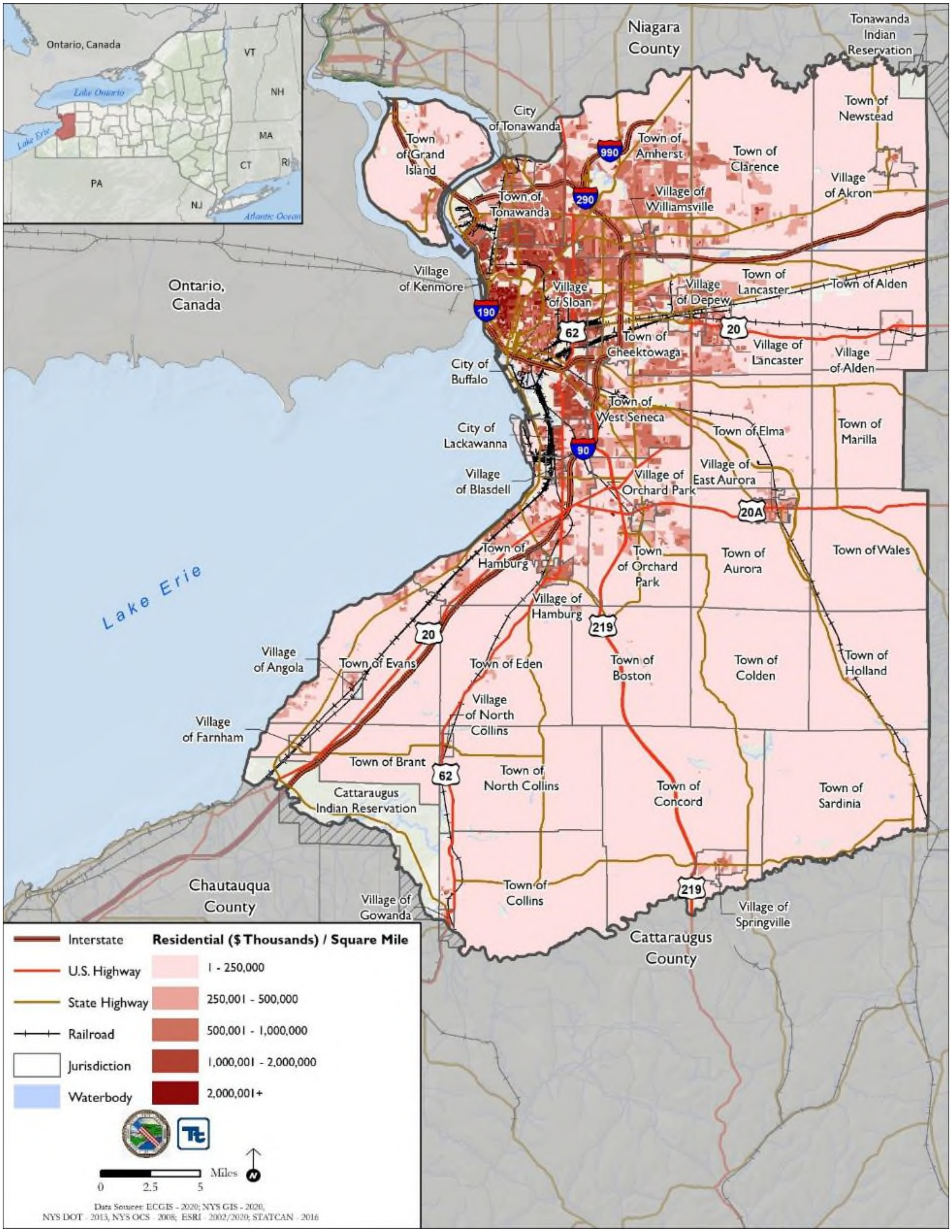


Figure 4-6. Distribution of Commercial Building Stock and Exposure Density in Erie County

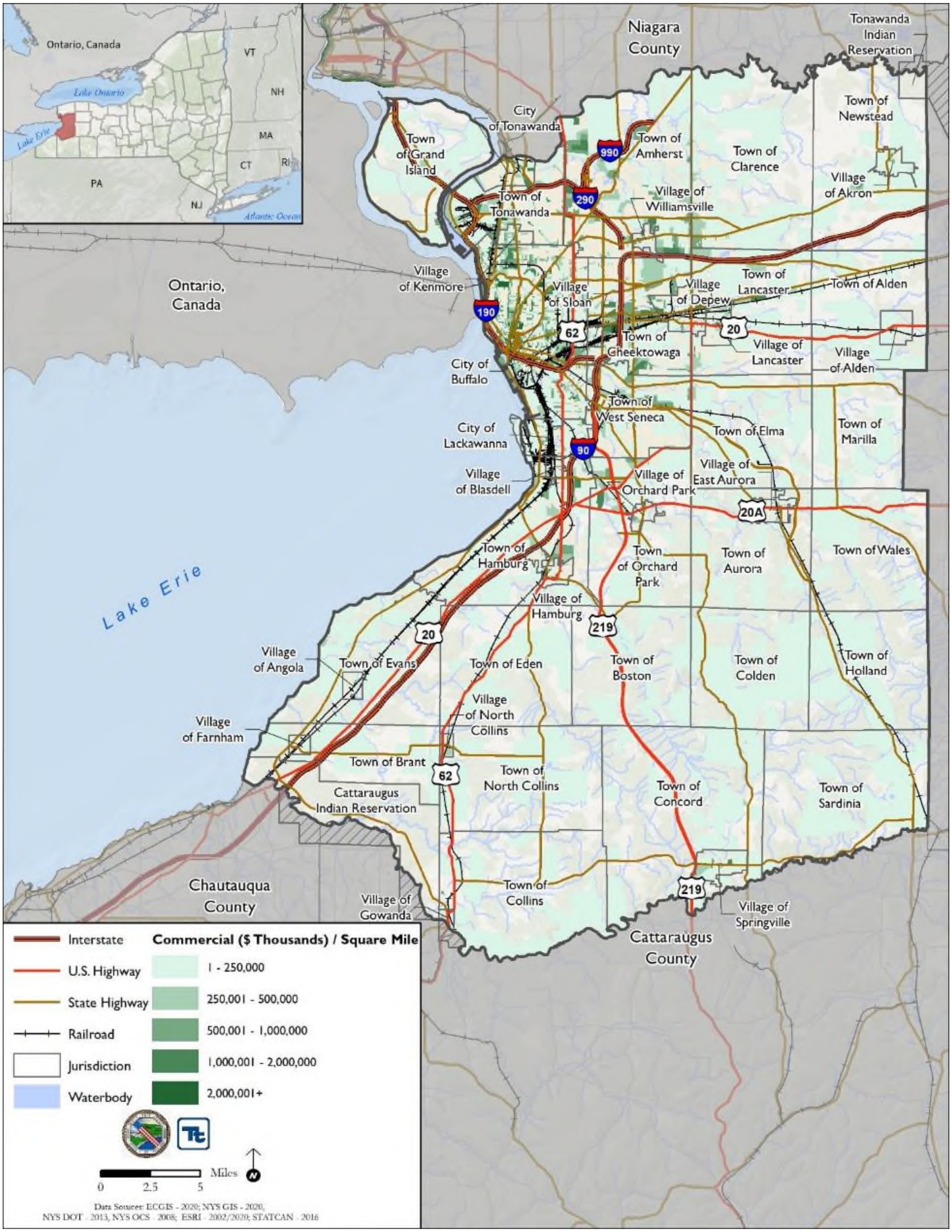
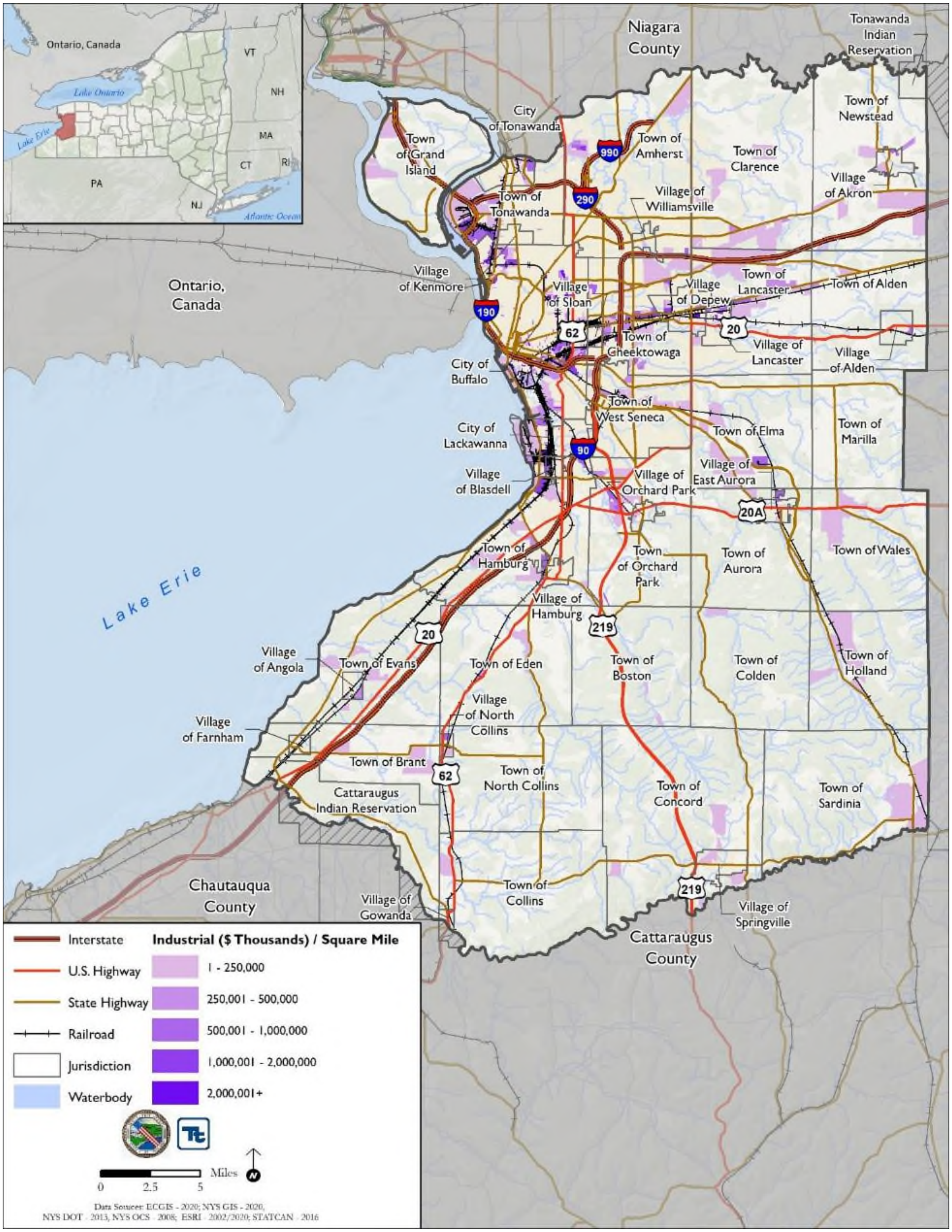


Figure 4-7. Distribution of Industrial Building Stock and Exposure Density in Erie County

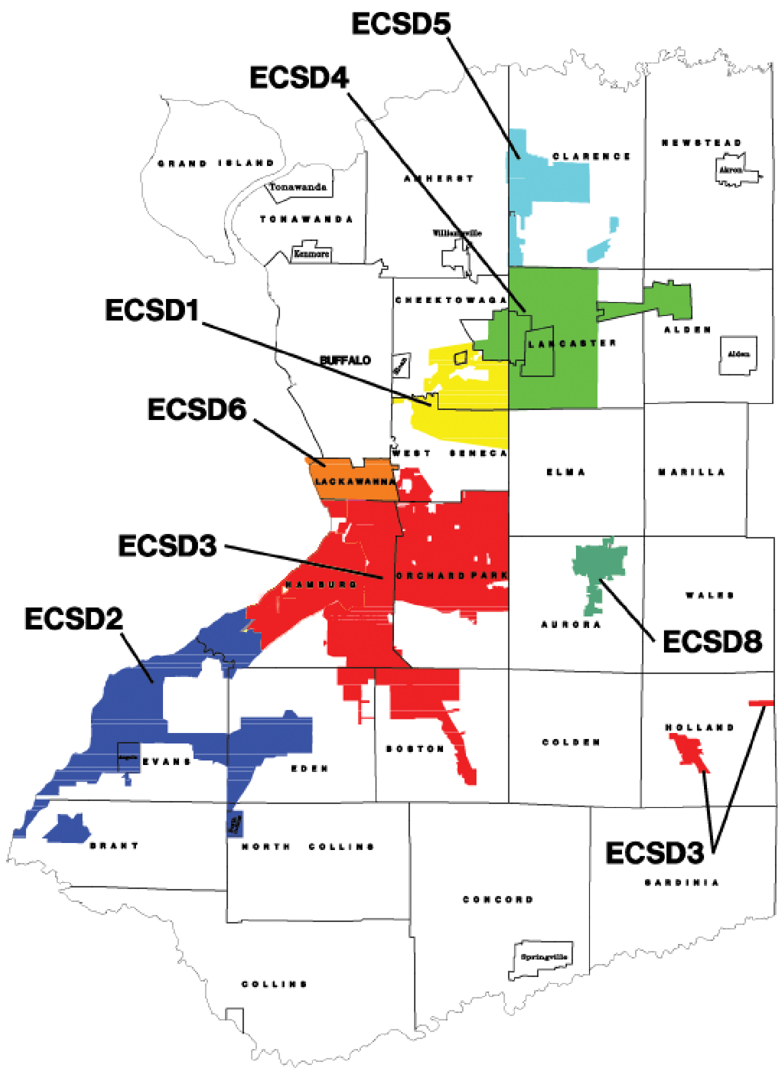


4.5.1 Land Use and Development Trends

Land use in Erie County is influenced by natural resources, topographic constraints, water lines, sewers, and roads. The City of Buffalo is the center of a large urbanized area. Suburban development extends well beyond the city border. Areas on the county's easter Department of Economic Development, Planning & Tourism, 2015).

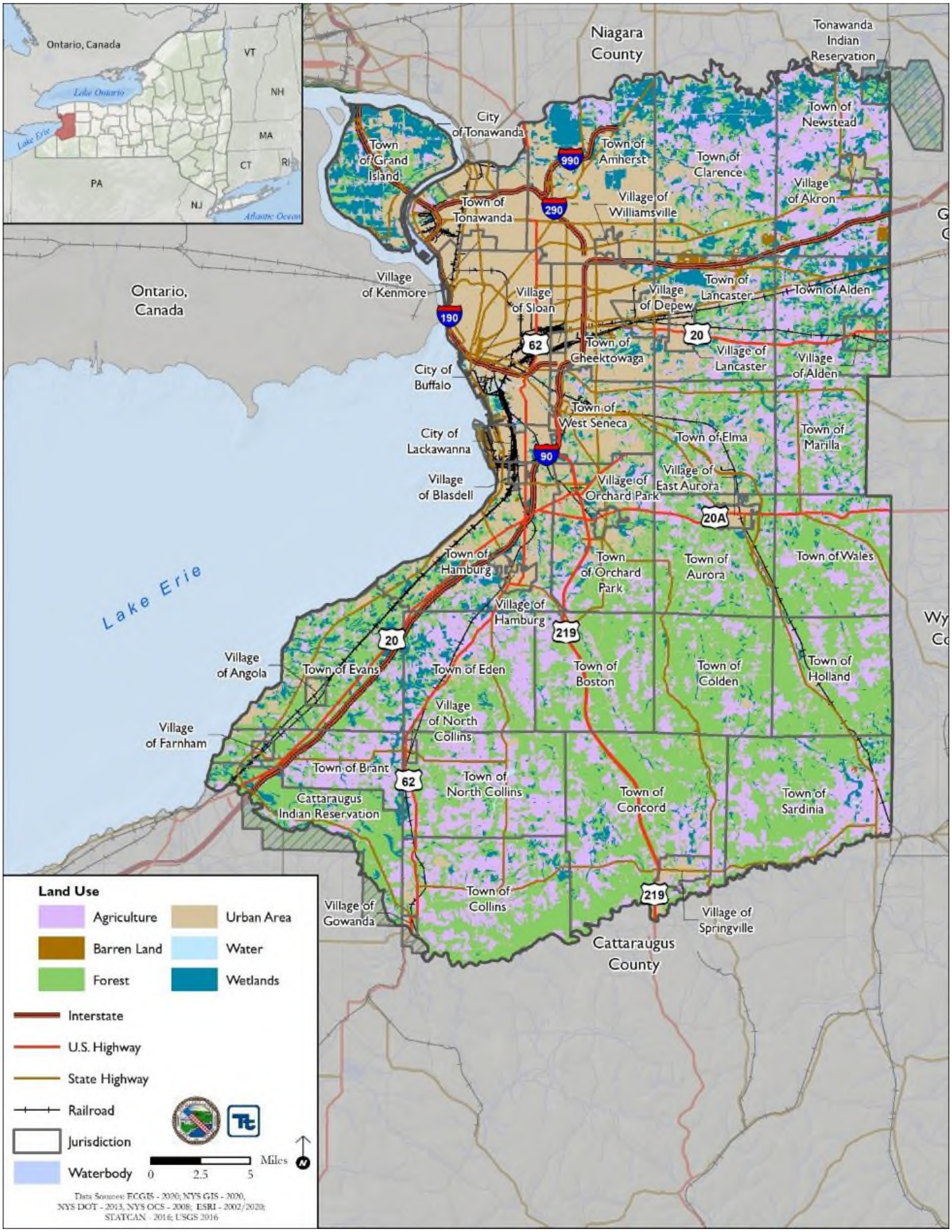
The County's urbanized area is centered in the City of Buffalo but in recent decades suburban development has expanded into all towns that border Buffalo and beyond. Suburban areas include villages and hamlets and are surrounded by farmland, wooded areas, parks, and protected open space. Retail and commercial uses are concentrated in central business districts and along heavily developed and travelled roadways and intersections. Agriculture remains a large land use. Although the number of farms is decreasing slightly, the size of farms is increasing. This trend toward fewer but larger farm operations parallels statewide trends (Erie County Department of Economic Development, Planning & Tourism, 2015).

Figure 4-8. 2016 County-owned sewer districts



Source: Erie County. The map above shows only the districts maintained by Erie County. Other portions of the county maybe served be included in other sewer districts.

Figure 4-9. 2016 Land Cover for Erie County



4.5.2 Development Trends and New Development

In New York State, land use regulatory authority is vested in towns, villages, and cities. However, many development and preservation issues transcend local political boundaries. In Erie County, each city, town and village are empowered by the Municipal Home Rule Law to plan and zone within its boundaries. DMA 2000 requires that communities consider land use trends, which can impact the need for, and priority of, mitigation options over time. Land use trends can also significantly impact exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

This plan provides a general overview of land use trends and types of development occurring within the study area. An understanding of these development trends can assist in planning for further development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure. Areas of recent and expected future development identified during this planning process are shown in the respective jurisdictional annexes (Section 9).

4.5.3 Potential Sites for Temporary Housing and Relocation

To identify potential sites for temporary housing and relocation, each municipality provided possible locations suitable for the placement of temporary housing for residents displaced by disaster, including sites to accommodate relocation of houses out of the floodplain or for the construction of new replacement developments. These locations are indicated in Table 4-3 and are located on the maps in the jurisdictional annexes (see Section 9).

Table 4-3. Potential Temporary Housing Locations in Erie County

Jurisdiction	Site Name	Address	Infrastructure/ Utilities Available	Capacity	Type
Akron (V)	Village Property	Eckerson Avenue & Clinton Street	Water, Electric.	15 Trailers on a site 20’ x 50’	Open Mowed Field Off Edge of Street
Akron (V)	Village Property	43 East Avenue, Old DPW Site	Water, Electric.	25 Trailers on a site 20’ x 50’	Open Stone Parking Lot
Alden (T)	Town Hall Parking Lot	3311 Wende	50 acres	Parking Lot/ Open Space	All
Alden (T)	Fire Company Parking Lot	Various Locations	100 acres	Parking Lot/ Open Space	All
Alden (T)	University at Buffalo North Campus	12 Capen Hall, Buffalo NY 14260	TBD	University campus facility	Water, sewer, electric, ample external parking lots for placement of trailers
Alden (T)	ECC North Campus	6205 Main St, Williamsville NY	Water, sewer, electric, external sports fields for placement	TBD	College facility
Alden (V)	Alden Town Park	W Main St.	Unknown	Park	Water, Electric, and Septic
Alden (V)	Darien Lakes State Park	Rt 20	Unknown	Park	Water and Electric
Amherst (T)	University at Buffalo North Campus	12 Capen Hall, Buffalo NY 14260	TBD	University campus facility	Water, sewer, electric, ample external parking lots for placement of trailers
Amherst (T)	ECC North Campus	6205 Main St, Williamsville NY	TBD	College facility	Water, sewer, electric, external sports fields for placement
Angola (V)	Lake Shore Schools Athletic Fields	100 High St.	Unknown	Unknown	Unknown

Jurisdiction	Site Name	Address	Infrastructure/ Utilities Available	Capacity	Type
Aurora (T)	Parking lot/fields	1003 Center Street	Unknown	Parking lot/fields	Electric, Gas, Water
Aurora (T)	Park	Emery Road east of Underhill	Unknown	Park	Electric, Gas, Water
Aurora (T)	Baseball fields	300 Gleed Avenue	Unknown	Baseball fields	Electric, Gas, Water
Aurora (T)	Park	736 Warren Drive	Unknown	Park	Electric, Gas, Water
Aurora (T)	Park	401 West Falls Road	Unknown	Park	Electric, Gas, Water
Aurora (T)	Park	Buffalo Road west of village line;	Unknown	Park	Electric, Gas, Water
Aurora (T)	Park	Knox Road west of village line; south side of road	Unknown	Park	Electric and Gas
Aurora (T)	Field	Girard Avenue at Buffalo Road	Unknown	Field	Electric, Gas, Water
Aurora (T)	Parking lot/field	141 Girard Avenue	Unknown	Parking lot/field	Electric, Gas, Water
Blasdell (V)	Blasdell Firemen's Park	165 Lake Ave Blasdell, NY	20	Baseball Field	Yes
Boston (T)	County Fairgrounds	5600 McKinley Pkwy, Hamburg, NY	266 acres	Open Space	All utilities available
Clarence (T)	Kelly Schultz, owner	Main Street	175 units	Trailer	Portable generator
Clarence (T)	Eastern Hills Mall	Main/Transit Area	250 units	Trailer	Portable generator
Colden (T)	Kummer Park	Park Street- off Route 240	40 acres of usable land	Park	Power/ Water/ Septic
Depew (V)	Depew High School	5201 Transit Road	20-30	Parking lot	Water/ Electric
East Aurora (V)	Parking lot/fields	1003 Center Street	50-100 spots	Parking lot/fields	All
East Aurora (V)	Park	Emery Road east of Underhill	20-30 spots	Park	All
East Aurora (V)	Baseball fields	300 Gleed Avenue	50-100 spots	Baseball fields	All
East Aurora (V)	Park	736 Warren Drive	50-100 spots	Park	All
East Aurora (V)	Park	401 West Falls Road	50-100 spots	Park	All
East Aurora (V)	Park	Buffalo Road west of village line;	50-100 spots	Park	All
East Aurora (V)	Park	Knox Road west of village line; south side of road	50-100 spots	Park	Electric and Gas
East Aurora (V)	Field	Girard Avenue at Buffalo Road	50-100 spots	Field	All
East Aurora (V)	Parking lot/field	141 Girard Avenue	50-100 spots	Parking lot/field	All
Eden (T)	Eden American Legion	2912 Legion Drive Eden NY 14057	40	FEMA Trailers	Fully outfitted for all utilities
Elma (T)	Iroquois HS	2111 Girdle Rd	100	Parking Lot	Yes
Elma (T)	Senior Center	3007 Bowen Rd	100	Parking Lot	Yes
Elma (T)	Jamison Rd FC	1071 Jamison Rd	100	Parking Lot	Yes
Elma (T)	Blossom FC	1000 N Blossom Rd	100	Parking Lot	Yes
Farnham (V)	Village Park	Commercial Street	5	Park Land	Water, electric, septic
Grand Island (T)	Nike Base	3278 Whitehaven Rd, Grand Island	Unknown	Building	Water, electric, septic
Holland (T)	Town Park	Legion Drive	5	Park	Water and Electric
Holland (T)	Three Valley	Olean Rd	50	Camp Site	Electric
Holland (T)	Mountain Meadows	Parker Rd	50	Camp Site	Electric
Kenmore (V)	Kenmore Community Center	135 Wilber; Kenmore, NY 14217	unknown	Community Center	All available
Kenmore (V)	Kenmore Middle School	155 Delaware Road, Kenmore, NY 14217	unknown	Public School	All available
Kenmore (V)	Roosevelt Elementary	283 Washington; Kenmore, NY 14217	unknown	unknown	All available

Jurisdiction	Site Name	Address	Infrastructure/ Utilities Available	Capacity	Type
Lancaster (T)	Fire Hall	5423 Broadway, Lancaster, NY 14086	100	Lot	All
Lancaster (T)	Senior Center	100 Oxford Ave, Lancaster, NY 14086	200	Lot	All
Lancaster (V)	Como Lake Park	2220 Como Park Blvd, Lancaster, NY 14086	Unsure	Park	Water
Marilla (T)	Marilla Primary School	11683 Bullis Rd, Marilla, NY 14102	25-30	Lot	W/E/S
Marilla (T)	Fireman's Grounds	West Ave.	30-35	Lot	NA
Newstead (T)	Veteran's Park	5929 Buell Street/Route 93 Akron, NY 14001	100 trailers	Open mowed field with a stone roadway	Water, electric
Newstead (T)	Newstead Sports complex	44 Skyline Drive Akron, NY 14001	100 trailers	Open mowed field with stone roadway	Water, electric
Newstead (T)	Town property	5750 Crittenden Road Akron, NY 14001	100 trailers	Open field mowed. No road	Water and electric available at the road
North Collins (T)	Fricano Park	Gowanda State Road	Yes	800	Park Grounds
North Collins (T)	Langford Park	Langford Road	Water/electric	300	Park Grounds
North Collins (T)	Tractor Pull Area	Sission Highway	Water/electric	500	Park Grounds
Orchard Park (T)	Compost/Soccer Complex	6909 Milestrip Road	300,000 Sq. Ft. Available	Parkland	Yes
Orchard Park (T)	Webster Road Vacant Land	Webster Road, SBL162.00-1-28.121	400,000 Sq. Ft. Available	Vacant Parkland	Yes
Orchard Park (T)	Orchard Park Little League Baseball Parking Lot	Thorn Ave, SBL 172.11-1-3.11	52,000 Sq. Ft. Available	Parking Lot	Yes
Orchard Park (T)	Brush Mountain Park	4520 California Road	200,000 Sq. Ft. Available	Parkland	Yes
Orchard Park (V)	Compost/Soccer Complex	6909 Milestrip Road	Yes	300,000 Sq. Ft. Available	Parkland
Orchard Park (V)	Webster Road Vacant Land	Webster Road, SBL162.00-1-28.121	Yes	400,000 Sq. Ft. Available	Vacant Parkland
Orchard Park (V)	Orchard Park Little League Baseball Parking Lot	Thorn Ave, SBL 172.11-1-3.11	Yes	52,000 Sq. Ft. Available	Parking Lot
Orchard Park (V)	Brush Mountain Park	4520 California Road	Yes	200,000 Sq. Ft. Available	Parkland
Tonawanda (C)	Veterans Park	Niagara Street	Water. Power, Sewer in area	24	Trailers on Pavement
Tonawanda (C)	Big Lots Plaza Parking Lot	750 Young Street	Water. Power, Sewer in area	30 to 40 (More if Businesses are Closed)	Trailers on Pavement
Tonawanda (C)	Kohler Pool Parking Lot	291 Kohler St	Water. Power, Sewer in area	20	Trailers on Pavement
Tonawanda (T)	Town of Tonawanda Aquatic Center	1 Pool Plaza	100	Parking lot and one building	Parking lot does not have utilities but inside the building has utilities
Tonawanda (T)	Town Tonawanda Senior Center	291 Ensminger	25	Parking lot and building	Parking lot does not have utilities but inside the building has utilities
Wales (T)	Wales	12345 Big Tree Road	20-25 Acres	Flat Land	There are no utilities on site
Wales (T)	Town Park	Rt 20A	30 Acres	Open Space	None

Shelters

HAZUS-MH v4.2 estimates displacement and long-term sheltering needs for flood, hurricane, and earthquake events. These results are presented under Impacts on Life, Health, and Safety in the Vulnerability Assessments for Section 5.4.1 (Flood) and Section 5.4.3 (Severe Storm). These results indicate that the need for sheltering large numbers of residents may be significant. However, these results should be used as a starting point for determining the sheltering needs for the county, as this will not include sheltering for populations in surrounding counties or residents that are displaced due to widespread power outages. Table 4-4 lists the shelters identified by municipal officials during the planning process. The Erie County Department of Homeland Security and Emergency Services and American Red Cross maintain a separate list of facilities that could potentially serve as shelters.

Table 4-4. Shelters in Erie County

Municipality	Site Name	Address	Capacity	Accommodates Pets?	ADA Compliant?	Backup Power?	Types of Medical Services Provided	Other Services Provided	Identified by:
Akron (V)	Akron Fire Hall	1 Main Street Akron N.Y. 14001	275	Yes	No	Yes	Basic First Aid	Food, Heat, Air Conditioning, . Sleeping Area	Village
Alden (T)	Town Line Church	1159 Town Line Rd, Alden, NY	100	Unknown	Yes	Yes	First AID kit, AED	Food/ Beverage Service	Town
Alden (V)	Municipal Building	13336 Broadway	145	Yes	Yes	Yes	House fire and EMS Department	Full kitchen	Village
Alden (V)	Alden Station 2	11856 Broadway	75	Yes	Yes	Yes	House fire and EMS Dept	None	Village
Amherst (T)	Town of Amherst Senior Center	370 John James Audubon Parkway	100	Yes	Yes	Yes	Emergency medical	Town of Amherst Senior Center	Town
Angola (V)	MPB	22 Prospect	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Village
Angola (V)	Fire Station 2	151 S. Main	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Village
Angola (V)	JT Waugh School	100 High St.	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Village
Aurora (T)	Aurora Senior Center	101 King St., E. Aurora	100	No	Yes	Yes	None – local FD or EMT would be called	None	Town
Boston (T)	Town Hall	8500 Boston State Rd, Boston, NY	100	Yes	Yes	No	None	Need power generator, and showers. Not adequate space – addressed in project 001	Town
Cheektowaga (T)	Cheektowaga Senior Center	3349 Broadway	200	See Animal Control Plan	Partial	Yes	Emergency	Feeding	Town
Cheektowaga (T)	Alexander Bldg.	275 Alexander Avenue	1075	See Animal Control Plan	No	No	Emergency	None	Town
Cheektowaga (T)	Southline Fire Station	1049 French Road	150	See Animal Control Plan	Yes	Yes	Emergency	Feeding	Town
Clarence (T)	Senior Center	Thompson Road	150	No	Yes	Yes	Contact EMT	Food prep capable	Town
Clarence (T)	Senior High School	Main Street	300-500	No	Yes	Yes	Contact EMT	Food prep capable	Town
Colden (T)	Colden Elementary School	8263 Boston-Colden Road, Colden, NY	500	Yes	Yes	Yes	Provided by fire company	No	Town
Colden (T)	Colden Senior Center	8811 NY-240, Colden, NY	100	Yes	Yes	No – mitigation action	Various	No	Town
Concord (T)	Senior Center	Commerce Dr	100	-	Yes	Yes	No	Shelter	Town
Concord (T)	Erie County Fire Department	Genesee Rd	100	-	Unknown	No	No	Warming	Town
Concord (T)	Morton County Fire Department	Mortons Corners Rd	80	-	Unknown	No	No	Warming	Town
Collins (T)	Gowanda High School	Village	As needed	Optional	Yes	Yes	As Needed	Food	Town
Collins (T)	Gowanda Elementary School	Village	As needed	Optional	Yes	Yes	As needed	Food	Town
Collins (T)	Gowanda Fire Hall	230 Aldrich Street	As needed	Optional	Yes	Yes	As needed	Food	Town

Municipality	Site Name	Address	Capacity	Accommodates Pets?	ADA Compliant?	Backup Power?	Types of Medical Services Provided	Other Services Provided	Identified by:
Depew (V)	Senior Center	85 Manitou Street, Depew	25-50	Yes	Yes	Yes	Urgent Care	None	Village
East Aurora (V)	Senior Center	101 King Street	100	No	Yes	Yes	Unknown	None	Village
Eden (T)	Eden JR/SR HS	3000 Schoolview Rd Eden NY 14057	250	Yes	Yes	Yes	None	None	Town
Eden (T)	Eden Town Hall	2795 East Church Street Eden NY 14057	40	Yes	Yes	Yes	None	None	Town
Elma (T)	Iroquois HS	2111 Girdle Rd	100	Yes	Yes	Yes	Unknown	-	Town
Elma (T)	Senior Center	3007 Bowen Road	100	Yes	Yes	Yes	Unknown	-	Town
Elma (T)	Jamison Rd FC	1071 Jamison Rd	100	Yes	Yes	Unknown	Unknown	-	Town
Elma (T)	Blossom FC	1000 N. Blossom Rd	100	Yes	Yes	Yes	Unknown	-	Town
Evans (T)	Highland VFC	1 George Nablo, Derby	250	Y	Y	Y	Ambulance, Basic first aid	Fire/Rescue	Town
Evans (T)	N Evans VFC	6980 Versailles, Derby	150	Y	Y	Y	Basic first Aid	Fire/Rescue	Town
Evans (T)	Evans Center VFC	8298 Erie Road, Angola	50	Y	Y	Y	Ambulance – Basic First Aid	Fire/Rescue	Town
Evans (T)	Lake Erie Beach VFC	9483 Lake Shore, Angola	150	Y	Y	Y	Ambulance – Basic first Aid	Fire/Rescue	Town
Farnham (V)	Village Hall	Commercial Street	100	Yes	Yes	Yes	Fire/EMS	Kitchen/Generator	Village
Gowanda (V)	Gowanda High School	Village	As needed	Optional	Yes	Yes	As Needed	Food	Village
Gowanda (V)	Gowanda Elementary School	Village	As needed	Optional	Yes	Yes	As needed	Food	Village
Gowanda (V)	Gowanda Fire Hall	230 Aldrich Street	As needed	Optional	Yes	Yes	As needed	Food	Village
Grand Island (T)	Grand Island High	1100 Ransom Rd, Grand Island	unknown	No	Yes	No	School nurse	None	Town
Grand Island (T)	Grand Island Middle	1100 Ransom Rd, Grand Island	unknown	No	Yes	No	School nurse	None	Town
Grand Island (T)	Huth Road Elementary	1773 Huth Rd, Grand Island	unknown	No	Yes	No	School nurse	None	Town
Grand Island (T)	Kaegabein Elementary	1690 Love Rd, Grand Island	unknown	No	Yes	No	School nurse	None	Town
Grand Island (T)	Sidway School	2451 Baseline Rd, Grand Island	No	No	Yes	No	School nurse	None	Town
Hamburg (T)	Hamburg High School	Legion Drive	-	No	Yes	Yes	Fire department	Kitchen facilities, showers bathrooms	Town
Hamburg (T)	Hamburg Middle School	Division Street	-	No	Yes	Yes	Fire department	Kitchen facilities, showers bathrooms	Town
Hamburg (T)	Charlotte Avenue School	Charlotte Avenue	-	No	Yes	Yes	Fire department	Kitchen facilities, showers bathrooms	Town
Hamburg (T)	Union Pleasant Grade School	Pleasant Avenue	-	No	Yes	Yes	Fire department	Kitchen facilities, showers bathrooms	Town
Holland (T)	Community Center	3 Legion Dr	100	No	Yes	No	HFD EMT		Town
Holland (T)	Holland School	103 Canada St	500	No	Yes	Yes	HFD EMT		Town

Municipality	Site Name	Address	Capacity	Accommodates Pets?	ADA Compliant?	Backup Power?	Types of Medical Services Provided	Other Services Provided	Identified by:
Holland (T)	Town Hall	47 Pearl St	50	No	Yes	Yes	HFD EMT		Town
Kenmore (V)	Kenmore Community Center	135 Wilber; Kenmore, NY 14217	unknown	No	Yes	No	Kenmore	Kitchen on premises	Village
Kenmore (V)	Kenmore Middle School	155 Delaware Road, Kenmore, NY 14217	unknown	No	Yes	Yes	Kenmore	Kitchen on premises	Village
Lancaster (T)	Fire Hall	5423 Broadway, Lancaster, NY 14086	100	No	Yes	Yes	Immediate Care	None	Town
Lancaster (T)	Senior Center	100 Oxford Ave, Lancaster, NY 14086	200	No	Yes	Yes	Immediate Care	None	Town
Lancaster (V)	Village Hall	21 Central Ave #1, Lancaster, NY 14086	Unsure	Yes	Yes	No	None	None	Village
Marilla (T)	Marilla Fire Co.	1950 West Ave, Marilla, NY 14102	100	Yes	Yes	Yes	First Aid	Kitchen	Town
Marilla (T)	Marilla Primary School	11683 Bullis Rd, Marilla, NY 14102	500	Yes	Yes	Yes	First Aid	Kitchen	Town
Marilla (T)	Community Center	1810 Two Rod Road	100	Yes	Yes	Yes	First Aid	Kitchen	Town
Newstead (T)	Newstead Senior Center	5691 Cummings Road Akron, NY 14001	48	Yes	Yes	Yes	Basic First Aid	Food, heat, A.C., sleeping area	Town
Newstead (T)	Newstead Fire Hall Station #1	5691 Cummings Road Akron, NY 14001	250	Yes	Yes	Yes	Paramedic services by Twin City Ambulance	Food, Heat, AC, Sleeping Area	Town
Newstead (T)	Newstead Fire Hall Sta. #2	12012 Rapids Road, Akron, NY 14001	25	Yes	No	No	Basic First Aid	Warming Shelter	Town
North Collins (T)	Senior Center	Gowanda State Rd	100	No	Yes	No	None	Shelter/Kitchen	Town
North Collins (T)	Langford Fire Dept.	Langford Rd	125	No	Yes	Yes	EMT	Food/Shelter	Town
North Collins (T)	Town Hall	Gowanda State Rd	125	No	Yes	No	Sheriff/EMT	Shelter/Water	Town
Orchard Park (T)	Orchard Park Community Activity Center	4520 California Road	100	Yes, not at site, can utilize Dog Control Facility	Yes	No	None	Warming and cooling station only	Town
Orchard Park (T)	Orchard Park Middle School	60 S. Lincoln Ave	100	Yes, not at site, can utilize Dog Control Facility	Yes	Yes	None	Warming and cooling station only	Town
Orchard Park (V)	Orchard Park Community Activity Center	4520 California Road	100	Yes, not at site, can utilize Dog Control Facility	Yes	No	None	Warming and cooling station only	Village
Orchard Park (V)	Orchard Park Middle School	60 S. Lincoln Ave	100	Yes, not at site, can utilize Dog Control Facility	Yes	Yes	None	Warming and cooling station only	Village

Municipality	Site Name	Address	Capacity	Accommodates Pets?	ADA Compliant?	Backup Power?	Types of Medical Services Provided	Other Services Provided	Identified by:
Sardinia (T)	Town Hall	12320 Savage Road	TBD	No	Yes	Yes	First Responders/Red Cross	-	Town
Sardinia (T)	St. Jude's Roman Catholic Church	12800 Genesee Road	TBD	No	Yes	TBD	First Responders/Red Cross	-	Town
Sloan (V)	Piekarski Community Center	140 Halstead Avenue	75	Yes	Partial	Yes	First aid and EMS with local fire department	Short term shelter use (1-2 days)	Village
Tonawanda (C)	Tonawanda High School	600 Fletcher Street	500	No,	Yes	Yes	Local EMS and Hospitals in region.	2 Kitchens, Refrigerators, Freezers, Griddles, Ovens, Convection Ovens, Microwave Ovens, 2-way radios, 30 phone lines,	City
Tonawanda (C)	(ARC Approved)			Assistance Provided by SPCA				PA System, At times Govt surplus food on sight	City
Tonawanda (C)	Tonawanda Senior Center	35 Main St	60	No,	Yes	No	Local EMS and Hospitals in region	Small Kitchen	City
Tonawanda (C)	(ARC Approved)			Assistance Provided by SPCA					City
Tonawanda (C)	Tonawanda Youth Center (ARC Approved)	291 Kohler St	45	No, Assistance Provided by SPCA	Yes	No	Local EMS and Hospitals in region	Small Kitchen	City
Tonawanda (C)	Boys and Girls Club (ARC Approved)	325 Franklin St	150	No, Assistance Provided by SPCA	Yes	No	Local EMS and Hospitals in region	Kitchen, Steamer, Refrigerators, Freezers, 8 Burners, Max seating 250. PA system	City
Tonawanda (T)	Hoover School	249 Thorncliff	unknown	unknown	Yes	Yes	unknown	unknown	Town
Tonawanda (T)	Multiple Schools	Ken-Ton School District	unknown	unknown	Yes	Yes	unknown	unknown	Town
Wales (T)	Town Hall	12345 Big Tree Rd, Wales Center, NY 14169	50	Yes	Yes	Yes	None	None	Town
West Seneca (T)	Union Fire Co	1845 Union Rd West Seneca, NY 14224	100	Yes	Yes	Yes	Basic EMS & Paramedics as needed	Red Cross trailer on site.	Town

Note: ADA = Americans with Disabilities Act

Evacuation Routes

Section 24 of the New York State Executive Law-2B allows first responders to take actions necessary to protect public safety in the absence of an emergency declaration. This authority is often applied when immediate action is necessary to evacuate citizens from a hazardous or potentially unsafe area.

Erie County has identified I-90, I-190, U.S. 20, U.S. 20A, U.S. 62, and several state routes as evacuation routes. The primary roads and highways can also serve as evacuation routes for the county. The route used depends on the location of the incident. The county is fortunate to have a variety of well-connected arterial roadways throughout all regions, offering a variety of routing options. Figure 4-10 illustrates the major roadways in Erie County that would be utilized as evacuation routes in and out of the county in the event of an emergency that results in an evacuation.

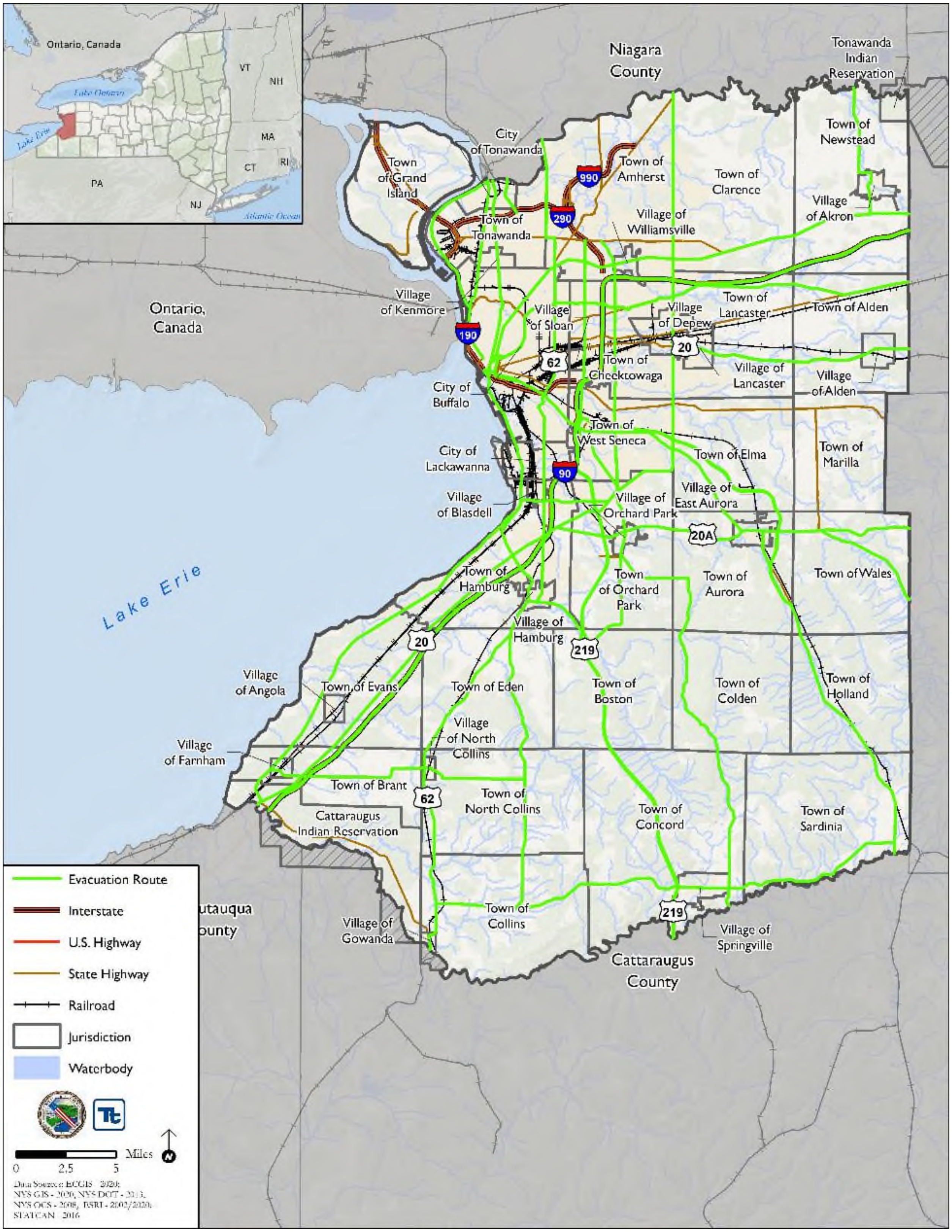
Other than evacuation plans based on the geographically specific risks, evacuations are conducted on an event-specific basis. Because of the variable nature of such events, the Erie County Department of Homeland Security and Emergency Services assists with the coordination and communication of evacuation routing for the county. County residents can enroll in NY-Alert, a program that allows residents to receive emergency-related information specific to their area. Alerts include severe weather warmings, significant highway closures, hazardous material spills, and other emergency conditions. Residents can receive alerts via text message, phone, email, or fax.

Responsibilities & Priorities

During evacuation, state and local personnel are responsible for clearing roadways of debris and making repairs. State responsibilities including clearing debris from impacted roadways and public property. Local responsibilities include removing debris to a storage/disposal site. Priorities for debris removal after an evacuation are as follows:

- First priority – clearing of transportation corridors to allow passage of emergency vehicles
- Second priority – clearing of transportation corridors and other property to allow utility crews access to damaged power lines and other utility infrastructure needing repair to allow for power restoration
- Third priority – other emergency-related needs, as identified by the affected local municipality or by state agencies, and as authorized by the State Coordinating Officer.

Figure 4-10. Evacuation Routes in Erie County



Long-Term Housing

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

1) FEMA floodplain (1- and 0.2 percent annual chance flood).
2) Wetlands (National Wetlands Inventory; National Land Cover Database)
3) Steep Slopes (Greater than 25% Slope)

The jurisdictional annexes provide maps of potential long-term housing locations in Erie County's municipalities. Developable land displayed on the figures represents the portion of each identified vacant parcels with greater than 50 percent of their land area outside the two above hazard areas.

4.6 CRITICAL FACILITIES

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

> ***Critical Facilities*** are those facilities considered critical to the health and welfare of the population and that are especially important following a hazard. As defined for this HMP, critical facilities include essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities.
>
> ***Essential facilities*** are a subset of critical facilities that include those facilities that are important to ensure a full recovery following the occurrence of a hazard event. For the county risk assessment, this category was defined to include police, fire, EMS, schools/colleges, shelters, senior facilities, and medical facilities.

A comprehensive inventory of critical facilities in Erie County was developed from various sources, including the Erie County Department of Homeland Security and Emergency Services and Department of Environment and Planning, and input from the Steering Committee and Planning Partnership. The inventory of critical facilities presented in this section represents the current state of this effort at the time of publication of the draft HMP and used for the risk assessment in Section 5 (Risk Assessment). The numbers and types of critical facilities and infrastructure identified for this plan are indicated in Appendix F.

4.6.1 Essential Facilities

This section provides information on emergency facilities, hospital and medical facilities, schools, shelters, and senior care and living facilities. For the purposes of this plan, emergency facilities include police, fire, emergency medical services (EMS), and emergency operations centers (EOC). Figure 4-11 shows the location of the facilities and a list of the critical facilities is provided in Appendix F (Critical Facilities).

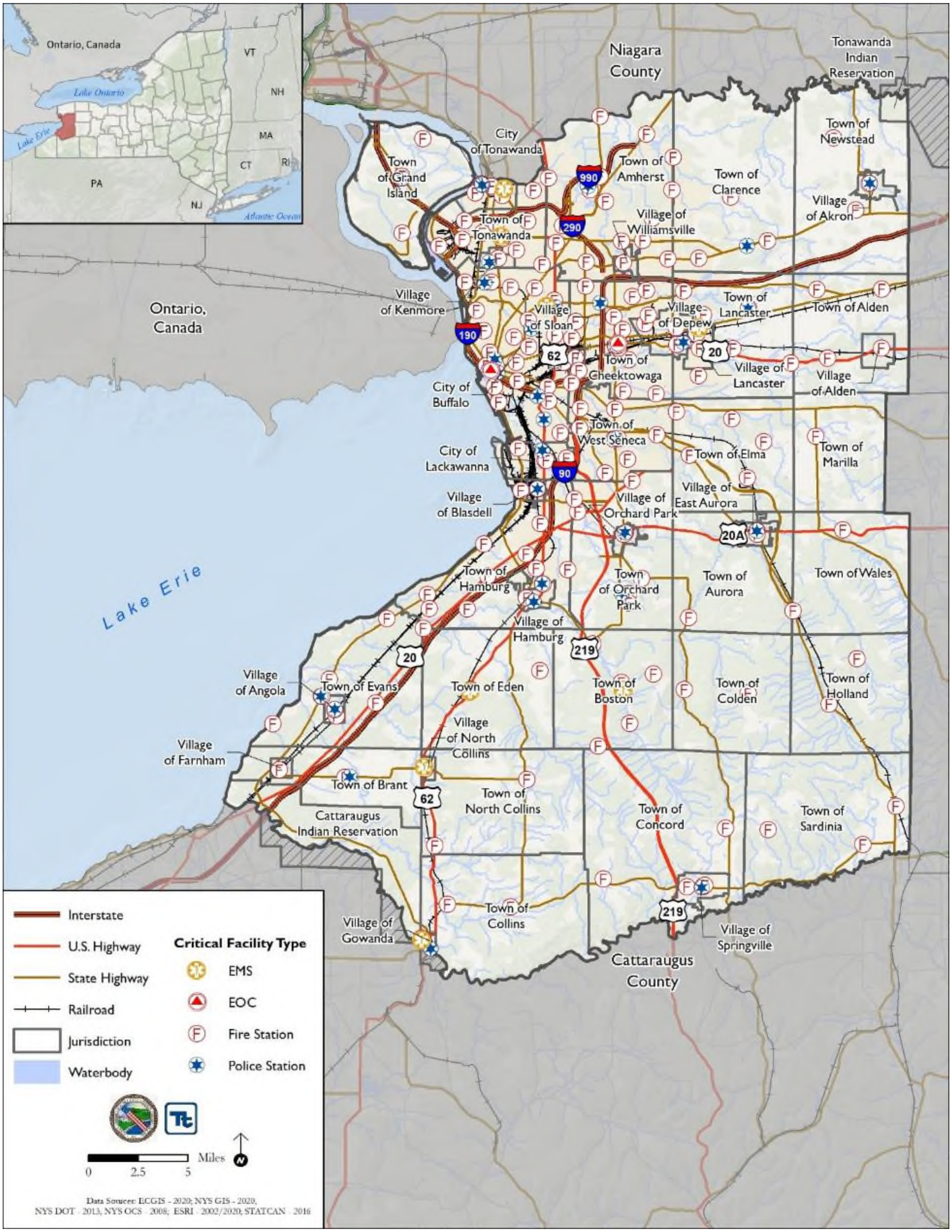
Emergency Facilities

The Erie County Department of Homeland Security and Emergency Services is responsible for coordinating the county's emergency planning and management, including coordination of fire service and emergency medical services, training of first responders, and the creation and maintenance of Comprehensive Emergency Management Plans. The Department works with county departments and other local, state, and federal agencies during an emergency to help protect lives and property, assist those injured, and to provide the rapid restoration of normal services. The Department maintains a countywide radio system consisting of over 3,000 mobile and portable radios, 14 base stations and several radio towers. The Department's specific programs include Fire Safety, Emergency Medical Services, and Homeland Security/Emergency Management/Disaster Preparedness.

- Fire Safety The Fire Safety Division operates from the Emergency Services Training & Operations Center in Cheektowaga, NY. The Fire Safety Office coordinates the recruitment, training and mutual aid operations of our county's 97 fire departments to assist them in serving the needs of the residents, businesses and visitors to their communities.
- Emergency Management The Civil Defense/Disaster Preparedness Division executes the County plan for civil defense and disaster relief before, during and after any type of natural, man-made disaster or war time situation. The activities of this Division are mandated by State Law, with the County maintaining control over certain levels of services.
- Emergency medical services Under the direction of the EMS Division, Medical Emergency Radio System (MERS) Control serves as the County's emergency dispatch center, dispatching ambulances for the City of Buffalo, NYS Thruway and the Buffalo Niagara International Airport (B.N.I.A.). Additionally, MERS Control coordinates the countywide ambulance-to-hospital MERS. MERS Control also acts as the after-hours answering point for the Erie County Department of Emergency Services and the Erie County Department of Health (ECDOH).
- The Emergency Services Communications division COML supports Fire, EMS, Law Enforcement and other public safety related agencies with the design, configuration, repair, installation and programming of portable, mobile and base station radio systems and all of the associated hardware, software, towers, antennas and accessories. These systems encompass 400MHZ two-radio communications and our recent deployment of a new First Responder Alerting Network (www.iamresponding.com) as a secondary means of notification with more than 10,000 users in the county.

The Erie County Sheriff's Office in headquartered in downtown Buffalo , located in the Town of Little Valley, is the primary law enforcement agency in the county, and consists of several main operating Divisions, including the Administrative Civil Enforcement, Jail Management, Professional Standards, Special Services, Reserve and Policing divisions. In addition to the Sheriff's Department, several municipalities have their own police departments. The New York State Police also provide services within the county. There are seven Sheriff substations within the county.

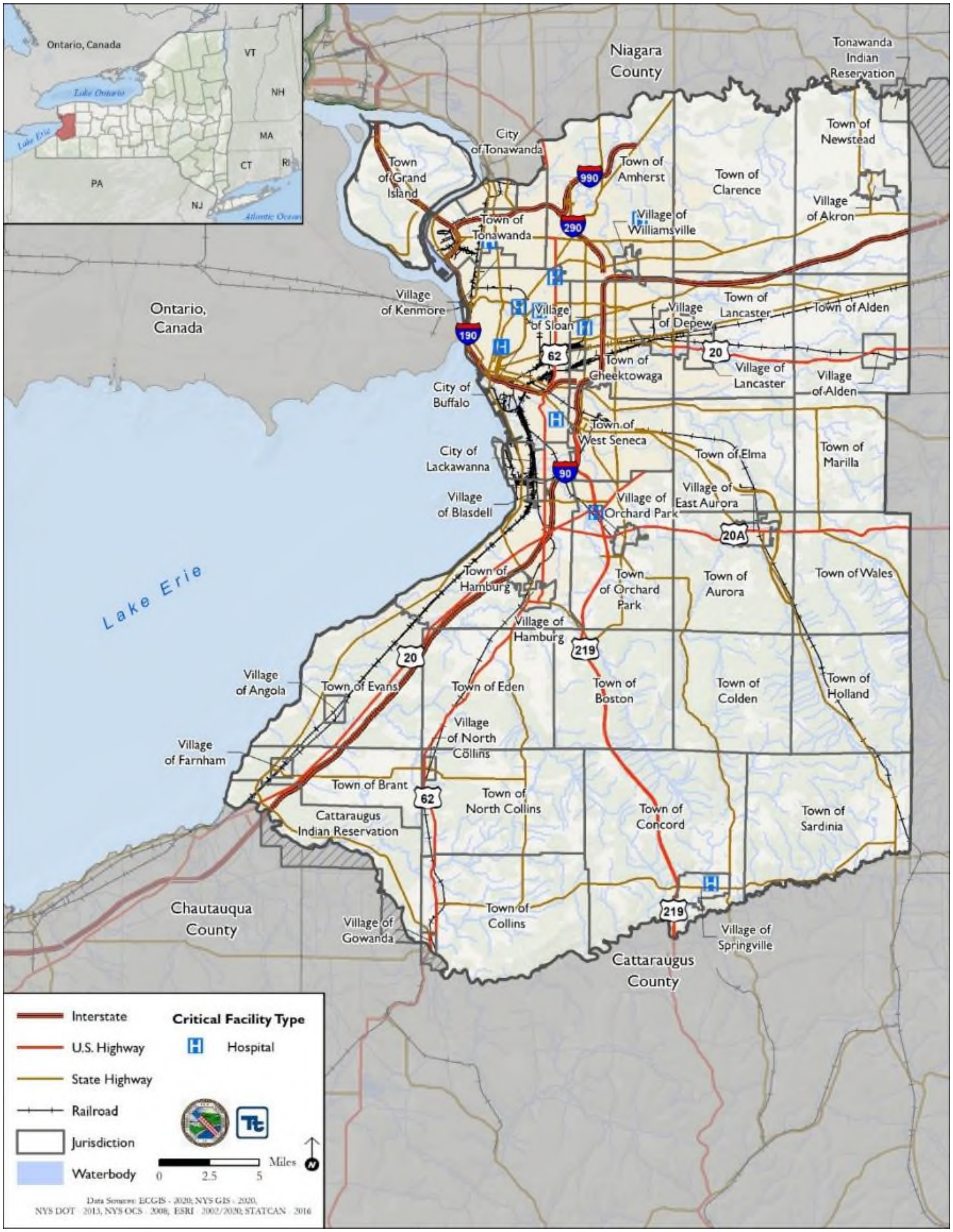
Figure 4-11. Emergency Facilities in Erie County



Hospitals and Medical Facilities

There are 11 major hospitals and medical facilities located within Erie County, six of which are located in the City of Buffalo. The other five are located in Amherst, Cheektowaga, Orchard Park, Springville and Tonawanda.

Figure 4-12. Hospitals in Erie County

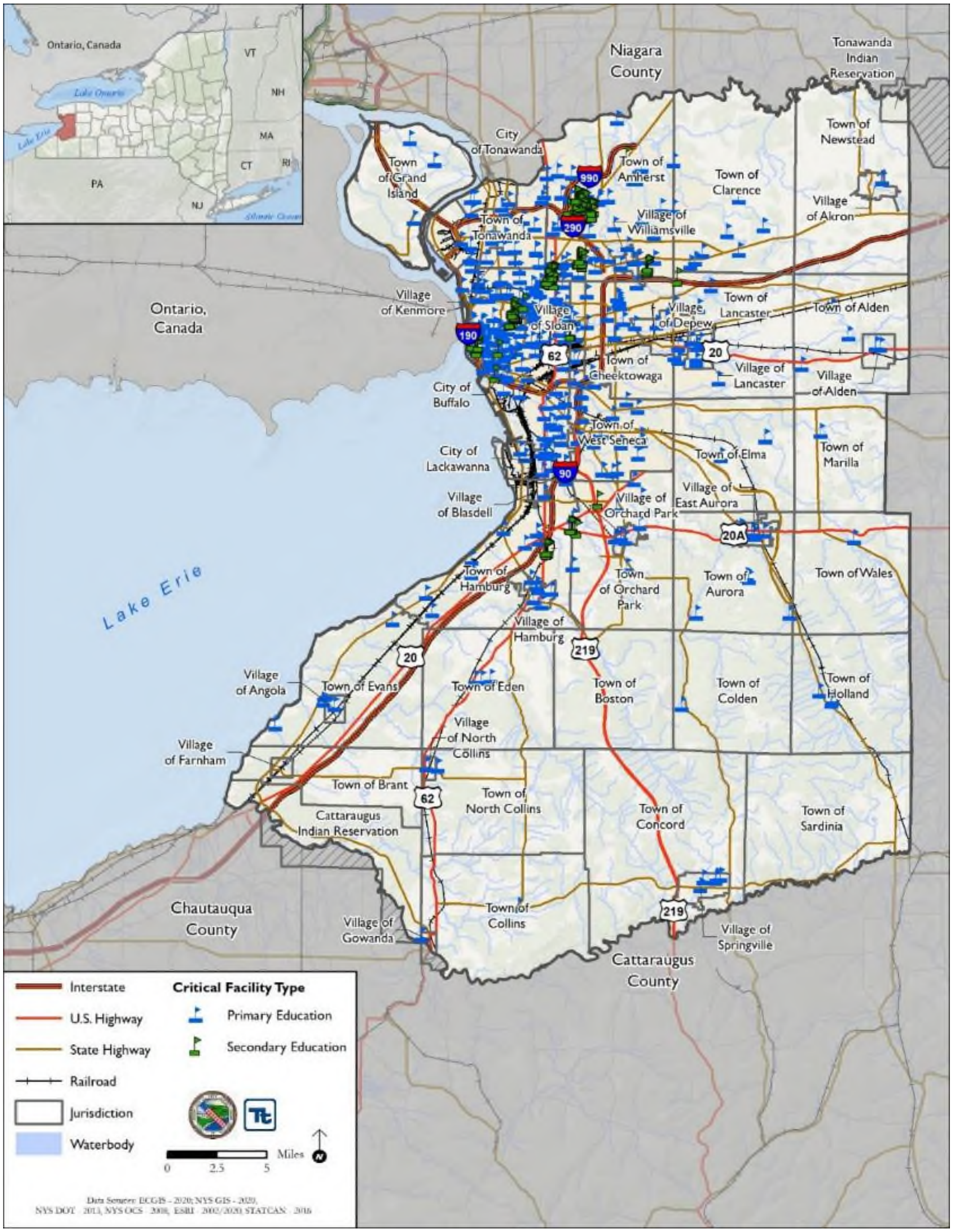


Schools

Erie County is home to 32 public school districts. Erie Community College, SUNY Buffalo, Buffalo State College, Canisius College and Daemon College are some of the institutions within the county.

In times of need, schools can function as shelters and are an important resource to the community. Figure 4-13 shows the location of schools within the county.

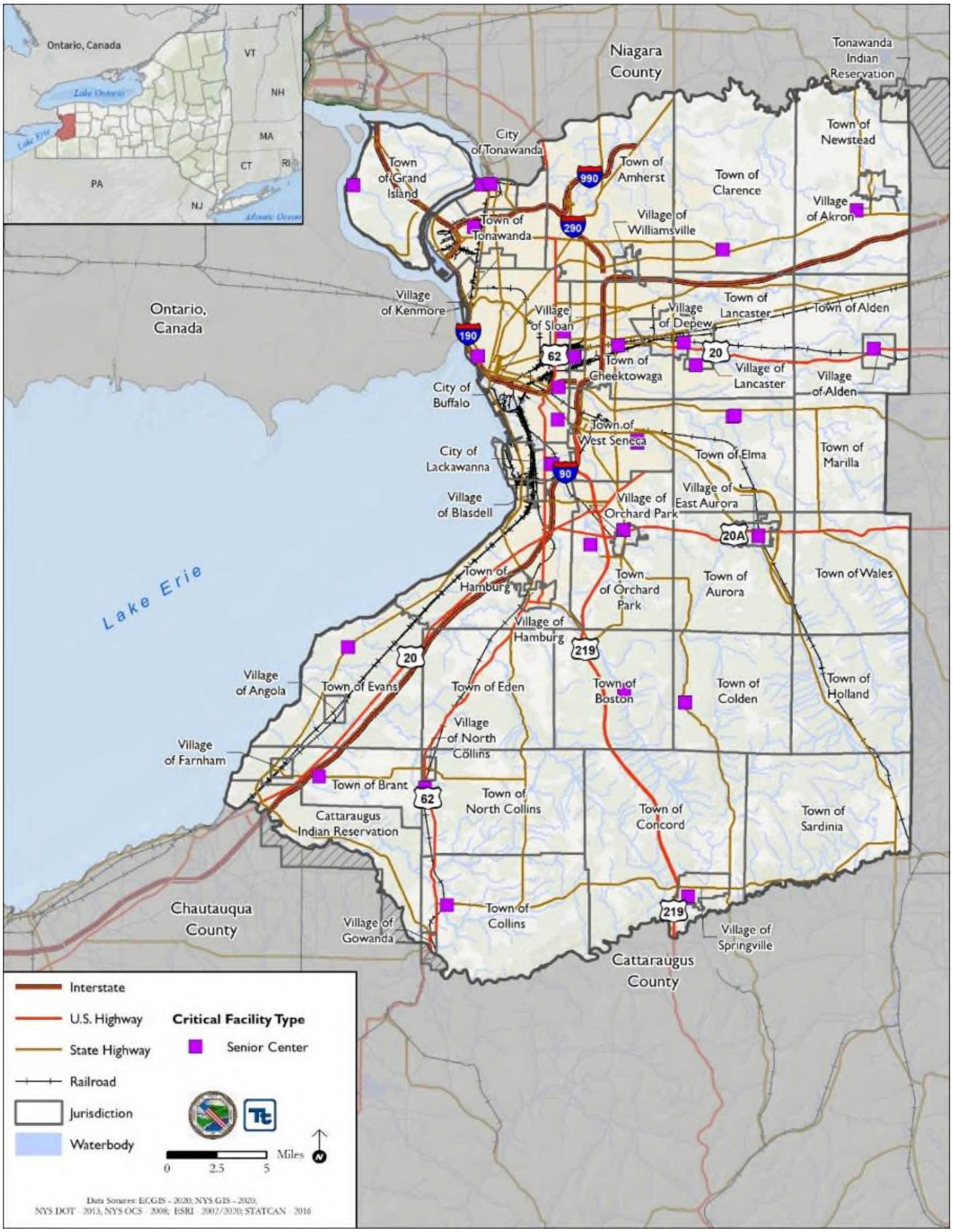
Figure 4-13. School Buildings within Erie County



Senior Care and Living Facilities

Erie County has 37 senior care facilities. The 2015-2019 American Community Survey 5-Year Estimates identified 161,744 people over the age of 65 living within Erie County. Figure 4-14 shows the location of senior care facilities within the county.

Figure 4-14. Senior Facilities in Erie County



4.6.2 Transportation Systems

Erie County's transportation network offers residents and employees various options for transportation throughout the county and the region. Three interstate highways traverse the county; Interstate 90, 190, 290 and 990.

Highway, Roadways and Associated Systems

There are 18 state routes that run through the county. The county's Highway Department maintains county roads within all towns. Nearly 3,000 miles of roadways in Erie County are owned by individual municipalities, with most of them identified as being local roadways. The county owns approximately 438 miles of the roads in the county. Transportation features are shown in Figure 4-15.

Airports and Heliports

Air passenger service is provided by the five airports in Erie County. The Greater Buffalo International Airport is by far the largest and best resourced. There are smaller airports in Cheektowaga, Hamburg, Lancater, Newstead and the Buffalo Airpark, which are paved or have grass runways and are most suitable for small private planes, gliders, turboprop, and jet air craft.

Bus and Other Transit Facilities

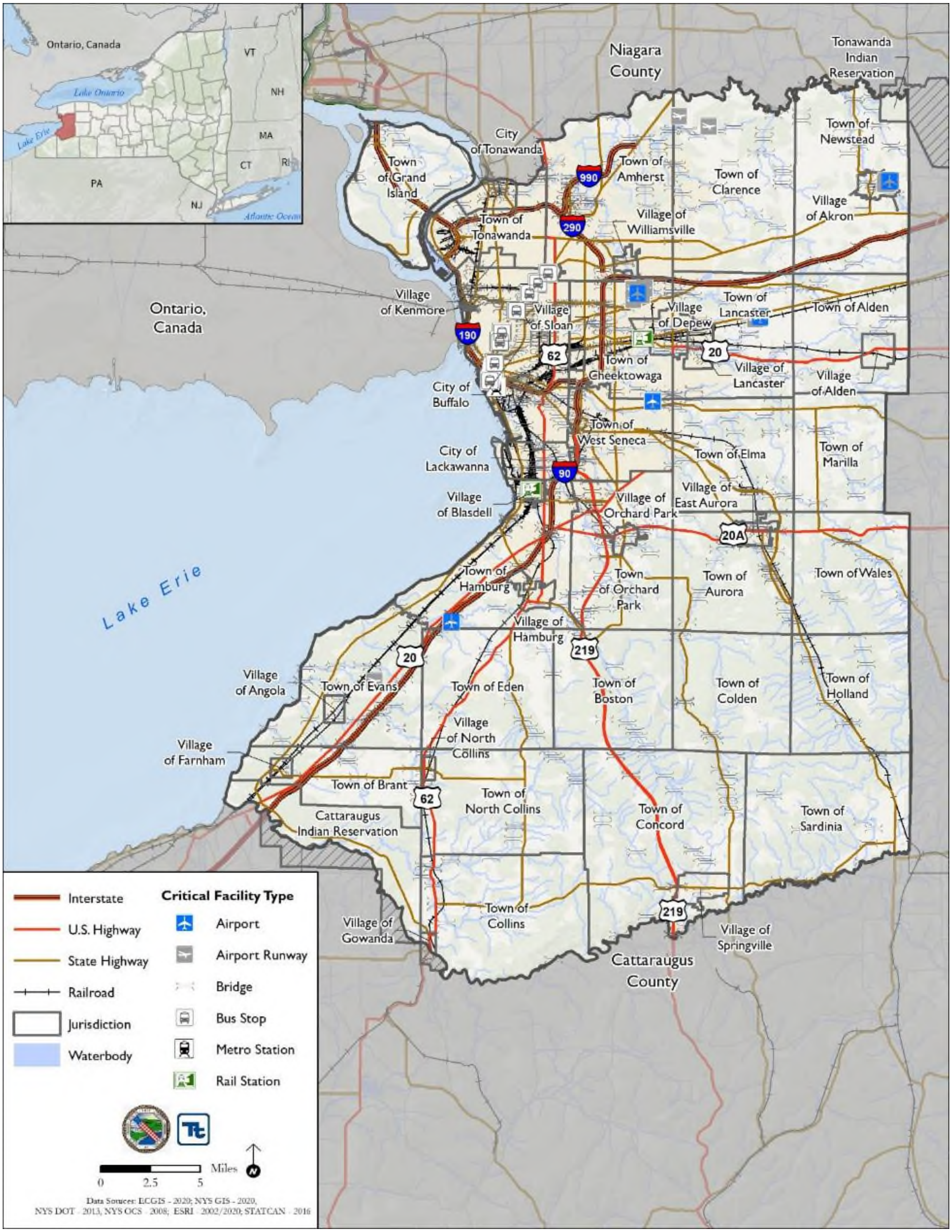
The Niagara Frontier Transportation Authority (NFTA) operates the public transit system serving Erie County and linking it to Niagara County. The system has over 60 bus routes covering cities and suburbs, and the Metro Rail runs six miles along Main Street in Buffalo. Most routes in the City of Buffalo offer frequent service during peak travel hours, but wait times are higher in outer suburbs where lower density and demand limits the financial feasibility of running buses frequently. NFTA also provides curb-to-curb paratransit services for passengers with disabilities. Other providers offer public transportation to and from rural areas and nearby counties, like the Seneca Transit System,

Rideshare services are also present in the county, including Uber and Lyft, although service will be dependent on driver location and availability.

Railroad Facilities

Erie County is served by Amtrak, the national passenger service. Three rail freight companies serve Erie County: the Norfolk Southern, the Buffalo Pittsburgh Railroad and the Buffalo Pittsburgh Railroad. (NYSDOT 2021)

Figure 4-15. Transportation Features in Erie County



4.6.3 Lifeline Utility Systems

This section presents data and information on lifeline utility systems. Lifelines include utility services and infrastructure that provide water, power, and other necessary services to residents. Because of heightened security concerns, some location information for lifelines is not provided in this HMP, although the number of facilities and their general location are considered (as data are available). Additionally, because the majority of power supply lines are privately held, this information is generally difficult to obtain and is not for public release. However, consideration of the utilities in the area is presented below to support the risk assessment in Section 5 (Risk Assessment).

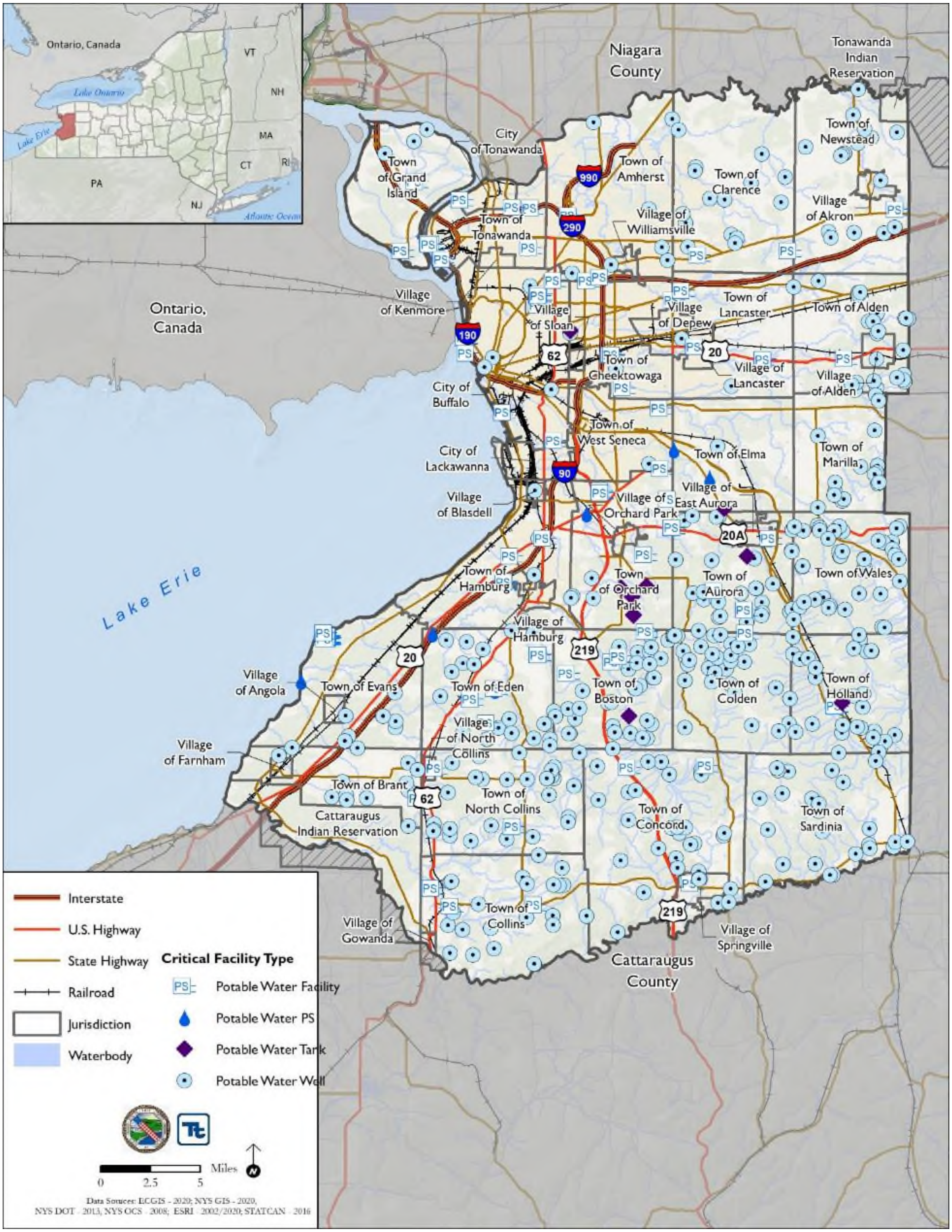
Potable Water

Because of the rural nature of the county, the most common sources of potable water within Erie County are municipal and private sources. Private sources of water include drilled wells, driven point wells, and springs. Municipal water supplies (provided by towns and cities) include community water systems, noncommunity water systems, non-transient noncommunity water systems, and water systems regulated as a condition of a "Permit to Operate" issued by the Department of Health. The Erie County Water Authority is responsible for ensuring compliance with treatment, reporting, and water quality standards for all public water systems.

The NYS DEC Water Well Information database began documenting potable water wells beginning in 2000, and currently reports 386 new wells drilled within the county since that date.

Figure 4-16 identifies potable water facilities in Erie County.

Figure 4-16. Potable Water Facilities in Erie County

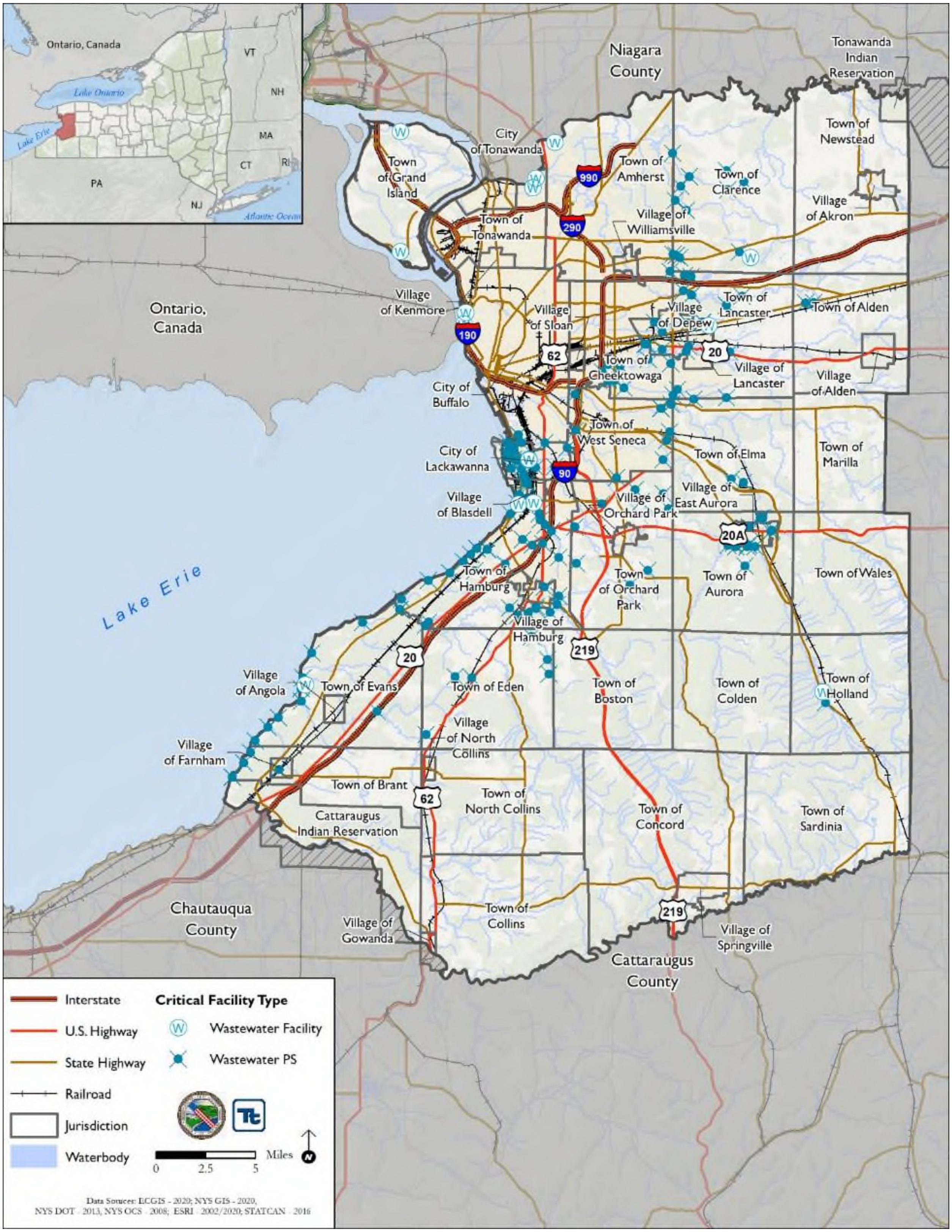


Wastewater Facilities

Municipal wastewater treatment services are provided by wastewater treatment plants, wastewater treatment facilities, and sewage treatment plants. Private wastewater treatment within Erie County includes septic systems and sand filters. Where municipal sewage treatment is not available, on-site septic systems are used. Soil quality in the county is variable, resulting in many parts of the county being unsuitable for on-site wastewater treatment. Undersized or unmaintained on-site septic systems can be an issue, particularly in the drinking watersheds, where exposure and runoff can impair water quality.

During the planning process, the Steering Committee and Planning Partnership identified 16 wastewater treatment facilities in Erie County. Additionally, 187 wastewater pump stations were identified. These facilities and pump stations are displayed in Figure 4-17.

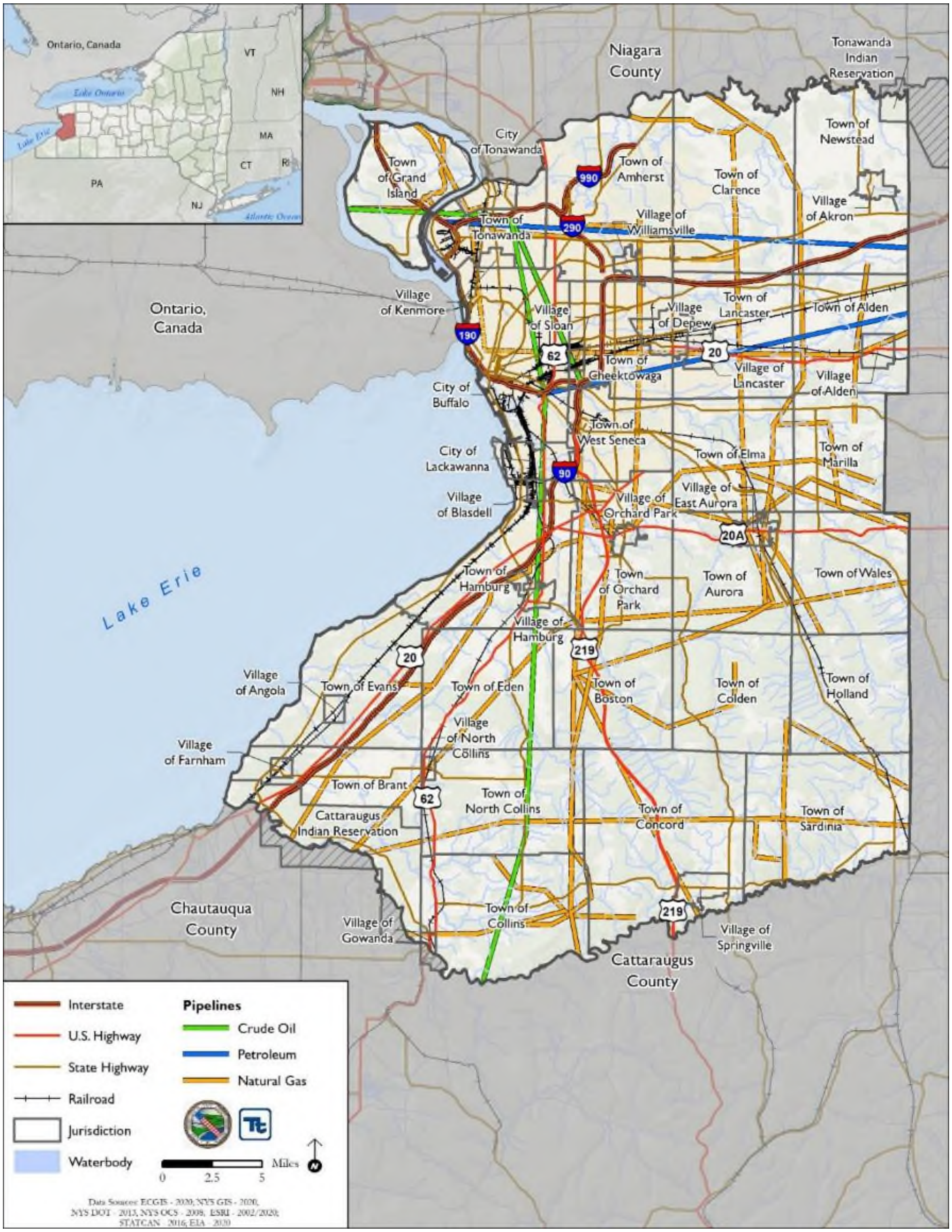
Figure 4-17. Wastewater Facilities in Erie County



Energy Resources

Gas and oil are transmitted through the County primarily by National Fuel Gas Distribution Company, Tennessee Gas, and Empire Pipeline Company. Numerous natural gas, petroleum, and crude oil pipelines cross the county. Figure 4-18 shows the location of pipelines in Erie County.

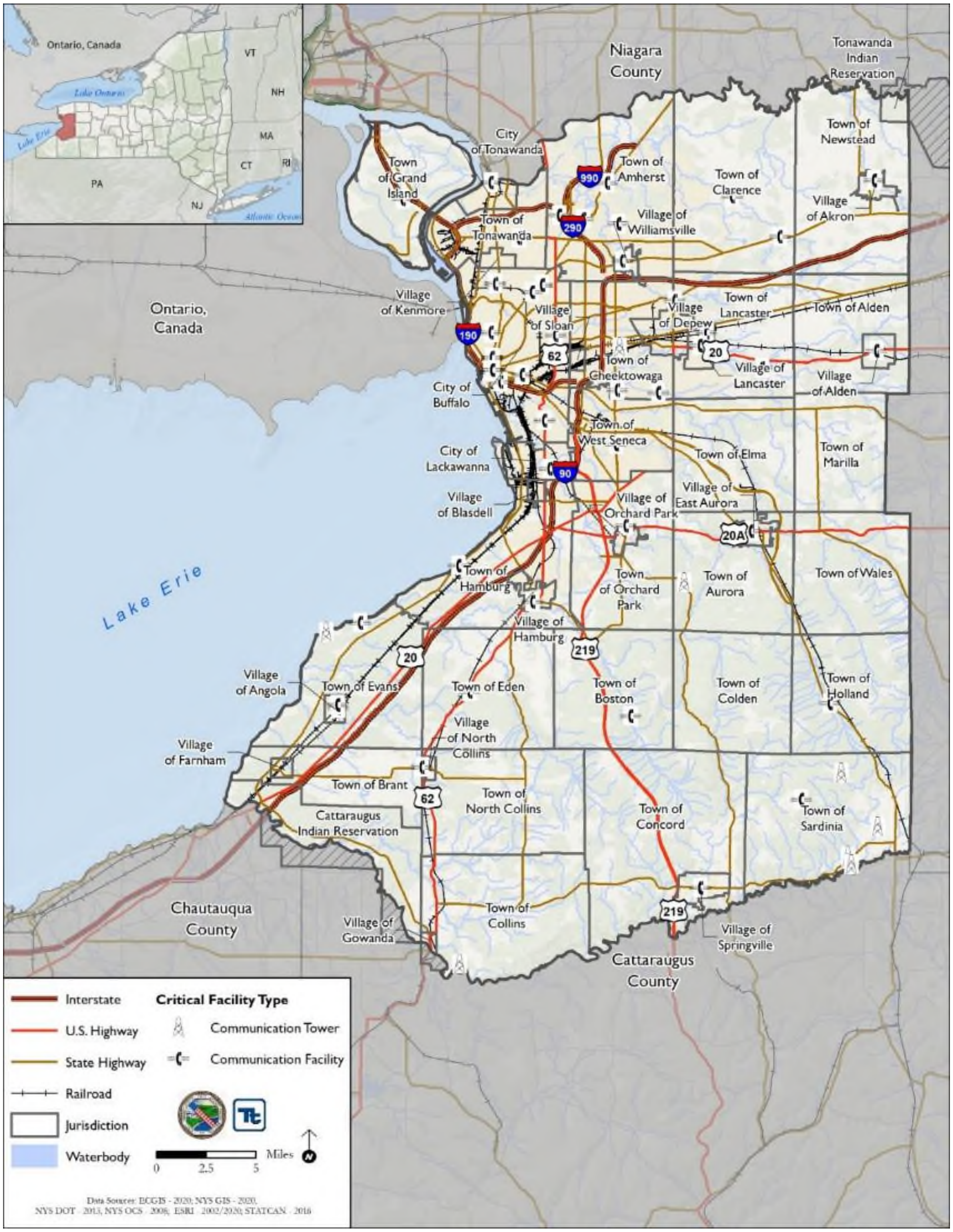
Figure 4-18. Pipelines in Erie County



Communications

Erie County is served by a variety of communications systems, including traditional land line and cellular service provided by multiple companies, such as Verizon, AT&T, and Sprint. In addition to land line, fiber optic, and cellular communications systems, Erie County has an extensive radio communications network that is utilized by emergency services agencies, hospitals, law enforcement, public works, transportation, and other supporting organizations. Communication facilities within Erie County are shown in Figure 4-19.

Figure 4-19. Communication Facilities within Erie County



4.6.4 High-Potential Loss Facilities

High-potential loss facilities include dams, levees, hazardous materials (HAZMAT) facilities, nuclear power plants, and military installations. Dams and levees are discussed below.

HAZMAT Facilities

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

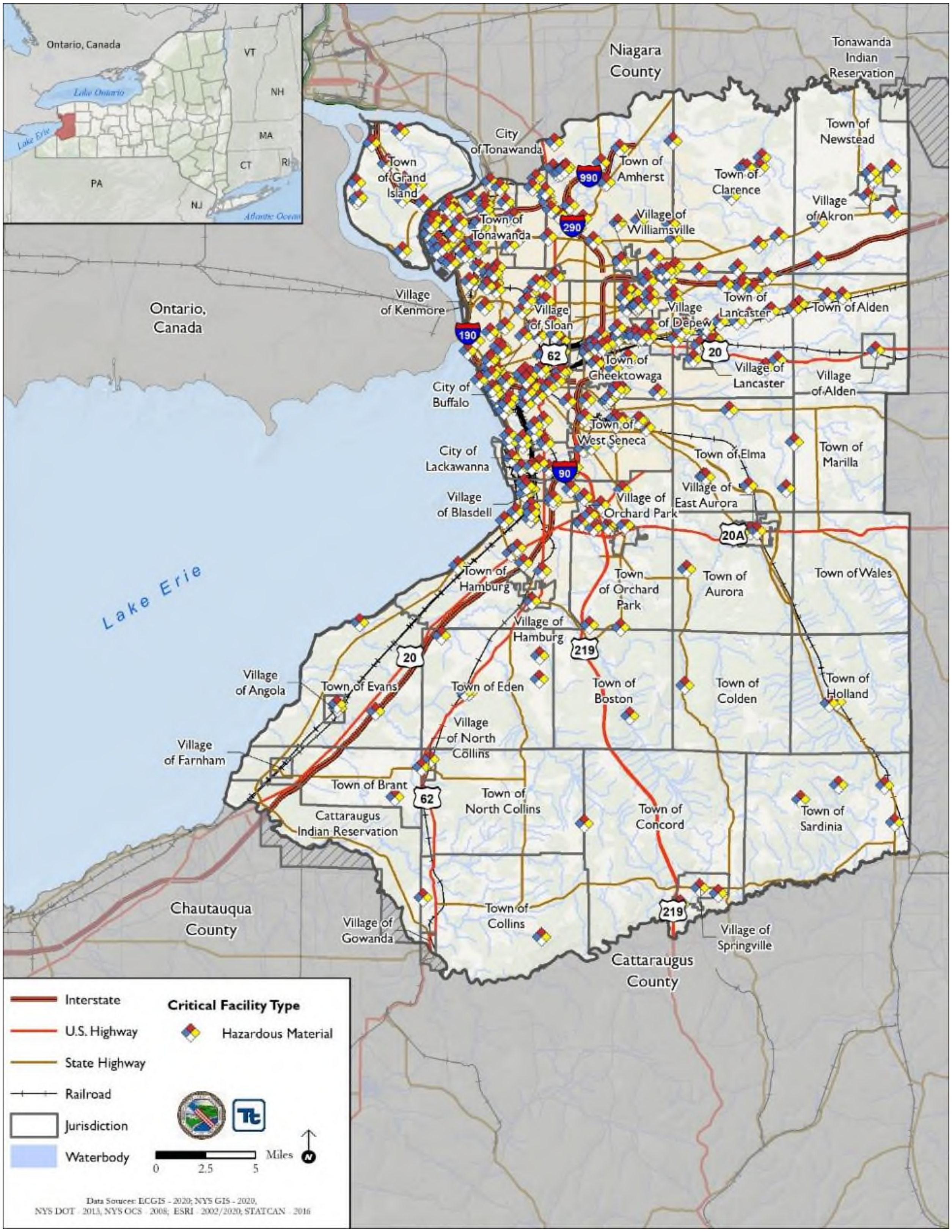
Abandoned hazardous waste sites placed on the federal NPL include those that the EPA has determined present “a significant risk to human health or the environment,” with the sites being eligible for remediation under the Superfund Trust Fund Program. As of 2020, Erie County contains two hazardous sites in the Federal Superfund Program that are included on the NPL (CERCLIS 2020).

Superfund sites are contaminated locations, requiring a long-term response to clean up hazardous materials; NPL sites are included. The EPA Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) (Superfund) Public Access Database (CPAD) reports currently three archived Superfund site are located in Erie County (CERCLIS 2020). An archived Superfund site is a site with no further interest under the Federal Superfund Program based on available information and that is no longer part of the CERCLIS inventory.

In addition to the hazardous waste sites, there are numerous hazardous facilities in Erie County cataloged by the NYSDEC’s Bulk Storage Program Database. The Bulk Storage Program includes three types of facilities; Petroleum Bulk Storage (PBS), Major Oil Storage Facilities (MOSF), and Chemical Bulk Storage (CBS). Registration with NYSDEC is mandatory for all PBS facilities with a total storage capacity of 1,100 gallons or more; all CBS underground tanks and all stationary aboveground tanks with a capacity of 185 gallons or more; and all MOSF sites storing more than 400,000 gallons of petroleum products. As of March 2021, 2,904 sites are listed in the NYSDEC’s Bulk Storage Program Database in Erie County, New York (New York State Department of Environmental Conservation [NYSDEC] 2021).

Figure 4-20 identifies HAZMAT facilities identified by Erie County.

Figure 4-20. HAZMAT Facilities within Erie County



Dams and Levees

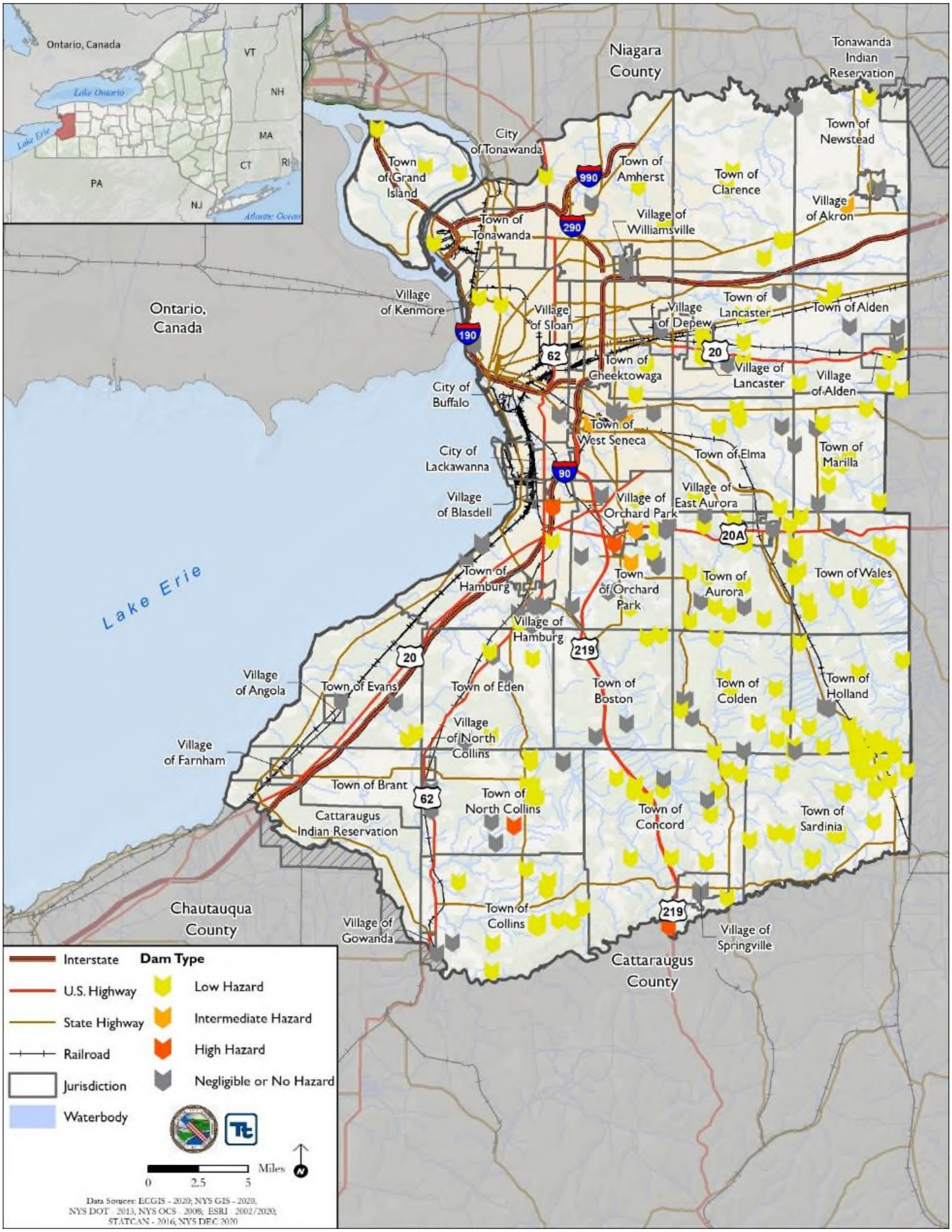
Dams

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

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

The New York State Inventory of Dams, identifies 164 dams in Erie County: 164 low hazard, 5 intermediate hazard, 4 high hazard, 73 negligible or no hazard classification (NYSDEC, 2020). Figure 4-21 shows dam locations in Erie County.

Figure 4-21. Dam Locations in Erie County



Levees

Nine accredited levee systems are present within Erie County. These were constructed by the United State Army Corps of Engineers and area operated and maintained by the New York State Department of Environmental Conservation. The locations of these levee systems are displayed in Figure 4-22.

The Blasdell Creek Left Bank levee system protects a population of 192 people, 82 structures and an estimated property value of $30,310,075.74

The Cayuga Creek-Cheektowaga levee system is located on the right bank of Cayuga Creek in the Town of Cheektowaga, NY. It extends from the Union Road Bridge to 1,600 feet upstream of the bridge. The total levee length is 0.28 miles, with an average height of six feet and a protected Leveed Area of 35.2 acres. The levee system, including channel, has prevented greater than an estimated $7,153,000 of flood damages since completion.

The Cayuga Creek-Lancaster-Left Bank levee system is located on the left bank of Cayuga Creek in the Village of Lancaster, NY. It extends from to Lake Ave. to Penora St. in the Village of Depew, NY. The levee system total length is 1 mile, average height is 8 feet and the leveed area is 64 acres. A flood in the area behind the level could impact approximately 447 people, 207 commercial and residential structures, and could cause an estimated $ $75,987,510.00million in flood-related damage (USACE, 2020).

Cayuga Creek - Lancaster - Right Bank - Legion Field The levee system is located on the right bank (looking downstream) of Cayuga Creek in the Village of Lancaster, NY. It extends from Park Blvd. to the Broadway bridge in the Village of Lancaster. The levee system is 0.37 miles long, with an average height of eight feet and a leveed area of 23.7 acres. A flood in the area behind the level could impact approximately 184 people, 88 commercial and residential structures, and could cause an estimated $ $25,310,670.00 in flood-related damage (USACE, 2020).

Cayuga Creek - Lancaster - Right Bank - St. Mary's The levee system is located on the right bank (looking downstream) of Cayuga Creek in the Village of Lancaster, NY. It extends from St. Mary’s St. at the water tower to St. Mary’s St. west of the cemetery. The levee system is 0.42 miles long, with an average height of six feet and a leveed area of 30 acres. A flood in the area behind the level could impact approximately 56 people, 24 commercial and residential structures, and could cause an estimated $6,689,480.00 in flood-related damage (USACE, 2020).

Ellicott Creek-Amherst levee system. The levee system is located on the right bank (looking downstream) of Ellicott Creek in the Town of Amherst, NY. It extends from the Hidden Creek Ct. residential community to the Maple Rd. bridge. The levee system is 0.21 miles in length, with an average of three feet height and a leveed area of 11.5 acres. A flood in the area behind the level could impact approximately 55 people, 14 commercial and residential structures, and could cause an estimated $4,579,550.00 in flood-related damage (USACE, 2020).

Scajaquada Creek - Cheektowaga - Main Stem The levee system is located on the left bank of Scajaquada Creek in the Town of Cheektowaga, NY. It extends from downstream of Central Blvd. to upstream of Harlem Rd. The levee system is 0.44 miles long, with an average height of 3.5 feet and a leveed area of 70.4 acres. A flood in the area behind the level could impact approximately 427 people, 202 commercial and residential structures, and could cause an estimated $58,203,900.00 in flood-related damage (USACE, 2020).

Scajaquada Creek - Cheektowaga – Tributary T-3 The levee system is located on the right bank (looking downstream) of Tributary T-3 in the Town of Cheektowaga, NY. It extends from the downstream limit of Tributary T-2A to George Urban Blvd. The levee system total length is 0.36 miles, with an average height of 3.5 feet and a leveed area of 26.9 acres. A flood in the area behind the level could impact approximately 380 people, 132 commercial and residential structures, and could cause an estimated $12,940,760.00 in flood-related damage

(USACE, 2020).

Scajaquada Creek - Cheektowaga – Tributary 3B The levee system is located on the right bank of Tributary T-3B in the Town of Cheektowaga, NY. It extends between Dick Rd. and Union Rd. The levee system is 0.18 miles long, with an average height of 2.5 feet and a leveed area of 22.4 acres. A flood in the area behind the level could impact approximately 122 people, 52 commercial and residential structures, and could cause an estimated $13,348,750.00 in flood-related damage (USACE, 2020).

Figure 4-22. Levee System Locations in Erie County

Source: USACE, 2021

SECTION 5 . RISK ASSESSMENT

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

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

This section presents the Erie County risk assessment and is outlined as follows:

- Methodology and tools used to conduct the risk assessment
- Identification of hazards of concern that impact Erie County
- Hazards of concern profiles and vulnerability assessment
- Hazard ranking

5.1 METHODOLOGY AND TOOLS

The Erie County risk assessment was updated using the following best-available information:

- A new building stock inventory was generated using Microsoft's 2018 building footprints, 2020 RSMeans cost adjustment values, and 2020 tax assessor and parcel data.
- 2015-2019 American Community Survey 5-year Population Estimates were utilized.
- A critical facility was generated and reviewed by the Planning Partnership and county jurisdictions.
- Lifelines were identified in the critical facility inventory to align with Federal Emergency Management Agency's (FEMA) lifeline definition.
- Hazards-U.S. (Hazus) was used to estimate potential impacts to the flood, wind, and seismic hazards.
- Best-available hazard data were used, as described in this section.

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

5.1.1 Asset Inventories

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

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

Population

Total population statistics from the 2015-2019 American Community Survey (ACS) 5-year estimate were used to estimate the exposure and potential impacts to the county's population in place of the 2010 U.S. Census block estimates. To determine population statistics for village and towns, village population totals were subtracted from the total town population. Where villages were split between towns and counties, the percentage of the geographic area of the village within each town and county was calculated and applied to the total population to estimate the population in the village within Erie County. Population counts at the jurisdictional level were averaged among the residential structures in the county to estimate the population at the structure level. This estimate provides a more precise distribution of population across the county compared to only using the Census block or Census tract boundaries. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate for planning purposes.

FEMA's Hazus program was used to model estimated potential losses to flood, seismic and wind hazards; as discussed further later in this section. Hazus still contains 2010 U.S. Census data and was used to estimate sheltering and injuries as part of the hazard analysis.

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

Buildings

A custom general building stock was created countywide. The general building stock was updated countywide with a custom-building inventory using the 2018 Microsoft building stock inventory data set. The building inventory attributes were updated using parcel tax assessor information provided by Erie County GIS. Attributes provided in the associated files were used to further define each structure, such as year built, number of stories, basement type, occupancy class, and square footage. The centroid of each building footprint was used to estimate the building location. Structural and content replacement cost values (RCV) were calculated for each building using the available assessor data, the building footprint, and RSMeans 2020 values. The analysis used a location factor associated by location zip-code, which produced location factors of 1.01 and 1.05 for residential and non-residential occupancy classes, respectively. RCV is the current cost of returning an asset to its pre-damaged condition using present-day cost of labor and materials. Total RCV consists of both the structural cost to replace a building and the estimate value of contents of a building. The occupancy classes available in Hazus were condensed into the categories of residential, commercial, industrial, agricultural, religious, governmental, and educational to facilitate analysis and presentation of results. Residential loss estimates addressed both multi-family and single-family dwellings.

Critical Facilities and Lifelines

A critical facility inventory, which includes essential facilities, utilities, transportation features and user-defined facilities, was created by the Planning Partnership and county jurisdictions. The development involved a review for accuracy, additions or deletions of new or moved critical assets, identification of backup power for each asset (if known) and whether the critical facility is considered a lifeline in accordance with FEMA's definition (refer to Appendix F, Critical Facilities). To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

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

Environment and Land Use Area

National land use land cover data created by the U.S. Geological Survey (USGS) in 2016 was used to assess land use characteristics of the county. This dataset was converted from a raster to a vector polygon, which informed spatial areas of residential, non-residential, and natural land use areas. Residential land-use types incorporated all classes listed as developed land use, except for those identified as vacant (i.e., Developed – Low Intensity, Developed – Medium Intensity, Developed – High Intensity). Non-residential land-use types included all other classes. Within non-residential land-use types, natural land areas were extracted into a new category, which includes barren land, forest, water, and wetlands. The natural land areas were referenced to calculate the total acres of natural land area exposed to hazard areas of concern.

New Development

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

New development was identified as (1) anticipated in the next 5 years and (2) recently developed over the last 5 years. An exposure analysis was conducted in geographic information system (GIS) to determine hazard exposure to these development sites. Projects built on multiple parcels were assessed as one unit. If one parcel identified within the project boundary intersected a spatial hazard layer, the entire project was considered "exposed" to the hazard area of concern.

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

5.1.2 Methodology

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

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

Table 5.1-1. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities	New Development
Coastal Erosion	E	E	E	E
Cyber Security	Q	Q	Q	Q
Earthquake	E, H	E, H	E, H	E
Expansive Soils	E	E	E	E
Extreme Temperature	Q	Q	Q	Q
Flood	E, H	E, H	E, H	E
Hazmat	E	E	E	E
Landslide	E	E	E	E
Pandemic	Q	Q	Q	Q
Severe Storm	H	H	H	Q
Severe Winter Storm	Q	Q	Q	Q
Utility Failure	Q	Q	Q	Q
Wildfire	E	E	E	E

Notes: E = Exposure analysis; H = Hazus analysis; Q = Qualitative analysis

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

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

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

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

Table 5.1-2. Summary of Hazus Analysis Levels

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

Coastal Erosion

Best-available data were used to assess Erie County's vulnerability to coastal erosion. The New York State Department of Environmental Conservation (NYS DEC) has paper maps from 1988 that show the Coastal Erosion Hazard Area (CEHA) of the Towns of Bryant, Evans, and Hamburg. Although dated, the NYS DEC commissioner is tasked to review the boundaries of these hazard areas every 10 years and after major coastal storms and to revise the maps if the CEHA boundary changed by 25 feet or more. These CEHA buffers were digitized for the available towns and exposure was analyzed. The City of Tonawanda, City of Lackawanna, City of Buffalo, Town of Grand Island, and Town of Tonawanda also sit along the shore of Lake Erie, but do not have CEHA maps available.

Cyber Security

All of Erie County is exposed to cyber security attack events. A qualitative assessment was conducted to assess Erie County's risk to cyber security attacks. Information from the U.S. Department of Homeland Security, FEMA, and NYS Department of Financial Services were referenced to review the county's overall risk.

Earthquake

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

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

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

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

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

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

Expansive Soils

Soils data from the U.S. Department of Agriculture (USDA) and Natural Resources Conservation Service (NRCS) were used to determine the expansive soils hazard areas in Erie County. Soil classes that have a linear extensibility, or the shrink-swell potential, of greater than 3-percent were considered expansive soils. The NRCS Soil Report defines linear extensibility as, "the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state." The report separates linear extensibility over a range (volume change) by depth (inches). The average of the median linear extensibility was calculated for each soil type. If the linear extensibility was greater than 3 and less than or equal to 6, it was considered to have moderate linear extensibility. There are 31 types of soils that are considered to have moderate linear extensibility, with no rating higher than 5.7. An exposure analysis was implemented by overlaying the asset inventory layers and the expansive soils hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values exposed to expansive soils.

Extreme Temperatures

All of Erie County is exposed to extreme temperature events. A qualitative assessment was conducted for the extreme temperatures hazard. Information from the Centers for Disease Control and Prevention, the National Weather Service, U.S. Environmental Protection Agency (EPA), and the Planning Partnership were used to assess the potential impacts to the county's assets.

Flood

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

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

- The Erie County FEMA Effective Digital Flood Insurance Rate Map (DFIRM) dated June 2019
- The Erie County FEMA Preliminary Digital Flood Insurance Rate Map (DFIRM) dated February 2019
- The depth grid developed by using data from the NYOIT 1-meter Resolution Digital Elevation Model (DEM), and the 2019 FEMA preliminary and effective DFIRM

The preliminary and effective Erie County FEMA DFIRM published in 2019 were used to evaluate exposure and determine potential future losses. In the cases where there was a new preliminary panel, the preliminary DFIRM was used. This was combined with the effective DFIRM for all other areas. The depth grid generated using the DFIRM and 1-meter DEM was integrated into the Hazus riverine flood model and used to estimate potential losses for the 1-percent annual chance flood event.

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

Hazardous Materials

Overall, potential losses from hazardous materials (hazmat) incidents are difficult to quantify due to the many variables and human elements. Data regarding this hazard were obtained from Erie County and the Planning Partnership as well as appropriate state and federal resources.

The exposure analysis was conducted for the county's assets (population, building stock, critical facilities, and new development) using a radius around potential HazMat incident sites as follows: exposure within 0.5 mile of highways, exposure within 0.5 mile of railways, exposure within 0.5 mile of pipelines, and exposure within an individually unique area of hazmat facilities. Assets with their centroids in one or more of these hazard areas were considered vulnerable to a hazardous material incident.

Landslide

An exposure assessment was conducted using a steep slope layer to determine the county's risk to the landslide hazard. A steep slope layer was created using the 2019 NYOIT 1-meter DEM. The DEM was converted to percent slope and slopes greater than 25 percent were selected. The county's assets (population, buildings, critical facilities, and new development) were examined to determine if they are built in areas of steep slopes (greater than 25 percent).

Pandemic

All of Erie County is considered exposed to disease outbreak events. A qualitative analysis was conducted using data from the county's Coronavirus Disease 2019 (COVID-19) resource website and research from the Centers for Disease Control and Prevention to review the county's risk to illnesses, including the most recent COVID-19 outbreak.

Severe Storm

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

Severe Winter Storm

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

Utility Failure

To assess the county's vulnerability to the utility failure hazard and its associated impacts, a qualitative assessment was conducted. Information from the Erie County Water Authority, EPA, and FEMA were referenced to assess the potential impacts to the county's assets from utility failure.

Wildfire

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

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

Considerations for Mitigation and Next Steps

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

- All Hazards
  - Create an updated user-defined general building stock dataset using up-to-date parcels, footprints, and RSMeans values.
  - Utilize updated and current demographic data. If 2020 U.S. Census demographic data are available at the U.S. Census block level during the next plan update, use the Census block estimates and residential structures for a more precise distribution of population, or the current American Community Survey 5-Year Estimate populations counts at the Census tract level.
- Earthquake
  - Identify unreinforced masonry in critical facilities and privately-owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response or recovery efforts at these properties can be developed.
- Extreme Temperatures
  - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at-risk areas.
- Flood
  - The general building stock inventory can be updated to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
  - Conduct a Hazus loss analysis for more frequent flood events (e.g., 10- and 50-year flood events).
  - Conduct a repetitive loss area analysis.
  - Continue to expand and update urban flood areas to further inform mitigation.
  - As more current FEMA floodplain data become available (i.e., DFIRMs), update the exposure analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version.
- Landslide
  - A pilot study conducted in Schenectady County, NY (Landslide Susceptibility – A Pilot Study of Schenectady County, NY) provided a detailed methodology for delineating high-risk landslide areas. This study looked at a variety of environmental characteristics including slope and soil conditions to determine areas at risk to landslide. To coincide with the methodology of that study, the generated slopes were categorized into five classes: 0 to 2 percent; 3 to 7 percent; 8 to 15 percent; 16 to 25 percent; Greater than 25 percent. Should the county determine the need for a more detailed assessment of risk, it could determine steep slope by other percent categorizations. Additional environmental and soil characteristics used in the Schenectady County plan can be collected and used to follow the methodology used to further delineate the county's most at-risk areas.
- Pandemic
  - As more information has been collected about COVID-19, future assessments should consider adding an evaluation of how the county responded to the pandemic. It should identify critical facilities that have vulnerabilities/limitations to respond effectively, as well as major transit routes that connect the community to facilities that help treat or vaccinate patients impacted by the pandemic.

- Severe Storm
    - The general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates.
    - Integrate evacuation route data that are currently being developed.
- Wildfire
    - General building stock inventory can be updated to include attributes such as roofing material or fire detection equipment or integrate distance to fuels as another measure of vulnerability.

5.1.3 Data Source Summary

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

Table 5.1-3. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau; American Community Survey 5-Year Estimates	2010; 2019	Digital (GIS) format
Building Inventory	Erie Parcel Data, Microsoft Building Footprints, Tetra Tech	2018/2020	Digital (GIS) format
Wildfire Fuel Hazard	University of Wisconsin - Madison	2010	Digital (GIS) format
Critical facilities	Erie Planning Partnership and County Jurisdictions	2020	Digital (GIS) format
Digitized Effective FIRM maps	FEMA	2019	Digital (GIS) format
Digitized Preliminary FIRM maps	FEMA	2019	Digital (GIS) format
Expansive Soils	USDA/NRCS	2020	Report
NEHRP Soil	NYS	n.d.	Digital (GIS) format
Rail Network	NYS DOT	2013	Digital (GIS) format
Road Network	NYS GIS	2020	Digital (GIS) format
1-Meter Digital Elevation Model	New York Office of Information Technology	2019	Tif
New Development Data	Erie Planning Partnership and County Jurisdictions	2020	Digital (GIS) Format

Notes: DOT = Department of Transportation
FEMA = Federal Emergency Management Agency
NRCS = Natural Resources Conservation Service
USDA = U.S. Department of Agriculture

Limitations

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

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

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

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

5.2 IDENTIFICATION OF HAZARDS OF CONCERN

To provide a strong foundation for mitigation actions considered in Section 6 (Mitigation Strategy) and Section 9 (Jurisdictional Annexes), Erie County focused on considering a full range of hazards that could impact the area and then identified and ranked those hazards that presented the greatest concern. The hazard of concern identification process incorporated input from the county and participating jurisdictions; review of the New York State Hazard Mitigation Plan (NYS HMP 2019); review of the 2015 Erie County HMP (2015 Erie County Multi-Jurisdictional Hazard Mitigation Plan); research and local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously or could feasibly impact the region; and qualitative or anecdotal information regarding natural (not man-made) hazards and the perceived vulnerability of the study area's assets to them. Table 5.2-1 documents the process of identifying the natural hazards of concern for further profiling and evaluation. Specific hazards not identified as a hazard of concern for Erie County will not be further discussed in detail.

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

Natural Hazards are those hazards that are a source of harm or difficultly created by a meteorological, environmental, or geological event.

5.2.1 Changes from 2015 Hazard Mitigation Plan

The 2015 Erie County Hazard Mitigation Plan did not identify Cyber Security, Hazardous Materials, Pandemic, or Utility Failure as hazards of concern. Members of the Steering Committee and Planning Partnership identified all four of these hazards as hazards of concern for the 2022 Hazard Mitigation Plan Update.

The 2022 Erie County Hazard Mitigation Plan includes best available data throughout the plan to present an updated understanding of Erie County's risk.

Source: NYIS (2019)

5.2.2 Hazard Groupings

The Steering Committee approved use of the following hazard event groupings which are the same as those provided by the Federal Emergency Management Agency (FEMA) guidance documents (*FEMA 386-2 Understanding Your Risks, Identifying Hazards and Estimating Losses*; *Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy*; *Local Mitigation Planning Handbook*), and with consideration of hazard grouping in the NYS HMP.

Coastal Erosion is one of the primary hazards leading to loss of lives or damage to property and infrastructure in coastal areas. Many natural factors affect erosion of the shoreline, including shore and near-shore morphology, shoreline orientation, and the response of these factors to storm frequency and sea-level rise.

A *Cyber Security* incident involves either the theft or modification of information on government agency computer systems or a system compromise with the potential to disrupt essential services.

An *Earthquake* is the sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge of the earth's tectonic plates, a volcanic eruption, or a man-made explosion.

The *Expansive Soil* hazard involves soils and soft rock that tend to swell or shrink due to changes in moisture content are known as expansive soils. Expansive soils are often referred to as swelling clays because clay materials are most susceptible to swelling and shrinking. Changes in soil volume present a hazard primarily to structures built on expansive soils. The most extensive damage occurs to highways and streets.

The *Extreme Temperature* hazard includes both heat and cold events, which can have a significant impact to human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country based on what the population is accustomed to. The 2022 HMP considers the heat island effect that occurs within developed areas.

The *Flood* hazard includes riverine flooding, flash flooding, shallow flooding, ice jam flooding, urban drainage flooding, and dam failure flooding. Inclusion of the various forms of flooding under a general *Flood* hazard is consistent with that used in FEMA's *Multi-Hazard Identification and Risk Assessment* guidance and the NYS HMP.

The *Hazardous Materials* profile includes materials and wastes that are considered severely harmful to human health and the environment, as defined by the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (also known as Superfund). Many hazardous materials are commonly used substances, which are harmless in their normal uses but are quite dangerous if released.

The *Landslide* hazard includes rock falls, rock topples, rotational slump, transitional slide, earth flows, creep, block slides, debris avalanche, and debris flows.

The *Pandemic* hazard exists when there are more cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time. An aggregation of cases in a given area over a particular period, regardless of the number of cases, is called a cluster. In an outbreak or epidemic, it is presumed that the cases are related to one another or that they have a common cause.

The *Severe Storm* hazard includes windstorms that often entail a variety of other influencing weather conditions, including thunderstorms, hail, lightning, and tornadoes. Tropical disturbances (hurricanes, tropical storms, and tropical depressions) are often identified as a type of severe storm. For this HMP update, *Severe Storm* includes thunderstorms, hail, lightning, tornadoes, hurricanes, and tropical storms.

The *Severe Winter Storm* hazard includes blizzards, ice storms, snowstorms, sleet, and freezing rain.

The *Utility Failure* hazard is defined as any interruption or loss of electrical service caused by disruption of power transmission from accident, sabotage, natural hazards, or equipment failure (also referred to as a loss of power or power outage). A significant power failure is defined as any incident of a long duration, which would require the involvement of the local and/or state emergency management organizations to coordinate provision of food, water, heating, cooling, and shelter.

The *Wildfire* hazard can be defined as any non-structural fire that occurs in the wildland. Three distinct types of wildland fires have been defined and include naturally occurring wildfire, human-caused wildfire, and prescribed fire. They may be highly destructive and become difficult to control. Wildfires result in the disturbance of forest and brush and destruction of real estate and personal property and have secondary impacts on other hazards, such as flooding, by removing vegetation and disturbing watersheds.

Other than the Utility Failure hazard profile, technological (e.g., hazardous material incidents) and man-made hazards (e.g., terrorism, man-made dam breaches/failures) are not being addressed in this planning process. The DMA 2000 regulations do not require consideration of such hazards, and due to limited funding, these were not chosen for inclusion in this plan by Erie County and planning participants. The county can expand the scope of this HMP to include other less frequent natural, technological, and man-made hazards as resources permit.

Table 5.2-1. Identification of Natural Hazards of Concern for Erie County

Hazard	Is this a hazard that may occur in Erie County?	If yes, does this hazard pose a significant threat to Erie County?	Why was this determination made?	Source(s)
Avalanche	No	No	• The New York State Hazard Mitigation Plan (NYS HMP) identifies avalanche as a hazard of concern. • Avalanches can occur in any situation where snow, slope, and weather conditions combine to create proper conditions. About 90 percent of all avalanches start on slopes of 30 to 45 degrees, and about 98 percent of all avalanches occur on slopes of 25 to 50 degrees. The topography of Erie County does not support the occurrence of an avalanche. • New York State, in general, has a very low occurrence of avalanche events based on statistics provided by National Avalanche Center – American Avalanche Association (NAC-AAA) between 1998 and 2018. • Avalanche was identified as a hazard in the NYS HMP, and there have been occurrences in the state; however, there were no occurrences in Erie County. The Steering Committee and Planning Partnership do not consider the hazard to be a significant concern.	• NYS DHSES • NAC-AAA
Coastal Erosion	Yes	Yes	• The NYS HMP identifies coastal erosion as a hazard of concern for New York State. Erosion can impact all of the state's coastal counties along Lake Erie and the Niagara River, Lake Ontario and the St. Lawrence River, Atlantic Ocean and Long Island Sound, Hudson River south of the federal dam in Troy, the East River, the Harlem River, the Kill van Kull and Arthur Kill, and all connecting waterbodies, bays, harbors, shallows, and wetlands. • Erie County is a coastal county, and the Steering Committee and Planning Partnership consider the hazard to be a significant concern.	• NYS DHSES • Input from Steering Committee and Planning Partnership
Dam Failure	Yes	No	• The 2019 NYS HMP does not identify dam failure as a hazard of concern for New York State, though it is included in the Flood hazard profile. • According to the NYS DEC, there are 248 dams within Erie County, as shown in Section 4. Of these 248 dams in Erie County: 164 low hazard, 6 intermediate hazard, 3 high hazard, 63 negligible or no hazard classification, and 12 with no classification code (NYSDEC 2020). • Dam failure is included in the flood profile.	• NYS DHSES • Input from Steering Committee and Planning Partnership • NYSDEC • NYS GIS
Pandemic	Yes	Yes	• The 2019 NYS HMP does not identify disease outbreak as a hazard of concern for New York State. • The county has been impacted by various diseases (influenza, Lyme disease, COVID-19). The Steering Committee and Planning Partnership has identified disease outbreak as a hazard of concern for Erie County.	• NYS DHSES • NYS DEC • Input from Steering Committee and

Table 5.2-1. Identification of Natural Hazards of Concern for Erie County

Hazard	Is this a hazard that may occur in Erie County?	If yes, does this hazard pose a significant threat to Erie County?	Why was this determination made?	Source(s)
				Planning Partnership
Drought	Yes	No	• The NYS HMP identifies drought as a hazard of concern for the state. Erie County has been impacted by several drought events that have occurred in New York State. • Drought conditions can cause shortages in water for human consumption, impact agricultural production, and lead to reduced local firefighting capabilities. A majority of Erie County relies on groundwater for their potable water, and droughts can impact groundwater resources significantly, limiting the availability of drinking water to county residents. • New York State was included in one FEMA drought-related disaster declaration, which did not include Erie County. • Erie County was included in five recent drought-related U.S. Department of Agriculture (USDA) disaster declarations: o S3441 – Drought – 2012 o S3427 – Drought / Excessive Heat – 2012 o S4023 – Drought / Excessive Heat – 2016 o S4031 – Drought / Excessive Heat – 2016 o S4037 – Drought / Excessive Heat – 2016 • According to the Northeast Regional Climate Center (NRCC), Erie County is in the Western Plateau Climate Division. This division has been impacted by periods of severe and extreme drought, including the following events: o October – November 1985 o November 1908 – January 1909 o October 1930 – June 1931 o November – December 2001 • Despite the occurrence of certain drought events in the county, the Steering Committee and Planning Partnership did not identify drought as a hazard of concern for Erie County.	• NYS DHSES • FEMA • USDA • Input from Steering Committee and Planning Partnership • NOAA-NCEI • NRCC

Table 5.2-1. Identification of Natural Hazards of Concern for Erie County

Hazard	Is this a hazard that may occur in Erie County?	If yes, does this hazard pose a significant threat to Erie County?	Why was this determination made?	Source(s)
Earthquake	Yes	Yes	• The NYS HMP identified earthquake as a hazard of concern for the state. • Erie County has a peak ground acceleration (PGA) below 3%g. According to the FEMA document "Understanding Your Risks: Identifying Hazards and Estimating Losses", areas with 3%g should conduct a risk assessment for earthquakes. • New York State was included in one FEMA earthquake-related disaster declaration (DR-1415); Erie County was not included in this declaration. • According to the NYS HMP, between 1737 and 2016, there were 550 earthquakes epicentered in the state and numerous earthquakes outside of the state that were felt within the state. From 1996 to 2017, there have been no significant earthquakes epicentered in Erie County. • Based on input from the Steering Committee and Planning Partnership, earthquake has been identified as a hazard of concern for Erie County.	• NYS DHSES • Input from Steering Committee and Planning Partnership • U.S. Geological Survey (USGS) – Earthquake Hazards Program, Review of USGS Seismic Maps
Expansive Soils	Yes	Yes	• The NYS HMP does not identify expansive soils as a hazard of concern for New York State. While a majority of Erie County is underlain by soils with little to no swelling potential, and less than 50% of the area is underlain by soils with abundant clays of slight to moderate swelling potential. The Town of Amherst and certain other areas, however, are potentially significantly by this hazard. • The Steering Committee and Planning Partnership identified expansive soils as a hazard of concern for Erie County.	• NYS DHSES • Input from Steering Committee and Planning Partnership • Review of USGS 1989 Swelling Clays Map of the Conterminous United States
Extreme Temperature	Yes	Yes	• The NYS HMP identifies Coldwaves and Heatwaves as hazards of concern for New York State. • Erie County was included in four recent USDA disaster declarations related to extreme temperature events: o S3249 – March 2012 – Frosts and Freezes	• NYS DHSES • Input from Steering Committee and Planning Partnership

Table 5.2-1. Identification of Natural Hazards of Concern for Erie County

Hazard	Is this a hazard that may occur in Erie County?	If yes, does this hazard pose a significant threat to Erie County?	Why was this determination made?	Source(s)
			o S3250 – March 2012 – Frosts and Freezes, Unseasonably Warm Temperatures, and Excessive Heat o S3427 – June 2012 – Excessive Heat (also included Drought) o S3886 – January 2015 – Frosts and Freezes • The Steering Committee and Planning Partnership identified extreme temperature as a hazard of concern for Erie County.	• NOAA-NCEI • USDA
Flood (riverine, ice jam, dam failure, urban flooding, and flash flooding)	Yes	Yes	• The NYS HMP identifies flooding as a hazard of concern for New York State. • Between 1956 and 2020, Erie County was included in 7 FEMA flood-related declarations. o FEMA DR 494 March 19, 1976 Severe Ice Storm o FEMA DR 1233 June 25, 1998 - July 10, 1998 Severe Storm(s) o FEMA DR 1335 May 3, 2000 - August 12, 2000 Severe Storm(s) o FEMA DR 1534 May 13, 2004 - June 17, 2004 Severe Storm(s) o FEMA DR 1665 October 12, 2006 - October 25, 2006 Severe Storm(s) o FEMA DR 1857 August 8, 2009 - August 10, 2009 o FEMA DR 4472 October 31, 2019 - November 1, 2019 Severe Storm(s) Based on the history of flooding and its impacts on Erie County and input from the Steering Committee and Planning Partnership, flooding has been identified as a hazard of concern for the county.	• NYS DHSES • Input from Steering Committee and Planning Partnership • FEMA • NOAA-NCEI • USACE CRREL Ice Jam Database
Hailstorm	Yes	Yes	Please see Severe Storm Profile	
Hurricane	Yes	Yes	Please see Severe Storm Profile	
Ice Jams	Yes	Yes	Please see Flood Profile	
Ice Storm	Yes	Yes	Please see Severe Winter Storm Profile	
Invasive Species/Infestation	Yes	No	• The 2019 NYS HMP does not identify invasive species as a hazard of concern for New York State. • New York State has been affected by various instances of invasive ticks and mosquitos. • The NYS DEC has identified Erie County to be located within the emerald ash borer restricted zone and identified several known locations of the emerald ash borer within the county. • The Erie County Steering Committee and Planning Partnership did not identify invasive species or infestation as a hazard of concern within Erie County.	• NYS DEC • Input from Steering Committee and Planning Partnership

Table 5.2-1. Identification of Natural Hazards of Concern for Erie County

Hazard	Is this a hazard that may occur in Erie County?	If yes, does this hazard pose a significant threat to Erie County?	Why was this determination made?	Source(s)
Land Subsidence	Yes	No	• NYS HMP indicates New York State is vulnerable to land subsidence; however, this hazard is "extremely localized" and poses a "very low risk to population and property", according to the 2019 NYS HMP. • The Steering Committee and Planning Partnership did not identify land subsidence as a hazard of concern for Erie County.	• NYS DHSES • Input from Steering Committee and Planning Partnership • USGS
Landslide	Yes	Yes	• The 2019 NYS HMP includes landslide as a hazard of concern for New York State. • Between 1954 and 2020, New York State has included in one landslide-related disaster declaration, which included Erie County. • Based on previous occurrences and input from the Steering Committee and Planning Partnership, the landslide hazard was identified as a hazard of concern for Erie County.	• NYS DHSES • Input from Steering Committee and Planning Partnership • FEMA
Nor'Easters	No	No	• The Steering Committee and Planning Partnership do not consider Nor'Easters to be a hazard of concern for Erie County.	• NYS DHSES • FEMA • NOAA-NCEI
Severe Storm (windstorms, thunderstorms, hurricanes / tropical storms, hail, and tornadoes)	Yes	Yes	The NYS HMP identifies severe storm as a hazard of concern for New York State; however, for the state HMP, the hazards were profiled in individual sections lightning, hail, tornadoes, high winds, and hurricanes/tropical storms. For the Erie County HMP, the hazards were combined into one profile. Between 1954 and 2020, Erie County was included in seven FEMA severe storm-related declarations. o FEMA DR 4472 2019-10-31 Severe Storm(s) o FEMA DR 1857 2009-08-08 Severe Storm(s) o FEMA DR 1665 2006-10-12 Severe Storm(s) o FEMA DR 1534 2004-05-13 Severe Storm(s) o FEMA DR 1335 2000-05-03 Severe Storm(s) o FEMA DR 1233 1998-06-25 Severe Storm(s) o FEMA DR 494 1976-03-19 Severe Ice Storm • Erie County was included in two severe storm-related U.S. Department of Agriculture (USDA) disaster declarations: o S3593 – 2013 Excessive rain and related flooding, high winds, and hail	• NYS DHSES • FEMA • NOAA-NCEI • SPC • Input from Steering Committee and Planning Partnership

Table 5.2-1. Identification of Natural Hazards of Concern for Erie County

Hazard	Is this a hazard that may occur in Erie County?	If yes, does this hazard pose a significant threat to Erie County?	Why was this determination made?	Source(s)
			o S3885 – 2015 Excessive Rain, High Winds, Hail, Lightning, and Tornado According to the National Environmental Information Center, storm events database indicates that Erie County was impacted by approximately 22 tornado events between 1950 and 2020, causing a total of 6 injuries and approximately $4.7 million in property damage. • Based on previous occurrences and input from the Steering Committee and Planning Partnership, severe storms are identified as a hazard of concern for Erie County.	
Severe Winter Storm (heavy snow, blizzards, ice storms)	Yes	Yes	• The NYS HMP identifies ice storms and snow storms as hazards of concern for New York State. According to the 2019 NYS HMP, Erie County has an annualized count of 6 Severe Winter Storm events, and their annualized winter storm losses are $8 million. • FEMA included Erie County in 22 winter storm-related disaster declarations: o DR-494 March 19, 1976 Severe Ice Storm o DR-527 February 5, 1977 Snow o EM-3027 January 29, 1977 Snow o EM-3107 March 13-17, 1993 Snow o EM-3136 January 1-15, 1999 Snow o EM-3157 November 19-21, 2000 Snow o DR-1404/EM-3170 December 24-29, 2001 Snow o EM-3268 October 12-25, 2006 Snow o DR-4204 November 17-26, 2014 Snow • Based on previous occurrences and input from the Steering Committee and Planning Partnership, severe winter storms are identified as a hazard of concern for Erie County.	• NYS DHSES • FEMA • NOAA-NCEI • Input from Steering Committee and Planning Partnership
Tornado	Yes	Yes	Please see Severe Storm	
Tsunami	No	No	• Tsunami is identified as a hazard of concern in the NYS HMP. • The Steering Committee and Planning Partnership do not consider tsunami to be a hazard of concern for Erie County.	• NYS DHSES • Input from Steering Committee and Planning Partnership
Volcano	No	No	• The NYS HMP identifies volcano as a hazard of concern for New York State. However, the the Steering Committee and Planning Partnership do not consider volcano to be a hazard of concern for Erie County.	• NYS DHSES • Input from Steering

Table 5.2-1. Identification of Natural Hazards of Concern for Erie County

Hazard	Is this a hazard that may occur in Erie County?	If yes, does this hazard pose a significant threat to Erie County?	Why was this determination made?	Source(s)
				Committee and Planning Partnership
Wildfire	Yes	Yes	• The NYS HMP identifies wildfire as a hazard of concern for New York State. • Erie County was not included in any FEMA wildfire-related disaster declarations. • NYS DEC records indicate the possibility that there have been hundreds of wildfires or brush fires in Erie County between 2003–2017. • Based on available data and the nature of the county, the Steering Committee and Planning Partnership identified Wildfire as a hazard of concern.	• NYS DHSES • Input from Steering Committee and Planning Partnership • FEMA
Windstorm	Yes	Yes	Please see Severe Storm	

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

5.2.3 Summary of Hazards of Concern

In summary, a total of 13 hazards of concern were identified as significant hazards affecting the entire county, to be addressed at the county level in this plan (shown here in alphabetical order):

- Coastal Erosion
- Cyber Security
- Earthquake
- Expansive Soils
- Extreme Temperature
- Flood
- Hazardous Materials
- Landslide
- Pandemic
- Severe Storm
- Severe Winter Storm
- Utility Failure
- Wildfire

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

5.3 HAZARD RANKING

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

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

5.3.1 Hazard Ranking Methodology

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

Table 5.3-1. Summary of Hazard Ranking Approach

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Probability of Occurrence		Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1 percent annual chance probability.	0	30%
		Rare	Between 1 and 10 percent annual probability of a hazard event occurring.	1	
		Occasional	Between 10 and 100 percent annual probability of a hazard event occurring.	2	
		Frequent	100 percent annual probability; a hazard event may occur multiple times per year.	3	
Impact (Sum of all 3)	Population (Numeric Value x 3)	Low	14 percent or less of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.	1	30%
		Medium	15 to 29 percent of population is exposed to a hazard with potential for measurable life-safety impact due to its extent and location.	2	
		High	30 percent or more of population is exposed to a hazard with potential for measurable life-safety impact, due to its extent and location.	3	
	Property (Numeric Value x 2)	Low	Property exposure is 14 percent or less of the total number of structures for your community.	1	
		Medium	Property exposure is 15 to 29 percent of the total number of structures for the community.	2	

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
		High	Property exposure is 30 percent or more of the total number of structures for the community.	3	
	Economy (Numeric Value x 1)	Low	Loss estimate is 9 percent or less of the total replacement cost for the community.	1	
		Medium	Loss estimate is 10 to 19 percent of the total replacement cost for the community.	2	
		High	Loss estimate is 20 percent or more of the total replacement cost for the community.	3	
Adaptive Capacity		Low	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	3	30%
		Medium	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/jurisdiction capabilities.	2	
		High	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.	1	
Climate Change		Low	No local data are available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
		Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
		High	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change; very high confidence level (strong evidence, well documented, and acceptable methods).	3	

Probability of Occurrence

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

Table 5.3-2. Probability of Occurrence Ranking Factors

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

Hazard Impacts

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

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

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

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

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

Additional Impacts

Along with impacts on population, property, and economy, the overall risk ranking considers two additional impacts that affect the county's vulnerability: Capability and Climate Change. Table 5.3-4 presents the numerical rating and description for each category.

Adaptive Capacity

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

Climate Change or Changing Future Conditions

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

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

Category	Low Impact	Medium Impact	High Impact
Capability	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/jurisdiction capabilities.	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available and capabilities are high.
Climate Change	No local data are available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	Studies and modeling projections indicate exacerbated conditions and increased future risk due to climate change; very high confidence level (strong evidence, well documented and acceptable methods).

Note: "Low impact" for adaptive capacity means the jurisdiction does not have the capability to effectively respond, which increases vulnerability; whereas high impact for adaptive capacity means the jurisdiction does have the capability to effectively respond, which decreases vulnerability.

Risk Ranking Value

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

Example Risk Ranking Equation
Risk Ranking = [(Impact on Population x 3) + (Impact on Property x 2) + (Impact on Economy x 1) x 0.3] + [Capability x 0.3] + [Climate Impact x 0.1] + [Probability of Occurrence x 0.3]

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

5.3.2 Hazard Ranking Results

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

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

Table 5.3-5 shows the probability ranking assigned for the likelihood of occurrence for each hazard.

Table 5.3-5. Probability of Occurrence Ranking for Hazards of Concern for Erie County

Hazard of Concern	Probability	Numeric Value
Coastal Erosion	Unlikely	0
Cyber Attack	Frequent	3
Earthquake	Rare	1
Expansive Soils	Rare	1
Extreme Temperature	Rare	1
Flood	Frequent	3
Hazardous Materials	Frequent	3
Landslide	Unlikely	0

Hazard of Concern	Probability	Numeric Value
Pandemic	Unlikely	0
Severe Storm	Frequent	3
Severe Winter Storm	Frequent	3
Utility Interruption	Frequent	3
Wildfire	Occasional	2

Table 5.3-6 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy on the county level. The weighting factor results and a total impact for each hazard also are summarized. It is noted that several hazards that have a high impact on the local jurisdictional level can have a lower impact when analyzed countywide.

Table 5.3-6. Impact Ranking for Hazards of Concern for Erie County

Hazard of Concern	Population			Property			Economy			Total Impact Rating (Population + Property + Economy)
	Impact	Numeric Value	Multiplied by Weighing Factor (3)	Impact	Numeric Value	Multiplied by Weighing Factor (2)	Impact	Numeric Value	Multiplied by Weighing Factor (1)	
Coastal Erosion	Low	1	3	Low	1	2	Low	1	1	6
Cyber Attack	Low	1	3	Low	1	2	High	1	3	8
Earthquake	High	3	9	High	3	6	Low	1	1	16
Extreme Temperature	High	3	9	Low	1	2	Low	1	1	12
Expansive Soils	Low	1	3	Low	1	2	Medium	2	2	7
Flood	Low	1	3	Low	1	2	Low	1	1	6
Hazardous Materials	Low	1	3	Low	1	2	Medium	2	1	6
Landslide	Low	1	3	Low	1	2	Low	1	1	6
Pandemic	High	3	9	Low	1	2	High	3	3	14
Severe Storm	High	3	9	Low	1	2	Low	1	1	12
Severe Winter Storm	High	3	9	Low	1	2	Low	1	1	12
Utility Interruption	Medium	2	6	Medium	2	4	Medium	2	2	12
Wildfire	Medium	2	6	Medium	3	6	Medium	2	2	14

Table 5.3-7 shows the additional impact rankings for the hazards of concern. This includes the overall capabilities of the county and municipalities and the consideration of changing future conditions, such as climate change.

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

Hazard of Concern	Capabilities	Numeric Value	Climate Change	Numeric Value
Coastal Erosion	High	1	Medium	2
Cyber Attack	Medium	2	Low	1
Earthquake	High	1	Low	1
Extreme Temperature	High	1	High	3
Expansive Soils	High	1	Low	1
Flood	Medium	2	High	3
Hazardous Materials	High	1	Low	1

Hazard of Concern	Capabilities	Numeric Value	Climate Change	Numeric Value
Landslide	High	1	Low	1
Pandemic	High	1	Medium	2
Severe Storm	High	1	Medium	2
Severe Winter Storm	High	1	Medium	2
Utility Interruption	High	1	Medium	2
Wildfire	High	1	High	3

Table 5.3-8 presents the total calculations for each hazard ranking value for the hazards of concern. The rankings were categorized and assigned a color as follows: Low = values less than or equal to 3.8 (green); Medium = values between 3.9 and 4.9 (yellow); High = values greater than or equal to 5.0 (red).

Table 5.3-8. Total Hazard Ranking Values for the Hazards of Concern for Erie County

Hazard of Concern	Probability x 30%	Total Impact x 30%	Adaptive Capacity x 30%	Changing Future Conditions x 10%	Total Risk Ranking Value
Coastal Erosion	0	3	2	1	Low
Cyber Attack	0.9	3	2	3	Medium
Earthquake	0.3	9	6	1	High
Expansive Soils	0.3	3	2	2	Low
Extreme Temperature	0.3	9	2	1	Medium
Flood	0.9	3	2	1	Low
Hazardous Materials	0.9	3	2	2	Low
Landslide	0	3	2	1	Low
Pandemic	0	9	2	3	Medium
Severe Storm	0.9	9	2	1	High
Severe Winter Storm	0.9	9	2	1	High
Utility Interruption	0.9	6	4	2	High
Wildfire	0.6	6	4	2	Medium

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

Table 5.3-9 presents the jurisdictional hazard ranking for each hazard. An evaluation of the total risk ranking score determined ranking categories that were grouped into three categories: low, medium, and high. It also includes input by the municipalities.

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

Table 5.3-9. Summary of Overall Ranking of Hazards by Jurisdiction

Erie County Municipalities	Coastal Erosion	Cyber	Earthquake	Expansive Soils	Extreme Temperature	Flood	Hazardous Material	Landslide	Pandemic	Severe Storm	Severe Winter Storm	Utility Interruption	Wildfire
Erie County	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	Medium
Erie County Water Authority	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	Medium
Akron (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	High	High	High	High	Low
Alden (T)	Low	Medium	Low	Low	Medium	Medium	Low	Low	Medium	Medium	High	Medium	Low
Alden (V)	Low	Medium	Low	Low	Medium	Low	Medium	Low	Low	Medium	High	High	Low
Amherst (T)	Low	Medium	Medium	Medium	Medium	Low	Low	Low	Medium	Medium	Medium	Medium	Low
Angola (V)	Low	Medium	Medium	Low	Medium	Low	Low	Low	High	High	High	High	Medium
Aurora (T)	Low	Medium	Low	Low	Medium	High	Low	Medium	Medium	Medium	Medium	High	Low
Blasdell (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	Medium	Medium	Low	Low
Boston (T)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Brant (T)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Buffalo (C)	Low	Medium	High	Low	Medium	Low	Low	Low	High	High	High	High	Low
Cheektowaga (T)	Low	Medium	Medium	Low	Medium	Low	Low	Low	High	High	High	High	Low
Clarence (T)	N/A	Medium	Medium	Medium	Medium	Low	Low	Low	High	High	High	High	Low
Colden (T)	Low	Medium	Low	Low	Medium	Low	Low	Medium	Medium	High	High	High	Medium
Collins (T)	Low	Medium	High	Low	Medium	Low	Low	Medium	Medium	High	High	High	High
Concord (T)	Low	Medium	High	Low	Medium	Low	Low	Medium	High	High	High	High	High
Depew (V)	Low	Medium	Medium	Low	Medium	High	Medium	Low	Medium	Medium	Medium	Medium	Low
East Aurora (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Eden (T)	Low	Medium	Medium	Medium	Medium	Low	Low	Low	High	High	High	Medium	Medium
Elma (T)	Low	Medium	High	Medium	Medium	Low	Low	Low	Medium	High	Medium	Medium	High
Evans (T)	High	Medium	Medium	Medium	Medium	High	Low	Low	High	High	High	High	Medium
Farnham (V)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Gowanda (V)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Grand Island (T)	Medium	Medium	Low	High	Medium	Low	Low	Low	High	Low	Medium	High	High
Hamburg (T)	Low	Medium	High	High	Medium	Low	Low	Low	High	High	High	High	High
Hamburg (V)	Low	Medium	High	Low	Medium	Low	Low	Low	High	High	High	High	Low
Holland (T)	Low	Medium	Low	Low	Medium	Medium	Low	Medium	Medium	High	High	High	Low
Kenmore (V)	Low	Medium	High	Low	Medium	Low	Low	Low	High	High	High	High	Low

Erie County Municipalities	Coastal Erosion	Cyber	Earthquake	Expansive Soils	Extreme Temperature	Flood	Hazardous Material	Landslide	Pandemic	Severe Storm	Severe Winter Storm	Utility Interruption	Wildfire
Lackawanna (C)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	Low
Lancaster (T)	Low	Medium	Medium	Medium	Medium	High	Medium	Low	Medium	High	High	High	Medium
Lancaster (V)	Low	Medium	High	Medium	Medium	High	High	Low	Medium	High	High	Medium	Low
Marilla (T)	Low	Low	Medium	Low	Medium	Low	Low	Low	Medium	Medium	Medium	High	Low
Newstead (T)	Low	Medium	Medium	Low	Medium	Medium	Low	Low	High	High	High	High	Medium
North Collins (T)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	High
North Collins (V)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Orchard Park (T)	Low	Medium	Low	Low	Medium	Low	Medium	Low	Medium	High	High	High	Medium
Orchard Park (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	Low
Sardinia (T)	Low	Medium	High	Low	Medium	Medium	High	Low	High	High	High	High	High
Sloan (V)	Low	Medium	High	Low	Medium	Low	Low	Low	High	High	High	High	Low
Springville (V)	Low	Medium	High	Low	Medium	Low	Low	Low	Medium	High	High	High	High
Tonawanda (C)	Low	Medium	Medium	Low	Medium	Low	High	Low	High	High	High	High	Low
Tonawanda (T)	Low	Medium	High	Low	Medium	Low	High	Low	High	High	High	High	Low
Wales (T)	Low	Low	Low	Low	Medium	Low	Medium	Low	Medium	Medium	Medium	Medium	Low
West Seneca (T)	Low	Medium	High	Medium	Medium	High	Medium	Low	High	High	High	High	Medium
Williamsville (V)	Low	Medium	Low	Low	Medium	Low	Low	Low	Medium	High	High	High	Low

5.4.1 Coastal Erosion

This section provides a profile and vulnerability assessment of the coastal erosion hazard for Erie County.

5.4.1.1 Hazard Profile

This section presents the coastal erosion description, extent, location, previous occurrences and losses, and probability of future occurrences.

Hazard Description

Along with flooding, coastal erosion is one of the primary hazards leading to loss of lives or damage to property and infrastructure in coastal areas. Many natural factors affect erosion of the shoreline, including shore and near-shore morphology, shoreline orientation, and the response of these factors to storm frequency and sea level rise. Coastal shorelines change constantly in response to wind, waves, tides, water level fluctuation, seasonal and climatic variations, human alteration, and other factors that influence the movement of sand and material within a shoreline system.

Coastal erosion is a natural phenomenon consisting of an endless sediment redistribution process that continually changes beaches, dunes, and bluffs. Waves, currents, wind-driven water, ice, rainwater runoff, and groundwater seepage all move sand, sediment, and water along the coastline. Other contributing factors can increase coastal erosion of a natural protective feature and these include length of fetch; wind direction and speed; wavelength, height, and period; nearshore water depth; tidal influence; and overall strength of a storm (NYS DEC 2020).

Coastal erosion can result in significant economic loss through the destruction of buildings, roads, infrastructure, natural resources, and wildlife habitats. Damage often results from an episodic event, such as the combination of severe storm waves and dune or bluff erosion.

Erosion results in the transfer of sediment from one location to another. The addition of sediment to a location is referred to as accretion. Accretion can be beneficial if it strengthens a shoreline, leading to wider beaches and more material for dune building. However, accretion can also result in the narrowing and shoaling of channels and inlets. This can ultimately lead to a potential increase of coastal flooding risk or lack of safe water access for emergency response boats.

Coastal erosion is usually a sporadic event and most typically associated with another hazard event, such as a strong storm. Additionally, erosion rates are influenced by local geographic features and man-made structures. Although coastal erosion is most typically associated with flooding, it can also be caused by windstorm events, which can blow beach and dune sand overland into adjacent low-lying marshes, upland habitats, inland bays, and communities. If related to a flood event, erosion is typically seen when extreme rainfall scours and erodes dunes and when inland floodwaters return through the dunes and beach face into the ocean (FEMA 1996). Within Erie County, erosion and fluctuations of water levels along Lake Erie are the most serious and present coastal hazard threat.

Human activities can also lead to coastal erosion and intensify the effects of natural processes and speed up the coastal erosion process. This includes construction, shipping, boating, and recreation, which can all increase erosion of sandy beaches, dunes, and bluffs (NYS DEC 2020). Humans contribute to the coastal erosion in several ways:

- By removing vegetation, exposing bare soil to be easily eroded by wind, waves, and precipitation;

- Directing run-off from streets, parking lots, roofs, and other locations over a bluff edge causing it to erode; or
- By construction of 'hardened' structures along the shore that block that movement of sand along the coast, reflect wave energy onto adjacent shorelines, or cause deepening of the nearshore area (NYS DEC 2020).

Historically, some of the methods used by municipalities and property owners to stop or slow down coastal erosion or shoreline change have actually exacerbated the problem. Attempting to halt the natural process of erosion with shore parallel or perpendicular structures, such as seawalls (groins and jetties) and other hard structures, typically worsens the erosion in front of the structure (i.e., walls), prevents or starves any sediment behind the structure (groins) from supplying down-drift properties with sediment, and subjects down-drift beaches to increased erosion. Since most sediment transport associated with erosion and longshore drift has been reduced, some of the state's greatest coastal assets and attractions—beaches, dunes, barrier beaches, salt marshes, and estuaries—are threatened and will slowly disappear as the sediment sources that feed and sustain them are eliminated.

Bluff coastlines along Lake Erie are constantly changing as the result of wind, currents, storms, and changing lake levels. Because of this, developed sandy shorelines are often stabilized with hardened structures (seawalls, bulkheads, revetments, rip-rap, gabions, and groins) to protect coastal properties from erosion. While hardened structures typically prove to be beneficial in reducing property damage, the rate of coastal erosion typically increases near stabilization structures. Shore protection structures, such as seawalls and revetments, usually eliminate natural wave run-up and sand deposition processes and can increase reflected wave action and currents at the waterline. Increased wave action can cause localized scour in front of structures and prevent settlement of suspended sediment (FEMA 1996). This increased erosion impacts natural habitats, spawning grounds, recreational activity areas, and public access (Frizzera 2011).

A variety of natural- and human-induced factors influence the erosion process. For example, shoreline orientation and exposure to prevailing winds, seiches, and waves all influence erosion rates. Beach composition influences erosion rates as well. For example, a beach composed of a finer sand and silt is easily eroded compared to beaches primarily consisting of course sand, boulders, gravel or large rocks, which are more resistant to erosion. Common contributing factors to coastal erosion include, but are not limited to, the following and further discussed below:

- Impacts from storms;
- Decreased sediment supplies;
- Storm-induced high water or seiches;
- Elevated lake levels; and
- Wave action.

Impacts from Storms

Beaches, dunes, and bluffs are a natural barrier between Lake Erie and inland communities, ecosystems, and resources. During a strong storm, changes to beaches, dunes, and bluffs can be significant and the results are sometimes catastrophic. The U.S. Geological Service (USGS) provides scientific support for mitigation planning through observations of beach, dune, and bluff change, as well as models of waves and storm surge to identify areas vulnerable to extreme coastal changes. By identifying areas of coastline in New York State likely to experience extreme and devastating erosion during a coastal storm, it is possible to determine risk levels associated with development in areas where the land shifts and moves with each land-falling storm (NYS DHSES 2013).

Decreased Sediment Supplies

Coastal landforms, such as bluffs, are essential in maintaining a supply of sediment to beaches and dunes. If engineered structures are used to stabilize shorelines, the natural process of erosion is disturbed and decreases the amount of sediment supply. With reduced sediment, the ability of natural protective features (dunes and beaches) to provide prevention from storms and flood control benefits is reduced (NYS DHSES 2013).

Storm-Induced High Water or Seiches

Great Lakes storms can occur any time of the year and at varying levels of severity. Natural protective features within coastal erosion hazard areas provide buffering and protection to shorelines from erosion. Dunes and bluffs are effective against storm-induced high water and related wave action (NYS DHSES 2013).

Wind and weather conditions on the Great Lakes may create a seiche, an oscillating wave which can be several feet high. In many of the Great Lakes, the time period between the “high” and “low” of a seiche may be between 4 and 7 hours. As this is similar to the 6-hour time period of the tides on the ocean, it is frequently mistaken for a tide.

Elevated Lake Levels

Elevated lake levels contribute to higher rates of coastal erosion. Higher lake levels will magnify the reach of currents and wave action. Unlike oceans which have tides, the Great Lakes are considered to be non-tidal and experience change in water levels primarily because of meteorological effects. Water levels in the Great Lakes have long-term, annual, and short-term variations. Long-term variations depend on precipitation and water storage over many years. Annual variations occur with the changing seasons with an annual high in the late spring and a low in the winter. These changes occur at a rate that can be measured in feet per month (NOAA 2020).

Wave Action

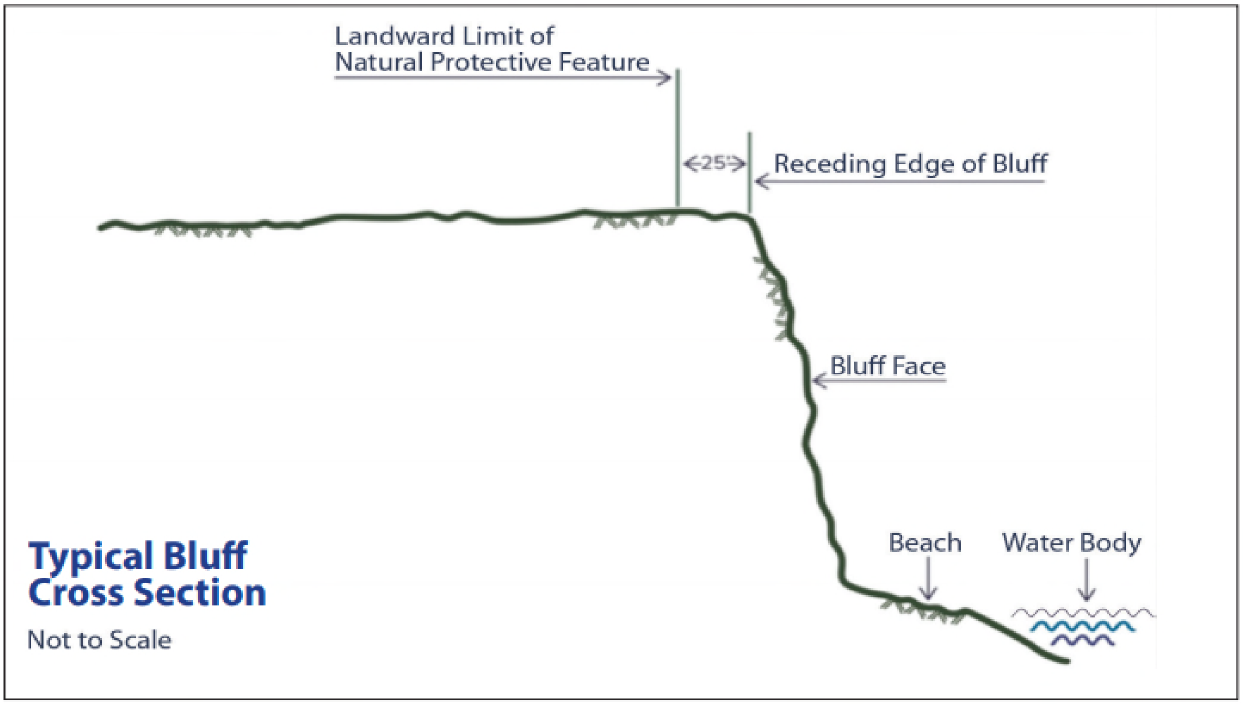
As waves approach a shoreline, they crest and break, losing some initial energy. The remaining wave runs up the beach before pulling back down. Depending on the size of the wave, angle of wave “attack,” and the wave period, waves can cause erosion or accretion of sediment. Seasonal high temperatures and seiches contribute to elevated lake levels allowing larger waves to reach the shoreline. Greater water depths near shore also result in less loss of wave energy from shoaling.

Bluff Erosion

The stability of coastal bluffs along New York’s Great Lakes depends on the action of the surface water over the face of the bluff as much as it does on the material of the bluff, steepness of the slope and wave action at the toe of the slope. Human disturbances on the bluff may also affect stability (NY Sea Grant 2019). During heavy rainfall, sediment can be washed down the face of the bluff if it is not vegetated, similar to the beach and dune erosion processes just discussed. Storm-related increases in water height can also be detrimental to coastal bluffs. When waves begin to attack the base of the bluff, which is normally protected by a beach, sediment will be removed from the base (i.e., toe) resulting in undercutting and leaving a vertical scarp. This will make the entire bluff unstable because of the continual slumping of bluff material from above the eroded toe, which in turn removes the vegetation that provides stability and protective cover, furthering erosion (NYS Sea Grant 2018). This slumping can also result in small landslides on the face of the bluff.

Groundwater can also increase erosional rates in coastal bluffs. As the groundwater moves, it loosens and picks up material; erosion will result when the water flows out of the bluff removing sediment with it. The coarser the bluff material, the more easily this can occur. Gullies, which form as a result of surface water flowing down or through the bluff face, indicate groundwater-related problems. In freezing temperatures, the groundwater will become trapped in the bluff and expand as cracks. This separates larger chunks of sediment, which slide down the face (NYS Sea Grant 2018).

Figure 5.4.1-1. Cross Section of Typical Great Lakes Bluff



Source: NYS Sea Grant 2019

Extent

Coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. Geologists measure the severity of erosion in two ways, as a rate of linear retreat (feet of shoreline recession per year) and volumetric loss (cubic yards of eroded sediment per linear foot of shoreline frontage per year) (NYC Emergency Management 2019).

Coastal erosion can occur rapidly or gradually. However, measuring erosion is often difficult, because the extent of natural erosion in a specific shoreline varies significantly from year to year. If choices are made to dredge or nourish beaches along particular parts of the coast, it can be difficult to determine how much beach is being lost or gained through natural processes and how much is being affected by human activities (NYC Emergency Management 2019). Coastal erosion may also be exacerbated by human activities, such as boat wakes, shoreline hardening, and dredging (FEMA 1996).

Several factors determine whether a community exhibits greater long-term erosion or accretion:

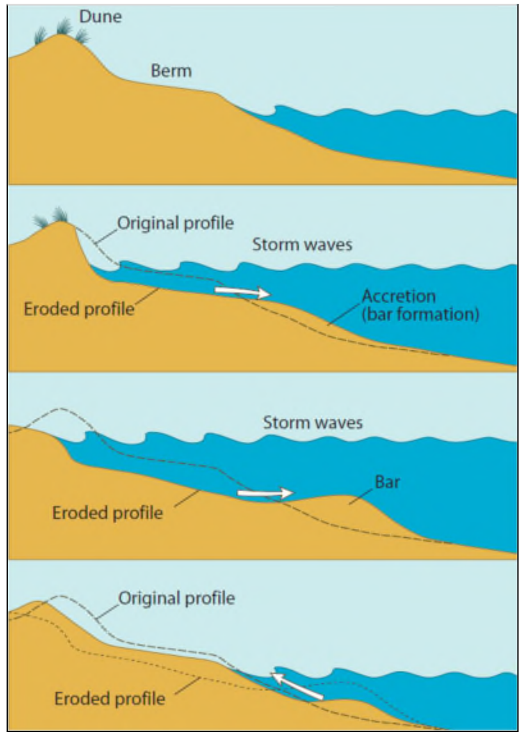
- Exposure to high-energy storm waves,
- Sediment size and composition of eroding coastal landforms feeding adjacent beaches,
- Near-shore bathymetric variations that direct wave approach,
- Along-shore variations in wave energy and sediment transport rates,
- Relative lake elevations,
- Frequency and severity of storm events, and

- Human interference with sediment supply (e.g. revetments, seawalls, jetties) (Woods Hole Sea Grant 2003).

Beaches constantly change daily, weekly, monthly, and yearly, primarily in response to waves. The size and presence of any part of a beach at a given time is influenced by a number of factors: size and direction of the waves, size and shape of sand grains on the beach, the level of water at the time waves strike, and the initial shape of the beach.

Waves play a major role in controlling the form, position, and size of the beach. Waves are responsible for picking up and moving sand along the coast. The beach responds quickly to changes in wave energy. Very large, choppy waves tend to pick up and remove sand from the beach berm, which lowers the elevation, flattening the beach profile and causing the berm and shoreline to move landward. The material picked up from the waves can move in many directions depending on numerous factors. Most frequent, material is moved offshore and is deposited in a bar during storms. As the bar grows, it causes larger waves to break and dissipate their energy before they reach the landward berm, which adds protection to the beaches. In calmer weather, long, gentle waves can pick up much of the sand and bring it back onshore, building up the berm, raising the height of the backshore and moving the beach berm and shoreline back seaward. This creates a cycle where the beach erodes and builds back up in response to wave action. Over the course of a year, beaches can move back and forth by as much as 270 feet (Tanski 2012). Figure 5.4.1-2 illustrates the beach response to waves.

Figure 5.4.1-2. Beach Response to Waves



Source: Tanski 2012

Location

Much of New York's Great Lakes shorelines are naturally subject to erosion, which becomes a concern particularly where there are homes, businesses, or other structures nearby. Since the last glaciers retreated more than 10,000 years ago, Great Lakes water levels have varied dramatically, as have the flows of water between these five massive lakes and their combined outflow to the Atlantic Ocean. (NY Sea Grant 2019). Changes in water level move the shoreline and areas likely to experience erosion.

Erie County has extensive shoreline that can be impacted by coastal erosion, including the coastline along Lake Erie and along the Niagara River. Erie County borders the upper 12 miles of the East Branch of the Niagara River in the Town of Grand Island, The Town of Tonawanda, and the City of Tonawanda. Grand Island is one of the world's largest freshwater islands and has a shoreline edge of about 23.5 miles (USACE 1971). The City of Buffalo, the City of Lackawanna, the Town of Hamburg, the Town of Evans, the Town of Brant, and the Cattaraugus Reservation are directly located on the shoreline of Lake Erie.

The average height of the shore bluffs is 40 to 50 feet and up to 100 feet in short reaches. The lower part of the bluffs consists of shale, generally well above the limit of wave uprush. In some places, shale extends the full height of the bluff, but more generally the top half is earth. For some distance on either side of river mouths, the bluffs are lower and may be entirely granular material or silt and clay. Narrow gravel and shingle beaches, 40 to 50 feet wide at average lake levels, extend along some of the shale bluff reaches. Several wider sand beaches occur mainly between Silver Creek and Cattaraugus Creek and in the Town of Evans. Except for these beaches and occasional pockets of sand trapped by natural headlands or shore structures, little sand is present in this entire reach, and if present, is likely a thin layer over the shale bottom (USACE 1971).

Because of the relative stability of the high shale bluffs, severe erosion and flooding problems in Erie County are relatively few. Erosion of the bluffs and deterioration from weathering and frost action do occur, and improvements close to the top of the bluffs become threatened (USACE 1971).

In the City of Buffalo, most of the shoreline along Niagara River and Lake Erie is protected by breakwaters. The outer harbor breakwater protects Buffalo Harbor by alleviating the severity of flooding on Lake Erie. The other breakwater, which is further north and parallels the lake's eastern shore, separates Black Rock Canal from the Niagara River (FEMA FIS 2019). New York uses other protection measures for coastal erosion in the Great Lakes, such as sea walls, revetments, bulkheads, groins, jetties, and nature-based solutions (reestablishing natural shorelines and vegetation) (NYS Sea Grant 2019).

Coastal Erosion Hazard Area

The coastline of Lake Erie is designated by NYS DEC as an area at risk to coastal erosion from natural and human activities and is therefore regulated. NYS DEC has two programs focused on the protection of coastal erosion: Coastal Erosion Hazard Area (CEHA) permit program and the United States Army Corps of Engineers (USACE) Civil Works Program. The CEHA program regulates and issues permits for activities within a coastal erosion hazard area. NYS DEC works with USACE to study coastal erosion problems along coastlines and to develop coastal erosion solutions. These are usually large-scale projects that impact entire communities (NYS DEC 2020).

NYS prevents and reduces coastal erosion by:

- Promoting and preserving the natural protective features, such as dunes and bluffs, beaches, and near-shore areas of coastal regions;
- Restricting or prohibiting activities or development in natural protective feature areas;
- Ensuring new construction or structures are built a safe distance from areas of active coastal erosion and the impact of coastal storms;
- Regulating the placement and construction of coastal erosion protection structures, when justified, to minimize damage to property, natural protective features, and other natural resources;
- Restricting development involving public investment in services, facilities, or activities (for example, extending public water supply and sewer services) which are likely to encourage new permanent development in coastal erosion hazard areas;
- Requiring publicly financed coastal erosion protection structures (intended to minimize coastal erosion damage) to be used only where necessary to protect human life or where the public benefits of such structures clearly outweigh the public expenditures; and
- Encouraging administration of coastal erosion management programs by coastal municipalities and establishing procedural standards for local program implementation and establishing standards for the issuance of coastal erosion management permits (NYS DEC 2020).

Because of the consistent coastal erosion problems along the New York State coastline, the State Legislature passed the CEHA Act (Article 34 of the Environmental Conservation Law [ECL]), establishing the state's coastal policy in August 1981. Under this act:

- Areas prone to coastal erosion are identified.

- Activities in areas subject to coastal erosion are undertaken in such a way that damage to property is minimized, increases in coastal erosion are prevented, and natural features are protected. Public actions likely to encourage new development in CEHA should not be undertaken unless the areas are protected by structural or other erosion control projects, which could prevent erosion damage during the life of the proposed action.
- Erosion control projects are publicly financed only where needed to protect human life for existing or new development, which absolutely requires a location within a given hazard area.
- Public and private erosion control projects should minimize damage to other human-made property, natural protective features, and other natural resources.

As of April 23, 2021, Erie County contains no certified CEHA communities; however, the Town of Brant and the Town of Evans are NYS DEC-regulated CEHA communities. Regulated CEHA communities have various actions that are restricted, prohibited, or require a permit (NYS DEC 2020a, b).

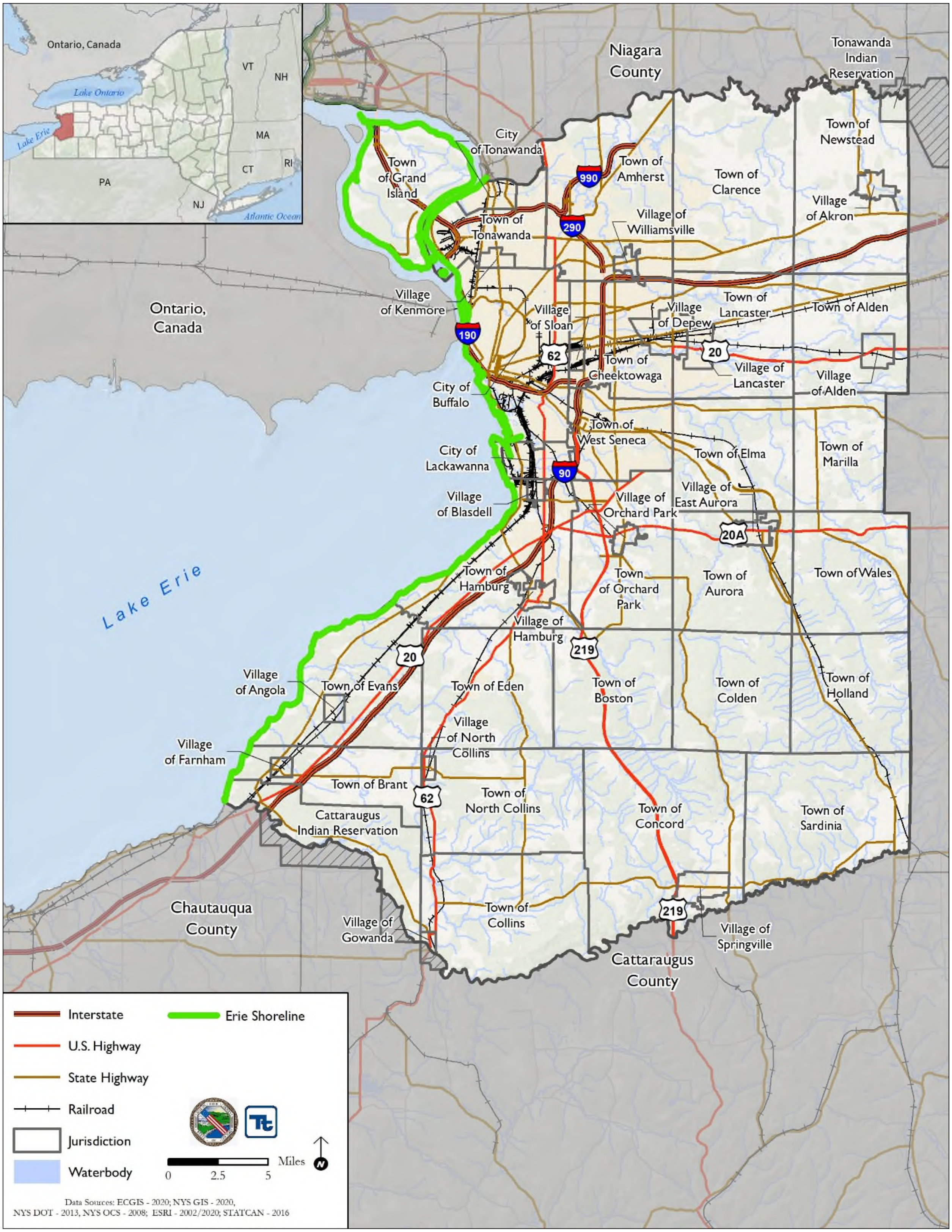
As a part of the CEHA Act, NYS DEC has developed minimum standards and criteria, 6 NYCRR Part 505 – Coastal Erosion Management, for the statewide regulation of development and other activities within these areas. Part 505 defines a regulatory program to be administered by DEC within identified CEHA and establishes standards for the issuance of coastal erosion management permits by the DEC. Procedural requirements have also been established for local governments that wish to implement a local program, although local implementation is not required until after the NYS DEC has filed CEHA maps for a municipality (NYS DEC 1988). Part 505 establishes two categories of CEHA: (1) Structural Hazard Areas and (2) Natural Protective Features.

- *Structural Hazard Areas* are shorelands, located landward of natural protective features, and have shorelines receding at a long-term average annual recession rate of 1 foot or more per year. The inland boundary of a structural hazard area is calculated by starting at the landward limit of the fronting natural protective feature and measuring it along a line perpendicular to the shoreline a horizontal distance which is 40 times the long-term average annual recession rate (NYS DEC 1988).
- *Natural Protective Feature Area (NPFA)s* are a land and/or water area containing natural protective features, the alteration of which might reduce or destroy the protection afforded other lands against erosion or high water, or lower the reserves of sand or other natural materials available to replenish storm losses through natural processes. All NPFAs are delineated as such on CEHA maps (NYS DEC 1988). NYS DEC is in the process of updating these maps.

The NYS DEC 1988 CEHA paper maps depict CEHA along the Towns of Brant, Hamburg, and Evans. These maps show the landward limit of the natural protective features, but do not include the surface hazard areas. The NYS DEC commissioner is tasked to review the boundaries of these hazard areas every 10 years, and after major coastal storms, and revise the maps if the CEHA boundary changed by 25 feet or more (NYS DEC Article 34, Chapter 841).

Since the CEHA maps do not depict the complete hazard area, they are not illustrated as a part of this risk assessment. Instead, Figure 5.4.1-3 highlights the shoreline of Erie County. The entire shoreline is vulnerable to coastal erosion.

Figure 5.4.1-3. Coastal Erosion Hazard Areas for Erie County



NYS DEC is currently proposing a general permit (Great Lakes Erosion Control General Permit) for the purposes of shore protection to safeguard existing functional erosion control structures, roads, bridges, infrastructure, and property along the Lake Ontario shoreline, Lake Erie shoreline, Niagara River, and Saint Lawrence River, including affected portions of navigable bays and tributaries (NYS DEC 2020).

Previous Occurrences and Losses

Although many factors contribute to the natural coastal erosion of Erie County shorelines; historical storm events have significantly increased coastal erosion processes. Because Erie County is located along Lake Erie, strong Great Lakes storm events that commonly occur within the area have resulted in significant losses and temporary or permanent changes to the County's shorelines. Details regarding Severe Storm and Severe Winter Storm events that have impacted Erie County are presented earlier in Section 5.4.10 and Section 5.4.11, respectively.

Between 1954 and 2020, New York State and Erie County were not included in any FEMA declared coastal erosion specific disasters (DR) or emergency declarations (EM). However, Erie County has been included in numerous declarations that involved severe storms and severe winter storms. Section 5.4.6 (Flood), Section 5.4.10 (Severe Storm), and Section 5.4.11 (Severe Winter Storm) include more information on these declarations. For this 2022 Hazard Mitigation Plan (HMP), known coastal erosion events that have impacted Erie County between 2000 and 2020 are identified.

Table 5.4.1-1. Coastal Erosion Events in Erie County, 2000 to 2020

Dates of Event	Event Type	FEMA Declaration Number	Erie County Designated?	Location	Losses / Impacts
December 12, 2000	Flood, Coastal Erosion	N/A	N/A	Lake Erie	The high winds caused water levels at the eastern end of Lake Erie to rise over 5 feet in a few hours. The high water levels coupled with waves of 10 to 14 feet caused shoreline erosion and localized flooding. Evacuations took place at Hoover Beach in the Town of Hamburg.
November 6, 2005	Flood, Coastal Erosion	N/A	N/A	Lake Erie	High water levels and waves of 10 to 15 feet resulted in some erosion of the lake shore and limited property damage.
January 30, 2008	Flood, Coastal Erosion	N/A	N/A	Lake Erie	The high water levels and waves to 12 to 16 feet resulted in erosion of the lake shore and significant flooding at the extreme eastern end of the lake.
October 31, 2019	Coastal Erosion	N/A	N/A	Buffalo, Lake Erie	The North Breakwater in the Buffalo Harbor suffered severe storm damage resulting in gaps in the breakwater. Gaps in the structure could be seen from the east end of Erie Basin Marina and also from Ralph C. Wilson Jr. Centennial Park.
November 27, 2019	High Wind, Coastal Erosion	N/A	N/A	Buffalo, Lake Erie	Strong low pressure moved from the central Great Lakes to north of Lake Ontario. The trailing cold front entered western New York early in the afternoon of 11/27 and swept through later that evening. 50-60 knot winds blew for a 3-5 hour period in the cold advection behind the cold front. A seiche peaked at 9.56 feet above low water datum with the level above Lake Erie's flood stage for about 4 hours. This flooded Canalside in downtown Buffalo, flooded Route 5, and caused additional damage to breakwaters in Dunkirk in Buffalo. Selected peak wind speeds included 69 mph in Fredonia, 66 mph in Hamburg, 59 mph at Buffalo Airport, 58 mph in Batavia, and 58 mph in Warsaw.
January 12, 2020	Strong Wind, Coastal Erosion	N/A	N/A	Buffalo, Lake Erie	Post-frontal winds mixed well behind an early morning cold front brought wind gusts across much of western New York, especially along the Lake Erie shore, Buffalo, and Batavia area that exceeded 65 mph. Widespread non-thunderstorm wind damage was reported in all lakeshore counties from Monroe westward along Lake Ontario and all counties bordering Lake Erie, as well. High winds drove a seiche on Lake Erie, resulting in water flooding Route 5 in Hamburg, additional damage to the Dunkirk Pier and break wall, damage to the Buffalo break wall, and flooding in Canalside in downtown Buffalo. The seiche peaked the water level in Buffalo at 9.85 feet above low water datum.
January 18, 2020	Lakeshore Flood, Coastal Erosion	N/A	N/A	Buffalo, Lake Erie	A relatively deep, progressive mid-level trough crossed southern Ontario and the Lower Great Lakes Saturday night and early Sunday, January 18-19 resulting in snow. As the cold front passed that brought colder air in, a seiche on Lake Erie again brought lakeshore flooding to Chautauqua and Erie counties, doing further damage to the Dunkirk Pier, Buffalo break wall, and closing Route 5 in Hamburg. There were two distinct pulses of higher water on the east end of the lake, as well. The first corresponded with lake levels of 8.18 feet above low water datum, and the second of 7.3 feet above low water datum.

Source: NOAA-NCEI 2021; FEMA 2021

Probability of Future Occurrences

Coastal erosion is a frequent event and occurs because of both natural and human activities. All beaches are affected by coastal erosion, but the rate and severity of erosion vary in frequency. Chronic erosion is the gradual recession of a shoreline over a period of decades and will be impacted by wave heights, wave angles, climate changes, and human causes such as development, removal of vegetation, runoff from development, and impacts of hard structures in the coastal zone (NYS DEC 2020). Episodic erosion occurs in response to flood events or coastal storms and is characterized by a rapid recession of the shoreline. Because coastal erosion is tied closely to other activities, frequency rates and severity levels are best evaluated in conjunction with other related hazards' probabilities and by analyzing secondary impacts from storms, human actions, and other factors. Sections 5.4.10 (Severe Storm) and 5.4.11 (Severe Winter Storm) include information on the probability of severe storms and severe winter storms.

Section 5.3 ranks the identified hazards of concern for Erie County. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering and Planning Committees, the probability of occurrence for coastal erosion in the County is considered 'unlikely' (not likely to occur or less than 1 percent annual chance of occurring).

Climate Change Impacts

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

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Erie County is part of Region 1, Western New York and the Great Lakes Plain. In Region 1, it is estimated that temperatures will increase by 3.7 ºF to 7.3 ºF by the 2050s and 4.2 ºF to 12.0 ºF by the 2080s (baseline of 47.7 ºF). Precipitation totals will increase between 2 to 12 percent by the 2050s and 1 to 17 percent by the 2080s (baseline of 34.0 inches). Regional precipitation across New York State is projected to increase by approximately 1-8 percent by the 2020s, 3-12 percent by the 2050s, and 4-15 percent by the 2080s (NYSERDA 2014).

The projected increase in precipitation is expected to occur in heavy downpours and less in light rains. Downpours are very likely to increase in frequency and intensity (NYSERDA 2014). Heavy rainfall can contribute to greater amounts of sediment being carried off of bluffs and coastlines.

Overall regional precipitation is the primary driver of average Great Lakes water levels. Increases in annual precipitation will impact the elevation of lakes. Projected increases in precipitation totals are likely to increase the elevation of Lake Erie. Higher lake elevations lead to greater rates of erosion.

Temperatures are predicted to increase in Erie County, which may lead to an increase in intensity and frequency of severe storm events. This increase may lead to more weather patterns that cause coastal erosion events. Warmer temperatures are also likely to reduce the amount of time per winter that the Great Lakes are covered in ice (NYSERDA 2014). Ice typically dampens or eliminates wave action. A reduction in ice coverage and the length of the ice season is likely to result in more frequent wave events, which in turn may increase severe coastal erosion event frequency and overall erosional rates.

5.4.1.2 Vulnerability Assessment

To understand the County's current risk to coastal erosion, the 1988 NYS DEC CEHA paper maps were digitized. These maps were only available for the Towns of Brant, Evans, and Hamburg. Section 5.2 includes additional details on the methodology used to assess coastal erosion risk. Other jurisdictions along the Lake Erie shore could potentially feel the effects of coastal erosion. The City of Tonawanda, City of Lackawanna, City of Buffalo, Town of Grand Island, and Town of Tonawanda also sit along the shore of Lake Erie, but do not have CEHA maps available. Figure 5.4.1-3 illustrates the entire shoreline of Erie County.

Impact on Life, Health and Safety

To estimate population exposed and vulnerable to the coastal erosion hazard areas, a spatial analysis was conducted. Table 5.4.1-2 lists the estimated population located in the digitized CEHA buffer. Overall, 214 people live within the coastal risk hazard area. The same analysis was performed using the CEHA boundary and buffer; an estimated 6,996 people live in this delineated area susceptible to erosion. The Town of Evans has the greatest number of persons living within the designated coastal risk hazard area.

Table 5.4.1-2. Approximate Population Residing in the CEHA Buffer

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to the Coastal Erosion Hazard Area (CEHA)	
		Number of Persons Exposed	Percent of Total
Brant (T)	1,541	1	0.1%
Evans (T)	13,782	137	1.0%
Hamburg (T)	45,985	76	0.2%
Erie County Total	**917,296**	**214**	**<0.1%**

Source: NYS DEC 1988; American Community Survey 5-year Estimate 2019
Note: Only jurisdictions with CEHA data are include in totals
T = Town;, % = Percent

Research has also shown that some populations may experience exacerbated impacts and prolonged recovery if/when impacted because of many factors, including their physical and financial ability to react or respond during a hazard. Socially vulnerable populations (e.g., low-income populations, persons with disabilities, and the elderly) in Erie County may be at the greatest risk to coastal erosion. Within the County, there are 126,806 persons living in poverty and 120,246 persons with disabilities. The cost of interventions to protect properties from coastal erosion risk may financially stress lower- or middle-income residents. Relocating may be difficult because of the expenses and the availability of accessible housing or the time needed to make housing accessible. Structural improvements may not be possible because doing so could render the housing inaccessible (NYC Emergency Management 2019).

The population over the age of 65 is also more vulnerable and, physically, they may have more difficulty evacuating. They may require extra time or outside assistance during evacuations and are more likely to seek or need medical attention, which may not be available during a storm event. Population estimates for the County indicate that 161,744 persons over 65 currently live in Erie County.

The CDC 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Erie County's overall score is 0.3986, indicating that in general its communities have low to moderate vulnerability (CDC 2016).

As discussed above, the application of the CEHA data set for assessing vulnerability is limited. Communities along inland bays, such as the Towns of Grand Island and Tonawanda, may be vulnerable to the coastal erosion hazard but are not assessed based upon the limitation to the spatial hazard layer's extent.

Impact on General Building Stock

To understand buildings that may be at risk to coastal erosion, an exposure analysis was conducted to determine buildings located in the digitized CEHA buffer. There are an estimated 122 structures located in the CEHA buffer area with a replacement cost value of approximately $62.2 million (less than 1 percent of the total replacement cost value in the County).

It is important to note that these estimates are considered high because coastal erosion generally occurs in increments of inches to feet per year along the coastline, with the exception of large-scale events, and may not necessarily occur across the entire coastline at the same time.

Table 5.4.1-3. Building Exposure to the CEHA Buffer

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed to the Coastal Erosion Hazard Area (CEHA)			
			Number of Buildings Exposed	Percent of Total	Total Replacement Cost Value Exposed	Percent of Total
Brant (T)	1,325	$657,594,060	1	0.1%	$293,344	0.0%
Evans (T)	7,952	$3,335,060,692	86	1.1%	$33,546,029	1.0%
Hamburg (T)	19,130	$11,911,210,828	35	0.2%	$28,330,911	0.2%
Erie County Total	**360,925**	**$222,515,035,436**	**122**	**<0.1%**	**$62,170,285**	**<0.1%**

Source: NYS DEC 1988; RS Means 2020
Note: Only jurisdictions with CEHA data are include in totals
T = Town, % = Percent

Impact on Critical Facilities

It is important to determine the critical facilities and infrastructure that may be at risk to coastal erosion impacts, and to identify persons who may be impacted if damage occurs. Coastal erosion can degrade the surrounding infrastructure and utility lines, depending on their location on the property. Critical services may be interrupted because of direct damage or if transportation corridors that connect these facilities to the community are damaged. Roads that are damaged may isolate residents and prevent access to many service providers needing to reach vulnerable populations.

Critical facility and lifeline exposure to the coastal erosion hazard areas was examined. If the critical facility is located in the coastal erosion hazard area, it is considered exposed. Table 5.4.1-4 and Table 5.4.1-5 list the number of critical facilities and lifelines at risk of coastal erosion per jurisdiction, and are summarized by each FEMA lifeline category, respectively. The Town of Evans has the most critical facilities in the CEHA buffer (three) and a majority of them are wastewater pump stations.

Table 5.4.1-4. Critical Facilities Located in the CEHA Buffer

Jurisdiction	Critical Facilities Exposed to the Coastal Erosion Hazard Area (CEHA)		
	Dam	Potable Water Pumping Station	Wastewater Pump Station
Brant (T)	0	0	0
Evans (T)	0	1	2

Jurisdiction	Critical Facilities Exposed to the Coastal Erosion Hazard Area (CEHA)		
	Dam	Potable Water Pumping Station	Wastewater Pump Station
Hamburg (T)	1	0	0
Erie County Total	**1**	**1**	**2**

Source: NYS DEC 1988
Note: Only jurisdictions with CEHA data are include in totals
T = Town,

Table 5.4.1-5. Total Number of Lifelines Located in the CEHA Buffer

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to Coastal Erosion Hazard Area (CEHA)
Communications	59	0
Energy	176	0
Food, Water, Shelter	951	3
Hazardous Materials	398	0
Health and Medical	144	0
Safety and Security	1,047	0
Transportation	1,158	0
Erie County Total	**3,933**	**3**

Source: NYS DEC 1988; FEMA 2020
Note: Only jurisdictions with CEHA data are include in totals

Impact on Economy

Rapid coastal erosion has the potential for financial loss in the local and regional economy. Gradual coastal erosion may also pose financial risks such as damage to general building stock and associated tax loss, impacts to utilities and infrastructure, interruption to business, and impacts on tourism. In areas that are directly experiencing coastal erosion, renovations of commercial and industrial buildings may be necessary, disrupting associated services. If businesses and residents relocate from waterfront property, the low availability and high cost of housing in coastal areas may present a challenge. However, if residents with waterfront property remain, they may be required to make structural changes or construct bulkheads or riprap to protect their property. The cost of these interventions may financially stress lower- or middle-income residents (NYC Emergency Management 2019). The Impact on Buildings subsection discusses direct impacts to buildings in Erie County.

Coastal erosion can cause extensive damage to the County's local economy, such as tourism. In 2017, tourism was a $1.8 billion industry for the County (Visit Buffalo Niagara 2017). Therefore, destruction caused by coastal erosion in any of the parks and coastal communities relying on tourism may have negative economic consequences.

Impact on the Environment

Erosion is a natural or man-made process that can greatly impact the environment. Sediment transferred through streams, lakes, and rivers can erode soil and impact ecosystems. High sediment concentrations can benefit the environment by retaining dead plant production and capturing suspended sediment (USGS n.d.). Alternatively, upland erosion can degrade water quality and quantity, ultimately impacting aquatic life. Negative overall impacts to the environment occur when erosion eliminates or contaminates critical habitats. For instance, filter-feeding bivalves consume small particles, which, if contaminated from erosion runoff, could kill them (Kreeger et al. 2010).

Cascading Impacts to Other Hazards

Coastal erosion can increase the risk of floods. Section 5.4.6 includes more information on the impact of floods.

Future Changes That May Impact Vulnerability

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and in how they interact can also provide insight to plan for the future.

Projected Development

Section 4 identifies areas targeted for future growth and development across the County. Any areas of growth located in the defined coastal risk areas could be potentially impacted by coastal erosion. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

According to the U.S. Census Bureau, the population of Erie County has remained stable between 2010 and 2019 (917,173 persons in 2010 and 917,296 persons in 2019). Estimated population projections provided by the 2017 Cornell Program on Applied Demographics indicates that the County's population will decrease into 2040, decreasing the total population to approximately 769,396 persons (Cornell Program on Applied Demographics 2017). Changes in the density of population can impact the number of persons exposed to erosion. As forests continue to be cleared for new development and run-off persists, the population in the County will remain exposed to this hazard. Furthermore, County visitors and tourists will continue to drive potential growth in the coastal communities and their amenities, exposing more persons to coastal erosion hazard areas.

Climate Change

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of events that exacerbate coastal erosion. While predicting changes of coastal erosion under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (U.S. Environmental Protection Agency [EPA], 2006). Ultimately, warmer temperatures may lead to an increase in frequency of storms, thus leading to more weather events with potentially increased severity, that cause erosion.

Change of Vulnerability Since 2015 HMP

Erie County continues to be vulnerable to the coastal erosion hazard. However, there are several differences between the exposure estimates of this plan update and the results reported in the 2015 HMP. Updated building stock from RS Means 2020 was used in the current risk assessment. Further, exposure for both the population and critical facilities was analyzed. These updated datasets provide a more accurate exposure analysis to the coastal erosion hazard.

5.4.2 Cyber Security

This section provides a hazard profile (description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment of the cyber security hazard for the Erie County Hazard Mitigation Plan (HMP).

5.4.2.1 Hazard Profile

This section presents the cyber security description, extent, location, previous occurrences and losses, and probability of future occurrences.

Hazard Description

A cyber incident involves either the theft or modification of information on government agency computer systems, or a system compromise with the potential to disrupt essential services. A system compromise can impact one or more government agencies, a private utility, or specific Critical Infrastructure/Key Resources (CIKR) such as the power grid, public transportation systems, and wireless networks (NYC Emergency Management 2019).

Cyber incidents differ by motive, attack type and vector, and perpetrator profile. Motives for cyber incidents can vary, ranging from the pursuit of financial gain to political or social aims. Cyber threats are difficult to identify and comprehend. Types of threats include viruses erasing entire systems, intruders breaking into systems and altering files, intruders using someone's personal computer to attack others, or intruders stealing confidential information. The spectrum of cyber risks is limitless, with threats having a wide range of effects on the individual, community, organizational, and national sectors (NYC Emergency Management 2019). These risks include:

- Organized cyber-crime, state-sponsored hackers, and cyber espionage can pose national security risks to the United States
- Transportation, power, and other services may be disrupted by large-scale cyber incidents. The extent of the disruption is highly uncertain as it will be determined by many unknown factors, such as the target and size of the incident.
- Vulnerability to data breach and loss increases if an organization's network is compromised. Information about a company, its employees, and its customers can be at risk.
- Individually owned devices (such as computers, tablets, mobile phones, and gaming systems) that connect to the Internet are vulnerable to intrusion. Personal information may be at risk without proper security (NYC Emergency Management 2019).

A cyber-attack can affect a variety of sectors with potentially severe consequences, as described below.

- Android: Malicious software designed to exploit the Android operating systems (OS) running on smartphones, tablets, and other devices. Some variants of Android malware have the capability of disabling the device, allowing a malicious actor to remotely control the device, track the user's activity, lock the device, or encrypt or steal personal information transmitted from or stored on the device. As users are increasingly turning to mobile devices for both business and personal use, cyber threat actors are devoting their efforts to developing malware designed to compromise the device software.
- Botnets: A group of Internet-connected computers and devices that have been infected by malware that allows a malicious actor to control them remotely. The malicious actor then uses the botnet for nefarious purposes such as sending spam email, stealing data, spreading additional malware infections to other devices, generating illicit advertising revenue through click-fraud, mining cryptocurrencies, or conducting distributed denial-of-service (DDoS) attacks. In the cases where botnets are used to conduct DDoS attacks, these infected devices are used to generate an excessive amount of network traffic

designed to overwhelm a website, server, or online service to the point that legitimate users cannot access it.

- Exploit Kits (EKs): Toolkits that automate the exploitation of vulnerabilities in popular software applications to maximize successful infections and serve as a platform to deliver malicious payloads, such as Trojans, spyware, ransomware, and other malicious software. Most users will encounter EKs from visiting seemingly legitimate, high-traffic websites that either contain links to EKs embedded within malicious advertising (malvertising) or have malicious code hidden directly within the website itself. Malicious URLs linking to EKs are commonly distributed through spam email and spear-phishing campaigns.
- ICS: A collective term for several types of control systems and other equipment used to operate and/or automate industrial processes. ICS includes supervisory control and data acquisition (SCADA) systems – often incorrectly used interchangeably with ICS – and distributed control systems (DCS).
- iOS: Malicious software designed to exploit Apple's iOS operating system running on smartphones, tablets, and other devices. Some variants of iOS malware have the capability of disabling the device, allowing a malicious actor to remotely control the device, track the user's activity, lock the device, or encrypt or steal personal information transmitted from or stored on the device. As users are increasingly turning to mobile devices for both business and personal use, cyber threat actors are increasingly devoting their efforts to developing malware designed to compromise mobile devices, including operating systems (such as iOS) and applications (such as those available in the App Store). Android devices have historically seen more malware threats than iOS largely because of the open-source operating system; however, malware specifically targeting iOS has increased in the last 2 years.
- macOS: Though the majority of known malware targeting operating systems are made to exploit Microsoft Windows, devices running macOS are vulnerable as well. Furthermore, as macOS has become increasingly popular, more malware has been created to target macOS. More macOS malware was discovered in the second quarter of 2017 than in all of 2016.
- Point of Sale (PoS): Malicious software designed to steal credit and debit card data from payment processing systems, known as point-of-sale (PoS) terminals.
- Ransomware: Malicious software (malware) that attempts to extort money from victims by restricting access to a computer system or files. The most prevalent form of this profit-motivated malware is crypto-ransomware, which encrypts files into encoded messages that can only be decrypted (decoded) with a key held by the malicious actor.
- Trojans: A type of malware that, unlike viruses and worms, does not self-replicate. Named after the mythological wooden horse used to sneak Greek warriors through the gates of Troy, trojans are often disguised as legitimate software to avoid detection or trick users into installing the trojan onto their system. Users can be exposed to trojans through numerous vectors, such as clicking on links or opening attachments in phishing emails, other forms of social engineering, malicious advertising (malvertisting), or by visiting compromised websites, known as drive-by downloads. Once a trojan executes, it often downloads other malware onto the system or provides an attacker with a backdoor to gain access and conduct further malicious activity, such as stealing, deleting, or modifying data (New Jersey Cybersecurity and Communications Integration Cell 2019).

Cyber terrorism is the use of existing computers and information, particularly over the Internet, to cause physical or financial harm or a severe disruption of infrastructure service. Transportation, public safety, and utility services are all critical, and are highly dependent on information technology. The motive behind such disruptions can be driven by religious, political, or other objectives. Three kinds of attacks can be conducted on computers and these include attacks of physical means, attacks of electronic means, and attacks using malicious code (Waldron 2011). Specifically, these types of attacks include the following:

- Conventional kinetic weapons can be directed against computer equipment, a computer facility, or transmission lines to create a physical attack that disrupts the reliability of equipment.

- The power of electromagnetic energy, most commonly in the form of an electromagnetic pulse (EMP), can be used to create an electronic attack (EA) directed against computer equipment or data transmissions. By overheating circuitry or jamming communications, an EA disrupts the reliability of equipment and the integrity of data.
- Malicious code can be used to create a cyber-attack, or computer network attack (CNA), directed against computer processing code, instruction logic, or data. The code can generate a stream of malicious network packets that can disrupt data or logic through exploiting vulnerability in computer software, or a weakness in the computer security practices of an organization. This type of cyber-attack can disrupt the reliability of equipment, the integrity of data, and the confidentiality of communications (Wilson and Clay 2007).

Cyber terrorists typically have two broad motivations to carry out an attack, as described below.

- Effects-based: Cyber terrorism exists when computer attacks result in effects that are disruptive enough to generate fear comparable to a traditional act of terrorism.
- Intent-based: Cyber terrorism exists when unlawful or politically motivated computer attacks are done to intimidate or coerce a government or people to further a political objective, or to cause grave harm or severe economic damage (Wilson and Clay 2007).

Table 5.4.2-1. Perpetrator Categories for Cyber-attacks

Category	Category Description	Description of Attack
External	Outside the victim organization	These attacks—which can be perpetrated by subgroups including organized crime, nation-state or state-affiliated entities, unaffiliated individuals, activists, former employees, acquaintances, competitors, or customers—can take any number of forms.
Internal	Inside the victim organization	These attacks have usually been malicious, for the purposes of financial gain, though some were the result of breaches because of careless or accidental data exposure. Internal actor subgroups include system admin, end-user, doctor or nurse, developer, manager, executive, cashier, finance, and human resources.
Partner	Third party sharing a business relationship with the victim	This attack is the least common of the three perpetrator categories and often unintentional. Example: a courier losing a device containing sensitive data

Source: Verizon Wireless DBIR 2018

In terms of specific attacks on computers, cyber terrorists have the ability to attack several types of computer systems in a variety of ways. The systems are summarized in Table 5.4.2-2.

Table 5.4.2-2. Computer Systems that can be Attacked

Computer System	Description
All system and network devices with BIND weaknesses	The Berkeley Internet Name Domain (BIND) package is the most widely used implementation of Domain Name Service (DNS) by which systems on the Internet are located by name, without having to know specific Internet protocol (IP) addresses. In a typical example of a BIND attack, intruders erase system logs and install tools to gain administrative access. They then compile and install Internet Relay Chat (IRC) utilities and network scanning tools, which are used to scan more than a dozen class-B networks in search of additional systems running vulnerable versions of BIND. In a matter of minutes, they can use the compromised system to attack hundreds of remote systems.
Vulnerable Common Gateway Interface (CGI) programs and application extensions (such as ColdFusion) installed on web servers (multiple UNIX and Linux systems)	Most web servers support CGI for data collection and verification. Intruders have exploited vulnerable CGI programs to vandalize web pages and steal credit cards.

Computer System	Description
RPC weaknesses (all Web servers)	Remote procedure calls (RPC) allow programs on one computer to execute programs on a second computer. They are widely used to access network services, such as shared files in the Network File System (NFS). There is compelling evidence that the vast majority of service attacks launched during 1999 and early 2000 were executed by systems that had been victimized because they had RPC vulnerabilities. In 1998, the broadly successful attack on U.S. military systems during the Solar Sunrise incident also exploited an RPC flaw found on hundreds of Department of Defense systems.
RDS security hole in Microsoft IIS (multiple UNIX and Linux systems)	Malicious users took advantage of programming flaws in Microsoft's Internet Information Server (IIS), which is used to host websites deployed on Microsoft Windows NT and Windows 2000, to run remote commands with administrator privileges. Experts who developed the "Top Ten" list of the most exploited Internet security flaws believe that exploiting other IIS flaws, such as .HTR files, are as common as exploits of Remote Desktop Services (RDS).
Sadmind (Solaris machines only)	Global file sharing and inappropriate information sharing via NetBIOS and Windows NT ports allow file sharing over networks. When improperly configured, they can expose critical system files or give full file system access to hostile parties.
User IDs, especially root/administrator with no or weak passwords (UNIX, Windows, and Macintosh systems)	Some systems come with "demo" or "guest" accounts with no passwords or with widely known default passwords. Service workers often leave maintenance accounts with no passwords, while some database management systems install administration accounts with default passwords. In addition, busy system administrators often select system passwords that are easily guessable ("love," "money," "wizard" are common) or use a blank password. Many attackers try default passwords and then try to guess passwords before resorting to more sophisticated methods.
IMAP and POP buffer overflow vulnerabilities or incorrect configuration (all systems)	Internet message access protocol (IMAP) and Post Office Protocol (POP) are popular remote access mail protocols, allowing users to access their e-mail accounts. The "open access" nature of these services makes them especially vulnerable to exploitation because openings are frequently left in firewalls to allow for external e-mail access. Attackers who exploit flaws in IMAP or POP often gain instant root- level control.
Default SNMP community strings set to "public" and "private" (multiple UNIX and Linux systems)	The Simple Network Management Protocol (SNMP) is widely used by network administrators to monitor and administer all types of network-connected devices, ranging from routers to printers to computers. SNMP uses an unencrypted "community string" as its only authentication mechanism. Lack of encryption creates one level of security vulnerability, but the default community string used by the vast majority of SNMP devices is "public," with a few clever network equipment vendors changing the string to "private," which presents a greater security risk. Attackers can use this vulnerability in SNMP to reconfigure or shut down devices remotely.

Source: New Jersey Office of Emergency Management 2019

In addition to the motivations for cyber-attack on vulnerable systems, cyber-attacks can be further divided by the complexity of the attack. The categories of attacks include:

- ***Simple-unstructured attacks*** are the most common. These are amateurish attacks with relatively minimal consequences.
- ***Advanced-structured attacks*** are more sophisticated and consequential and have a greater emphasis on targeting victims prior to an attack, resulting in a more debilitating effect.
- ***Complex-coordinated attacks*** are the most advanced and most troublesome type of attack where success could mean a network shutdown.

Because virtually all critical systems are reliant upon computer systems, the secondary hazards that could result from a cyber terrorism attack could be devastating. For example, many of New York's roadway systems rely on sophisticated traffic control systems that prevent gridlock and accidents daily. Without these systems, the risk of accidents increases, not only auto accidents but also hazardous materials in-transit incidents. Additionally, a cyber-attack on a nuclear power plant could have devastating consequences if the plant suffers an intentional catastrophic failure. A cyber-attack could also completely incapacitate the communications infrastructure, not only in New York but across the United States, leading to disturbing secondary consequences and hazards. Public Safety Answering Points (PSAPs) could be targeted by cyber-attacks, and if affected, significant impacts could occur to public safety response and dispatching of emergency services.

Because the power grid is also largely controlled by computer systems, a widespread power outage is a possibility. A failure of the power grid would severely impact the health and welfare of individuals reliant on power, such as those with medical needs requiring specialized equipment. The number of critical systems reliant on computer systems are numerous, thus disruption of one or more of the systems would cause severe secondary-cascading hazards. Secondary impacts could also affect private structures and systems within them, such as HVAC systems, life support systems, and security systems.

Since cyber security is a fairly new concept, limited regulations are in place. The United States Department of Homeland Security (DHS) recognizes the threat of a potential cyber-attack and has established the Cyber and Infrastructure Security Agency (CISA) Division to address cyber related threats. CISA is responsible for protecting the nation's critical infrastructure from physical and cyber threats. This mission requires effective coordination and collaboration among a broad spectrum of government and private-sector organizations (U.S. Department of Homeland Security N.D.).

Extent

The magnitude or extent of an incident will vary greatly based on the size, extent, and duration of the impact. Additionally, the extent will vary based upon which specific system is affected by an attack, the warning time, and ability to preempt an attack.

The extent, nature, and timing of cyber incidents are impossible to predict. There may or may not be any warning. Some cyber incidents take a long time (weeks, months or even years) to be discovered and identified (FEMA 2019).

The Multi-State Information Sharing and Analysis Center (MS-ISAC) created the Cyber Alert Level Indicator. It shows the current level of malicious cyber activity and reflects the potential for, or actual damage. The five cyber alert levels include low, guarded, elevated, high, and severe. Each level is indicated by a color. The following is additional information regarding these levels:

- **Low** – Indicates a low risk. No unusual activity exists beyond the normal concern for known hacking activities, known viruses, or other malicious activity.
- **Guarded** – Indicates a general risk of increased hacking, virus, or other malicious activity. The potential exists for malicious cyber activities, but no known exploits have been identified, or known exploits have been identified but no significant impact has occurred.
- **Elevated** – Indicates a significant risk because of increased hacking, virus, or other malicious activity that compromises systems or diminishes service. At this level, known vulnerabilities are being exploited with a moderate level of damage or disruption, or the potential for significant damage or disruption is high.
- **High** - Indicates a high risk of increased hacking, virus, or other malicious cyber activity that targets or compromises core infrastructure; causes multiple service outages; compromises multiple systems; or compromises critical infrastructure. At this level, vulnerabilities are being exploited with a high level of damage or disruption, or the potential for severe damage or disruption is high.
- **Severe** - Indicates a severe risk of hacking, virus, or other malicious activity resulting in wide-spread outages and/or significantly destructive compromises to systems with no known remedy; or debilitates one or more critical infrastructure sectors. At this level, vulnerabilities are being exploited with a severe level or widespread level of damage or disruption of Critical Infrastructure Assets.

The United States Federal Cybersecurity Centers, in coordination with departments and agencies with a cybersecurity or cyber operations mission, adopted a common schema for describing the severity of cyber incidents affecting the homeland, U.S. capabilities, or U.S. interests. The schema establishes a common framework for evaluating and assessing cyber incidents to ensure that all departments and agencies have a common view of the:

- The severity of a given incident;
- The urgency required for responding to a given incident;
- The seniority level necessary for coordinating response efforts; and
- The level of investment required of response efforts (United States Federal Cybersecurity Centers, N.D.).

The figure below depicts several key elements of the schema.

Figure 5.4.2-1. Cyber Incident Severity Schema

	General Definition
Level 5 *Emergency* (Black)	*Poses an imminent* threat to the provision of wide-scale critical infrastructure services, national gov't stability, or to the lives of U.S. persons.
Level 4 *Severe* (Red)	*Likely to result in a significant* impact to public health or safety, national security, economic security, foreign relations, or civil liberties.
Level 3 *High* (Orange)	*Likely to result in a demonstrable* impact to public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence.
Level 2 *Medium* (Yellow)	*May impact* public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence.
Level 1 *Low* (Green)	*Unlikely to impact* public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence.
Level 0 *Baseline* (White)	Unsubstantiated or inconsequential event.

Observed Actions	Intended Consequence[1]
Effect	Cause physical consequence
	Damage computer and networking hardware
Presence	Corrupt or destroy data
	Deny availability to a key system or service
Engagement	Steal sensitive information
	Commit a financial crime
Preparation	Nuisance DoS or defacement

Source: United States Federal Cybersecurity Centers N.D.

Location

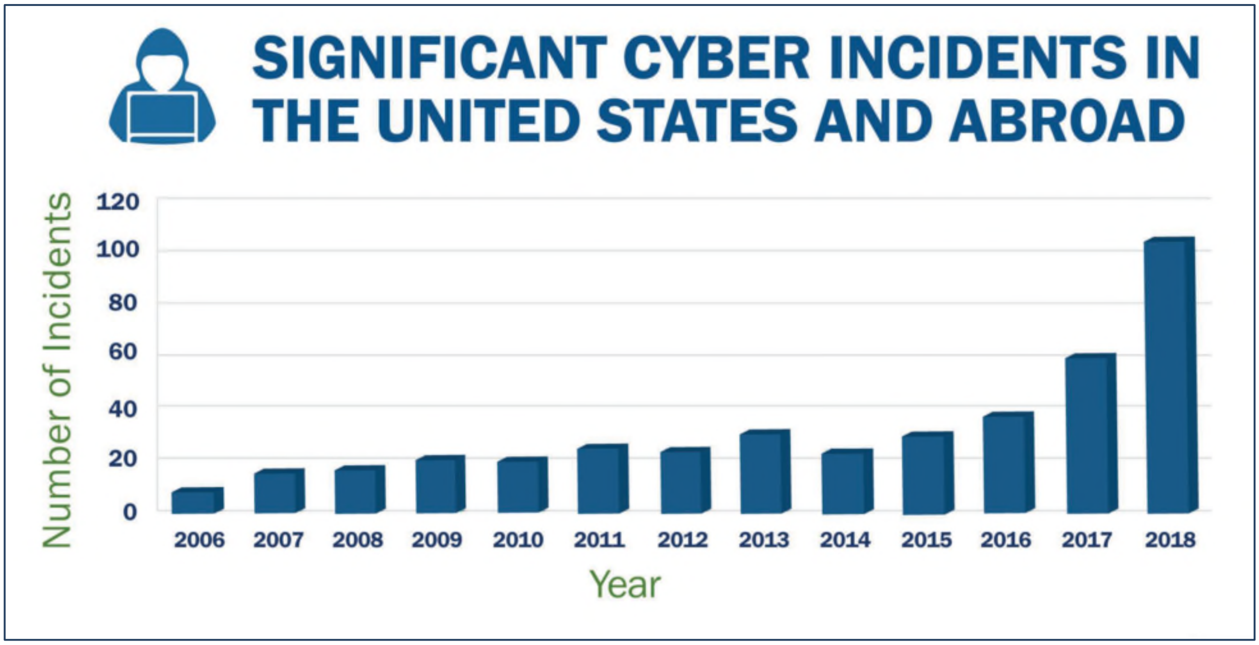
Cyber security incidents do not impact only a specific geographic location. Information systems are accessible all over the world. Potential threats can be foreign or domestic, internal or external, state-sponsored or a single rogue element. Terrorists, insiders, disgruntled employees, and hackers are included in this profile. Across New York State, countless systems rely on computers for day-to-day operations, including traffic signals, power plants, and HVAC systems, as well as systems responsible for ensuring the state's government can operate. All of Erie County is at risk for cyber security incidents.

Previous Occurrences and Losses

While no major direct cyber-attacks have affected Erie County, cyber terrorism is an emerging hazard that can impact the state's computer infrastructure and the systems and services provided to the public. Across the United States and globally, concerns over cyber terrorism are growing (U.S. Department of Homeland Security 2019). Many smaller-scale attacks have occurred.

To date, no FEMA disaster declarations have been related to a cyber-attack. According to the U.S. Department of Homeland Security, significant cyber incidents have risen steadily in the last 5 years in the United States and abroad.

Figure 5.4.2-2. Significant Cyber Incidents in the United States and Abroad



Source: U.S. Department of Homeland Security 2019

Probability of Future Occurrences

The Department of Homeland Security has noted that cyber incidents are on the rise globally, as shown in the figure above (U.S. Department of Homeland Security 2019). The level of success of an attack and the subsequent damage it can create will vary greatly. With the growing popularity and use of computers, there has been a significant increase in investigations where computers are being utilized for the commission of fraud and identify theft. The probability of a cyber-attack that will affect Erie County is difficult to calculate; however, it is estimated that Erie County will continue to experience direct and indirect impacts of cyber-attacks.

In Section 5.3, the identified hazards of concern for Erie County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Partnership, the probability of occurrence for cyber-attacks in the county is considered to be "frequent."

Climate Change Impacts

Because cyber-attacks are human-caused, no climate change impacts are associated with this hazard.

5.4.2.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable to the identified hazard. The following discusses Erie County's vulnerability, in a qualitative nature, to the cyber security hazard. Table 5.4.2-3 summarizes potential impacts on population, facilities, economy, and the environment.

Table 5.4.2-3. Cyber-Attack Impact Summary

Consideration	Description
General Public	No direct loss of life is expected from an attack. Indirect injuries or deaths may result from secondary effects to critical life-sustaining resources, such as energy and water, as well as loss of medical devices.
Response Personnel	No direct effects to the health and safety of response personnel are expected; however, critical response systems may be affected.
Property, Facilities, and Infrastructure	Effects can range from annoyance to complete shutdown of critical infrastructures caused by infiltration of supervisory control and data acquisition (SCADA) systems. Secondary effects could disturb public welfare and property by denying services or providing false readings.
Economic	Because of the heavy reliance on the electronic transfer of economic and commercial information, the economy could be affected by communication difficulties.
Environment	Generally, cyber terrorism has no direct effect on the environment; however, the environment may be affected should a release of a hazardous material occur because of critical infrastructure failure.
Continuity of Operations	Severe effects to continuity of operations could result if a cyber-attack reached critical operational systems or systems needed to carry out the operation.
Reputation of the Entity	If exposed vulnerabilities were known and not reduced or eliminated before the attack, the entity would suffer major damage to their reputation for not taking action before the incident.
Delivery of Services	Cyber-attacks may affect delivery of services if the system was infiltrated and directed to malfunction by self-destructing or overloading.
Regulatory and Contractual Operations	Cyber-attacks would have no significant effect on regulatory or contractual obligations, other than the possible elimination of electronic records, which would affect both.

Source: NJOEM 2019

Impact on Life, Health and Safety

Although no direct loss of life is expected from a cyber-attack, all residents in Erie County are exposed to this hazard. Commonly stolen personal information includes name, social security number, and drivers' license information. Because it is difficult to predict the particular target of cyber terrorism, assessing vulnerability to the hazard is also difficult. Generally, all populations who directly use a computer or those receiving services from automated systems are vulnerable to cyber terrorism. Although all individuals in Erie County are vulnerable to an attack, certain types of attacks would impact specific segments of the population.

If the cyber-attack targeted the state's power or utility grid, vulnerable populations could be most impacted. For example, individuals with medical needs are vulnerable because many of the life-saving systems they rely on require power. Also, if an attack occurred during months of extreme hot or cold weather, the county's elderly population (those 65 years of age and older; i.e., 158,532 total persons in the county) would be vulnerable to the effects of the lack of climate control. These individuals may require shelter or admission to a hospital. Young children are also vulnerable to the secondary effects of cyber terrorism.

Furthermore, households located near vulnerable facilities could experience greater impacts of a cyber-attack. If a cyber-attack targeted a facility storing or manufacturing hazardous materials, individuals living adjacent to these facilities would be vulnerable to the secondary effects, should the attack successfully cause a critical failure at that facility. Individuals living within 10 miles of a nuclear power plant would be vulnerable if an attack occurred that caused a plant failure.

Impact on General Building Stock

Currently, about 360,925 buildings in Erie County are at risk of experiencing impacts from a cyber-attack. A cyber-attack can impact buildings ranging from annoyance to complete shutdown caused by infiltration of SCADA systems. Secondary effects could disturb public welfare and property by denying services or providing false readings (NJOEM 2019). If services are disrupted by a cyber-attack, damage may be incurred to physical assets. Should a cyber-attack target fire suppression systems, these structures are likely to be at higher risk for structural fire. In many cases, attacks on these systems are initially undetectable, and it may be some time before it is known that system impairment or failure is the result of a cyber event (NYC Emergency Management 2019).

Impact on Critical Facilities

Critical facilities and lifelines are vulnerable to cyber-attacks based on the significance of the facilities, and the potential to interrupt critical systems in the county. As previously mentioned, many critical facilities are reliant upon computer networks to monitor and control critical functions. This can include utilities, public safety facilities, medical facilities, or government buildings. A cyber-attack could result in catastrophic failure of one of these facilities. The power grid is reliant upon computer systems to distribute power to the county. An attack could disrupt power to all Erie County residents. This is just one example of how critical facilities are vulnerable to cyber-attacks. Given the importance of critical facilities to daily living activities, critical facilities are highly vulnerable to cyber-attacks.

Impact on the Economy

Cyber-attacks can have a damaging effect on public trust in systems that are traditionally considered stable and secure. Cyber-attacks can also have extensive economic impacts. Companies and government services can lose large sums of unrecoverable revenue from site down-time and possible compromise of sensitive confidential data. Further, the cost of malicious cyber activity involves more than the loss of financial assets or intellectual property. Cyber crimes can cause damage to a company's brand and reputation, consumer losses from fraud, the costs of service disruption and "cleaning up" after cyber incidents, and the cost of increased spending on cybersecurity (McAfee 2013).

Given the proliferation of electronic commerce and the reliance on electronics, virtually all elements of Erie County's economy are vulnerable to cyber-attacks. The secondary impacts of a significant attack would be devastating to the economy. For example, an attack that caused the loss of power to hundreds of thousands of businesses during peak holiday shopping months could potentially cost the state millions of dollars in tax revenue if these businesses were closed. Additionally, a disruption in New York's manufacturing, agricultural, or tourism sectors would have devastating impacts on the economy. While it is difficult to quantitatively measure the economic impact of a cyber terrorism attack, it is safe to say that the impact would be great, thus the economy is vulnerable to cyber- attacks and cyber terrorism.

According to FEMA, cyber-attack victims in the United States lost a collective $1.33 billion to cyber actors in 2016 (FEMA 2019). However, this estimate could be understated. In the United States, the costs of cyber terrorism are estimated somewhere between $24 billion and $120 billion annually. These costs represent approximately 0.2 percent to 0.8 percent of the total gross domestic product (GDP) in the United States (McAfee 2013).

Cyber crimes against banks and other financial institutions can cost many hundreds of millions of dollars every year. Cyber theft of intellectual property and business-confidential information can cost developed economies billions of dollars—how many billions is an open question. These losses could be considered simply as the cost of doing business, or they could be a major new risk for companies and nations as these illicit acquisitions damage global economic competitiveness and undermine technological advantage (McAfee 2013).

Impact on the Environment

The impacts from cyber-attack are limited to infrastructure and people, as highlighted in earlier sections. Therefore, there are no known primary impacts to the environment.

Cascading Impacts to Other Hazards

Cyber-attacks may have cascading impacts causing other hazards, including threats to the utilities reliant on power as well as the potable water supply.

Future Changes that May Impact Vulnerability

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

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

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across Erie County. Any areas of growth could be potentially impacted by the cyber-attack hazard because the entire county is exposed and vulnerable. Additional development of structures or infrastructure reliant on computer systems could increase the county's risk to cyber-attack. Development of more structures using public power grids could also be affected by cyber-attacks and ultimately experience power outage. Therefore, understanding state requirements and recommendations may minimize risk for new development projects. For example, the New York Department of Financial Services issued a new set of cyber security regulations in 2017 for banks, lenders, mortgage companies, insurance companies, and service providers (NYS Department of Financial Services 2017). This regulation requires active protection against customer information by implementing a robust set of cybersecurity protocols, including the installation and use of a cybersecurity program, monitoring and testing of the selected program, and encryption of nonpublic information.

Projected Changes in Population

The population of Erie County is growing and is expected to increase until 2033 when it is expected to slowly decrease (Cornell University 2020). It is important to note that the population is aging (U.S. Census ACS 2010, ACS 2018) A growing population means that the number of persons vulnerable to cyber-attacks may increase for the county.

Climate Change

Because cyber-attacks are human-caused, no climate change impacts are associated with the cyber security hazard.

Change of Vulnerability Since the 2015 HMP

Cyber Security is a new hazard of concern for the 2022 Erie County HMP.

5.4.3 Earthquake

This section provides profile information, including description, location, extent, previous occurrences and losses, probability of future occurrences, and climate change impacts, as well as the vulnerability assessment for the earthquake hazard in Erie County.

5.4.3.1 Hazard Profile

Description

An earthquake is the sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge of the earth's tectonic plates, a volcanic eruption, or a manmade explosion (Federal Emergency Management Agency [FEMA] 2013; Shedlock and Pakiser 1995). Most earthquakes occur at the boundaries where the earth's tectonic plates meet (faults); however, less than 10 percent of earthquakes occur within plate interiors. New York State is in an area where plate interior-related earthquakes occur. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes from stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser 1995).

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

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

Extent

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

- Great Mw > 8
- Major Mw = 7.0 – 7.9
- Strong Mw = 6.0 – 6.9

- Moderate Mw = 5.0 – 5.9
- Light Mw = 4.0 – 4.9
- Minor Mw = 3.0 – 3.9
- Micro Mw = 3.0 – 3.9

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale, as well as the perceived shaking and damage potential for structures, are shown in Table 5.4.3-1. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake because of complexities in the structure of the earth's crust. Table 5.4.3-2 displays the Modified Mercalli Intensity (MMI) scale and its relationship to the areas peak ground acceleration.

Table 5.4.3-1. Modified Mercalli Intensity Scale

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

Source(s): USGS 2020

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

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

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
X	>124	Extreme	Very Heavy

Source: Freeman et al. (Purdue University) 2004
Note: PGA Peak ground acceleration

The ground experiences acceleration as it shakes during an earthquake. Peak ground acceleration (PGA) expresses the severity of an earthquake and is a measure of how hard the earth shakes, or accelerates, in each geographic area. PGA is expressed as a percent acceleration force of gravity (%g). For example, 1.0%g PGA in an earthquake (an extremely strong ground motion) means that objects accelerate sideways at the same rate as if they had been dropped from the ceiling. An earthquake with a 10%g PGA means that the ground acceleration is 10 percent that of gravity (Freeman, et al. 2004). Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 5.4.3-3.

Table 5.4.3-3. Damage Levels Experienced in Earthquakes

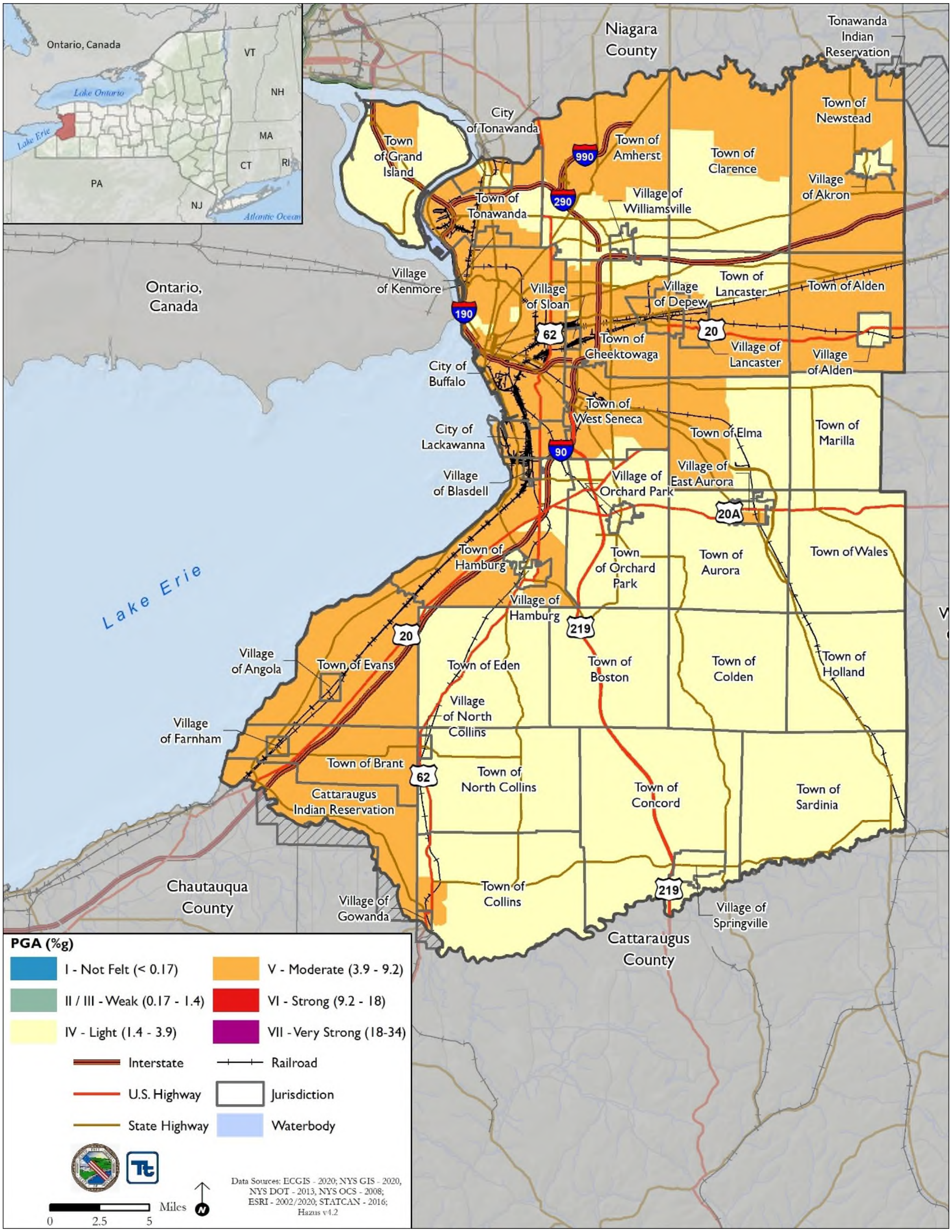
Ground Motion Percentage	Explanation of Damage
1-2%g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 - 20%g	May cause minor-to-moderate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

Source: Freeman et al. (Purdue University) 2004
Note: %g Percent acceleration force of gravity

National maps of earthquake shaking hazards have been produced since 1948. They provide information essential to creating and updating the seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning used in the United States. Scientists frequently revise these maps to reflect new information and knowledge. Buildings, bridges, highways, and utilities built to meet modern seismic design requirements are typically able to withstand earthquakes better, with less damage and disruption. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (USGS 2016).

A probabilistic assessment was conducted for the 500-year mean return period (MRP) in Hazards U.S.—Multi-Hazard (Hazus) v4.2 to analyze the earthquake hazard for Erie County. The Hazus analysis evaluates the statistical likelihood that a specific event will occur and what consequences will occur. Figure 5.4.3-1 illustrates geographic distributions of the Modified Mercalli Scale based on PGAs (%*g*) across Erie County for a 500-year MRP event at the census-tract level. A 500-year MRP is an earthquake with 0.2 percent chance that mapped PGAs will be exceeded in any given year.

Figure 5.4.3-1. Peak Ground Acceleration Modified Mercalli Scale for a 500-Year MRP Earthquake Event



The New York State Geological Survey conducted seismic shear-wave tests of the state's surficial geology. Based on these test results, the surficial geologic materials of New York State were categorized according to the National Earthquake Hazard Reduction Program's (NEHRP) Soil Site Classifications (Table 5.4.3-4). The NEHRP developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from A to E (as noted in Table 5.4.3-4), where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class E soils include water-saturated mud and artificial fill. The strongest amplification of shaking is expected for this soil type. Seismic waves travel faster through hard rock than through softer rock and sediments. As the waves pass from harder to softer rocks, the waves slow down and their amplitude increases. Shaking tends to be stronger at locations with softer surface layers where seismic waves move more slowly. Ground motion above an unconsolidated landfill or soft soils can be more than 10 times stronger than at neighboring locations on rock for small ground motions (NYS DHSES 2019).

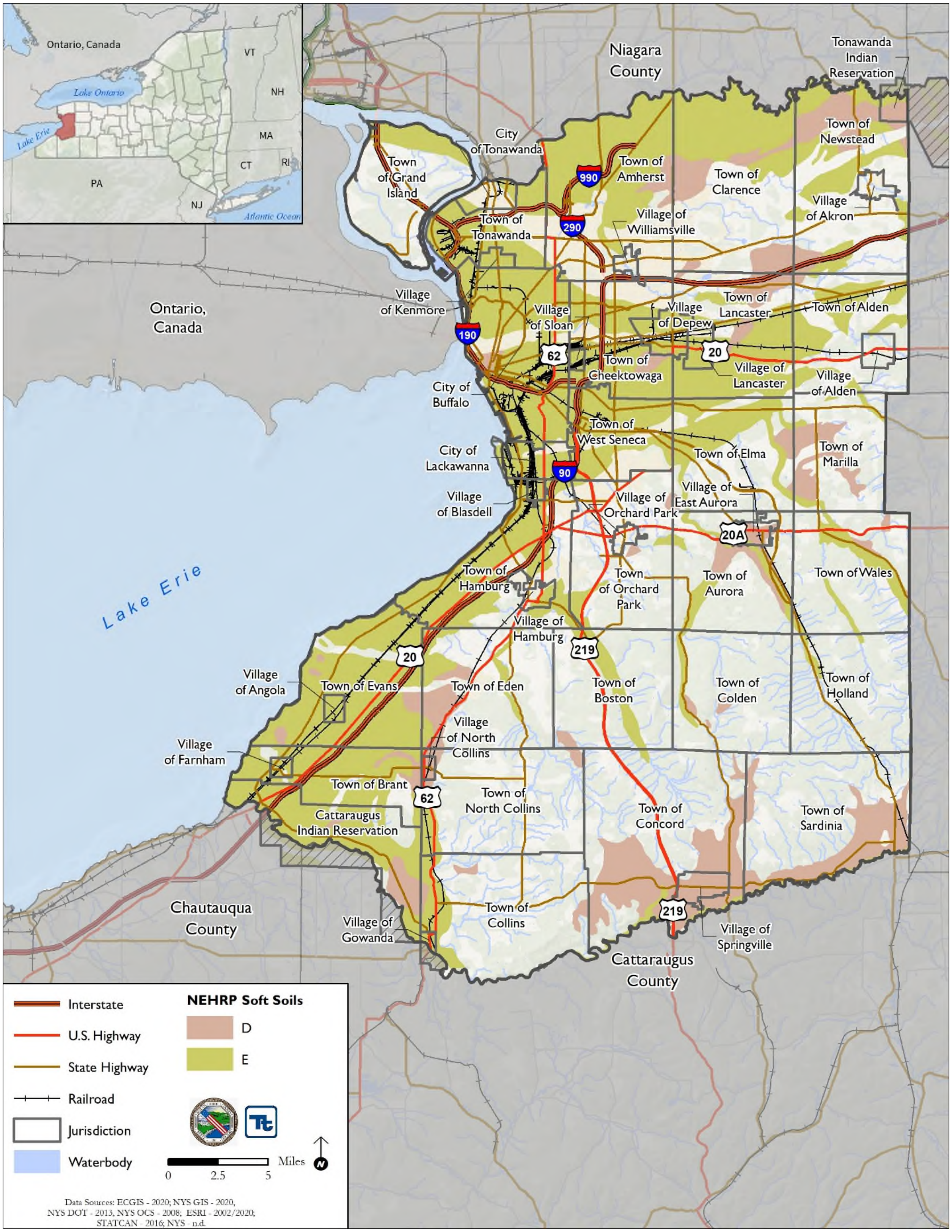
Table 5.4.3-4. NEHRP Soil Classifications

Soil Classification	Description
A	Very hard rock (e.g., granite, gneisses; and most of the Adirondack Mountains)
B	Rock (sedimentary) or firm ground
C	Stiff clay
D	Soft to medium clays or sands
E	Soft soil, including fill, loose sand, waterfront, lakebed clays

Source: NYS DHSES 2019

Figure 5.4.3-2 illustrates the NEHRP soils located throughout Erie County, according to NYS DHSES data. The available NEHRP soils information is incorporated into the Hazus v4.2 earthquake model for the risk assessment (discussed in further detail later in this section). Figure 5.4.3-2 shows that Erie County contains both D and E soft soils, with Class E being the predominate soft soil.

Figure 5.4.3-2. NEHRP Soils in Erie County

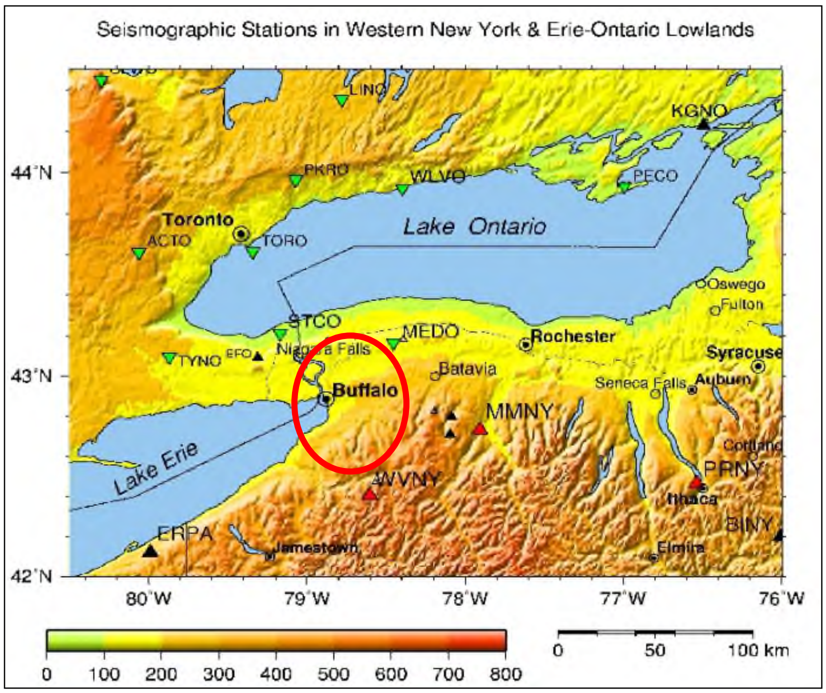


Location

The potential for earthquakes exists across all of New York State and four general regions would experience an amplification of ground motion during seismic activity. These regions are (1) Northwest NY – Northern Erie County, North Central; (2) Northeast NY – Jefferson, St. Laurence, and Northern Franklin Counties; (3) Upper Hudson River area of Eastern NY – Northern Saratoga, Washington, and Southern Warren Counties; and (4) Southeastern NY – Western Nassau County and New York City. Overall, these four regions are the most seismically active areas of the state. Erie County is located in Region 1 (NYS DHSES 2019).

The Lamont-Doherty Cooperative Seismographic Network (LCSN) monitors earthquakes that occur primarily in the northeastern United States. The goals of the monitoring project are to compile a complete earthquake catalog for this region, to assess the earthquake hazards, and to study the causes of the earthquakes in the region. The LCSN operates 40 seismographic stations in the following seven states: Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, and Vermont. No seismographic stations are present in Erie County; however, there are several within the vicinity of the county. Figure 5.4.3-3 shows the location of these stations in the western New York State area (LCSN 2014).

Figure 5.4.3-3. Lamont-Doherty Seismic Station Locations in the Western New York State Area



Source: *LCSN 2014*
Note: *The red oval indicates the approximate location of Erie County.*
The red triangles indicate secondary school, college, and university facility stations.
The black triangles indicate environmental research and education centers.
In addition to the Lamont-Doherty seismic stations, USGS operates a global network of seismic stations to monitor seismic activity. While no seismic stations are located in New York State, nearby stations are positioned
The green triangles indicate public places or state geological survey centers.

Figure 5.4.3-4 shows locations of USGS seismic stations near New York State, specifically in State College, Pennsylvania, and Oak Ridge, Massachusetts.

Figure 5.4.3-4. USGS Seismic Stations Near New York State

Source: USGS 2020
Note: The red circle indicates the approximate location of Erie County.

Previous Occurrences and Losses

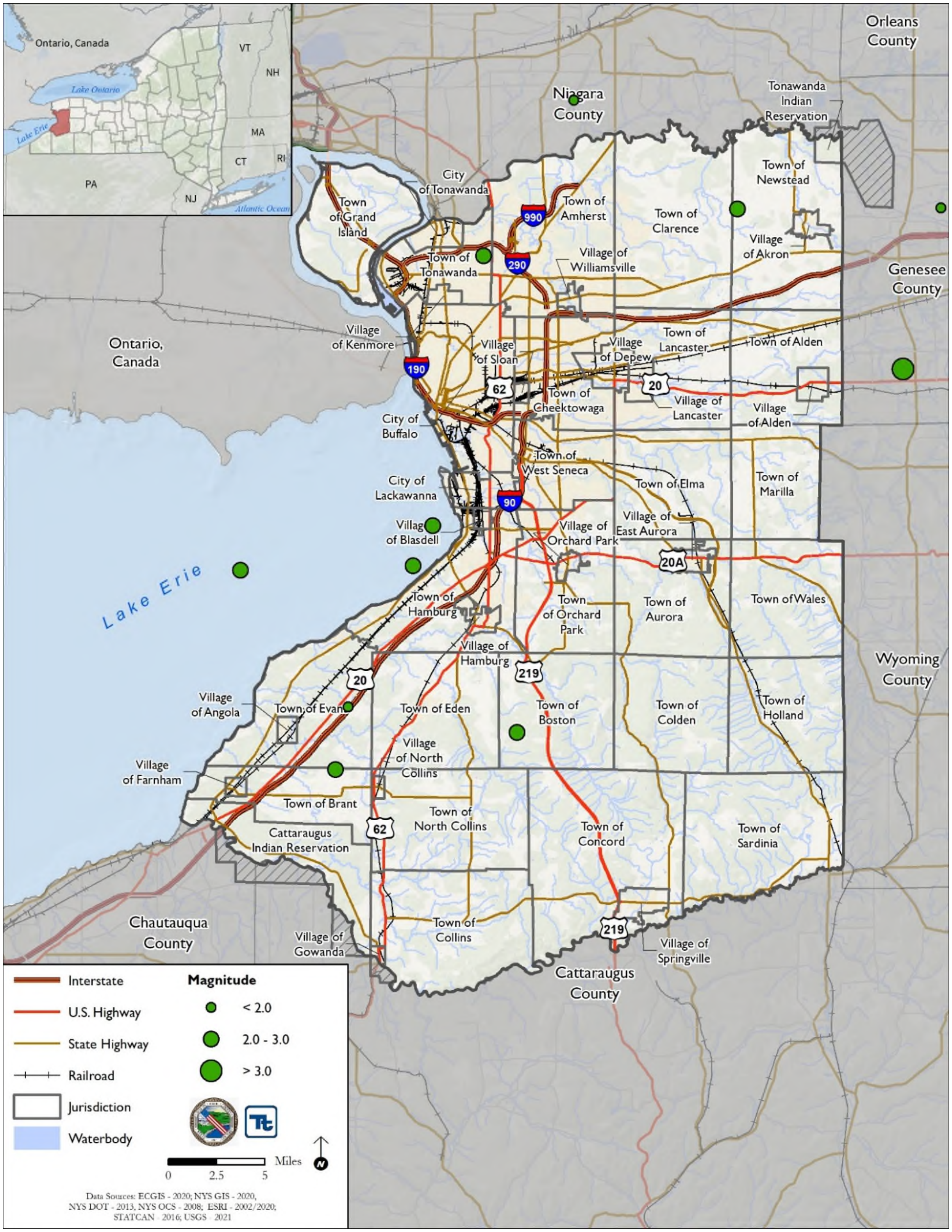
Many sources provided historical information on previous occurrences and losses associated with earthquakes throughout New York State. Therefore, with so many sources reviewed for the purpose of this HMP update, loss and impact information for many events could vary depending on the source.

Between 1954 and 2019, New York State was included in one earthquake-related major disaster (DR) or emergency (EM) declaration; DR-1415: Earthquake. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. Erie County was not included in any earthquake-related DRs or EMs (FEMA 2020).

According to the NYS Geological Survey and the New York State 2019 HMP update, approximately 551 significant earthquakes affected New York State between 1737 and 2016 (NESEC 2020). as obtained from the New York State Hazard Mitigation Plan. There has been one significant seismic event in the vicinity of Erie County: an event of reported magnitude 5.2 to 5.8 (depending on the source) centered on Attica in Wyoming County in August 1929. Within Erie County, only one event is recorded in Buffalo in 1857, though this event is not deemed "significant" by nature of having a magnitude of 5.0 or above. A handful of minor earthquakes have been epicentered in and around Erie County since 1737, although details of these events were not readily available (NYS DHSES 2019).

Figure 5.4.3-5 illustrates historic earthquake epicenters in Erie County between 1950 and 2019. According to this figure, eight earthquakes with epicenters in Erie County (including epicenters in eastern Lake Erie) have occurred. In addition to these earthquakes in Erie County, numerous events have originated outside of the county that have been felt within the county. Table 5.4.3-5 includes details regarding these events.

Figure 5.4.3-5. Earthquake Epicenters in Erie County and the Surrounding Area, 1950 – 2019



Note: *Smallest magnitude shown: M1.62*
Largest magnitude shown: M4.7

For this 2022 HMP update, known earthquake events that have impacted areas in and around Erie County between 1950 and 2020 are identified in Table 5.4.3-5. Loss and impact information could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP update.

Table 5.4.3-5. Earthquake Events in Erie County, 1950 to 2019

Dates of Event	Magnitude (Modified Mercalli Scale)	Location	FEMA Declaration Number	County Designated?	Losses / Impacts
March 18, 2016	M1.7	Attica, NY	N/A	N/A	No damage reported.

Source(s): FEMA 2021; USGS 2020, NYS Hazard Mitigation Plan 2019
Note: All magnitudes listed refer to the, Modified Mercalli Scale, unless otherwise specified.
FEMA Federal Emergency Management Agency
N/A Not Applicable
USGS U.S. Geological Survey

Probability of Future Events

Earthquake hazard maps illustrate the distribution of earthquake shaking levels that have a certain probability of occurring over a given time period. According to the USGS, in 2017 (the date of the most recent analysis), Erie County had a PGA of 6%g to 10%g for earthquakes with a 2-percent probability of an occurrence within 50 years.

The New York State Disaster Preparedness Commission (NYS DPC) indicates that the earthquake hazard in New York State is often understated because other natural hazards occur more frequently (e.g., hurricanes, tornadoes, and flooding) and are much more visible. However, the potential for earthquakes does exist across the entire northeastern United States, and New York State is no exception.

In Section 5.3, the identified hazards of concern for Erie County were ranked. NYS DHSES conducts a similar ranking process for hazards that affect the state. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Partnership, the probability of occurrence for earthquakes in the county is considered “rare” (not likely to occur within 25 years, as presented in Table 5.3-1). However, for the 500-year mean return period (MRP) earthquake modeled in the Vulnerability Assessment section (below), the probability of occurrence is considered “rare” (not likely to occur within 100 years). With few incidents having occurred within Erie County, and few incidents reportedly affecting Erie County, it is anticipated that the county will experience few direct and indirect impacts from earthquakes in the future.

Climate Change

The potential impacts of global climate change on earthquake probability are unknown. Some scientists feel that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth’s crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. National Aeronautics and Space Administration (NASA) and USGS scientists found that retreating glaciers in southern Alaska might be opening the way for future earthquakes (NASA 2007).

Secondary impacts of earthquakes could be magnified by future climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity because of the increased saturation. Dams storing increased volumes of water according to a revised hydrograph could fail during seismic events. During the 1989 Loma Prieta, California, earthquake, liquefaction of the soils and debris used to fill a lagoon caused major subsidence, fracturing, and horizontal sliding of the ground surface (USGS n.d.). There are currently no models available to estimate these impacts.

5.4.3.2 Vulnerability Assessment

A probabilistic assessment was conducted for the 500-year MRPs through analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates. Figure 5.4.3-2 shows the geographic distribution of the NEHRP soil types in the county. Section 5.1 (Methodology and Tools) provides additional details on the methodology used to assess earthquake risk.

Impacts on Life, Health, and Safety

Overall, the entire population of Erie County is exposed to the earthquake hazard event. The impact of an earthquake on life, health, and safety is dependent upon the severity of the event. Risk to public safety and estimated loss of life from an earthquake in the county is minimal. However, populations inside or nearby unreinforced masonry construction are at higher risk due to greater potential for structural damage; people walking below building ornamentation and chimneys could be injured if those become loose and fall as a result of the earthquake.

Socially vulnerable populations, including the elderly (persons over age 65) and individuals living below the census poverty threshold, are most susceptible. Factors leading to this higher susceptibility include decreased mobility and financial ability to react or respond during a hazard, and the location and construction quality of their housing. There are 161,744 persons over the age of 65 and 126,806 persons living in poverty in Erie County (ACS 2019).

An exposure analysis was performed using the NEHRP soil data and the 2019 U.S. Census population data. As noted earlier, NEHRP Class D and E soils are soft soils that amplify and magnify ground shaking and increase building damage and losses; and thus, potentially increasing population at risk to the hazard event. The sum of the population (by Census block within the NEHRP Class D and E soil types) was calculated and summarized in Table 5.4.3-6 below. Overall, approximately 65.8-percent of the County's population is located on NEHRP Class D and E soils.

Table 5.4.3-6. Total Population Located in Class D and E NEHRP Soils

Jurisdiction	Total Population	Estimated Population Exposed to Class D and E NEHRP Soils Hazard Area	
		Number of People	Percent of Total
Akron (V)	2,871	0	0.0%
Alden (T)	7,418	2,514	33.9%
Alden (V)	2,577	0	0.0%
Amherst (T)	120,276	55,361	46.0%
Angola (V)	2,373	2,373	100.0%
Aurora (T)	7,599	2,244	29.5%
Blasdell (V)	2,645	2,645	100.0%
Boston (T)	8,042	2,838	35.3%
Brant (T)	1,541	1,361	88.3%
Buffalo (C)	256,480	232,768	90.8%
Cheektowaga (T)	73,129	54,869	75.0%
Clarence (T)	32,440	11,384	35.1%

Jurisdiction	Total Population	Estimated Population Exposed to Class D and E NEHRP Soils Hazard Area	
		Number of People	Percent of Total
Colden (T)	3,328	505	15.2%
Collins (T)	5,418	2,205	40.7%
Concord (T)	4,186	1,634	39.0%
Depew (V)	15,102	14,550	96.3%
East Aurora (V)	6,184	5,036	81.4%
Eden (T)	7,631	1,445	18.9%
Elma (T)	11,732	4,883	41.6%
Evans (T)	13,782	13,228	96.0%
Farnham (V)	459	410	89.3%
Gowanda (V)	1,043	1,043	100.0%
Grand Island (T)	21,047	4,328	20.6%
Hamburg (T)	45,985	34,289	74.6%
Hamburg (V)	9,636	3,653	37.9%
Holland (T)	3,355	159	4.7%
Kenmore (V)	15,132	15,135	100.0%
Lackawanna (C)	17,831	13,871	77.8%
Lancaster (T)	27,625	19,634	71.1%
Lancaster (V)	10,144	9,432	93.0%
Marilla (T)	5,378	2,053	38.2%
Newstead (T)	5,804	2,014	34.7%
North Collins (T)	2,130	316	14.8%
North Collins (V)	1,370	1,370	100.0%
Orchard Park (T)	26,361	1,879	7.1%
Orchard Park (V)	3,148	0	0.0%
Sardinia (T)	2,780	1,138	40.9%
Sloan (V)	3,562	3,562	100.0%
Springville (V)	4,298	4,129	96.1%
Tonawanda (C)	14,830	3,049	20.6%
Tonawanda (T)	57,027	38,634	67.7%
Wales (T)	3,020	931	30.8%
West Seneca (T)	45,344	30,490	67.2%
Williamsville (V)	5,233	0	0.0%
Erie County Total	**917,296**	**603,360**	**65.8%**

Sources: NYS GIS n.d.; American Community Survey 2019
Note: C - City; T – Town; V – Village; % - Percent

Residents may be displaced or require temporary to long-term sheltering after an earthquake event. The number of people requiring shelter is generally less than the number displaced, as some displaced persons use hotels or stay with family or friends following a disaster event. Table 5.4.3-7 estimates the number of households displaced, and population that may require short-term sheltering as a result of the 500-year MRP earthquake event. It is an aggregate value of the entire County and estimates that one household would be displaced, and one person would require short-term shelter.

Table 5.4.3-7. Summary of Estimated Sheltering Needs for Erie County

Scenario	Displaced Households	People Requiring Short-Term Shelter
500-Year Earthquake	66	39

Sources: NYS GIS n.d.; Hazus v4.2

According to the 1999-2003 NYCEM Summary Report (*Earthquake Risks and Mitigation in the New York / New Jersey / Connecticut Region*), a strong correlation exists between structural building damage and the number of injuries and casualties from an earthquake event. Further, the time of day also exposes different sectors of the community to the hazard. For example, HAZUS considers the residential occupancy at its maximum at 2:00 a.m., where the educational, commercial, and industrial sectors are at their maximum at 2:00 p.m., and peak commute time is at 5:00 p.m. Whether directly impacted or indirectly impacted, the entire population will be affected to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of utilities could impact populations that suffered no direct damage from an event itself. Table 5.4.3-8 summarizes Countywide injuries and casualties estimated for the 500-year MRP earthquake event.

Table 5.4.3-8. Estimated Number of Injuries and Casualties from the 500-Year MRP Earthquake Event

	Time of Day		
Level of Severity	2:00 AM	2:00 PM	5:00 PM
Injuries	30	62	30
Hospitalization	4	9	4
Casualties	1	1	1

Sources: NYS GIS n.d.; Hazus v.4.2

Impacts on General Building Stock

The entire County's general building stock is considered at risk and exposed to this hazard. As stated earlier, soft soils (NEHRP Soil Classes D and E) can amplify ground shaking to damaging levels even during a moderate earthquake (NYCEM 2003). Therefore, buildings located on NEHRP Classes D and E soils are at increased risk of damage from an earthquake. Table 5.4.3-9 summarizes the number and replacement cost value of buildings in Erie County located on NEHRP soil classes D and E.

Table 5.4.3-9. Number and Replacement Cost Value of Buildings Located on NEHRP Class D and E Soils

			Estimated Building Stock Exposed to Class D and E NEHRP Soil Hazard Area			
Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	1	0.1%	$1,320,894	0.2%
Alden (T)	3,400	$1,748,473,245	1,170	34.4%	$677,152,419	38.7%
Alden (V)	1,102	$602,655,574	0	0.0%	$0	0.0%
Amherst (T)	38,528	$27,372,255,690	17,586	45.6%	$12,384,553,543	45.2%
Angola (V)	874	$525,704,230	874	100.0%	$525,704,230	100.0%
Aurora (T)	4,280	$2,496,885,036	1,270	29.7%	$670,683,376	26.9%
Blasdell (V)	1,026	$638,571,953	1,026	100.0%	$638,571,953	100.0%
Boston (T)	4,040	$1,702,475,276	1,470	36.4%	$682,577,130	40.1%
Brant (T)	1,325	$657,594,060	1,166	88.0%	$581,530,213	88.4%
Buffalo (C)	83,471	$58,603,851,634	75,648	90.6%	$52,674,127,383	89.9%
Cheektowaga (T)	30,938	$17,530,893,277	23,039	74.5%	$12,031,221,540	68.6%
Clarence (T)	13,660	$9,866,246,863	4,703	34.4%	$3,028,841,540	30.7%

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed to Class D and E NEHRP Soil Hazard Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Colden (T)	2,110	$854,417,381	370	17.5%	$186,343,406	21.8%
Collins (T)	2,521	$1,189,158,504	976	38.7%	$509,391,402	42.8%
Concord (T)	3,245	$1,338,570,261	1,313	40.5%	$595,833,420	44.5%
Depew (V)	6,532	$3,841,823,815	6,239	95.5%	$3,283,049,383	85.5%
East Aurora (V)	2,441	$1,723,816,550	2,012	82.4%	$1,350,854,445	78.4%
Eden (T)	4,290	$2,180,455,513	787	18.3%	$394,939,063	18.1%
Elma (T)	6,093	$3,775,039,302	2,530	41.5%	$1,340,165,638	35.5%
Evans (T)	7,952	$3,335,060,692	7,643	96.1%	$3,192,262,346	95.7%
Farnham (V)	189	$87,990,422	169	89.4%	$81,364,324	92.5%
Gowanda (V)	396	$249,516,940	396	100.0%	$249,516,940	100.0%
Grand Island (T)	8,426	$4,674,517,058	1,673	19.9%	$753,023,987	16.1%
Hamburg (T)	19,130	$11,911,210,828	14,137	73.9%	$8,571,232,523	72.0%
Hamburg (V)	3,794	$2,005,172,252	1,431	37.7%	$699,202,903	34.9%
Holland (T)	2,182	$1,151,194,342	133	6.1%	$79,197,301	6.9%
Kenmore (V)	6,017	$2,305,529,001	6,018	100.0%	$2,305,727,486	100.0%
Lackawanna (C)	6,751	$4,030,622,400	5,232	77.5%	$3,155,944,351	78.3%
Lancaster (T)	10,973	$6,845,493,469	7,756	70.7%	$4,640,798,063	67.8%
Lancaster (V)	4,323	$2,217,331,122	3,997	92.5%	$1,918,292,835	86.5%
Marilla (T)	2,956	$1,099,846,031	1,116	37.8%	$431,863,131	39.3%
Newstead (T)	4,202	$2,181,758,974	1,211	28.8%	$500,381,299	22.9%
North Collins (T)	1,898	$889,517,676	288	15.2%	$159,078,273	17.9%
North Collins (V)	551	$383,968,909	551	100.0%	$383,968,909	100.0%
Orchard Park (T)	10,748	$8,174,650,530	735	6.8%	$362,433,473	4.4%
Orchard Park (V)	1,211	$867,347,745	0	0.0%	$0	0.0%
Sardinia (T)	2,184	$1,068,523,829	926	42.4%	$541,848,093	50.7%
Sloan (V)	1,674	$634,998,253	1,674	100.0%	$634,998,253	100.0%
Springville (V)	1,816	$1,354,905,864	1,753	96.5%	$1,333,521,872	98.4%
Tonawanda (C)	6,452	$3,291,492,557	1,334	20.7%	$892,223,232	27.1%
Tonawanda (T)	23,999	$14,694,684,404	16,473	68.6%	$11,507,058,387	78.3%
Wales (T)	1,923	$833,853,270	621	32.3%	$280,506,198	33.6%
West Seneca (T)	17,970	$9,583,482,689	12,150	67.6%	$6,394,050,726	66.7%
Williamsville (V)	2,057	$1,126,868,443	2	0.1%	$39,338,903	3.5%
Erie County Total	**360,925**	**$222,515,035,436**	**229,599**	**63.6%**	**$140,664,694,787**	**63.2%**

Source: NYS GIS n.d; RS Means 2020
C – City; T – Town; V – Village; % - Percent

There is a strong correlation between PGA and damage a building might undergo (NYCEM 2003). The Hazus model is based on best available earthquake science and aligns with these statements. The Hazus probabilistic earthquake model was applied to analyze effects from the earthquake hazard on general building stock in Erie County. Figure 5.4.3-1 in this profile illustrates the geographic distribution of PGA (g) across the County for 500-year MRP events at the Census-tract level.

A building's construction determines how well it can withstand the force of an earthquake. The NYCEM report indicates that unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy. Additional attributes that affect a building's capability to withstand an earthquake's force include its age, number of stories, and quality of construction. Hazus v4.2 considers building construction and age of building as part of the analysis. Because a custom general building stock was used for this analysis, the building ages and building types from the inventory were incorporated into the Hazus v4.2 model.

Potential building damage was evaluated by Hazus across the following damage categories (none, slight, moderate, extensive, and complete). Table 5.4.3-10 provides definitions of these five categories of damage for a light wood-framed building; definitions for other building types are included in Hazus technical manual documentation.

Table 5.4.3-10. Example of Structural Damage State Definitions for a Light Wood-Framed Building

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

Source: Hazus Technical Manual

Building damage as a result of the 500-year MRP earthquake events was estimated using Hazus. Damage loss estimates include structural and non-structural damage to the building and loss of contents. Table 5.4.3-11 summarizes the estimated damages for the County by building type for the 500-year MRP earthquake events. Hazus estimates that 165 structures in the County will be face extensive damaged because of a 500-year earthquake event. The majority of these structures are un-reinforced masonry buildings. Hazus estimates that 1,335 structures will be moderately damaged, and majority of the buildings are un-reinforced masonry (i.e., 904 total), followed by wood buildings (i.e., 274 total).

Table 5.4.3-11 Estimated Number of Buildings Damaged by Building Type for 500-year MRP Earthquake Event

Building Category	Expected Number of Buildings Within Damage State Categories by Building Type 500-Year MRP				
	None	Slight	Moderate	Extensive	Complete
Wood	305,990	3,179	274	15	0
Steel	6,207	125	36	1	0
Concrete	1,762	32	10	0	0
Precast	0	0	0	0	0
Reinforced Masonry	0	0	0	0	0
Un-reinforced Masonry	34,968	2,129	904	147	15
Manufactured housing	4,698	319	111	2	0

Source: NYS GIS n.d.; Hazus v4.2

Hazus also summarizes damage state estimates for buildings by general occupancy class. Table 5.4.3-12 lists the severity of damage state structures will experience by the 500-year MRP earthquake event by general occupancy class. Table 5.4.3-13 also breaks down estimated damages by the structural general occupancy class for each jurisdiction.

Table 5.4.3-12. Estimated Buildings Damaged by General Occupancy for 500-year MRP Earthquake Events

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 500-Year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	334,595	None	328,122	98.1%
		Minor	5,126	1.5%
		Moderate	1,184	0.4%
		Severe	149	<0.1%
		Complete Destruction	14	<0.1%
Commercial Buildings	18,761	None	18,176	96.9%
		Minor	480	2.6%
		Moderate	95	0.5%
		Severe	9	<0.1%
		Complete Destruction	1	<0.1%
Industrial Buildings	1,758	None	1,674	95.2%
		Minor	60	3.4%
		Moderate	22	1.3%
		Severe	2	0.1%
		Complete Destruction	0	<0.1%
Government, Religion, Agricultural, and Education Buildings	5,812	None	5,653	97.3%
		Minor	119	2.0%
		Moderate	33	0.6%
		Severe	5	0.1%
		Complete Destruction	1	<0.1%

Source: NYS GIS n.d.; Hazus v4.2

Table 5.4.3-13. Estimated Replacement Cost Value (Building and Contents) Damaged by the 500-Year MRP Earthquake Event

Jurisdiction	Replacement Cost Value (RCV)	500-Year MRP				
		Estimated Total Damage (Building & Content Loss)	Percent of Total	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Akron (V)	$866,609,574	$87,100	<0.1%	$30,623	$12,494	$43,983
Alden (T)	$1,748,473,245	$645,897	<0.1%	$337,148	$95,294	$213,456
Alden (V)	$602,655,574	$126,572	<0.1%	$70,300	$25,734	$30,538
Amherst (T)	$27,372,255,690	$12,761,050	<0.1%	$7,109,573	$2,930,744	$2,720,733
Angola (V)	$525,704,230	$520,679	0.1%	$183,820	$110,915	$225,944
Aurora (T)	$2,496,885,036	$355,121	<0.1%	$210,042	$53,021	$92,058
Blasdell (V)	$638,571,953	$1,168,001	0.2%	$252,236	$143,509	$772,256
Boston (T)	$1,702,475,276	$134,261	<0.1%	$100,760	$17,652	$15,849
Brant (T)	$657,594,060	$296,916	<0.1%	$168,615	$55,395	$72,906
Buffalo (C)	$58,603,851,634	$55,329,241	0.1%	$22,708,580	$14,944,363	$17,676,297

Jurisdiction	Replacement Cost Value (RCV)	500-Year MRP				
		Estimated Total Damage (Building & Content Loss)	Percent of Total	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Cheektowaga (T)	$17,530,893,277	$16,976,978	0.1%	$8,251,974	$5,267,402	$3,457,601
Clarence (T)	$9,866,246,863	$2,369,093	<0.1%	$1,702,791	$360,924	$305,378
Colden (T)	$854,417,381	$47,591	<0.1%	$31,750	$4,532	$11,309
Collins (T)	$1,189,158,504	$265,123	<0.1%	$145,151	$55,777	$64,195
Concord (T)	$1,338,570,261	$103,559	<0.1%	$74,673	$10,583	$18,303
Depew (V)	$3,841,823,815	$4,343,543	0.1%	$1,607,697	$1,122,633	$1,613,214
East Aurora (V)	$1,723,816,550	$372,518	<0.1%	$200,938	$68,858	$102,723
Eden (T)	$2,180,455,513	$354,805	<0.1%	$158,699	$31,872	$164,234
Elma (T)	$3,775,039,302	$1,254,605	<0.1%	$783,903	$247,466	$223,236
Evans (T)	$3,335,060,692	$2,407,841	0.1%	$1,370,079	$479,418	$558,345
Farnham (V)	$87,990,422	$42,683	<0.1%	$24,247	$7,967	$10,469
Gowanda (V)	$249,516,940	$124,691	<0.1%	$49,352	$25,733	$49,607
Grand Island (T)	$4,674,517,058	$800,919	<0.1%	$461,784	$114,714	$224,421
Hamburg (T)	$11,911,210,828	$7,652,144	0.1%	$3,890,288	$1,360,820	$2,401,036
Hamburg (V)	$2,005,172,252	$704,201	<0.1%	$451,985	$111,906	$140,311
Holland (T)	$1,151,194,342	$74,669	<0.1%	$25,930	$8,343	$40,396
Kenmore (V)	$2,305,529,001	$2,223,090	0.1%	$1,568,890	$386,018	$268,181
Lackawanna (C)	$4,030,622,400	$4,179,985	0.1%	$2,007,918	$498,098	$1,673,968
Lancaster (T)	$6,845,493,469	$4,000,432	0.1%	$2,614,368	$754,927	$631,137
Lancaster (V)	$2,217,331,122	$2,603,086	0.1%	$1,301,071	$407,864	$894,151
Marilla (T)	$1,099,846,031	$164,429	<0.1%	$134,538	$7,814	$22,077
Newstead (T)	$2,181,758,974	$589,924	<0.1%	$309,716	$143,997	$136,211
North Collins (T)	$889,517,676	$76,814	<0.1%	$26,622	$13,939	$36,253
North Collins (V)	$383,968,909	$22,300	<0.1%	$7,728	$4,047	$10,525
Orchard Park (T)	$8,174,650,530	$769,777	<0.1%	$485,682	$123,421	$160,674
Orchard Park (V)	$867,347,745	$167,979	<0.1%	$85,371	$27,431	$55,178
Sardinia (T)	$1,068,523,829	$90,654	<0.1%	$38,626	$26,169	$25,859
Sloan (V)	$634,998,253	$719,689	<0.1%	$427,290	$144,959	$147,441
Springville (V)	$1,354,905,864	$373,141	<0.1%	$119,243	$133,605	$120,293
Tonawanda (C)	$3,291,492,557	$1,066,646	<0.1%	$342,189	$377,451	$347,006
Tonawanda (T)	$14,694,684,404	$14,073,232	0.1%	$5,996,845	$3,790,045	$4,286,342
Wales (T)	$833,853,270	$92,078	<0.1%	$60,790	$7,667	$23,621
West Seneca (T)	$9,583,482,689	$8,901,964	<0.1%	$5,037,937	$2,258,076	$1,605,951
Williamsville (V)	$1,126,868,443	$106,714	<0.1%	$61,056	$23,950	$21,708
Erie County Total	**$222,515,035,436**	**$149,541,734**	**0.1%**	**$71,028,818**	**$36,797,543**	**$41,715,372**

Source: NYS GIS n.d.; Hazus v4.2; RS Means 2020
C – City; T – Town; V – Village; % - Percent

Hazus estimated approximately $149.5 million in damage as a result of the 500-year earthquake event. This includes structural damage, non-structural damage, and loss of contents, representing 1-percent of the total replacement value for general building stock in Erie County. Residential buildings account for most of the damage for earthquake event.

Impact on Critical Facilities

After considering the general building stock exposed to, and damaged by, 500-year MRP earthquake event, critical facilities were evaluated. More than 60-percent of the critical facilities in Erie County are considered exposed to the earthquake hazard. Table 5.4.3-14 shows that of the 4,184 critical facilities in the County, 2,539 are located on NEHRP Class D and E soils. A total of 2,462 of these critical facilities are considered lifelines for the County. Table 5.4.3-15 through Table 5.4.3-17 summarize the number of critical facilities by type per jurisdiction in Erie County located on NEHRP Soil Class D and E hazard areas. The City of Buffalo has the greatest number of critical facilities exposed to the earthquake hazard area, and majority of the exposed critical facilities are bridges.

Table 5.4.3-14. Number of Critical Facilities Located Exposed to NEHRP D & E Soils

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Earthquake (NEHRP Soil D & E)			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	1	3.3%	1	3.8%
Alden (T)	76	68	36	47.4%	34	50.0%
Alden (V)	19	17	0	0.0%	0	0.0%
Amherst (T)	391	387	142	36.3%	141	36.4%
Angola (V)	20	18	20	100.0%	18	100.0%
Aurora (T)	95	81	43	45.3%	40	49.4%
Blasdell (V)	22	22	22	100.0%	22	100.0%
Boston (T)	81	75	35	43.2%	32	42.7%
Brant (T)	39	39	34	87.2%	34	87.2%
Buffalo (C)	751	748	676	90.0%	673	90.0%
Cheektowaga (T)	224	221	157	70.1%	154	69.7%
Clarence (T)	121	115	47	38.8%	46	40.0%
Colden (T)	67	56	23	34.3%	19	33.9%
Collins (T)	71	55	22	31.0%	19	34.5%
Concord (T)	84	68	29	34.5%	26	38.2%
Depew (V)	63	63	56	88.9%	56	88.9%
East Aurora (V)	42	41	36	85.7%	35	85.4%
Eden (T)	78	72	18	23.1%	16	22.2%
Elma (T)	83	75	36	43.4%	33	44.0%
Evans (T)	112	109	109	97.3%	106	97.2%
Farnham (V)	10	10	10	100.0%	10	100.0%
Gowanda (V)	7	7	7	100.0%	7	100.0%
Grand Island (T)	69	66	17	24.6%	16	24.2%
Hamburg (T)	189	181	158	83.6%	153	84.5%
Hamburg (V)	27	23	12	44.4%	8	34.8%
Holland (T)	90	70	9	10.0%	9	12.9%
Kenmore (V)	14	13	14	100.0%	13	100.0%
Lackawanna (C)	94	93	77	81.9%	77	82.8%
Lancaster (T)	109	103	67	61.5%	63	61.2%
Lancaster (V)	58	53	52	89.7%	47	88.7%
Marilla (T)	48	37	25	52.1%	20	54.1%
Newstead (T)	64	61	25	39.1%	23	37.7%
North Collins (T)	69	56	19	27.5%	18	32.1%
North Collins (V)	14	13	14	100.0%	13	100.0%
Orchard Park (T)	141	129	16	11.3%	15	11.6%
Orchard Park (V)	21	18	0	0.0%	0	0.0%
Sardinia (T)	78	57	31	39.7%	30	52.6%
Sloan (V)	8	8	8	100.0%	8	100.0%
Springville (V)	35	32	35	100.0%	32	100.0%
Tonawanda (C)	61	60	10	16.4%	10	16.7%
Tonawanda (T)	266	265	241	90.6%	240	90.6%
Wales (T)	82	68	35	42.7%	34	50.0%
West Seneca (T)	145	140	115	79.3%	111	79.3%
Williamsville (V)	16	14	0	0.0%	0	0.0%
Erie County Total	**4,184**	**3,933**	**2,539**	**60.7%**	**2,462**	**62.6%**

Source: NYS GIS n.d.; Erie County GIS 2020

C – City; T – Town; V – Village; % - Percent

Table 5.4.3-15. Number of Critical Facilities (A-M) Located in the NEHRP Soil Class D and E

Jurisdiction	Critical Facilities Exposed to Earthquake Class D and E NEHRP Hazard Soils																		
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station
Akron (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (T)	0	0	0	11	0	0	0	0	1	3	0	0	0	0	3	0	0	0	0
Alden (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	0	0	0	57	0	0	2	1	0	1	4	0	0	8	16	1	0	1	0
Angola (V)	0	0	0	3	0	0	2	0	0	1	1	0	0	2	2	1	0	1	0
Aurora (T)	0	0	0	22	0	0	0	0	0	3	0	0	0	1	0	1	0	0	0
Blasdell (V)	0	0	0	7	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0
Boston (T)	0	0	0	13	0	0	1	0	0	2	0	1	0	3	1	0	0	1	0
Brant (T)	0	0	1	10	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Buffalo ©	0	0	0	212	7	0	18	48	2	3	7	1	1	23	87	6	4	1	12
Cheektowaga (T)	0	0	0	50	0	1	2	2	0	2	4	0	1	12	27	2	0	1	0
Clarence (T)	0	2	0	22	0	0	0	0	0	1	0	0	0	1	3	0	0	0	0
Colden (T)	0	0	0	6	0	0	0	0	0	4	0	0	0	1	1	1	0	0	0
Collins (T)	0	0	0	7	0	1	0	0	0	3	0	0	0	1	1	0	0	1	0
Concord (T)	0	0	1	11	0	0	0	0	0	4	0	0	0	2	0	1	0	0	0
Depew (V)	0	0	0	15	0	0	0	1	0	1	0	0	0	3	8	3	0	0	0
East Aurora (V)	0	0	0	9	0	0	1	1	0	3	0	0	0	2	3	1	0	1	0
Eden (T)	0	0	0	7	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0
Elma (T)	0	0	0	18	0	0	0	0	0	3	2	0	0	3	2	0	0	0	0
Evans (T)	0	1	0	42	0	1	1	0	0	3	1	0	0	6	2	1	0	0	0
Farnham (V)	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Gowanda (V)	0	0	0	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Grand Island (T)	0	0	0	9	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0

Jurisdiction	Critical Facilities Exposed to Earthquake Class D and E NEHRP Hazard Soils																		
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station
Hamburg (T)	1	1	0	55	0	0	1	0	0	5	0	0	0	9	15	1	0	0	0
Hamburg (V)	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0
Holland (T)	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	0	1	0
Lackawanna ©	0	0	0	20	0	0	1	1	0	0	6	0	0	4	9	1	0	0	0
Lancaster (T)	1	2	0	24	0	0	1	0	0	4	1	0	0	3	14	2	0	0	0
Lancaster (V)	0	0	0	11	0	0	1	1	0	4	2	1	0	1	5	2	0	1	0
Marilla (T)	0	0	0	10	0	0	0	1	0	4	0	0	0	1	1	2	0	1	0
Newstead (T)	0	0	1	15	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0
North Collins (T)	0	0	0	3	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0
North Collins (V)	0	0	0	1	0	0	1	0	0	0	0	1	0	1	2	0	0	1	0
Orchard Park (T)	0	0	0	10	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Orchard Park (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sardinia (T)	0	0	0	9	0	3	0	0	0	1	0	0	0	2	1	1	0	0	0
Sloan (V)	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Springville (V)	0	0	0	2	0	0	1	1	0	2	0	0	0	3	3	2	1	1	0
Tonawanda ©	0	0	0	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Tonawanda (T)	0	0	0	34	0	0	1	2	0	2	14	1	0	9	49	4	1	0	0
Wales (T)	0	0	0	14	0	0	0	1	0	1	0	0	0	2	0	0	0	0	0
West Seneca (T)	1	1	0	43	0	0	1	0	0	5	2	0	0	3	13	1	0	0	0
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**3**	**7**	**3**	**800**	**7**	**6**	**35**	**61**	**3**	**76**	**45**	**7**	**2**	**115**	**276**	**37**	**6**	**13**	**12**

Source: NYS GIS n.d.; Erie County GIS 2020
C – City; T – Town; V – Village; % - Percent

Table 5.4.3-16. Number of Critical Facilities (N-Z) Located in the NEHRP Soil Class D and E

Jurisdiction	Critical Facilities Exposed to Earthquake Class D and E NEHRP Hazard Soils																	
	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Railway Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
Akron (V)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (T)	0	2	0	0	0	0	0	11	2	0	0	0	0	2	1	0	0	0
Alden (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	0	0	1	1	0	0	0	3	14	0	0	25	0	5	0	1	1	0
Angola (V)	0	0	1	1	0	0	0	0	1	0	0	0	0	3	1	0	0	0
Aurora (T)	0	0	0	1	0	0	0	7	2	0	0	0	0	0	0	0	6	0
Blasdell (V)	0	0	1	0	0	0	0	2	1	0	1	0	0	2	1	1	3	0
Boston (T)	0	1	1	2	1	0	1	2	1	0	0	0	1	2	1	0	0	0
Brant (T)	0	0	1	1	1	0	0	10	0	0	0	0	1	1	1	0	5	0
Buffalo ©	0	4	9	9	10	0	0	4	98	1	0	75	4	26	1	1	2	0
Cheektowaga (T)	0	0	2	1	7	0	2	1	19	0	0	3	1	6	1	0	10	0
Clarence (T)	0	1	0	2	1	0	0	5	3	0	0	0	0	1	0	1	4	0
Colden (T)	1	0	0	1	0	0	0	4	1	0	0	0	1	1	1	0	0	0
Collins (T)	0	0	0	1	2	0	0	3	0	0	0	0	1	0	1	0	0	0
Concord (T)	0	0	0	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0
Depew (V)	0	0	1	1	0	0	0	1	8	0	0	0	1	4	1	0	8	0
East Aurora (V)	0	0	1	0	0	0	0	0	4	0	0	0	2	0	2	1	5	0
Eden (T)	0	0	0	0	0	1	0	2	0	0	0	0	0	2	0	0	3	0
Elma (T)	0	0	0	0	0	1	0	1	0	0	0	0	2	2	0	0	2	0
Evans (T)	0	0	1	2	9	1	0	6	6	0	0	0	2	4	1	1	18	0
Farnham (V)	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	2	0
Gowanda (V)	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Grand Island (T)	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	1	0	0
Hamburg (T)	1	0	0	3	3	0	0	3	11	0	0	16	0	0	0	1	32	0
Hamburg (V)	0	0	1	0	0	0	0	0	2	0	0	0	0	2	1	0	1	0

Jurisdiction	Critical Facilities Exposed to Earthquake Class D and E NEHRP Hazard Soils																	
	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Railway Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
Holland (T)	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Kenmore (V)	0	0	1	1	0	0	0	0	2	0	0	0	0	2	2	0	0	0
Lackawanna ©	0	0	0	0	0	0	0	0	6	0	0	0	2	7	0	2	18	0
Lancaster (T)	0	0	0	1	2	0	0	1	1	0	0	1	0	2	0	0	7	0
Lancaster (V)	0	0	0	1	2	0	0	0	7	0	0	0	2	7	2	1	1	0
Marilla (T)	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1	0	0	0
Newstead (T)	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
North Collins (T)	0	2	0	1	1	0	0	5	2	0	0	0	1	0	0	0	0	0
North Collins (V)	0	0	1	1	0	0	0	0	2	0	0	0	0	1	2	0	0	0
Orchard Park (T)	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	1	0
Orchard Park (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sardinia (T)	0	0	0	2	0	0	0	11	0	0	0	0	0	0	1	0	0	0
Sloan (V)	0	0	0	0	0	0	0	0	1	0	0	0	1	3	1	0	0	0
Springville (V)	0	0	1	1	1	0	0	0	6	0	0	0	1	3	2	0	0	4
Tonawanda ©	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
Tonawanda (T)	1	85	1	1	9	0	0	0	17	0	0	0	1	7	0	2	0	0
Wales (T)	0	0	0	2	0	0	0	12	0	0	0	0	0	2	1	0	0	0
West Seneca (T)	0	6	0	1	1	0	0	0	19	0	0	0	0	9	0	0	9	0
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**3**	**101**	**25**	**41**	**54**	**3**	**3**	**118**	**240**	**1**	**1**	**120**	**24**	**108**	**28**	**13**	**138**	**4**

Source: NYS GIS n.d.; Erie County GIS 2020
C – City; T – Town; V – Village; % - Percent

Table 5.4.3-17 separates the critical facilities exposed to NEHRP soil by the lifeline category. A majority of the exposed lifelines fall under the transportation category.

Table 5.4.3-17. Number of Lifelines Exposed to NEHRP D Soils

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to Class D and E NEHRP Soils
Communications	59	41
Energy	176	151
Food, Water, Shelter	951	448
Hazardous Materials	398	276
Health and Medical	144	98
Safety and Security	1,047	615
Transportation	1,158	833
Erie County Total	**3,933**	**2,462**

Source: NYS GIS n.d.; Erie County GIS 2020; FEMA 2020

Hazus estimates the probability that critical facilities may sustain damage and the percent functionality as a result of 500-year MRP earthquake events (Table 5.4.3-18). As a result of a 500-Year MRP event, Hazus estimates that essential, utilities, and transportation facilities will be over 93-percent functional one day after the event. Furthermore, over 92-percent of these facilities will not sustain any damage.

Table 5.4.3-18. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities for the 500-Year MRP Earthquake Event

Name	Percent Probability of Sustaining Damage					Percent Functionality			
	None	Slight	Mod.	Ext.	Com.	Day 1	Day 7	Day 30	Day 90
Essential Facilities									
EOC	93.9%-97.6%	1.8%-4.4%	0.5%-1.5%	0.2%	<0.1 %	93.8%-97.5%	98.1%-99.3%	99.9%	99.9%
Fire	93.4%-99.6%	0.3%-4.7%	<0.1%-1.6%	0.2%	<0.1 %	93.3%-99.5%	98.0%-99.9%	99.8%	99.8%
Medical	98.6%-99.9%	0.0%-1.2%	0.2%	0.1%	<0.1 %	98.5%-99.9%	99.8%	99.9%	99.9%
Police	93.8%-99.5%	0.4%-4.5%	<0.1%-1.5%	<0.1 %	<0.1 %	93.7%-99.5%	98.1%-99.8%	99.8%	99.9%
School	93.4%-99.6%	0.3%-4.7%	<0.1%-1.6%	<0.1 %	<0.1 %	93.4%-99.5%	98.0%-99.9%	99.8%	99.9%
Utilities									
Communication	92.2%-99.9%	0.1%-4.9%	0.0%-2.6%	<0.1 %	0.0%	98.4%-99.9%	99.9%	99.9%	99.9%
Electric Power	93.7%-99.6%	0.4%-4.6%	<0.1%-1.6%	<0.1 %	<0.1 %	96.1%-99.7%	99.8%	99.9%	99.9%
Natural Gas	98.6%-99.9%	<0.1%-1.1%	0.1%	<0.1 %	<0.1 %	99.6%	99.9%	99.9%	99.9%
Oil	98.4%-99.9%	<0.1%-1.3%	0.2%	<0.1 %	<0.1 %	99.3%	99.8%	99.9%	99.9%
Potable Water	94.8%-99.8%	0.1%-2.9%	<0.1%-1.9%	0.1%	0.0%	96.5%-99.9%	99.9%	99.9%	99.9%
Wastewater	93.6%-99.5%	0.4%-4.6%	<0.1%-1.6%	0.1%	<0.1 %	95.3%-99.6%	99.8%	99.9%	99.9%
Transportation									
Airport Facility	98.0%-99.9%	0.1%-1.9%	<0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%

Name	Percent Probability of Sustaining Damage					Percent Functionality			
	None	Slight	Mod.	Ext.	Com.	Day 1	Day 7	Day 30	Day 90
Airport Runway	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0 %	100.0 %
Bus	98.1%-99.7%	0.3%-1.8%	<0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Highway Bridge	98.2%-100.0%	0.0%-1.4%	<0.1%	<0.1 %	<0.1 %	99.3%-100.0%	99.8%	99.9%	99.9%
Rail	98.1%-99.7%	0.3%-1.8%	0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%

Source: NYS GIS n.d.; Hazus v4.2
Notes: Mod. = Moderate Ext. = Extensive Com. = Complete

Impact on the Economy

Earthquakes also impact the economy, including loss of business function, damage to inventory (buildings, transportation, and utility systems), relocation costs, wage loss, and rental loss due to repair and replacement of buildings. Hazus estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses estimated by Hazus are summarized in Table 5.4.3-19.

Table 5.4.3-19. Building-Related Economic Losses from 500-Year MRP Earthquake Events

Mean Return Period (MRP)	Inventory Loss	Relocation Loss	Building and Content Losses	Wages Losses	Rental Losses	Capital-Related Loss
500-year MRP	$1,569,100	$19,172,800	$149,540,900	$8,645,000	$7,714,700	$3,835,900

Source: NYS GIS n.d.; Hazus v4.2

Although the Hazus analysis did not compute damage estimates for individual roadway segments and railroad tracks, assumedly these features would undergo damage due to ground failure resulting in interruptions of regional transportation and of distribution of materials. Losses to the community that would result from damage to lifelines could exceed costs of repair (FEMA 2012). Earthquake events can significantly affect road bridges, many of which provide the only access to certain neighborhoods. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses should be considered vulnerable. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with standards in place at time of construction.

Additionally, Hazus estimates volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare for and rapidly and efficiently manage debris removal and disposal. Debris estimates were divided into two categories: (1) reinforced concrete and steel that require special equipment to break up before transport can occur, and (2) brick, wood, and other debris that can be loaded directly onto trucks by use of bulldozers (Hazus Earthquake User's Manual).

Hazus estimated the generation of over 68,611 tons of total debris during the 500-year MRP event (Table 5.4.3-20)

Table 5.4.3-20. Estimated Debris Generated by the 500-year MRP Earthquake Event

Jurisdiction	500 Year MRP Debris (Tons)		
	Wood and Concrete	Metal and Steel	Total Debris
Akron (V)	49	8	58

Jurisdiction	500 Year MRP Debris (Tons)		
	Wood and Concrete	Metal and Steel	Total Debris
Alden (T)	257	51	307
Alden (V)	78	16	94
Amherst (T)	4,791	954	5,745
Angola (V)	248	54	302
Aurora (T)	168	28	197
Blasdell (V)	154	86	240
Boston (T)	82	13	94
Brant (T)	51	11	62
Buffalo (C)	15,703	4,191	19,893
Cheektowaga (T)	8,817	2,135	10,952
Clarence (T)	961	168	1,129
Colden (T)	26	4	30
Collins (T)	80	18	98
Concord (T)	34	6	40
Depew (V)	2,293	530	2,824
East Aurora (V)	121	25	146
Eden (T)	197	33	230
Elma (T)	521	98	619
Evans (T)	757	170	928
Farnham (V)	7	2	9
Gowanda (V)	55	12	67
Grand Island (T)	376	64	440
Hamburg (T)	2,474	654	3,128
Hamburg (V)	320	61	381
Holland (T)	46	7	53
Kenmore (V)	685	150	835
Lackawanna (C)	2,104	489	2,593
Lancaster (T)	1,386	283	1,670
Lancaster (V)	1,425	311	1,735
Marilla (T)	63	11	74
Newstead (T)	165	36	202
North Collins (T)	36	6	42
North Collins (V)	10	2	12
Orchard Park (T)	464	75	539
Orchard Park (V)	106	17	124
Sardinia (T)	37	6	44
Sloan (V)	316	68	385
Springville (V)	169	38	207
Tonawanda (C)	277	70	347
Tonawanda (T)	4,779	1,318	6,096
Wales (T)	38	6	45
West Seneca (T)	4,483	1,020	5,504
Williamsville (V)	82	12	94
Erie County Total	**55,294**	**13,317**	**68,611**

Source: NYS GIS n.d.; Hazus v4.2
C – City; T – Town; V – Village; % - Percent

Impact on the Environment

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

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

Cascading Impacts to Other Hazards

The Global Geoengineering Research Group in USGS has been investigating the relationship earthquakes have with ground failure, and coastal erosion (USGS n.d.). As mentioned in earlier sections, soft and loose soils are more susceptible to earthquake events. Ground failure can become exacerbated due to earthquake events, causing land sliding and coastal erosion. Areas of steep slopes are at greater risk of ground failure and potential erosion during earthquakes (USGS n.d.). Further, residual impacts from earthquakes could alter the floodplain extent for the County if ground failure and erosion occur. Damage could occur at coastal levees or canals may become breached as a result of an earthquake event, which could create flooding in the impacted areas. Refer to Sections 5.4.1, 5.4.6, and 5.4.8 for additional information.

Future Changes that May Impact Vulnerability

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

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

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County increased by a negligible amount between 2010 and 2019 (U.S. Census Bureau 2020). Estimated population projections provided by the Cornell Program on Applied Demographics indicates that the County's population will rise into 2040, increasing total population to approximately 945,891 persons (Cornell Program on Applied Demographics 2018). As population increases, persons that move into older structures in the County are at greater risk of being impacted by earthquake events because older structures are more vulnerable to ground shaking. Section 4 (County Profile) includes a more thorough discussion about population trends for the County.

Projected Development

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

Climate Change

Because the impacts of climate change on earthquakes are not well understood, a change in the County's vulnerability as the climate continues to change is difficult to determine. However, climate change has the potential to magnify secondary impacts of earthquakes. As a result of the climate change projections discussed above, the County's assets located on areas of saturated soils and on or at the base of steep slopes, are at a higher risk of landslides/mudslides because of seismic activity. Refer to Section 5.4.8 for additional discussion of the landslide hazard.

Change of Vulnerability

Since the 2015 HMP analysis, population statistics have been updated using the 5-Year 2015-2019 American Community Survey Population Estimates (American Community Survey 2019). The general building stock was also established using RS Means 2020 building valuations that estimated replacement cost value for each building in the inventory. Additionally, a critical facility dataset was provided from the County. Exposure to the earthquake hazard was determined by overlaying critical facilities and building centroids on New York State NEHRP soil layer. This layer was also imported into Hazus along with the building stock and critical facility data in order to determine the effects of a 500-year MRP event on both the County and individual jurisdictions.

Overall, this vulnerability assessment uses a more precise and thorough approach, which provides increased accuracy for estimated exposure and potential losses for Erie County.

5.4.4 Expansive Soils

This section provides a hazard profile and vulnerability assessment of the expansive soils hazard.

5.4.4.1 Hazard Profile

This section presents the expansive soils hazard description, extent, location, previous occurrences and losses, and probability of future occurrences.

Hazard Description

Soils and soft rock that tend to swell or shrink due to changes in moisture content are known as expansive soils. Expansive soils are often referred to as swelling clays because clay materials are most susceptible to swelling and shrinking. Changes in soil volume present a hazard primarily to structures built on expansive soils. The most extensive damage occurs to highways and streets (FEMA 1997).

In the U.S., two major groups of rocks serve as parent materials of expansive soils and these are most common in the western portion of the country. The first group consists of ash, glass, and rocks of volcanic origin. The aluminum silicate minerals in these volcanic materials often decompose to form expansive clay minerals, known as montmorillonite. The second group consists of sedimentary rocks containing clay minerals, for example, the shales of the semiarid west-central states (FEMA 1997).

The current New York State Hazard Mitigation Plan (HMP) does not profile expansive soils. However, according to the 2014 NYS HMP update, expansive soils are any soil that expands when wet and shrinks when dry. Soils are tested using an accepted standard of measurement to determine swell potential. Expansive soils can exert pressures up to 14,000 pounds per foot, causing the breakdown of building foundations and structural integrity. Roadbeds may also be affected and could lead to avalanche and collapse when cutting into mountains and hillsides (NYS DHSES 2014).

Expansive soils contain minerals, such as smectite clays, that are capable of absorbing water. As these clays absorb water, they increase in volume. The more water absorbed, the more their volume increases. Expansions of 10% or more are not uncommon. This change in volume can exert enough force on a building or other structure to cause damage. When dry, expansive soils shrink and can remove support from buildings or other structures and result in damaging subsidence. Fissures in the soil can also develop. Fissures can facilitate the deep penetration of water when moist conditions or runoff occurs. This produces a cycle of shrinkage and swelling that places repetitive stress on structures (NYS DHSES 2014).

Issues associated with expansive soils include:

- Foundation cracks
- Heaving and cracking on floor slabs and walls
- Jammed doors and windows
- Ruptured pipelines
- Heaving and cracking of sidewalks and roads
- Damage to the upper floors of the building (when motion in the structure is significant) (NYS DHSES 2014)

Extent

The extent to which soil expansion is present in an area or site can be measured using the Soil Expansion Potential standard (ASTM D-4829). The expansion index (EI) provides an indication of swelling potential of a compacted soil. The EI test is not used to duplicate any particular field conditions such as soil density, water content, loading, in-place soil structure, or soil water chemistry.

Table 5.4.4-1. Soil Expansion Index

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

Source: ASTM 2013
Note: The Uniform Building Code (UBC) mandates that special foundation design consideration be employed if the EI is 20 or greater.

Based on the expansion potential rating, mitigation may be required for building construction or repairs. The UBC mandates that special foundation design consideration be employed if the EI is 20 or greater. The New York Residential Building Code (Section R403.1.8) addresses consideration of expansive soils. Construction dangers are reduced when engineers incorporate cement or lime or other salts into expansive soils. These help to lessen the effects of expansion. Other methods of reducing expansive soil danger include replacing the top three to four feet of expansive soil with non-expansive soils or compacting existing expansive soil.

Linear extensibility is also used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent (refer to Table 5.4.4-2.). If linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and plant roots. As noted, special design is commonly needed; however, this data does not replace a geotechnical exploration and report used to determine expansive soil potential (USDA Natural Resource Conservation Services, 2020).

Table 5.4.4-2. Linear Extensibility Ratings

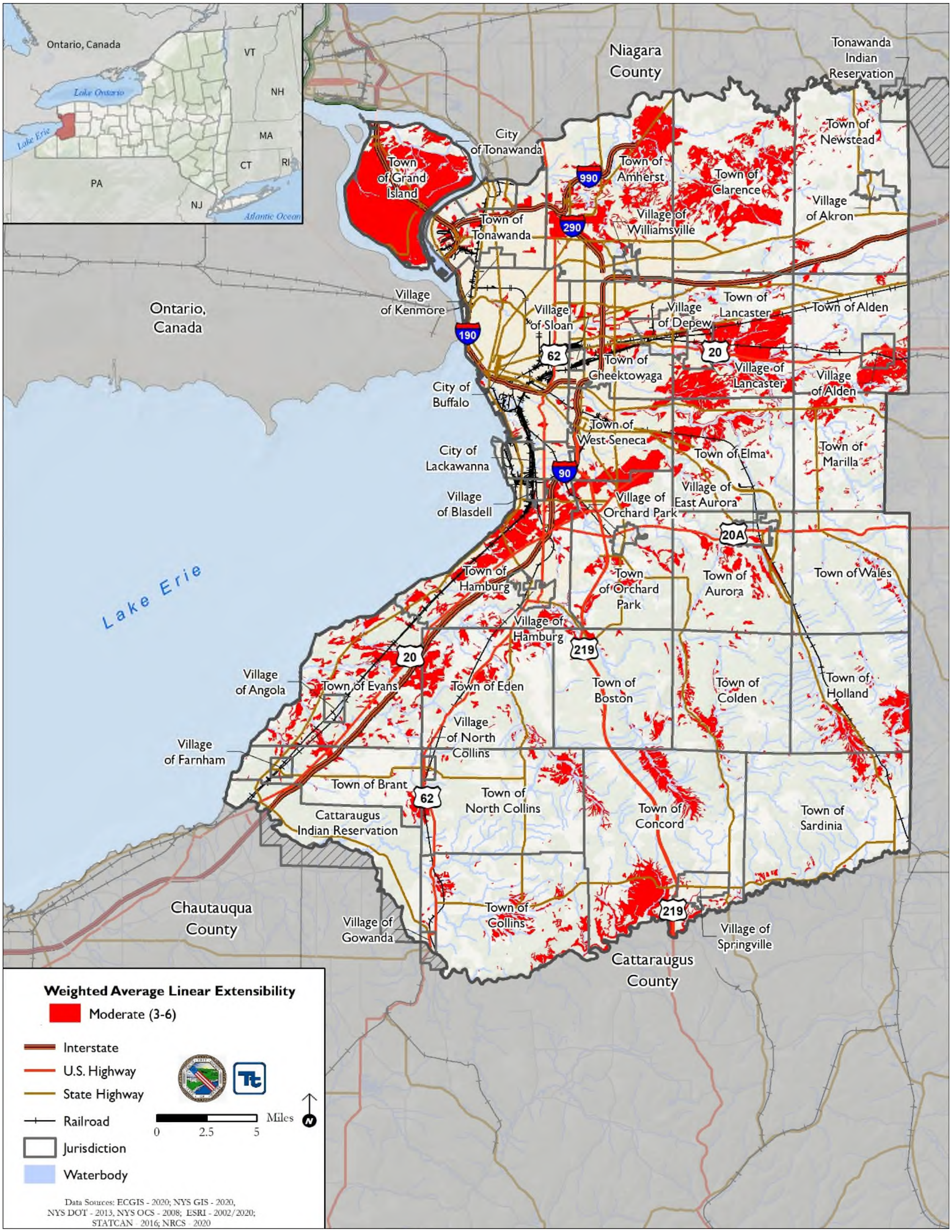
Percent Linear Extensibility	Shrink-Swell Potential
0-3	Low
3-6	Moderate
6-9	High
9-13	Very High

Source: USDA NRCA 2020

Location

A custom soil report was run for Erie County using USDA Natural Resources Conservation Area soils data. Out of the 211 types of soils in Erie County, 31 are considered to have moderate linear extensibility potential. These soils primarily occur in the northern half of the county and cover approximately 96,917 acres or 14.2 percent of the entire county. The highest-rated soils are Odessa Lakemont complex and Odessa silt loam soils, which have a median percent linear extensibility of 5.7 percent. This is considered to be moderate shrink-swell potential. Figure 5.4.4-1 illustrates the location of the linear extensibility potential in Erie County.

Figure 5.4.4-1. Expansive Soils in Erie County



Previous Occurrences and Losses

There have been no federally declared disasters for expansive soils in New York State. According to the New York State Geological Survey (NYSGS), historical records, including scientific study data for land subsidence in the state, is either sparse, not readily available, or does not exist in summary form. There may have been incidents of expansive soils causing damage, but these incidents have not been reported (NYS DHSES 2013).

Historic occurrences of damage caused by expansive soils are only known to be located in the Town of Amherst, generally in the area north of Main Street. In the 2015 Erie County HMP, the United States Armey Corps of Engineers (USACE) reported that between the years 1987 and 2005 – 3 to 4 percent of the total residential structures in the town reported slight to severe foundation-related damage and/or structural damage, in part due to building on expansive soils. New development generally has few reported problems. At that time, the USACE also determined that average total repair costs for damaged homes is about $7,900 but ranges from about $500 to $71,000.

Probability of Future Occurrences

In Section 5.3, the identified hazards of concern for Erie County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for expansive soils in Erie County is considered "occasional".

Although no reported incidents have occurred within the county, it is anticipated that Erie County may experience indirect impacts from expansive soils that may affect the general building stock and the local economy and may induce secondary hazards, such as fires and utility failure.

Climate Change Impacts

Climate change is beginning to affect both people and resources of Erie County, and the impacts of climate change will continue. Impacts related to increasing temperatures are already being felt in the county. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge. Each region in New York State, as defined by ClimAID, contains attributes that will be affected by climate change. Erie County is part of Region 1, Western New York, Great Lakes Plain. In Region 1, it is estimated that temperatures will increase by 3.0 ºF to 5.5 ºF by the 2050s and 4.5 ºF to 8.5 ºF by the 2080s (baseline of 48.0 ºF, mid-range projection). Precipitation totals will increase between 0 and 10% by the 2050s and 0 to 15% by the 2080s (baseline of 37.0 inches, mid-range projection). w displays the projected seasonal precipitation change for ClimAID Region 1 (NYSERDA 2014).

Table 5.4.4-3. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

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

Source: NYSERDA 2014

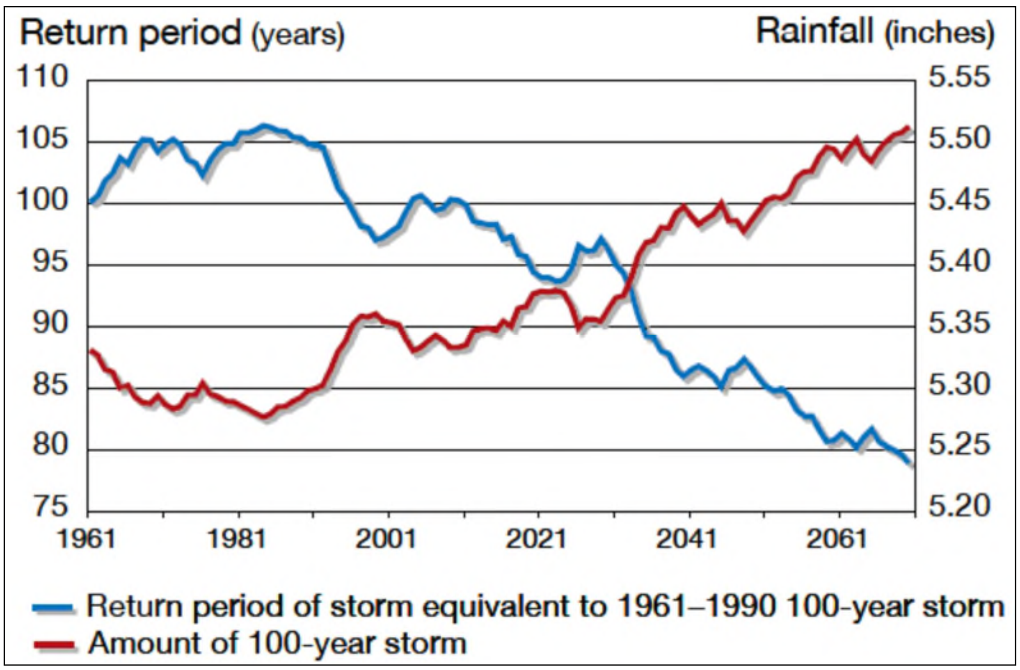
By the end of the century, the greatest increases in precipitation are projected to be in the northern parts of the state. Although seasonal projections are less certain than annual results, much of this additional precipitation is projected to occur during the winter months. During the late summer and early fall, in contrast, total precipitation is slightly reduced in many climate models. The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The increase in heavy downpours has the potential to affect drinking water;

heighten the risk of riverine flooding; flood key rail lines, roadways, and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA 2018).

Average annual temperatures are projected to increase across New York State by 2.0–3.4 ˚F by the 2020s, 4.1–6.8 ˚F by the 2050s, and 5.3–10.1 ˚F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern parts of the state. The state's growing season could lengthen by about a month, with summers becoming more intense and winters milder (NYSERDA 2018).

Increasing air temperatures intensify the water cycle by increasing evaporation and precipitation. This can cause an increase in rain totals during events with longer dry periods in between those events. These changes can have a variety of effects on the state's water resources (NYSERDA 2011). Figure 5.4.4-2 displays the project rainfall and frequency of extreme storms in New York State. The amount of rainfall in a 100-year event is projected to increase, while the number of years between such storms (return period) is projected to decrease. Rainstorms will become more severe and more frequent (NYSERDA 2011).

Figure 5.4.4-2. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA 2011

Total precipitation amounts have slightly increased in the Northeast U.S. by approximately 3.3 inches over the last 100 years. There has also been an increase in the number of two-inch rainfall events over a 48-hour period since the 1950s (a 67 percent increase). The number and intensity of extreme precipitation events are increasing in New York State as well. More rain heightens the danger of localized flash flooding, streambank erosion, and storm damage (Cornell University College of Agriculture and Life Sciences 2011).

Increased heavy precipitation events are expected in New York State due to climate change. As previously stated, as expansive soils absorb more water, they increase in volume, creating the potential to exert enough force on a building or other structure to cause damage. Temperatures are expected to increase throughout New York State. Increasing temperatures can increase the rate at which soils dry. When expansive soils are dry, they shrink and can remove support from buildings or other structures, resulting in damaging subsidence.

5.4.4.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable in the identified hazard area. An exposure analysis was conducted in GIS for the expansive soils hazard area utilizing Canadice silt loam soils. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess expansive soil hazard area risk.

As indicated by earlier sections, there are 31 soils considered to have moderate shrink-swell potential. The soils with the greatest median linear extensibility are Odessa silt loam and Odessa Lakemont complex (0 to 3 percent slopes). There are no soils with a median extensibility greater than moderate in the county.

Impact on Life, Health and Safety

According to the 2019 ACS annual estimate, Erie County had a population of 919,355 people. The Town of Amherst has the greatest population at risk of events caused by expansive soils (24,209 people). The Town of Grand Island has the greatest percentage of population exposed to expansive soils (78.2 percent of the total population). Table 5.4.4-4. shows that an estimated 7 residents and 92 residents live on the expansive soils hazard area in the Town of Southampton and Town of Southold, respectively.

Table 5.4.4-4. Population Exposed to Expansive Soil Hazard Areas

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to Expansive Soils Moderate Expansive Soils	
		Number of People	Percent of Total
Akron (V)	2,871	0	0.0%
Alden (T)	7,418	660	8.9%
Alden (V)	2,577	966	37.5%
Amherst (T)	120,276	24,209	20.1%
Angola (V)	2,373	70	3.0%
Aurora (T)	7,599	743	9.8%
Blasdell (V)	2,645	0	0.0%
Boston (T)	8,042	650	8.1%
Brant (T)	1,541	105	6.8%
Buffalo (C)	256,480	2,384	0.9%
Cheektowaga (T)	73,129	4,217	5.8%
Clarence (T)	32,440	8,442	26.0%
Colden (T)	3,328	281	8.4%
Collins (T)	5,418	332	6.1%
Concord (T)	4,186	408	9.7%
Depew (V)	15,102	916	6.1%
East Aurora (V)	6,184	772	12.5%
Eden (T)	7,631	1,165	15.3%
Elma (T)	11,732	2,147	18.3%
Evans (T)	13,782	2,535	18.4%
Farnham (V)	459	11	2.4%
Gowanda (V)	1,043	0	0.0%
Grand Island (T)	21,047	16,456	78.2%
Hamburg (T)	45,985	17,156	37.3%
Hamburg (V)	9,636	71	0.7%
Holland (T)	3,355	319	9.5%
Kenmore (V)	15,132	0	0.0%
Lackawanna (C)	17,831	576	3.2%
Lancaster (T)	27,625	12,789	46.3%
Lancaster (V)	10,144	2,837	28.0%
Marilla (T)	5,378	290	5.4%
Newstead (T)	5,804	60	1.0%

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to Expansive Soils Moderate Expansive Soils Number of People	Percent of Total
North Collins (T)	2,130	129	6.1%
North Collins (V)	1,370	186	13.6%
Orchard Park (T)	26,361	5,507	20.9%
Orchard Park (V)	3,148	29	0.9%
Sardinia (T)	2,780	53	1.9%
Sloan (V)	3,562	73	2.1%
Springville (V)	4,298	51	1.2%
Tonawanda (C)	14,830	199	1.3%
Tonawanda (T)	57,027	1,163	2.0%
Wales (T)	3,020	56	1.8%
West Seneca (T)	45,344	10,670	23.5%
Williamsville (V)	5,233	309	5.9%
Erie County Total	**917,296**	**119,992**	**13.1%**

Source: American Community Survey 2019; USDA/NRCS 2020

Notes: T = Town, V = Village, C = City, % = percent

** Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Impact on General Building Stock

Because of differences in building construction, residential structures and one-story commercial structures are more susceptible to damage by expansive soils compared to multi-story buildings. Multi-story buildings are heavier and can generally counter the swelling pressures. The exception is when multi-story buildings are built on wet clay and may experience damage by shrinkage of the clay if moisture levels are substantially reduced (by evapotranspiration or by evaporation from under heated buildings) (FEMA 1997).

FEMA's Coastal Construction Manual recommends that any development along the coast should follow the 2012 IBC requirements (FEMA n.d.). The 2012 IBC requires that geotechnical investigations are conducted if expansive soils are likely to be present. Subsurface testing includes boring, creating test pits, soil sampling, and laboratory tests. If an expansive soil is present, it is recommended that development does not occur. Table 5.4.4-5. summarizes the estimated number of buildings currently built on expansive soil hazard areas. The Town of Amherst has the greatest number of buildings and associated replacement cost value within the expansive soil hazard area (7,726 buildings and $5.8 billion). The Town of Grand Island has the greatest percentage of its buildings exposed to expansive soils (77.8 percent).

Table 5.4.4-5. Estimated Building Exposure to the Expansive Soils Hazard Areas

Wildfire Hazard Area	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed to Moderate Expansive Soils			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	0	0.0%	$0	0.0%
Alden (T)	3,400	$1,748,473,245	298	8.8%	$128,622,043	7.4%
Alden (V)	1,102	$602,655,574	396	35.9%	$185,379,522	30.8%
Amherst (T)	38,528	$27,372,255,690	7,726	20.1%	$5,813,313,261	21.2%
Angola (V)	874	$525,704,230	24	2.7%	$9,014,159	1.7%
Aurora (T)	4,280	$2,496,885,036	417	9.7%	$265,538,480	10.6%
Blasdell (V)	1,026	$638,571,953	6	0.6%	$24,596,890	3.9%
Boston (T)	4,040	$1,702,475,276	321	7.9%	$125,218,929	7.4%
Brant (T)	1,325	$657,594,060	81	6.1%	$21,483,054	3.3%
Buffalo (C)	83,471	$58,603,851,634	756	0.9%	$337,807,970	0.6%

Wildfire Hazard Area	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed to Moderate Expansive Soils			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Cheektowaga (T)	30,938	$17,530,893,277	1,876	6.1%	$1,626,137,655	9.3%
Clarence (T)	13,660	$9,866,246,863	3,452	25.3%	$2,524,048,964	25.6%
Colden (T)	2,110	$854,417,381	182	8.6%	$77,558,949	9.1%
Collins (T)	2,521	$1,189,158,504	175	6.9%	$74,129,751	6.2%
Concord (T)	3,245	$1,338,570,261	292	9.0%	$102,561,460	7.7%
Depew (V)	6,532	$3,841,823,815	453	6.9%	$682,322,037	17.8%
East Aurora (V)	2,441	$1,723,816,550	290	11.9%	$211,464,460	12.3%
Eden (T)	4,290	$2,180,455,513	656	15.3%	$470,796,887	21.6%
Elma (T)	6,093	$3,775,039,302	1,104	18.1%	$557,499,664	14.8%
Evans (T)	7,952	$3,335,060,692	1,423	17.9%	$492,675,750	14.8%
Farnham (V)	189	$87,990,422	4	2.1%	$1,548,017	1.8%
Gowanda (V)	396	$249,516,940	0	0.0%	$0	0.0%
Grand Island (T)	8,426	$4,674,517,058	6,552	77.8%	$3,563,177,171	76.2%
Hamburg (T)	19,130	$11,911,210,828	7,030	36.7%	$3,531,403,260	29.6%
Hamburg (V)	3,794	$2,005,172,252	26	0.7%	$7,279,494	0.4%
Holland (T)	2,182	$1,151,194,342	250	11.5%	$119,412,106	10.4%
Kenmore (V)	6,017	$2,305,529,001	0	0.0%	$0	0.0%
Lackawanna (C)	6,751	$4,030,622,400	208	3.1%	$67,179,569	1.7%
Lancaster (T)	10,973	$6,845,493,469	5,006	45.6%	$2,738,580,914	40.0%
Lancaster (V)	4,323	$2,217,331,122	1,245	28.8%	$868,235,822	39.2%
Marilla (T)	2,956	$1,099,846,031	163	5.5%	$60,177,050	5.5%
Newstead (T)	4,202	$2,181,758,974	34	0.8%	$14,132,607	0.6%
North Collins (T)	1,898	$889,517,676	91	4.8%	$32,629,027	3.7%
North Collins (V)	551	$383,968,909	72	13.1%	$33,965,891	8.8%
Orchard Park (T)	10,748	$8,174,650,530	2,311	21.5%	$1,728,383,735	21.1%
Orchard Park (V)	1,211	$867,347,745	10	0.8%	$4,680,599	0.5%
Sardinia (T)	2,184	$1,068,523,829	49	2.2%	$21,987,877	2.1%
Sloan (V)	1,674	$634,998,253	32	1.9%	$9,403,845	1.5%
Springville (V)	1,816	$1,354,905,864	22	1.2%	$24,631,650	1.8%
Tonawanda (C)	6,452	$3,291,492,557	109	1.7%	$134,382,200	4.1%
Tonawanda (T)	23,999	$14,694,684,404	631	2.6%	$1,183,390,054	8.1%
Wales (T)	1,923	$833,853,270	40	2.1%	$23,157,231	2.8%
West Seneca (T)	17,970	$9,583,482,689	4,118	22.9%	$1,810,406,742	18.9%
Williamsville (V)	2,057	$1,126,868,443	114	5.5%	$35,127,170	3.1%
Erie County Total	**360,925**	**$222,515,035,436**	**48,045**	**13.3%**	**$29,743,441,914**	**13.4%**

Source: Erie County GIS 2020; RS Means 2020; USDA/NRCS 2019
Notes: RCV = Total replacement cost value (structure and contents)
T = Town, V = Village, C = City, % = percent
** Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Impact on Critical Facilities

Approximately 11.3 percent of the critical facilities in Erie County are considered exposed to the expansive soils hazard area. Of the 474 critical facilities in the county exposed to expansive soils, 441 are considered lifelines. Table 5.4.4-6. summarizes the number of critical facilities by type per jurisdiction in Erie County located on expansive soil hazard areas. Table 5.4.4-7 summarizes the number of critical facilities exposed to the expansive soil hazard area by FEMA's lifeline categories. Table 5.4.4-8. summarizes the type of critical facilities exposed to expansive soils. Bridges, hazardous material sites, and secondary education locations are the three types of critical facilities that are the most exposed.

Table 5.4.4-6. Critical Facilities Located on Expansive Soils

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities in Expansive Soils			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	0	0.0%	0	0.0%
Alden (T)	76	68	6	7.9%	4	5.9%
Alden (V)	19	17	1	5.3%	1	5.9%
Amherst (T)	391	387	98	25.1%	97	25.1%
Angola (V)	20	18	0	0.0%	0	0.0%
Aurora (T)	95	81	14	14.7%	12	14.8%
Blasdell (V)	22	22	2	9.1%	2	9.1%
Boston (T)	81	75	6	7.4%	5	6.7%
Brant (T)	39	39	2	5.1%	2	5.1%
Buffalo (C)	751	748	5	0.7%	5	0.7%
Cheektowaga (T)	224	221	27	12.1%	27	12.2%
Clarence (T)	121	115	26	21.5%	25	21.7%
Colden (T)	67	56	3	4.5%	3	5.4%
Collins (T)	71	55	6	8.5%	6	10.9%
Concord (T)	84	68	8	9.5%	7	10.3%
Depew (V)	63	63	12	19.0%	12	19.0%
East Aurora (V)	42	41	4	9.5%	4	9.8%
Eden (T)	78	72	9	11.5%	9	12.5%
Elma (T)	83	75	5	6.0%	4	5.3%
Evans (T)	112	109	11	9.8%	10	9.2%
Farnham (V)	10	10	0	0.0%	0	0.0%
Gowanda (V)	7	7	0	0.0%	0	0.0%
Grand Island (T)	69	66	41	59.4%	38	57.6%
Hamburg (T)	189	181	48	25.4%	47	26.0%
Hamburg (V)	27	23	1	3.7%	0	0.0%
Holland (T)	90	70	9	10.0%	4	5.7%
Kenmore (V)	14	13	0	0.0%	0	0.0%
Lackawanna (C)	94	93	0	0.0%	0	0.0%
Lancaster (T)	109	103	25	22.9%	22	21.4%
Lancaster (V)	58	53	23	39.7%	21	39.6%
Marilla (T)	48	37	0	0.0%	0	0.0%
Newstead (T)	64	61	0	0.0%	0	0.0%
North Collins (T)	69	56	5	7.2%	3	5.4%
North Collins (V)	14	13	0	0.0%	0	0.0%
Orchard Park (T)	141	129	15	10.6%	14	10.9%
Orchard Park (V)	21	18	0	0.0%	0	0.0%
Sardinia (T)	78	57	3	3.8%	0	0.0%
Sloan (V)	8	8	0	0.0%	0	0.0%
Springville (V)	35	32	2	5.7%	1	3.1%
Tonawanda (C)	61	60	1	1.6%	1	1.7%
Tonawanda (T)	266	265	36	13.5%	36	13.6%
Wales (T)	82	68	4	4.9%	3	4.4%
West Seneca (T)	145	140	16	11.0%	16	11.4%
Williamsville (V)	16	14	0	0.0%	0	0.0%
Erie County Total	**4,184**	**3,933**	**474**	**11.3%**	**441**	**11.2%**

Source: Erie County GIS 2020; USDA/NRCS 2019
T = Town, V = Village, C = City, % = percent
** Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.4-7. Number of Lifelines Located on Expansive Soils

Lifeline Categories	Total Lifelines in the County	Expansive Soils Exposure
Communication	126	0
Energy	397	3
Food, Water, Shelter	1,458	1
Health and Medical	1,081	1
Safety and Security	1,956	0
Transportation	3,099	1
Total	**8,117**	**6**

Source: Erie County GIS 2020; FEMA 2020; USDA/NRCS 2019

Table 5.4.4-8. Critical Facility Types Located on Expansive Soils

Jurisdiction	Critical Facilities Exposed to Moderate Expansive Soils																										
	Airport	Airport Runway	Bridge	Communication Tower	Communications Facility	Community Center	Dam	Electric Power Station	Fire Station	Hazardous Material	Highway Garage	Library	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Akron (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (T)	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
Alden (V)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	0	0	17	0	3	0	1	2	6	7	0	0	0	0	0	3	0	0	0	0	5	51	0	3	0	0	0
Angola (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	0	4	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	2
Blasdell (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Boston (T)	0	0	2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Brant (T)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Buffalo (C)	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Cheektowaga (T)	0	0	6	1	0	1	0	1	4	8	0	0	0	0	1	0	0	0	0	0	2	0	1	2	0	0	0
Clarence (T)	0	0	3	0	1	0	0	0	0	6	0	1	0	1	0	1	0	0	0	5	2	0	0	2	1	0	3
Colden (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0
Collins (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	1	0	0	1	0	0	0
Concord (T)	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
Depew (V)	0	0	4	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
East Aurora (V)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
Eden (T)	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	3	0	0	1	0	0	2
Elma (T)	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Evans (T)	0	0	5	0	0	0	1	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
Farnham (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Island (T)	0	0	9	0	1	0	2	1	2	11	0	1	0	0	0	0	1	0	0	2	6	0	2	2	0	1	0
Hamburg (T)	0	0	16	0	1	0	1	0	1	10	0	0	0	0	0	1	1	0	0	0	7	0	0	0	0	0	10
Hamburg (V)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holland (T)	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lackawanna (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Critical Facilities Exposed to Moderate Expansive Soils																										
	Airport	Airport Runway	Bridge	Communication Tower	Communications Facility	Community Center	Dam	Electric Power Station	Fire Station	Hazardous Material	Highway Garage	Library	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Lancaster (T)	1	2	3	0	2	0	3	0	1	6	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	3
Lancaster (V)	0	0	0	0	2	1	2	2	1	6	1	1	0	0	0	1	0	0	0	0	1	0	0	2	2	1	0
Marilla (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newstead (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Collins (T)	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
North Collins (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchard Park (T)	0	0	5	0	0	0	1	0	2	1	0	0	0	0	0	0	0	1	1	1	2	0	0	0	0	0	1
Orchard Park (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sardinia (T)	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sloan (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Springville (V)	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonawanda (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Tonawanda (T)	0	0	12	0	0	0	0	5	0	12	0	0	1	3	0	0	1	0	0	0	1	0	1	0	0	0	0
Wales (T)	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
West Seneca (T)	0	0	6	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	2
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**1**	**2**	**101**	**1**	**10**	**3**	**31**	**13**	**24**	**75**	**4**	**3**	**1**	**4**	**1**	**9**	**12**	**3**	**1**	**39**	**32**	**51**	**4**	**16**	**4**	**2**	**27**

Source: Erie County GIS 2020; USDA/NRCS 2019

T = Town, V = Village, C = City, % = percent

** Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Critical facilities will experience similar impacts from expansive soils as highlighted in the general building stock section. Smaller structures built on expansive soils may be more susceptible to damages caused by the shrinking and swelling properties of expansive soils. Furthermore, roadways built on expansive soils that are major transportation routes leading to critical facilities or connect essential services to the community could also be affected. Roadways that become damaged from expansive soils could create a disruption to critical services. There are 892.1 miles of roadway exposed to the expansive soil hazard area out of a total of 5,818 miles of evacuation routes in the county.

Impact on the Economy

Expansive soils may impact the economy where structures and roadways are damaged. Businesses built on the hazard area may need to shut down for repairs or move to a new, potentially less profitable, location if the building does not meet the 2012 IBC code (FEMA n.d.). As discussed earlier, expansive soils may also cause damage to highways and roads. Damages result from differential vertical movement that occurs as clay moisture content adjusts to the changed environment. For pavement, differential movement of 0.4 inches with a horizontal distance of 20 feet can pose an engineering problem for fast travel (FEMA 1997). Infrastructure damage is costly and can impact the local and regional economy.

Impact on the Environment

As discussed in earlier sections, expansive soils shrink and swell based on available water content. Absorbing available water could reduce water availability for surrounding ecosystems. Shrinking soils from a lack of water could create cracks in the ground, impacted rooted plants. The instability of this soil type may not be the most ideal habitat for species in the county.

Cascading Impacts to Other Hazards

There are no known cascading impacts expansive soils cause to other hazards of concern for the county.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. Any areas of growth in the three jurisdictions where expansive soils exist could potentially be impacted by this hazard.

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across Erie County. The county areas targeted for potential future growth and development in the next five years have been identified across the county at the municipal level.

New development projects within the county will be advised to follow the 2012 IBC requirements (FEMA n.d.). The 2012 IBC requires that geotechnical investigations are conducted if expansive soils are likely to be present. Subsurface testing includes boring, creating test pits, soil sampling, and laboratory tests. If an expansive soil is present, it is recommended that development does not occur.

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has remained stable between 2010 and 2019 (919,040 persons in 2010 and 919,355 persons in 2019). Estimated population projections provided by the Cornell Program on Applied Demographics indicate that the county's population will increase into 2040, bringing total population to approximately 945,891 persons (Cornell Program on Applied Demographics 2017).

More housing units in the jurisdictions most vulnerable to expansive soil impacts suggests that a greater number of persons will be at risk of being exposed to expansive soil hazard areas.

Climate Change

Most studies project that the State of New York will see an increase in average annual temperatures. Additionally, the state is projected to experience more frequent droughts, which may affect the availability of water supplies, primarily placing an increased stress on the population and their available potable water. A decrease in water supply or increase in water supply demand may increase the county's vulnerability to expansive soil impacts. Critical water-related service sectors may need to adjust management practices and actively manage resources to accommodate for future changes.

Vulnerability Change Since the 2015 HMP

Since the 2015 HMP analysis, population statistics have been updated using the 5-Year 2015–2019 American Community Survey Population Estimates (American Community Survey 2019). The general building stock was also established using RS Means 2020 building valuations that estimated RCV for each building in the inventory. Additionally, a critical facility dataset was provided from the county. The most significant change is that a quantitative analysis was complete for the county using soils data from USGS/NRCS.

5.4.5 Extreme Temperature

This section provides a hazard profile (description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment of the extreme temperature hazard for the Erie County Hazard Mitigation Plan (HMP).

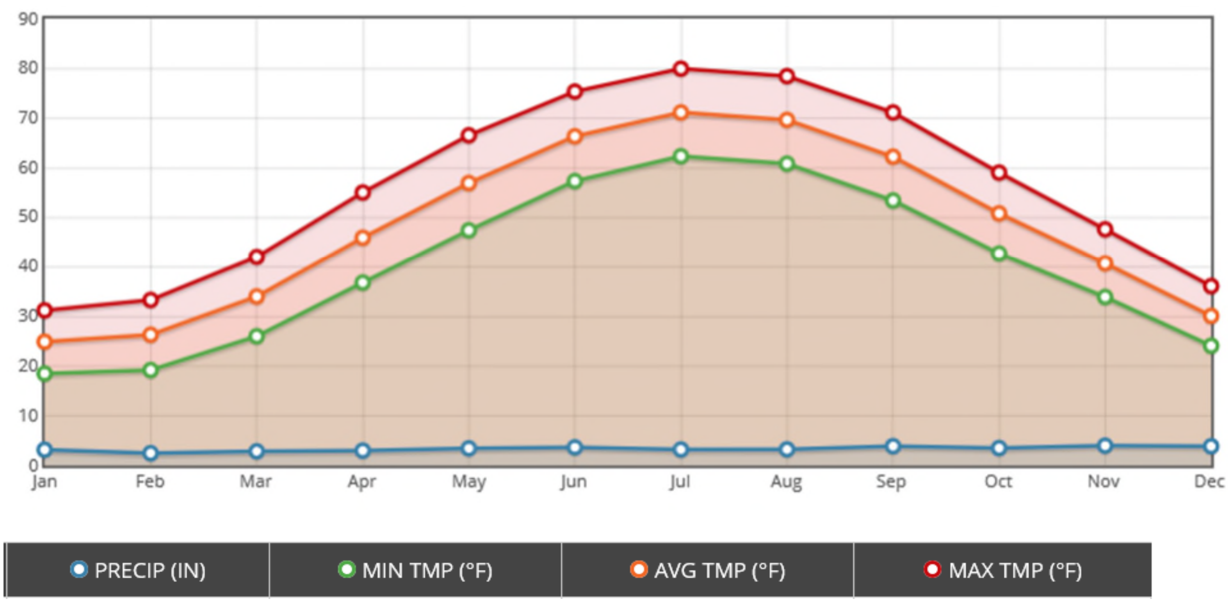
5.4.5.1 Hazard Profile

This section presents information regarding the extreme temperature hazard (heat and cold) description, extent, location, previous occurrences and losses, and probability of future occurrences.

Hazard Description

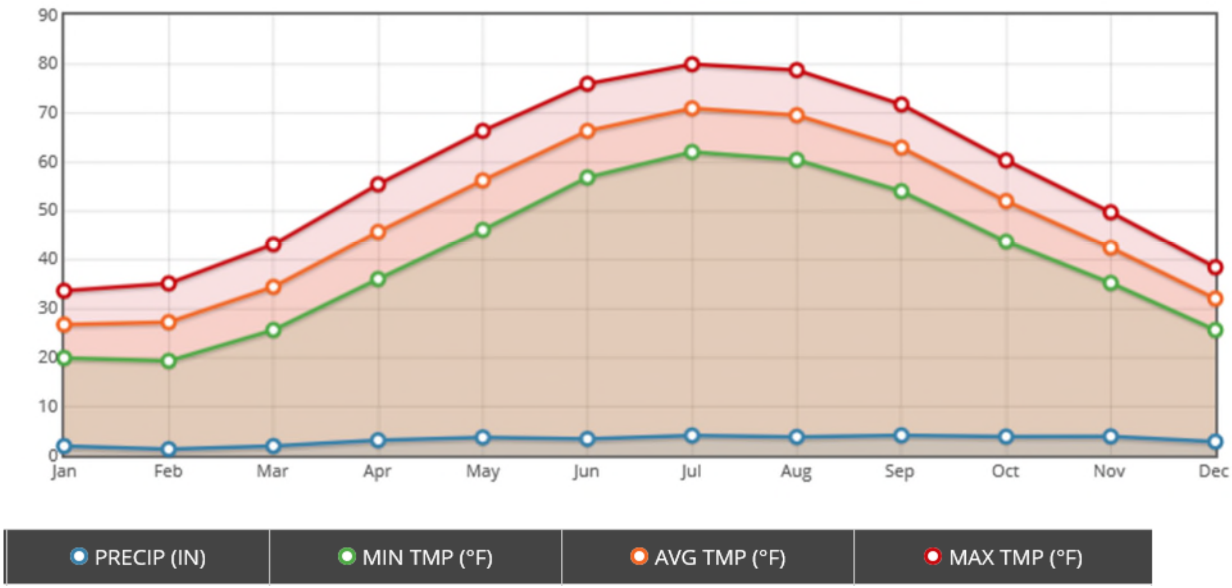
Extreme temperature includes both heat and cold events, which can have a significant impact to human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on what the population is accustomed to. Figure 5.4.5-1 and Figure 5.4.5-2 show the average low and high temperatures each month at the Buffalo Niagara International station and Dunkirk Chautauqua County Airport station located in Erie County.

Figure 5.4.5-1. Average Temperatures at Buffalo Niagara International



Source: NOAA NCEI 2020

Figure 5.4.5-2. Average Temperatures at Dunkirk Chautauqua County Airport



Source: NOAA NCEI 2020

Extreme Cold

Extreme cold events are when temperatures drop well below normal in an area. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Extreme cold temperatures are characterized by the ambient air temperature dropping to approximately 0 degrees Fahrenheit (ºF) or below (National Weather Service [NWS] 2015). Extensive exposure to extreme cold temperatures can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible to the effects of extreme changes in temperatures. Extreme cold also can cause emergencies in susceptible populations, such as those without shelter, those who are stranded, or those who live in a home that is poorly insulated (such as a mobile home) or without heat. Infants and the elderly are particularly at risk, but anyone can be affected (Centers of Disease Control and Prevention [CDC] 2007). In New York State, extreme cold days are defined to reflect the state's regional climate variations. Extreme cold days in the state are defined as individual days with minimum temperatures at or below 32° F or 0° C (NYSERDA 2014).

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

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

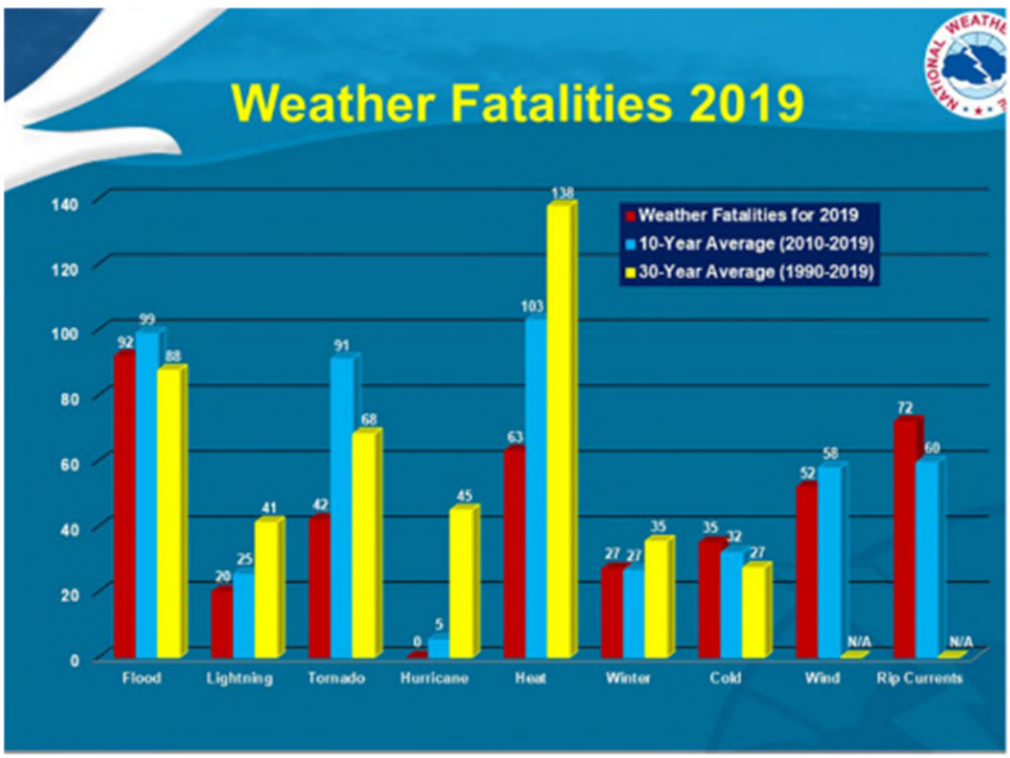
Extreme Heat

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for a region and that last for several weeks (CDC 2016). Humid or muggy conditions occur when a 'dome' of high atmospheric pressure traps hazy, damp air near the ground. An extended period of extreme heat of three or more consecutive days is typically called a heat wave and is often accompanied by high humidity (NWS 2013). In New York State, high temperatures and heat waves are defined in several ways to reflect the diversity of conditions experienced across the state. Extreme hot days in New York State are defined as individual days with maximum temperatures at or above 90° F. Heat waves are defined as three consecutive days with maximum temperatures above 90° F (NYSERDA 2014).

Depending on severity, duration, and location; extreme heat events can create or provoke secondary hazards including, but not limited to, dust storms, droughts, wildfires, water shortages and power outages (CDC 2016). This could result in a broad and far-reaching set of impacts throughout a local area or entire region. Impacts could include significant loss of life and illness; economic costs in transportation, agriculture, production, energy, and infrastructure; and losses of ecosystems, wildlife habitats, and water resources (Adams n.d.; Meehl and Tebaldi 2004; CDC 2016; NYS DHSES 2014).

Extreme heat is one of the leading weather-related causes of death in the United States. On a 10-year average, 103 people die each year from excessive heat. Figure 5.4.5-3 shows the number of weather fatalities based on a 10-year average and 30-year average. Heat had the highest average of weather-related fatalities between 1990 and 2019.

Figure 5.4.5-3. Average Number of Weather Related Fatalities in the United States



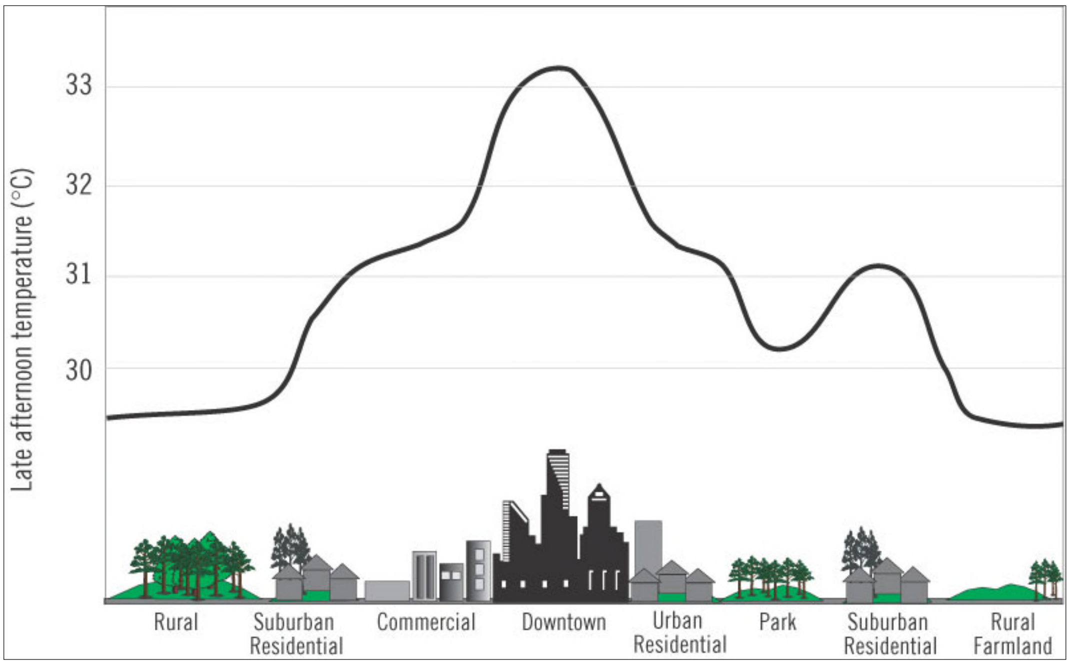
Source: NWS 2019

Urbanized areas and urbanization create an exacerbated type of risk during an extreme heat event, compared to rural and suburban areas. As these urban areas develop and change, so does the landscape. Buildings, roads, and other infrastructure replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas. This forms an 'island' of higher temperatures (U.S. Environmental Protection Agency [EPA] 2019).

The term 'heat island' describes built-up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with more than 1 million people can be between 1.8 ºF and 5.4ºF warmer than its surrounding areas. In the evening, the difference in air temperatures can be as high as 22ºF. Heat islands occur on the surface and in the atmosphere. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50ºF to 90ºF hotter than the air. Heat islands can affect communities by increasing peak energy demand during the summer; thereby escalating air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation (U.S. EPA 2019).

Figure 5.4.5-4 below illustrates an urban heat island profile. The graphic demonstrates that heat islands are typically most intense over dense urban areas. Further, vegetation and parks within a downtown area may help reduce heat islands (U.S. EPA 2019).

Figure 5.4.5-4. Urban Heat Island Profile



Source: EPA 2019
ºC degrees Celsius

Extent

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures are generally measured through the Wind Chill Temperature (WCT) Index. The Index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. For details regarding the WCT, refer to: https://www.weather.gov/safety/cold-wind-chill-chart. The WCT is presented in Figure 5.4.5-5.

Figure 5.4.5-5. NWS Wind Chill Index

Temperature (°F)

Wind (mph) / Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

Source: NWS 2016b

The National Weather Service (NWS) issues the nation's Wind Chill Warning, Watch, and Advisory:

- Wind Chill Warning: NWS issues a wind chill warning when dangerously cold wind chill values are expected or occurring.
- Wind Chill Watch: NWS issues a wind chill watch when dangerously cold wind chill values are possible.
- Wind Chill Advisory: NWS issues a wind chill advisory when seasonably cold wind chill values, but not extremely cold values, are expected or occurring (NYS DHSES 2019)

Cold weather can also impact the County's crops. In late spring or early fall, cold air outbreaks can damage or kill produce for farmers, as well as residential plants and flowers. A freeze occurs when the temperature drops below 32°F. Freezes and their effects are significant during the growing season. Frost develops on clear, calm nights and can occur when the air temperature is in the mid-30s. Each plant species has a different tolerance to cold temperatures (NYS DHSES 2019).

The NWS issues the nation's Freeze Watch, Warning, and Frost Advisory:

- Hard Freeze Warning: NWS issues a hard freeze warning when temperatures are expected to drop below 28°F for an extended period of time, killing most types of commercial crops and residential plants.
- Freeze Warning: When temperatures are forecasted to go below 32°F for a long period of time, NWS issues a freeze warning. This temperature threshold kills some types of commercial crops and residential plants.
- Freeze Watch: NWS issues a freeze watch when there is a potential for significant, widespread freezing temperatures within the next 24-36 hours. A freeze watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.
- Frost Advisory: A frost advisory means areas of frost are expected or occurring, posing a threat to sensitive vegetation (NYS DHSES 2019).

Extreme Heat

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Table 5.4.5-1. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. To determine the Heat Index, the temperature and relative humidity are needed. Once both values have been identified, the Heat Index is the corresponding number of both values (as seen in Table 5.4.5-1). This provides a measure of how temperatures actually feel; however, the values are devised for shady, light wind conditions. Exposure to full sun can increase the Index by up to 15 degrees (NYS DHSES 2014).

Table 5.4.5-1. Heat Index Chart

Temperature (°F)

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

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution · Extreme Caution · Danger · Extreme Danger

Source: NWS 2016c

Table 5.4.5-2 describes the adverse effects that prolonged exposure to heat and humidity can have on an individual.

Table 5.4.5-2. Adverse Effects of Prolonged Exposures to Heat on Individuals

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

Source: NYS DHSES 2014

The National Weather Service (NWS) provides alerts when Heat Indices approach hazardous levels. Table 5.4.5-3 explains these alerts. In the event of an extreme heat advisory, the NWS:

- Includes Heat Index values and city forecasts
- Issues special weather statements including who is most at risk, safety rules for reducing risk, and the extent of the hazard and Heat Index values
- Provides assistance to state/local health officials in preparing Civil Emergency Messages during severe heat waves (NYS DHSES 2019).

Table 5.4.5-3. National Weather Service Alerts

Alert	Criteria
Heat Advisory	Issued 12-24 hours before the onset of the following conditions: heat index of at least 100°F but less than 105°F for at least 2 hours per day
Excessive Heat Watch	Issued by the NWS when heat indices of 105°F or greater are forecast in the next 24 to 72 hours
Excessive Heat Warning	Issued within 12 hours of the onset of the following criteria: heat index of at least 105°F for more than 3 hours per day for two consecutive days, or heat index more than 115°F for any period of time

Source: NYS DHSES 2014

Location

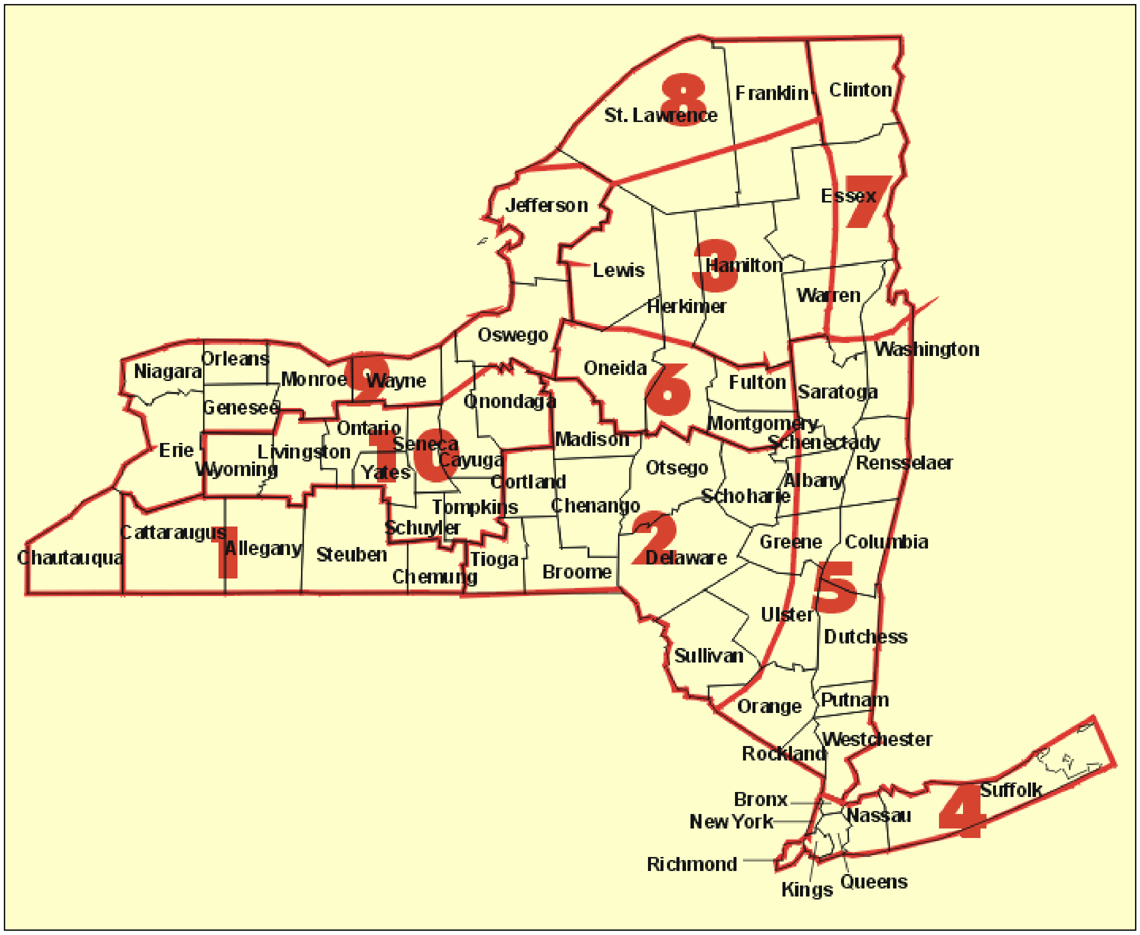
Varying land elevations, character of the landscape, and proximity to large bodies of water play a significant role in the state's temperatures. Erie County is susceptible to both extreme cold and extreme heat temperature events.

Extensive periods of extreme cold temperatures are a result from movement of great high-pressure systems into and through the eastern United States. Under higher than normal atmospheric pressures when arctic air masses are present, extreme winter temperatures hover over New York. New York State's location in the northeast makes it highly susceptible to extreme cold that can cause impact to human life and property (NYS DHSES 2019). Extreme cold temperatures occur throughout most of the winter season and generally accompany most winter storm events throughout the state. The NYSC Office of Cornell University indicates that cold temperatures prevail over the state whenever arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay (Cornell University Date Unknown).

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

New York State is divided into 10 climate divisions: Western Plateau, Eastern Plateau (Catskill Mountains), Northern Plateau (Adirondack Mountains), Coastal, Hudson Valley, Mohawk Valley, Champlain Valley, St. Lawrence Valley, Great Lakes, and Central Lakes. According to NCDC, "Climatic divisions are regions within each state that have been determined to be reasonably climatically homogeneous" (CPC 2005). Erie County is located within the Great Lakes Division (Division 9); Figure 5.4.5-6 depicts the climate divisions in New York State.

Figure 5.4.5-6. New York State Climate Divisions



Source: CPC, 2005

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

Previous Occurrences and Losses

Between 1954 and 2020, New York State and Erie County did not experience any extreme temperature FEMA disaster (DR) or emergency (EM) classifications. The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2014 and 2020, Erie County has been included in three USDA disaster declarations in relation to extreme temperature in 2016: S4023, S4031, and S4037: Drought; Wind, high winds; Fire, wildfire; Heat, excessive heat, high temperature; and insects.

USDA tracks drought losses on agriculture that often accompany extreme heat events. In 2016, heat-related crop losses totaled $5,096. In 2017, heat-related crop losses totaled $6,867. In 2018, heat-related crop losses totaled $27,811. In 2020, heat-related crop losses totaled $47,778 (USDA 2021).

Table 5.4.5-4 summarizes the known extreme temperature events that have impacted Erie County from 1999 to 2020.

Table 5.4.5-4. Extreme Temperature Events in Erie County, 1999 to 2020

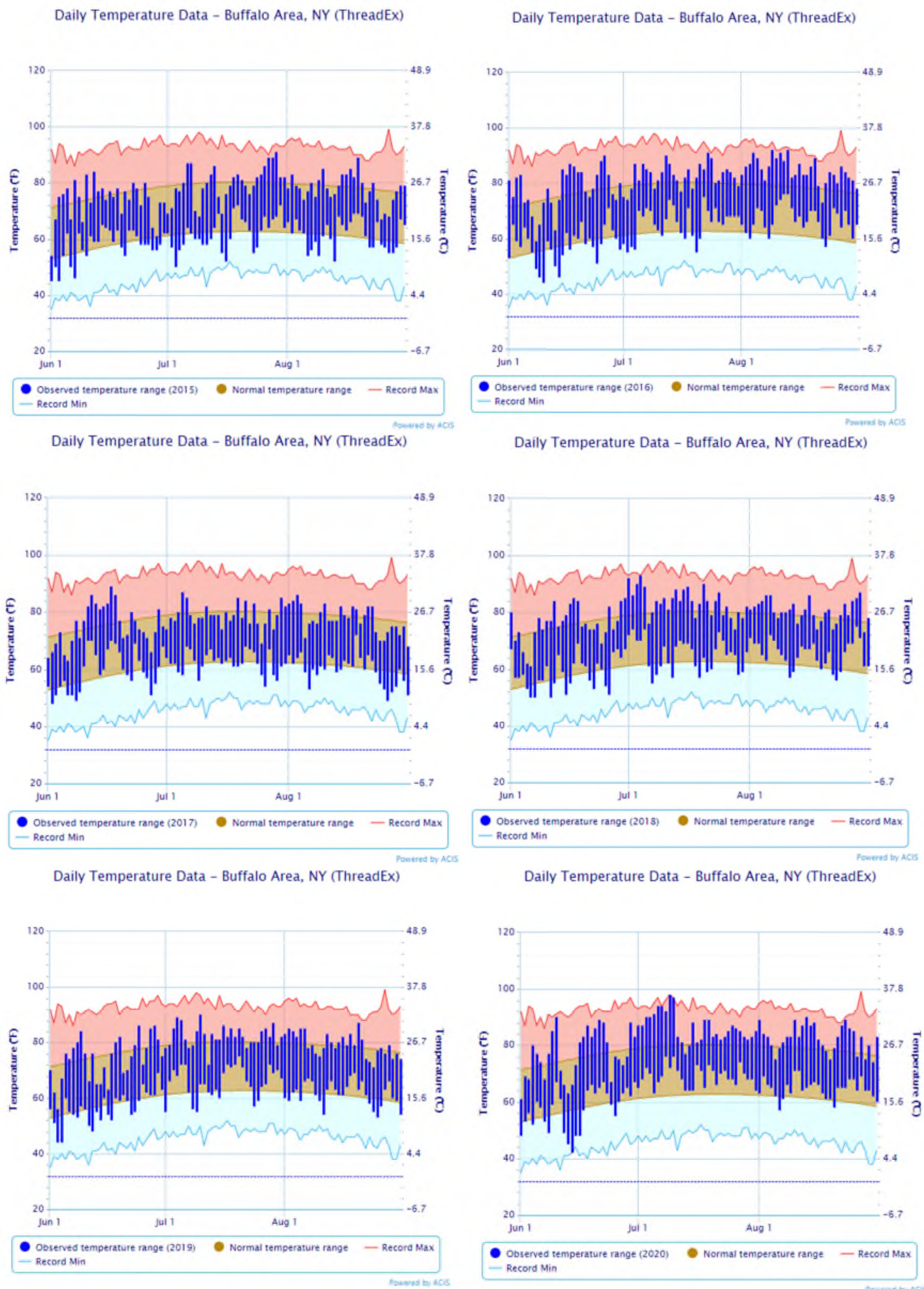
Dates of Event	Event Type	FEMA Declaration Number (if applicable)	Erie County Designated?	Location	Description
January 30, 2019	Extreme Cold/Wind Chill	N/A	N/A	Northern Erie, Southern Erie	Blowing and drifting snow across Northern Erie, temperatures dipped below zero. Wind gusts of 35-50 mph dropped winds chills substantially below zero. One homeless man died of exposure in Williamsville during the cold outbreak. Most schools and churches closed in the area.
January 5, 2018	Extreme Cold/Wind Chill	N/A	N/A	Southern Erie	A bitterly cold artic airmass entrenched across the region brought cold temperatures and dangerous wind chills across the southern tier and north country. Low temperatures dropped to -15 to -35 degrees Fahrenheit across the southern tier and as low as -50 degrees across the north country.
February 13, 2016	Extreme Cold/Wind Chill	N/A	N/A	Northern Erie, Southern Erie	Cold and brisk westerly winds produced wind chills of -25 to -30 degrees Fahrenheit. Warming shelters were opened and some outdoor activities were cancelled. Minimum wind chill temperatures reached -26 degrees.
July 13, 2005	Heat	N/A	N/A	Northern Erie	A 25-year old construction worker collapsed and died from heat stroke as he was walking home from his construction job.
February 1, 2003	Extreme Cold	N/A	N/A	Erie County	Extreme cold event reported to have caused $50,000 in crop damage.

Source: NOAA NCEI 2020; FEMA 2020

Note: With temperature documentation for New York State and Erie County being so extensive, not all sources have been identified or researched. Therefore, Table 5.4.4-4 may not include all events that have occurred in the County.

Figure 5.4.5-7 shows daily temperatures for the summer months from 2015 to 2020. The record highs and record lows are shown by the far top and bottom red and blue lines.

Figure 5.4.5-7. Daily Temperatures for Summer Months from 2015 to 2020



Source: National Weather Service 2021

Probability of Future Occurrences

It is estimated that Erie County will continue to experience extreme temperatures annually that may induce secondary hazards and associated impacts such as snow, hail, ice or wind storms, thunderstorms, drought, utility failure and transportation accidents. Some of these secondary hazards could affect human health.

According to the NOAA-NCEI database, Erie County experienced five extreme temperature events between 1950 and 2020. Table 5.4.5-5 summarizes the annual average number of events and the percent chance of these individual extreme temperature events occurring in Erie County in future years (NOAA NCEI 2021).

Table 5.4.5-5. Probability of Occurrences of Extreme Temperature Events

Hazard Type	Number of Occurrences Between 1950 and 2020	Recurrence Interval (in years) (# Years/Number of Events)	Percent (%) chance of occurrence in any given year
Cold/Wind Chill	0	0.00	0.00
Excessive Heat	0	0.00	0.00
Extreme Cold/Wind Chill	4	17.50	5.71
Heat	1	70.00	1.43
Total	**5**	**14.00**	**7.14**

Source: NOAA NCEI 2020
Note: Probability was calculated using the available data provided in the NOAA-NCEI storm events database.

Based on historical records and input from the Planning Committee, the probability of occurrence for extreme temperatures in Erie County is considered “rare.”

Climate Change Impacts

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2° F to 3.4° F by the 2020s, 4.1° F to 6.8° F by the 2050s, and 5.3° F to 10.1° F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the state (NYSERDA 2014). The total number of hot days in New York State is expected to increase as this century progresses. The frequency and duration of heat waves, defined as three or more consecutive days with maximum temperatures at or above 90 ˚F, are also expected to increase (Table 5.4.5-6). In contrast, extreme cold events, defined both as the number of days per year with minimum temperature at or below 32 ˚F and those at or below 0 ˚F, are expected to decrease as average temperatures rise (NYSERDA 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be uniquely affected by climate change. Erie County is part of Region 1. In Region 1, it is estimated that temperatures will increase by 3.0ºF to 5.5ºF by the 2050s and 4.5ºF to 8.5ºF by the 2080s (middle range estimate, baseline of 48ºF).

The frequency of heat waves is projected to increase while cold events are projected to fall in Region 1. With the increase in temperatures, heat waves will become more frequent and intense, increasing heat-related illness and death and posing new challenges to the energy system, air quality and agriculture (NYSERDA 2014). Table 5.4.5-6 displays the projected changes in extreme events and includes the minimum, central range, and maximum days per year.

Table 5.4.5-6. Changes in Extreme Events in Region 1 – Heat Waves and Intense Precipitation

Event Type	# Days Per Year	Baseline	2020s	2050s	2080s
Heat Waves	**Number of Days per year with maximum temperature exceeding minimum, (central range), and maximum**				
	90°F	8	8 (10 to 17) 23	12 (17 to 30) 44	16 (22 to 52) 68
	Number of heat waves per year	0.8	0.9 (1 to 2) 3	2 (2 to 4) 6	2 (3 to 7) 8
	Average duration	4	4 (4 to 4) 5	4 (4 to 5) 5	4 (4 to 5) 7
Extreme Cold	**Number of days per year: minimum, (central range), and maximum**				
	Below 32°F	133	99 (104 to 116) 124	76 (90 to 103) 108	55 (75 to 97) 106

Source: NYSERDA 2014
Note: Based upon the middle range (25th to 75th percentile estimate)

Vulnerability Assessment

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

Impact on Life, Health and Safety

The entire population of Erie County is exposed to extreme temperature events (population of 917,296 people, according to the 2015-2019 ACS population estimates). Extreme temperature events may cause potential health impacts, including injury or possibly death. According to the CDC, populations most at risk to extreme cold and heat events include the following: 1) the elderly, who are less able to withstand temperatures extremes because of their age, health conditions, and limited mobility to access shelters; 2) infants and children up to 4 years of age; 3) individuals with chronic medical conditions (e.g., heart disease, high blood pressure); 4) low-income persons that cannot afford proper heating and cooling; and 5) the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2016).

According to the 2019 ACS 5-Year population estimate, persons over the age of 65 are more vulnerable to extreme temperature events, which accounts for approximately 17.6-percent of Erie County's total population (161,498 persons). Furthermore, the homeless and residents below the poverty level might not have access to housing or their housing could be less able to withstand extreme temperatures (e.g., homes with poor insulation and heating supply). As of 2019, a total of 126,041 persons were living in poverty in the County (ACS 2019).

The CDC 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Erie County's overall score is 0.3986, indicating that its communities have low vulnerability (CDC 2016). This map shows that areas likely to be more vulnerable to extreme temperature events are fairly distributed throughout the County but are generally concentrated in the interior and southern coastal municipalities.

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

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

Impact on General Building Stock

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

Older buildings constructed under less stringent building codes are more vulnerable to extreme cold events because of cracks and leaks in the walls. Roof damage can also occur after excessive snow fall and extreme temperature change. Extreme heat may also be damaging to older structures. Further, structures with glass exposed to sunlight and structures exposed to heat on all four sides are more susceptible to damage, including interior damage from overheating (NYC 2019).

Impact on Critical Facilities and Lifelines

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

Transportation infrastructure may experience damage from extreme temperature events. This is particularly the case with ground transportation systems at risk of cracking, buckling, or sagging during periods of high temperatures (NYC 2019). This can cause disruptions to essential services that travel along these routes.

Impact on Economy

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

Impact on the Environment

Extreme temperature events can also impact the environment. For example, freezing and warming weather patterns create changes in natural processes. An excess amount of snowfall and earlier warming periods may affect natural processes, such as flow within water resources (USGS n.d.). Likewise, rain-on-snow events also exacerbate runoff rates with warming winter weather.

Extreme heat events can have particularly negative impacts on coastal marine aquatic systems, contributing to fish kills, aquatic plant die offs, and increased likelihood of harmful algal blooms.

Cascading Impacts to Other Hazards

Extreme heat events can increase the potential risk of wildfires. Refer to Section 5.4.13 for more information about the impacts of wildfires.

Future Changes that May Impact Vulnerability

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

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

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across Erie County. The ability of new development to withstand extreme temperature impacts lies in sound land use practices, building design considerations (e.g. Leadership in Energy and Environmental Design [LEED]), and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas forming heat islands (as described above). Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has remained stable between 2010 and 2019 (917,173 persons in 2010 and 917,296 persons in 2019). Estimated population projections provided by the 2017 Cornell Program on Applied Demographics indicates that the County's population will decrease into 2040, decreasing the total population to approximately 769,396 persons (Cornell Program on Applied Demographics 2017). While vulnerable populations (i.e., persons over 65) are decreasing, a number of people are still at great risk of impacts from extreme temperature events, which will increase.

Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures (NYC 2019). As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, susceptible populations could face increased vulnerability to extreme heat and its associated illnesses, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat.

Change of Vulnerability Since the 2015 HMP

The 2015 HMP included a quantitative assessment of the County's population and number of events. Extreme temperature events (heat and cold) were included in Erie County's 2015 HMP. As existing development and infrastructure continue to age, utility and transportation systems will be at increased risk to fail if they are not properly maintained and do not adapt to the changing environment.

5.4.6 Flood

The following section provides the hazard profile and vulnerability assessment of the flood hazard for Erie County Hazard Mitigation Plan (HMP).

5.4.6.1 Hazard Profile

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

Hazard Description

Many floods fall into three categories: riverine, coastal, and shallow (FEMA 2007). Other types of floods may include ice-jam floods, alluvial fan floods, dam failure floods, and floods associated with local drainage or high groundwater.

Floods are one of the most common natural hazards in the United States. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines, and multiple counties or states) (Federal Emergency Management Agency [FEMA] 2007). As defined in the New York State (NYS) HMP (NYS Division of Homeland Security and Emergency Services [DHSES] 2014), flooding is a general and temporary condition of partial or complete inundation of water on normally dry land caused by the following:

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

For the purpose of this HMP and as deemed appropriate by the Erie County Steering Committee, riverine, shallow flooding, flash flooding, ice jam, and dam and levee failure flooding are the main flood types of flooding that are of concern to the county. These types of floods are further discussed below.

Flooding can occur in Erie County during any season of the year, but it most likely occurs in the late winter – early spring months when melting snow may combine with intense rainfall to produce increased runoff. Ice jams and debris have often increased flood heights by impeding water flow at bridges and culverts. Floods can result from precipitation within falling within the watershed, from sharp rises in temperature in the spring that melt the snow cover of the basin and are followed by rains, and from localized thunderstorms.

Riverine (Inland) and Flash Flooding

Erie County is subject to both riverine and flash flooding. Riverine floods are the most common flood type. They occur along a channel and include overbank and flash flooding. Channels are defined as ground features that carry water through and out of a watershed, as defined as rivers, creeks, streams, or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas (Illinois Association for Floodplain and Stormwater Management 2006). Many areas of Erie County are also susceptible to urban (stormwater) flooding. Erie County communities bordering Lake Erie (the Cities of Buffalo and

Lackawanna, and the Towns of Hamburg, Brant, and Evans) are also potentially susceptible to coastal flooding from Lake Erie as a result of storm-induced rises and seiches.

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

Shallow Flooding

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

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

Urban drainage flooding is caused by increased water runoff due to urban development and drainage systems. Drainage systems are designed to remove surface water from developed areas as quickly as possible to prevent localized flooding on streets and other urban areas. They make use of a closed conveyance system that channels water away from an urban area to surrounding streams. This bypasses the natural processes of water filtration through the ground, containment, and evaporation of excess water. Because drainage systems reduce the amount of time the surface water takes to reach surrounding streams, flooding in those streams can occur more quickly and reach greater depths than prior to development in that area (FEMA 2007).

Ice Jam Flooding

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind any obstruction to the stream flow. Obstructions may include river bends, mouths of tributaries, points where the river slope decreases as well as dams and bridges. The water held back by this obstruction can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur as well (National Oceanic and Atmospheric Administration [NOAA] 2013). The formation of ice jams depends on the weather and physical condition of the river and stream channels. They are most likely to occur where the channel slope naturally decreases, in culverts, and along shallows where channels may freeze solid. Ice jams and resulting floods can occur during different times of the year: fall freeze-up from the formation of frazil ice; mid-winter periods when stream channels freeze solid, forming anchor ice; and spring breakup when rising water levels from snowmelt or rainfall break existing ice cover into pieces that accumulate at bridges or other types of obstructions (NYS DHSES 2014).

Ice Jams

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

(NYS DHSES 2014).

Dam and Levee Failure Flooding

A dam or a levee is an artificial barrier that can impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water (FEMA 2007). Dams are man-made structures built across a stream or river that impound water and reduce the flow downstream (FEMA 2003). They are built for the purpose of power production, agriculture, water supply, recreation, and flood protection. Dam failure is any malfunction or abnormality outside of the design that adversely affects a dam's primary function of impounding water (FEMA 2007). Levees typically are earthen embankments constructed from a variety of materials ranging from cohesive to cohesion-less soils (U.S. Bureau of Reclamation 2012).

Dams and levees can fail for one or a combination of the following reasons:

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

The Springville dam is county-owned and is designated a High Hazard Dam. The county assumed ownership of the former power dam from the Village of Springville and converted the parcel into a park. The county regularly reports to New York State Department of Environmental Conservation (NYSDEC) that the dam is serviceable, and an inundation map has been completed. The U.S. Army Corps of Engineers (USACE) plans to install a fish passage on the dam that will aid in fish migration in the 70 miles of Cattaraugus Creek above the dam. This project is on hold due to resource constraints imposed by the COVID-19 emergency. The creek bed has been tested for possible radiation contamination from the West Valley Nuclear materials storage site.

Flood Control Measures

Nine levee systems exist in the county that provide the community with some degree of protection against flooding. According to the USACE National Levee Database, Erie County is home to nine levee systems, made up of 111 structures encompassing 15 miles. Levees protect portions of the Scajaquada, Ellicott, Cayuga, and Blasdell creeks (USACE 2019).

Extent

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

- Minor Flooding - minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding - some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NWS 2011).

The severity of a flood depends not only on the amount of water that accumulates in a period, but also on the land's ability to manage this water. The size of rivers and streams in an area and infiltration rates are significant factors. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration rates decrease, and any more water that accumulates must flow as runoff (Harris 2008).

According to the NYSDEC Division of Water Bureau of Flood Protection and Dam Safety, the hazard classification of a dam is assigned according to the potential impacts of a dam failure pursuant to 6 NYCRR Part 673.3 (NYSDEC 2009). Dams are classified in terms of potential for downstream damage if the dam were to fail. These hazard classifications are identified and defined below:

- *Low Hazard (Class A)* is a dam located in an area where failure will damage nothing more than isolated buildings, undeveloped lands, or township or county roads and/or will cause no significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life. Losses are principally limited to the owner's property.
- *Intermediate Hazard (Class B)* is a dam located in an area where failure may damage isolated homes, main highways, minor railroads, interrupt the use of relatively important public utilities, and/or will cause significant economic loss or serious environmental damage. Failure or mis-operation would result in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be in areas with population and significant infrastructure.
- *High Hazard (Class C)* is a dam located in an area where failure may cause loss of human life, serious damage to homes, industrial or commercial buildings, important public utilities, main highways, or railroads and/or will cause extensive economic loss. This is a downstream hazard classification for dams in which excessive economic loss (urban area including extensive community, industry, agriculture, or outstanding natural resources) would occur as a direct result of dam failure.
- *Negligible or No Hazard (Class D)* is 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 defunct dams posing negligible or no hazard. The department may retain pertinent records regarding such dams.

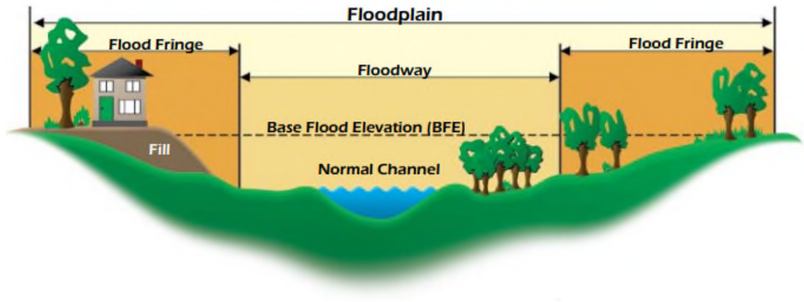
Location

Nearly all areas in Erie County could experience a flash flooding event. This depends on the intensity and duration of rainfall, the steepness of the watershed, the number of impervious surfaces within the watershed and vegetation. Flooding potential is influenced by climatology, meteorology, and topography (elevations, latitude, and water bodies and waterways). Flooding potential for each type of flooding that affects Erie County is described in the subsections below.

Floodplains

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. In Erie County, floodplains line the rivers and streams as well as the Laker Erie shore. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques. Figure 5.4.6-1 depicts the flood hazard area, the flood fringe, and the floodway areas of a floodplain.

Figure 5.4.6-1. Characteristics of a Floodplain



Most often floodplains are referred to as 100-year floodplains. A 100-year floodplain is not a flood that will occur once every 100 years; the designation indicates a flood that has a 1 percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. Due to this misleading term, FEMA has properly defined it as the 1 percent annual chance flood. Similarly, the 500-year floodplain will not occur every 500 years but is an event with a 0.2 percent chance of being equaled or exceeded each year. The "1 percent annual chance flood" is now the standard term used by most federal and state agencies and by the National Flood Insurance Program (NFIP) (FEMA 2003). The 1 percent annual chance floodplain establishes the area that has flood insurance and floodplain management requirements and is also referenced as the regulatory floodplain.

Locations of flood zones in Erie County as depicted from the FEMA Q3 data are illustrated in Figure 5.4.6-2 and the total land area in the floodplain, inclusive of waterbodies, is summarized in Table 5.4.6-1. Section 9 (Jurisdictional Annexes) includes a map of each jurisdiction depicting the floodplains. As depicted in Figure 5.4.6-2, flood hazard zones are present in differing amounts in communities throughout the county. Large areas of floodplain are found in the northern portions of Amherst, Clarence, Newstead, Lancaster, and Cheektowaga. Notable floodplain extents are also found along the Eighteenmile and Buffalo creek valleys.

The Digital Flood Insurance Rate Map (DFIRM) data provided by FEMA for Erie County show the following flood hazard areas:

- 1 Percent Annual Chance Flood Hazard: Areas subject to inundation by the 1 percent-annual-chance flood event. This includes both effective and preliminary, as well as AE and VE Zones. Mandatory flood insurance requirements and floodplain management standards apply.
- 0.2 Percent Annual Chance Flood Hazard: Area of minimal flood hazard, usually depicted on FIRMs as the 500-year flood level or Shaded X Zone.

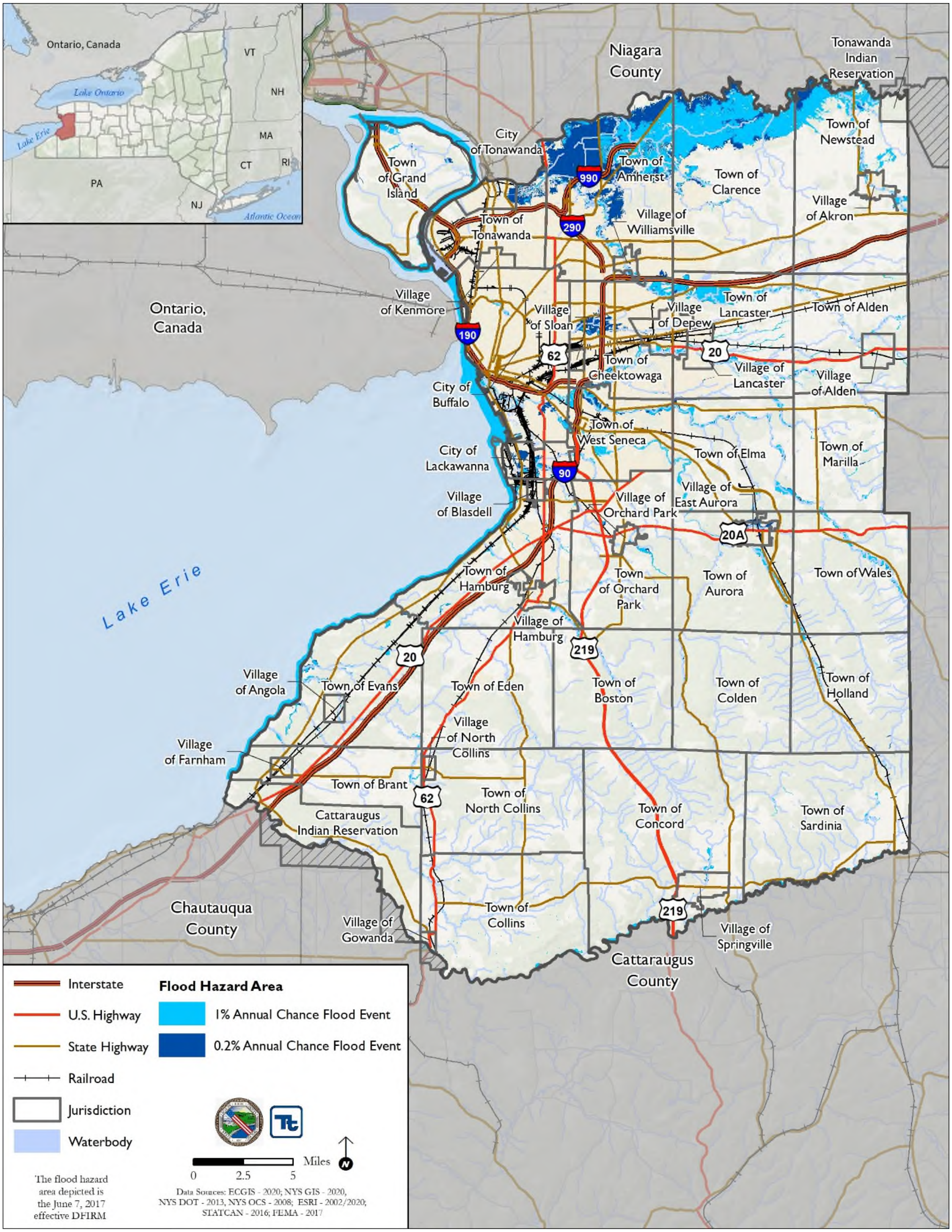
Table 5.4.6-1. Number of Acres Erie County Is Exposed to 1 Percent and 0.2 Percent Annual Chance Flood

Jurisdiction	Total Land Area	Estimated Land Area Exposed to the Flood Hazard Areas (Acres)					
		1 percent Annual Chance Flood - A Zones	Percent of Total	1 percent Annual Chance Flood - V Zones	Percent of Total	0.2 percent Annual Chance Flood	Percent of Total
Akron (V)	1,228	102	8.3%	0	0.0%	120	9.8%
Alden (T)	20,394	947	4.6%	0	0.0%	1,039	5.1%
Alden (V)	1,712	90	5.2%	0	0.0%	90	5.2%
Amherst (T)	33,489	5,928	17.7%	0	0.0%	14,225	42.5%
Angola (V)	870	61	7.0%	0	0.0%	63	7.3%
Aurora (T)	21,739	645	3.0%	0	0.0%	745	3.4%
Blasdell (V)	636	8	1.2%	0	0.0%	8	1.2%

Jurisdiction	Total Land Area	Estimated Land Area Exposed to the Flood Hazard Areas (Acres)					
		1 percent Annual Chance Flood - A Zones	Percent of Total	1 percent Annual Chance Flood - V Zones	Percent of Total	0.2 percent Annual Chance Flood	Percent of Total
Boston (T)	22,926	342	1.5%	0	0.0%	375	1.6%
Brant (T)	14,901	182	1.2%	40	0.3%	222	1.5%
Buffalo (C)	26,275	1,187	4.5%	9	<0.1%	1,454	5.5%
Cheektowaga (T)	16,292	1,068	6.6%	0	0.0%	1,995	12.2%
Clarence (T)	34,321	8,339	24.3%	0	0.0%	9,946	29.0%
Colden (T)	22,831	193	0.8%	0	0.0%	211	0.9%
Collins (T)	30,406	743	2.4%	0	0.0%	761	2.5%
Concord (T)	42,641	853	2.0%	0	0.0%	858	2.0%
Depew (V)	3,228	264	8.2%	0	0.0%	326	10.1%
East Aurora (V)	1,590	109	6.9%	0	0.0%	339	21.3%
Eden (T)	25,518	256	1.0%	0	0.0%	257	1.0%
Elma (T)	22,116	1,591	7.2%	0	0.0%	1,728	7.8%
Evans (T)	25,727	1,219	4.7%	174	0.7%	1,536	6.0%
Farnham (V)	652	0	0.0%	0	0.0%	0	0.0%
Gowanda (V)	360	36	10.0%	0	0.0%	44	12.2%
Grand Island (T)	18,181	865	4.8%	0	0.0%	944	5.2%
Hamburg (T)	24,225	1,166	4.8%	124	0.5%	1,444	6.0%
Hamburg (V)	1,524	23	1.5%	0	0.0%	24	1.6%
Holland (T)	22,874	440	1.9%	0	0.0%	470	2.1%
Kenmore (V)	916	0	0.0%	0	0.0%	0	0.0%
Lackawanna (C)	4,232	447	10.6%	36	0.8%	1,035	24.5%
Lancaster (T)	21,394	2,989	14.0%	0	0.0%	3,217	15.0%
Lancaster (V)	1,759	131	7.5%	0	0.0%	144	8.2%
Marilla (T)	17,546	608	3.5%	0	0.0%	683	3.9%
Newstead (T)	31,405	3,371	10.7%	0	0.0%	3,839	12.2%
North Collins (T)	27,009	0	0.0%	0	0.0%	0	0.0%
North Collins (V)	502	0	0.0%	0	0.0%	0	0.0%
Orchard Park (T)	23,808	697	2.9%	0	0.0%	785	3.3%
Orchard Park (V)	863	72	8.3%	0	0.0%	81	9.4%
Sardinia (T)	32,215	975	3.0%	0	0.0%	977	3.0%
Sloan (V)	503	0	0.0%	0	0.0%	0	0.0%
Springville (V)	2,325	45	2.0%	0	0.0%	56	2.4%
Tonawanda (C)	2,379	83	3.5%	0	0.0%	261	11.0%
Tonawanda (T)	11,173	234	2.1%	0	0.0%	695	6.2%
Wales (T)	22,861	936	4.1%	0	0.0%	969	4.2%
West Seneca (T)	13,743	1,484	10.8%	0	0.0%	1,775	12.9%
Williamsville (V)	768	86	11.2%	0	0.0%	109	14.1%
Erie County Total	**652,056**	**38,814**	**6.0%**	**383**	**0.1%**	**53,849**	**8.3%**

Source: Erie County GIS 2021; Erie County Q3 Data from FEMA, 2021
Note: The area presented includes the area of inland waterways.
C = City, T = Town, V = Village, % = Percent

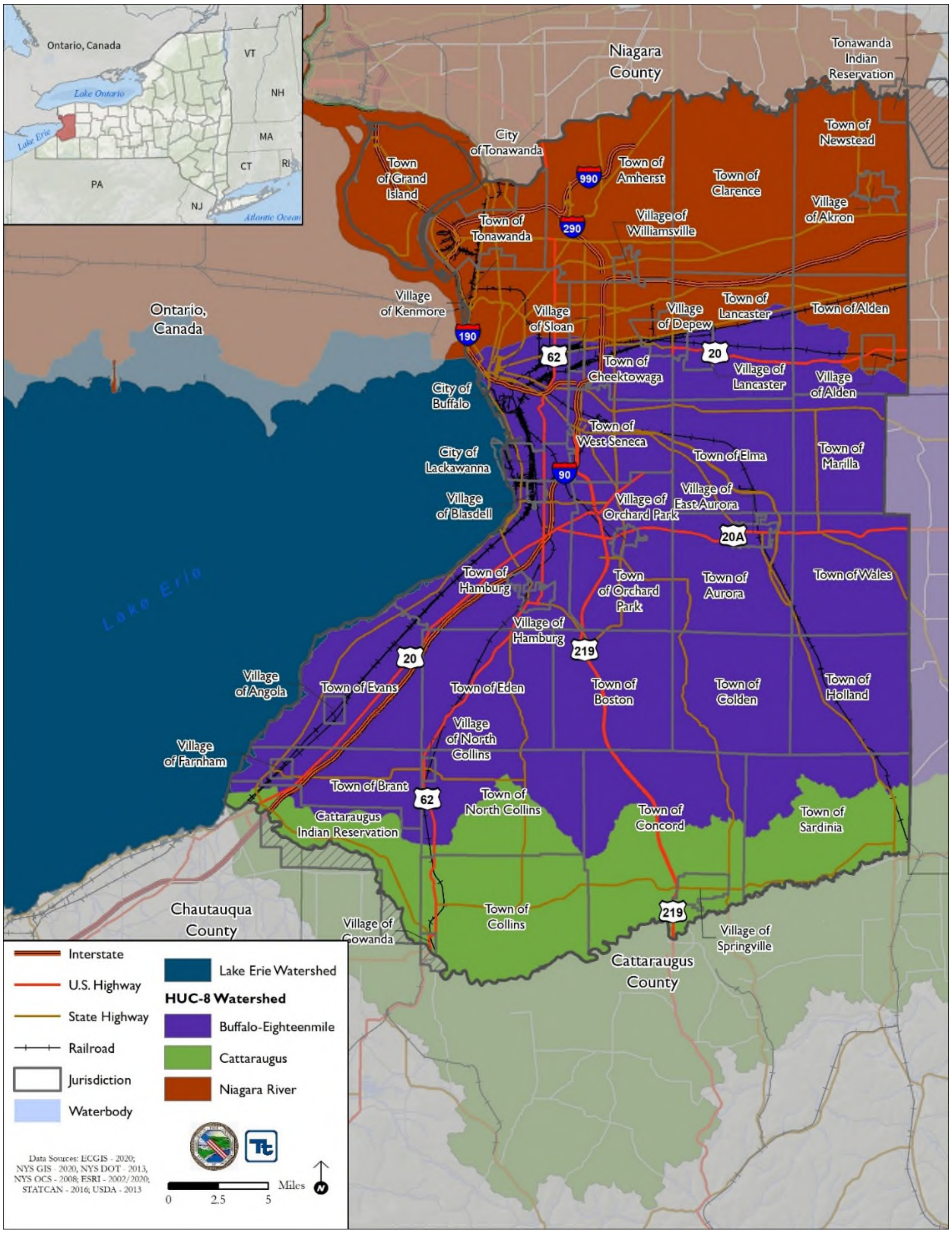
Figure 5.4.6-2. FEMA Flood Hazard Areas in Erie County



Riverine/Flash Flooding/Stormwater Flooding

Erie County includes parts of three major watershed that drain into the Great Lakes Basin and the Allegheny River Basin. The Niagara River watershed drains the county's northern tier. The Buffalo-Eighteenmile creek watershed is the county's largest and drains its central and a large portion of southern territory. The Cattaraugus Creek watershed drains the county's southernmost areas from Lake Erie to its eastern boundary (Erie County 2015).

Figure 5.4.6-3. Erie County Watersheds



Ice Jam Flooding

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind any obstruction to stream flow. Obstructions may occur at river bends, mouths of tributaries, points where the river slope decreases, as well as dams and bridges. Water held back by this obstruction can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur as well (NOAA 2011). Formation of ice jams depends on weather and physical condition of river and stream channels. Ice jams are most likely to occur where channel slope naturally decreases, in culverts, and along shallows where channels may freeze solid. Ice jams and resulting floods can occur at different times of the year: fall freeze-up from formation of frazil ice; mid-winter periods when stream channels freeze solid, forming anchor ice; and spring breakup when rising water levels from snowmelt or rainfall break existing ice cover into pieces that accumulate at bridges or other types of obstructions (NYS DHSES 2014).

The two main types of ice jams are freeze-up and breakup. Freeze-up jams occur when floating ice slows or stops due to a change in water slope as it reaches an obstruction to movement. Breakup jams occur during periods of thaw, generally in late winter and early spring. Ice cover breakup is usually associated with rapid increase in runoff and corresponding river discharge due to a heavy rainfall, snowmelt, or warmer temperatures (NWS 2011; NYS DHSES 2014).

Ice jams can occur along many of Erie County's rivers and streams. According to the Ice Jam Database maintained by the Ice Engineering Group at the USACE Cold Regions Research and Engineering Laboratory (CRREL), Erie County experienced 43 ice jam events between 1780 and 2020. These ice jam events have occurred within many jurisdictions within the county.

Dam Failure

According to USACE, the level of impact that a dam failure would have can be predicted based upon the hazard potential classification (USACE 2020). Table 5.4.6-2 outlines the recommended hazard classifications.

Table 5.4.6-2. U.S. Army Corps of Engineers Hazard Potential Classification for Dams

Urgency of Action	Actions for Dams in This Class	Characteristics of This Class
Very High (1)	Take immediate action to avoid failure. Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Implement interim risk reduction measures, including operational restrictions. Ensure the emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Expedite investigations to support remediation using all resources and funding necessary. Initiate intensive management and situation reports.	Critically near failure: Dam is almost certain to fail under normal operations within a few years without intervention. OR Extremely high incremental risk: Combination of life or economic consequences with likelihood of failure is very high. USACE considered this level of life-risk to be unacceptable except in extraordinary circumstances.
High (2)	Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Implement interim risk reduction measures, including operational restrictions as warranted. Ensure the emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Expedite confirmation of classification. Give very high priority for investigations to support the need for remediation.	Failure initiation foreseen: For confirmed and unconfirmed dam safety issues, failure could begin during normal operations or be initiated as the consequence of an event. The likelihood of failure from one of these occurrences, prior to remediation, is too high to ensure public safety. OR Very high incremental risk: The combination of life or economic consequences with likelihood of failure

Urgency of Action	Actions for Dams in This Class	Characteristics of This Class
		is high. USACE considered this level of life-risk to be unacceptable except in extraordinary circumstances.
Moderate (3)	Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Implement interim risk reduction measures, including operational restrictions as warranted. Ensure the emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Prioritize investigations to support the need for remediation informed by consequences and other factors.	Moderate to high incremental risk: For confirmed and unconfirmed dam safety issues, the combination of life, economic, or environmental consequences with likelihood of failure is moderate. USACE considers this level of life-risk to be unacceptable except in unusual circumstances.
Low (4)	Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Conduct elevated monitoring and evaluation. Give normal priority to investigations to validate classification but do not plan for risk reduction measures currently.	Low incremental risk: For confirmed and unconfirmed dam safety issues, the combination of life, economic, or environmental consequences with likelihood of failure is low to very low, and the dam may not meet all essential USACE guidelines. USACE considers this level of life-risk to be in the range of tolerability, but the dam does not meet all essential USACE guidelines.
Normal (5)	Continue routine dam safety activities and normal operations, maintenance, monitoring, and evaluation.	Very low incremental risk: The combination of life, economic, or environmental consequences with likelihood of failure is low to very low and the dam meets all essential USACE guidelines. USACE considers this level of life-safety risk to be tolerable.

Source: USACE 2020

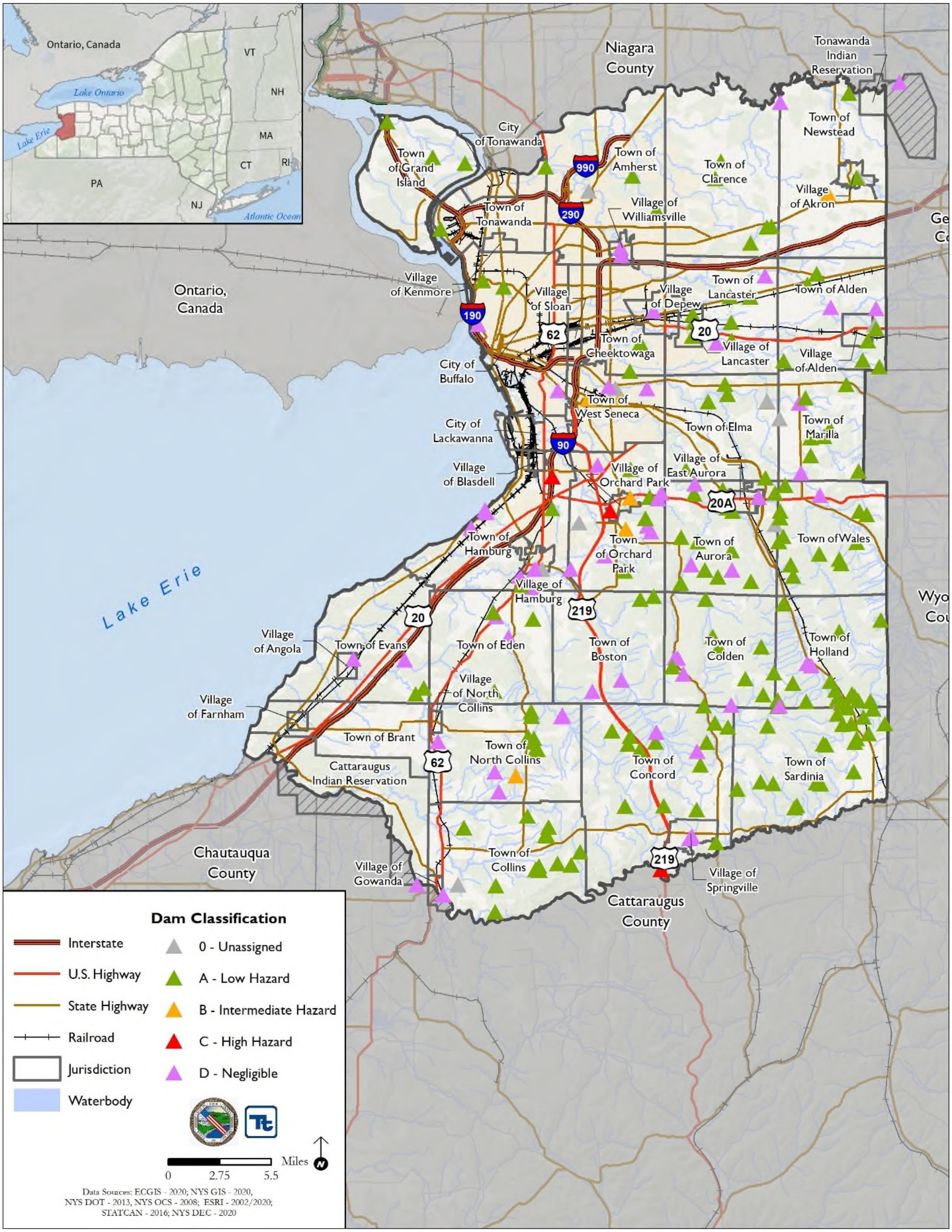
New York State uses four classifications to identify hazardous dams. These classifications - negligible, low, intermediate, and high - build upon each other, adding the consequences of the lower levels on the higher levels. According to the New York Inventory of Dams, Erie has 248 dams (Figure 5.4.6-4). These are classified as 164 low hazard, 6 intermediate hazard, 3 high hazard, 63 negligible hazard, and 12 with no classification code. This differs from the National Inventory of Dams, which identifies 25 dams: 16 low hazard, 6 significant hazard, and 3 high hazard.

Table 5.4.6-3. NYSDEC Dam Classifications

Code	Classification	Description
A	Low Hazard	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.
B	Intermediate Hazard	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.
C	High Hazard	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.
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.
0	Hazard Code has not been assigned	NA

Source: NYS DEC 2020

Figure 5.4.6-4. New York State Inventory of Dams in Erie County



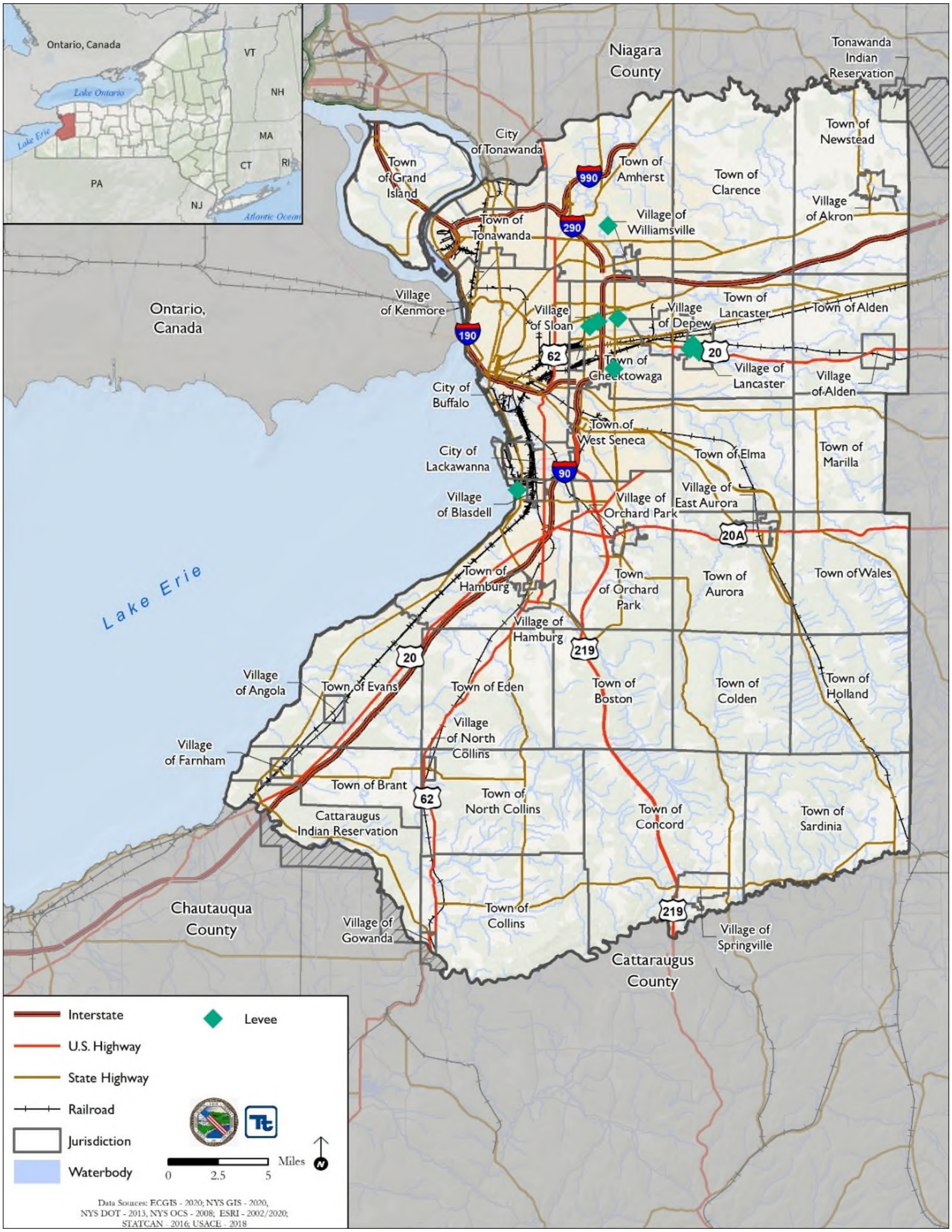
Levee Failure

Nine accredited levee systems are present within Erie County. These were constructed by USACE and area operated and maintained by the New York State Department of Environmental Conservation. The locations of these levee systems are displayed in Figure 5.4.6-5.

- The Blasdell Creek Left Bank levee system protects a population of 192 people, 82 structures, and an estimated property value of $30,310,075.74.
- The Cayuga Creek-Cheektowaga levee system is located on the right bank of Cayuga Creek in the Town of Cheektowaga, NY. It extends from the Union Road Bridge to 1,600 feet upstream of the bridge. The total levee length is 0.28 miles, with an average height of 6 feet and a protected Leveed Area of 35.2 acres. The levee system, including channel, has prevented greater than an estimated $7,153,000 of flood damages since completion.
- The Cayuga Creek-Lancaster-Left Bank levee system is located on the left bank of Cayuga Creek in the Village of Lancaster, NY. It extends from Lake Ave. to Penora St. in the Village of Depew, NY. The levee system total length is 1 mile, average height is 8 feet, and the leveed area is 64 acres. A flood in the area behind the levee could impact approximately 447 people and 207 commercial and residential structures and could cause an estimated $ $75,987,510.00 in flood-related damage (USACE, 2020).
- Cayuga Creek - Lancaster - Right Bank - Legion Field. The levee system is located on the right bank (looking downstream) of Cayuga Creek in the Village of Lancaster, NY. It extends from Park Blvd. to the Broadway bridge in the Village of Lancaster. The levee system is 0.37 miles long, with an average height of 8 feet and a leveed area of 23.7 acres. A flood in the area behind the level could impact approximately 184 people, 88 commercial and residential structures, and could cause an estimated $ $25,310,670.00 in flood-related damage (USACE, 2020).
- Cayuga Creek - Lancaster - Right Bank - St. Mary's. The levee system is located on the right bank (looking downstream) of Cayuga Creek in the Village of Lancaster, NY. It extends from St. Mary's St. at the water tower to St. Mary's St. west of the cemetery. The levee system is 0.42 miles long, with an average height of 6 feet and a leveed area of 30 acres. A flood in the area behind the level could impact approximately 56 people, 24 commercial and residential structures, and could cause an estimated $6,689,480.00 in flood-related damage (USACE, 2020).
- Ellicott Creek-Amherst levee system. The levee system is located on the right bank (looking downstream) of Ellicott Creek in the Town of Amherst, NY. It extends from the Hidden Creek Ct. residential community to the Maple Rd. bridge. The levee system is 0.21 miles in length, with an average of 3 feet height and a leveed area of 11.5 acres. A flood in the area behind the level could impact approximately 55 people, 14 commercial and residential structures, and could cause an estimated $4,579,550.00 in flood-related damage (USACE, 2020).
- Scajaquada Creek - Cheektowaga - Main Stem. The levee system is located on the left bank of Scajaquada Creek in the Town of Cheektowaga, NY. It extends from downstream of Central Blvd. to upstream of Harlem Rd. The levee system is 0.44 miles long, with an average height of 3.5 feet and a leveed area of 70.4 acres. A flood in the area behind the level could impact approximately 427 people, 202 commercial and residential structures, and could cause an estimated $58,203,900.00 in flood-related damage (USACE, 2020).
- Scajaquada Creek - Cheektowaga - Tributary T-3. The levee system is located on the right bank (looking downstream) of Tributary T-3 in the Town of Cheektowaga, NY. It is extending from the downstream limit of Tributary T-2A to George Urban Blvd. The levee system total length is 0.36 miles, with an average height of 3.5 feet and a leveed area of 26.9 acres. A flood in the area behind the level could impact approximately 380 people, 132 commercial and residential structures, and could cause an estimated $12,940,760.00 in flood-related damage (USACE, 2020).
- Scajaquada Creek - Cheektowaga - Tributary T-3B. The levee system is located on the right bank of Tributary T-3B in the Town of Cheektowaga, NY. It extends between Dick Rd. and Union Rd. The levee system is 0.18 miles long, with an average height of 2.5 feet and a leveed area of 22.4 acres. A flood in the area behind the level could impact approximately 122 people, 52 commercial and

residential structures, and could cause an estimated $13,348,750.00 in flood-related damage (USACE, 2020).

Figure 5.4.6-5. Location of Levee Systems in Erie County



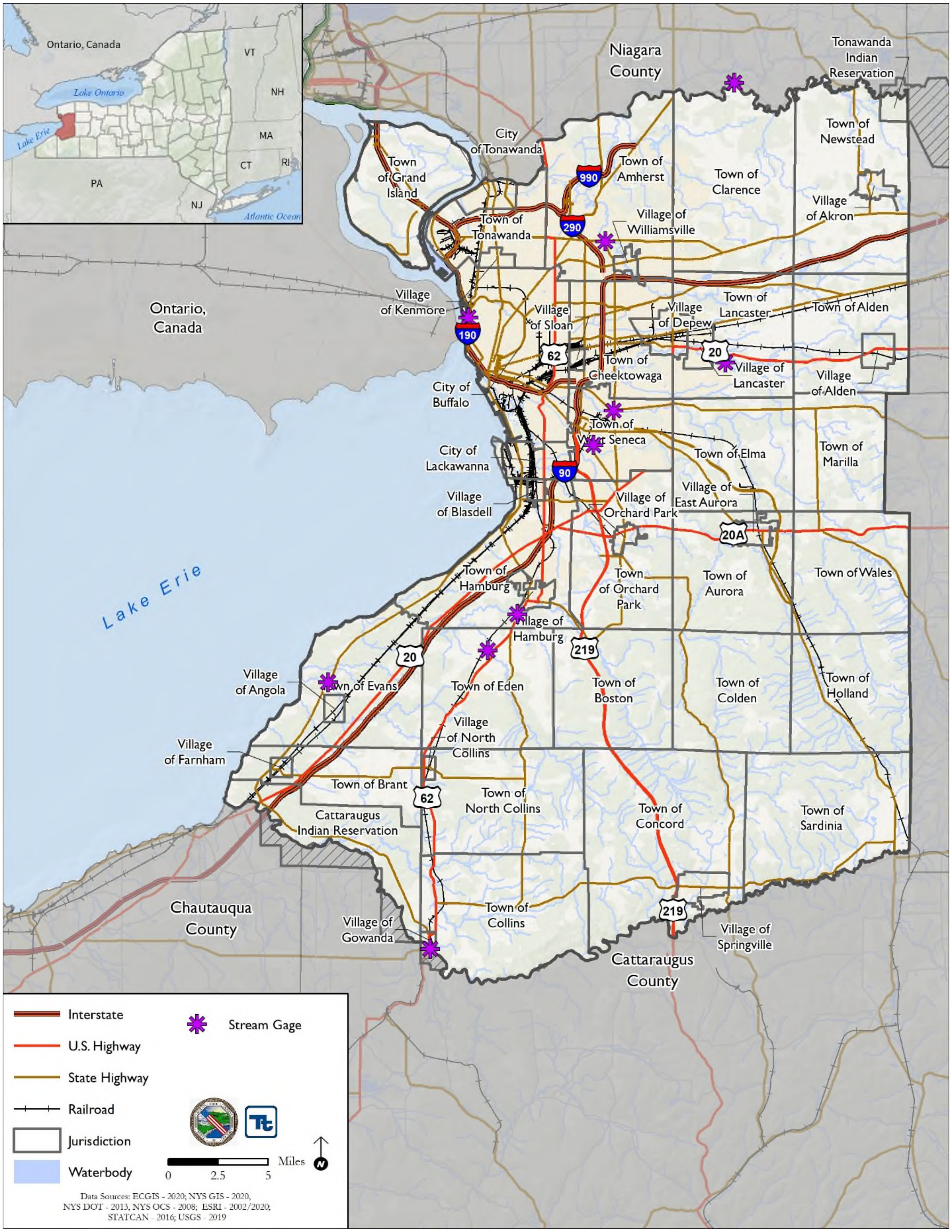
The United States Geological Survey (USGS) National Water Information System (NWIS) collects surface water data from more than 850,000 stations across the country. The time-series data describe stream levels, streamflow (discharge), reservoir and lake levels, surface water quality, and rainfall. The data are collected by automatic recorders and manual field measurements at the gage locations. USGS collects data in Erie County via 10 stream gages, as indicated in Table 5.4.6-4 and Figure 5.4.6-6.

Table 5.4.6-4. USGS Gages Located in Erie County

Site Number	Site Name	Category	Agency	Longitude	Latitude
4213500	Cattaraugus Creek at Gowanda NY	ST	USGS	-78.9342	42.46333
4214060	Big Sister Creek at Evans Center NY	ST	USGS	-79.0356	42.65667
421422210	Eighteenmile Creek at Hamburg NY	ST	USGS	-78.8493	42.70656
4214231	S Br Eighteenmile Cr at Bley Rd At Eden Valley	ST	USGS	-78.8787	42.68028
4214500	Buffalo Creek at Gardenville NY	ST	USGS	-78.755	42.85472
4215000	Cayuga Creek Near Lancaster NY	ST	USGS	-78.645	42.89
4215500	Cazenovia Creek at Ebenezer NY	ST	USGS	-78.775	42.82972
4218000	Tonawanda Creek at Rapids NY	ST	USGS	-78.6361	43.09306
4218518	Ellicott Creek below Williamsville NY	ST	USGS	-78.7636	42.97778
425520078535601	Manhole, Delevan St, 110 Ft West of Niagara St	FA	USGS	-78.8988	42.92228

Source: USGS 2021

Figure 5.4.6-6. USGS Gage Locations in Erie County



Water Level Data

A hydrograph shows how a water level changes over time at a specific location to enable a review of historic water levels which are useful in floodplain management planning. In Erie County, of the ten deployed USGS stream gages, five are continuously monitored and have associated hydrographs. These forecast hydrographs are useful to reference when flooding is expected or to determine the observed water level for the past few days:

- Action Stage - the stage which, when reached by a rising stream, lake, or reservoir, represents the level where the NWS or a partner/user needs to take some type of mitigation action in preparation for possible significant hydrologic activity.
- Minor Flooding - minimal or no property damage, but possibly some public threat.
- Moderate Flooding - some inundation of structures and roads near stream. 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.
- Record Flooding - flooding which equals or exceeds the highest stage or discharge at a given site during the period of record keeping.
- Stage - level of the water surface in a river measured with reference to some datum.
- Flow - volume of water passing a given point per unit of time.
- kcfs - measurement of water flow equivalent to 1000 cubic feet of water passing a given point for an entire second (NWS 2020) (*https://water.weather.gov/ahps2/pdf/hydrograph_terminology.pdf*).

Previous Occurrences and Losses

Table 5.4.6-5 documents historical flood events from 1950 to August 2020 in Erie County based on data collected from NOAA's National Centers for Environmental Information (NCEI), National Performance of Dams Program (NPDP), and CRREL databases.

Table 5.4.6-5. Flood Events 1954-2020

Hazard Type	Number of Occurrences Between 1950 and 2020	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Flash Flood	54	0	0	$21 M	$500,000
Flood	40	0	0	$3.2 M	$0
Total	**90**	**0**	**0**	**$24.2 M**	**$500,000**

Source: NOAA-NCEI 2021; CRREL 2018

FEMA Disaster Declarations

According to the New York State HMP, between 1954 and 2020, FEMA included New York State in 51 flood-related major disaster (DR) or emergency (EM) declarations (NYS DHSES 2020). Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. Erie County was included in seven of these flood-related declarations (Table 5.4.6-6).

Table 5.4.6-6. FEMA DR and EM Declarations for Flood Events in Erie County, 1954 to 2020

FEMA Declaration Number	Date(s) Of Event	Event Type	Details
494	March 19, 1976	Severe Ice Storm	Ice Storm, Severe Storms & Flooding
1233	June 25, 1998 - July 10, 1998	Severe Storm(s)	Severe Storms and Flooding
1335	May 3, 2000 - August 12, 2000	Severe Storm(s)	Severe Storms and Flooding

FEMA Declaration Number	Date(s) Of Event	Event Type	Details
1534	May 13, 2004 - June 17, 2004	Severe Storm(s)	Severe Storms and Flooding
1665	October 12, 2006 - October 25, 2006	Severe Storm(s)	Severe Storms and Flooding
1857	August 8, 2009 - August 10, 2009	Severe Storm(s)	Severe Storms and Flooding
4472	October 31, 2019 - November 1, 2019	Severe Storm(s)	Severe Storms, Straight-Line Winds, and Flooding

Source: FEMA 2020

U.S. Department of Agriculture Agricultural Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county. Erie County has experienced the following 10 USDA-designated agricultural disasters since 2013 that included or may have included losses due to flooding:

- S3593 - 2013 Excessive Rain and Related Flooding, High Winds, and Hail
- S3747 - 2014 Excessive Rain, Flash Flooding, Flooding, High Winds, and Hail
- S3777 - 2014 Excessive Snow, Flooding, Freeze, and High Wind
- S3885 - 2015 Excessive Rain, High Winds, Hail, Lightning, and Tornado
- S4274 - 2017 Excessive Rain and Related Flooding
- S4265 - 2017 Excessive Rain and Related Flooding, High Winds, and Hail
- S4479 - 2018 Excessive Rain

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Erie County has experienced crop losses from flood events. Table 5.4.6-7 provides details regarding crop losses in Erie County according to USDA records.

Table 5.4.6-7. USDA Crop Losses from Excess Moisture/Precipitation/Rain and/or Flooding in Erie County (2014-2019)

Year	Crop Type	Cause of Loss	Losses
2014	Wheat, corn, oats, beans, soybeans, all cover crops	Excess Moisture/Precipitation/Rain	$2 million
2015	Wheat, corn, oats, beans, soybeans	Excess Moisture/Precipitation/Rain	$1.6 million
2016	Wheat, corn, oats, beans, soybeans, oats	Excess Moisture/Precipitation/Rain	$1.2 million
2017	Wheat, corn, oats, beans, soybeans, grapes	Excess Moisture/Precipitation/Rain	$1.6 million
2018	Wheat, corn, oats, beans, soybeans	Excess Moisture/Precipitation/Rain	$1.1 million
2019	Wheat, corn, oats, beans, soybeans, oats	Excess Moisture/Precipitation/Rain	$2.1 million

Source: USDA 2021

Previous Events

For this update, flood events were summarized from 2013 to 2020. Known flood events that have impacted Erie County between 2015 and 2020, including FEMA disaster declarations, are identified in Table 5.4.6-8. Section 9 includes detailed information regarding flood impacts to each municipality.

Table 5.4.6-8. Flood Events in Erie County, 2015 to 2020

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
3/14/2015 & 3/15/2015	Flash Flood	-	-	Near record winter snowpack and ice on area creeks underwent a slow melt during the first half of the month. A rapid warm-up followed and resulted in ice jams on Cazenovia and Buffalo Creeks. Damages estimated at $20,000.
8/11/2015	Flash Flood	-	-	Showers and thunderstorms developed along the leading edge of a well-defined shortwave moving from Southern Ontario into Western New York. The storms mod across southern Erie county and rapidly intensified. Instantaneous rainfall rates of 4 to 6 inches per hour were observed on radar. Damages from the event are estimated at $100,000.
8/15/2015	Flash Flood	-	-	Thunderstorms developed and tracked along a stalled frontal boundary across Niagara and northern Erie counties. The slow-moving thunderstorms produced intense rainfall with reports of 5 to 8 inches in just a couple of hours. Damages from the event are estimated at $105,000.
4/20/2017	Flood	-	-	Several rounds of thunderstorms brought 1 to 3 inches of rain to the area in just a couple of hours. This resulted in ponding of water on area roadways. Several roads were closed by flood waters. Several basements were reported flooded in Alden. Damages from the event are estimated at $80,000.
4/21/2017	Flood	-	-	Several rounds of thunderstorms brought 1 to 3 inches of rain to the area in just a couple of hours. This resulted in ponding of water on area roadways. Several roads were closed by flood waters. Damages from the event are estimated at $10,000.
5/1/2017	Flood	-	-	A strong cold front moved across the region during the afternoon and evening hours. A line of thunderstorms just ahead of the front produced damaging winds that downed trees and wires across western New York through the Finger Lakes Region as well as areas east of Lake Ontario. A few falling trees caused minor structural damage. Damages from the event are estimated at $10,000.
7/13/2017	Flash Flood	-	-	A convective complex moved across Western New York late in the morning. This produced a quick 2 to 4 inches of rain which covered a significant portion of the region and resulted in flash flooding that impacted the Buffalo metro area, the Boston/Wyoming hills, and parts of the northern Finger Lakes Region. Flood Stage is 8 feet. It was the fifth highest crest on record and the highest warm season crest. Rises were quick on

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
				the creeks due to the brief period the rain fell. Damages from the event are estimated at $15,000.
11/5/2017	Flood	-	-	After a warm front brought soaking rains to the region, a cold front brought additional rain. The heavy precipitation fell on already saturated ground resulting in both area and river flooding. crested at 6.32 feet at 6:00 PM on the 7th (Flood Stage is 6 feet). Damages from the event are estimated at $30,000.
10/6/2018	Flash Flood	-	-	A weakening surface low tracked northeast across Lake Huron during the afternoon hours with its corresponding warm front extending to the east across Lake Ontario, then snaking south ahead of the higher terrain east of Syracuse. Damages from the event are estimated at $20,000.
2/4/2019	Flood	-	-	Rapid temperature warmups occurred across the area coming out of below zero cold that ended January. Record high temperatures occurred on February 4, resulting in almost total snow melt off and ice break up on local rivers. Ice jam flooding occurred on the Cazenovia Creek and Big Sister Creeks in Erie County. Damages from the event are estimated at $13,000.
2/24/2019	Flash Flood	-	-	Low pressure over the central Plains rapidly deepened as it moved into the central Great Lakes, ending up as a 970 mb low over western Quebec. A strong cold front trailing the low sliced through western New York trailing it and ushering in very gusty winds. The track of the strong surface low was a classic high wind track for our region. Damages from the event are estimated at $5,000.
8/21/2019	Flash Flood	-	-	Well ahead of an approaching cold front and more tied to convective enhanced shortwave, strong thunderstorms developed in clusters early morning. Warm rain processes dominated with precipitable water values closing in on 1.8 inches. Congealing storms dropped very heavy rain over north Buffalo to the Tonawandas. Damages from the event are estimated at $15,000.
10/31/2019	Lakeshore Flood/High Wind	EM 4472	-	A deepening area of consolidated low pressure tracked from the north shoreline of Lake Erie to Toronto, and then along the northern shoreline of Lake Ontario Thursday evening, October 31. Heavy rain also brought flooding concerns. All three climate stations broke their daily October 31 records with 1 to 3 inches of rain falling. High winds and lakeshore flooding continued into November 1.
6/2/2020	Flash Flood	-	-	A low-level boundary pushed southeast ahead of a mesoscale convective system late in the afternoon. This boundary followed

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
				the passage of a warm front with effective shear values jumping to 50-60 knots as the low-level boundary made its way across southern Ontario and into western New York. The evening Buffalo sounding strongly suggested that any convection would be elevated. There were no reported damages from this event.
7/11/2020	Flood	-	-	A sharp shortwave trough embedded within a broad upper level trough over the northeastern U.S. supported a wave of convection that moved across the entire area. There were no reported damages from this event. There were no reported damages from this event. There were no reported damages from this event.
7/16/2020	Flood	-	-	A mesoscale convective vortex pulled a pair of fronts across the area during the afternoon and evening near the time of peak heating. There were no reported damages from this event.
8/15/2020	Flash Flood	-	-	A diffuse and weak mid-level trough drifted across the eastern Great Lakes during the afternoon and evening, with a weak inverted trough at the surface extending from the Middle Atlantic states into western New York. Daytime heating resulted in moderate instability, although mid-level lapse rates were poor. Very weak flow through the low and mid-levels provided little to no shear. Damages from the event are estimated at $142,000.

Source: FEMA 2021; NOAA-NCEI 2021; NYS HMP 2019

Note: Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table.

FEMA Federal Emergency Management Agency

N/A Not Applicable

K Thousand

M Million

Climate Change Projections

Climate change is beginning to affect both people and resources of Erie County, and the impacts of climate change will continue. Impacts related to increasing temperatures are already being felt in the county. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York Each region in New York State, as defined by ClimAID, contains attributes that will be affected by climate change. Erie County is part of Region 1, Western New York, Great Lakes Plain. In Region 1, it is estimated that temperatures will increase by 3.0 ºF to 5.5 ºF by the 2050s and 4.5 ºF to 8.5 ºF by the 2080s (baseline of 48.0 ºF, mid-range projection). Precipitation totals will increase between 0 and 10% by the 2050s and 0 to 15% by the 2080s (baseline of 37.0 inches, mid-range projection). Table 5.4.6-9 displays the projected seasonal precipitation change for ClimAID Region 1 (NYSERDA 2014).

Table 5.4.6-9. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

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

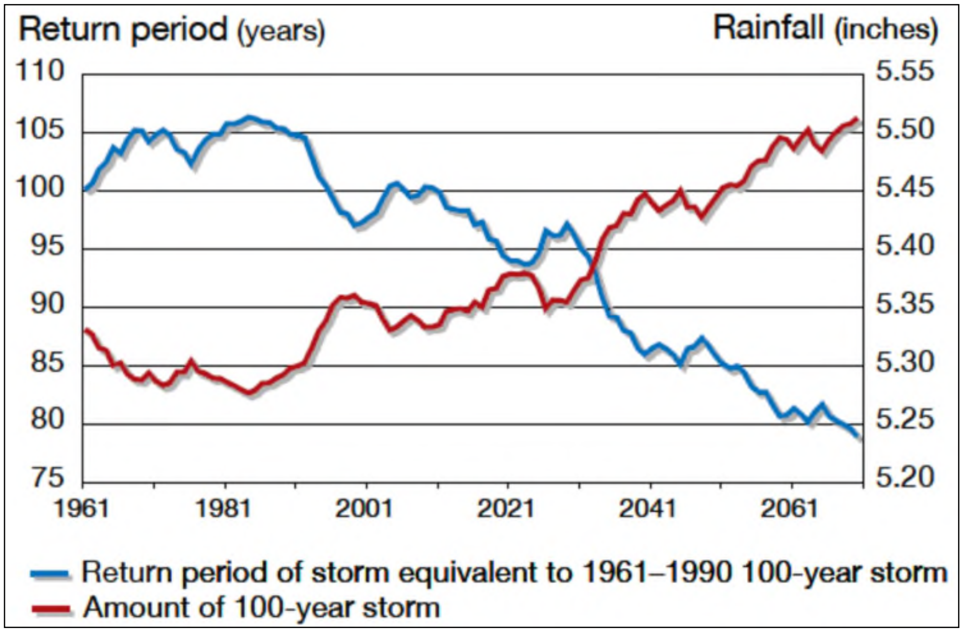
Source: NYSERDA 2014

By the end of the century, the greatest increases in precipitation are projected to be in the northern parts of the state. Although seasonal projections are less certain than annual results, much of this additional precipitation is projected to occur during the winter months. During the late summer and early fall, in contrast, total precipitation is slightly reduced in many climate models. The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. The increase in heavy downpours has the potential to affect drinking water; heighten the risk of riverine flooding; flood key rail lines, roadways, and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA 2018).

Average annual temperatures are projected to increase across New York State by 2.0–3.4 ˚F by the 2020s, 4.1–6.8 ˚F by the 2050s, and 5.3–10.1 ˚F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern parts of the state. The state's growing season could lengthen by about a month, with summers becoming more intense and winters milder (NYSERDA 2018).

Increasing air temperatures intensify the water cycle by increasing evaporation and precipitation. This can cause an increase in rain totals during events with longer dry periods in between those events. These changes can have a variety of effects on the state's water resources (NYSERDA 2011). Figure 5.4.6-7 displays the project rainfall and frequency of extreme storms in New York State. The amount of rainfall in a 100-year event is projected to increase, while the number of years between such storms (return period) is projected to decrease. Rainstorms will become more severe and more frequent (NYSERDA 2011).

Figure 5.4.6-7. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA 2011

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

Probability of Future Occurrences

Based on the historic and more recent flood events in Erie County, the county has a high probability of flooding for the future. The fact that the elements required for flooding exist and that major flooding has occurred throughout the county in the past suggests that many people and properties are at risk from the flood hazard in the future. It is estimated that Erie County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents, and inconveniences.

As defined by FEMA, geographic areas within the 1 percent annual chance flood area in Erie County are estimated to have a 1 percent chance of flooding in any given year. A structure located within a 1 percent annual chance flood area has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage. Geographic areas in Erie County located within the 0.2 percent annual chance flood area boundary are estimated to have a 0.2 percent chance of being flooded in any given year (FEMA 2007).

According to the NOAA-NCEI and the CRREL database, Erie County experienced 94 flood events between 1950 and 2020, including 40 floods and 54 flash floods. Table 5.4.6-10 shows these statistics, as well as the annual average number of events and the percent chance of these individual flood hazards occurring in Erie County in future years based on the historic record (NOAA-NCEI 2020).

Table 5.4.6-10. Probability of Future Occurrence of Flooding Events

Hazard Type	Number of Occurrences Between 1950 and 2020	Percent (%) chance of occurrence in any given year
Flash Flood	54	76.06
Flood	40	56.34
Lakeshore Flood	10	14.08
Total	**104**	**100.0**

Source: NOAA-National Climatic Data Center (NCDC) 2021; CRREL 2018; NPDP 2018

Climate change is expected to increase the severity and frequency of heavy rain events in Erie County. This is likely to lead to an increase in flooding events and dam and levee failure events.

In Section 5.3, the identified hazards of concern for Erie County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for flood in the county is considered *occasional*, having between 10 and 100 percent annual probability of the hazard occurring, as presented in Table 5.3-1 in Section 5.3, Hazard Ranking.

5.4.6.2 Vulnerability Assessment

To assess Erie County's risk to the flood hazard, a spatial analysis was conducted using the FEMA Risk Map effective and preliminary products dated June 2019 and February 2019, respectively. The 1 and 0.2 percent annual chance flood events were examined to determine the assets located in the hazard areas and to estimate potential loss using the FEMA Hazus riverine flood model. These results are summarized below.

Impact on Life, Health, and Safety

The impact of flooding on life, health, and safety is dependent upon several factors, including the severity of the event and whether or not adequate warning time is provided to residents. Exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to only those who reside in a defined hazard zone, but everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event). The degree of that impact will vary and is not strictly measurable.

To estimate population exposure to the 1 percent and 0.2 percent annual chance flood events, the DFIRM flood boundaries were used. Based on the spatial analysis, there are an estimated 9,633 residents living in the A Zones of the 1 percent annual chance floodplain or 1.1 percent of the County's total population. There are an estimated 14 residents living in the V Zones of the 1 percent annual chance floodplain, which is less than 0.1 percent of the County's total population. There are an estimated 48,397 residents living in the 0.2 percent annual chance floodplain, or 5.3 percent of the County's total population. The Town of Amherst has the greatest number of residents living in the floodplain, with approximately 2,818 residents living in the Special Flood Hazard Area (SFHA) and 24,611 people living in the 0.2 percent annual chance floodplain. Table 5.4.6-11. summarizes the population exposed to the flood hazard by jurisdiction.

Table 5.4.6-11. Estimated Population Exposed to the 1 Percent and 0.2 Percent Annual Chance Flood Event Hazard Area

Jurisdiction	American Community Survey (2014-2019) Population	Estimated Population Exposed to the Flood Hazard Areas					
		1 percent Annual Chance Flood (A Zones)	Percent of Total	1 percent Annual Chance Flood (V Zones)	Percent of Total	0.2 percent Annual Chance Flood	Percent of Total
Akron (V)	2,871	18	0.6%	0	0.0%	38	1.3%
Alden (T)	7,418	17	0.2%	0	0.0%	29	0.4%
Alden (V)	2,577	0	0.0%	0	0.0%	0	0.0%
Amherst (T)	120,276	2,818	2.3%	0	0.0%	24,611	20.5%
Angola (V)	2,373	3	0.1%	0	0.0%	3	0.1%
Aurora (T)	7,599	29	0.4%	0	0.0%	82	1.1%
Blasdell (V)	2,645	0	0.0%	0	0.0%	0	0.0%
Boston (T)	8,042	2	<0.1%	0	0.0%	4	0.1%
Brant (T)	1,541	0	0.0%	0	0.0%	0	0.0%
Buffalo (C)	256,480	828	0.3%	0	0.0%	3,956	1.5%
Cheektowaga (T)	73,129	110	0.2%	0	0.0%	5,033	6.9%
Clarence (T)	32,440	1,288	4.0%	0	0.0%	2,574	7.9%
Colden (T)	3,328	17	0.5%	0	0.0%	22	0.7%
Collins (T)	5,418	33	0.6%	0	0.0%	39	0.7%
Concord (T)	4,186	23	0.6%	0	0.0%	23	0.6%
Depew (V)	15,102	43	0.3%	0	0.0%	193	1.3%
East Aurora (V)	6,184	87	1.4%	0	0.0%	1,002	16.2%
Eden (T)	7,631	2	<0.1%	0	0.0%	2	0.0%
Elma (T)	11,732	46	0.4%	0	0.0%	114	1.0%
Evans (T)	13,782	509	3.7%	11	0.1%	616	4.5%
Farnham (V)	459	0	0.0%	0	0.0%	0	0.0%
Gowanda (V)	1,043	21	2.0%	0	0.0%	30	2.9%
Grand Island (T)	21,047	247	1.2%	0	0.0%	255	1.2%
Hamburg (T)	45,985	373	0.8%	3	<0.1%	495	1.1%
Hamburg (V)	9,636	0	0.0%	0	0.0%	0	0.0%
Holland (T)	3,355	25	0.7%	0	0.0%	29	0.9%
Kenmore (V)	15,132	0	0.0%	0	0.0%	0	0.0%
Lackawanna (C)	17,831	1,795	10.1%	0	0.0%	4,471	25.1%
Lancaster (T)	27,625	375	1.4%	0	0.0%	578	2.1%
Lancaster (V)	10,144	53	0.5%	0	0.0%	88	0.9%
Marilla (T)	5,378	134	2.5%	0	0.0%	158	2.9%
Newstead (T)	5,804	93	1.6%	0	0.0%	169	2.9%
North Collins (T)	2,130	0	0.0%	0	0.0%	0	0.0%
North Collins (V)	1,370	0	0.0%	0	0.0%	0	0.0%
Orchard Park (T)	26,361	32	0.1%	0	0.0%	84	0.3%
Orchard Park (V)	3,148	15	0.5%	0	0.0%	32	1.0%
Sardinia (T)	2,780	12	0.4%	0	0.0%	12	0.4%
Sloan (V)	3,562	0	0.0%	0	0.0%	0	0.0%
Springville (V)	4,298	11	0.3%	0	0.0%	21	0.5%
Tonawanda (C)	14,830	20	0.1%	0	0.0%	798	5.4%
Tonawanda (T)	57,027	28	<0.1%	0	0.0%	1,570	2.8%
Wales (T)	3,020	16	0.5%	0	0.0%	23	0.7%
West Seneca (T)	45,344	325	0.7%	0	0.0%	943	2.1%
Williamsville (V)	5,233	186	3.6%	0	0.0%	301	5.7%
Erie County Total	**917,296**	**9,633**	**1.1%**	**14**	**<0.1%**	**48,397**	**5.3%**

Source: FEMA 2019; American Community Survey 2019; Erie County GIS 2020
% = Percent; C = City; T = Town; V = Village
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors, including their physical and financial ability to react or respond during a hazard. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations may be more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a flood event, and they may have more difficulty evacuating. Within Erie County, there are approximately 161,744 people over the age of 65 and 126,806 people below the poverty level (American Community Survey 2019).

The Centers for Disease Control and Prevention (CDC) 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Erie County's overall score is 0.3986, indicating that its communities have low to moderate social vulnerability (CDC 2016). This score indicates that some county residents may not have enough resources to respond to flood events.

Using 2010 U.S. Census data, Hazus estimates the potential sheltering needs as a result of a 1 percent annual chance flood event. For the 1 percent flood event, Hazus estimates 21,383 households will be displaced, and 985 people will seek short-term sheltering. These statistics, by jurisdiction and by flood zone, are presented in Table 5.4.6-12.

Table 5.4.6-12. Estimated Population Displaced or Seeking Short-Term Shelter from the 1 Percent Annual Chance Flood Event Hazard Area

Jurisdiction	American Community Survey (2015-2019) Population	1 Percent Annual Chance Flood Event (V Zones)		1 Percent Annual Chance Flood Event (A Zones)		1 percent Annual Chance Flood Event (All A and V Zones)	
		Displaced Population	Persons Seeking Short-Term Sheltering	Displaced Population	Persons Seeking Short-Term Sheltering	Displaced Population	Persons Seeking Short-Term Sheltering
Akron (V)	2,871	0	0	63	0	63	0
Alden (T)	7,418	0	0	353	9	353	9
Alden (V)	2,577	0	0	18	0	18	0
Amherst (T)	120,276	0	0	6,604	419	6,604	419
Angola (V)	2,373	0	0	11	0	11	0
Aurora (T)	7,599	0	0	110	2	110	2
Blasdell (V)	2,645	0	0	1	0	1	0
Boston (T)	8,042	0	0	104	1	104	1
Brant (T)	1,541	8	0	2	0	10	0
Buffalo (C)	256,480	18	1	1,151	90	1,169	91
Cheektowaga (T)	73,129	0	0	1,312	88	1,312	88
Clarence (T)	32,440	0	0	2,019	76	2,019	76
Colden (T)	3,328	0	0	74	1	74	1
Collins (T)	5,418	0	0	76	1	76	1
Concord (T)	4,186	0	0	36	0	36	0
Depew (V)	15,102	0	0	416	9	416	9
East Aurora (V)	6,184	0	0	325	10	325	10
Eden (T)	7,631	0	0	21	0	21	0
Elma (T)	11,732	0	0	323	3	323	3
Evans (T)	13,782	92	1	728	15	820	16
Farnham (V)	459	0	0	0	0	0	0
Gowanda (V)	1,043	0	0	51	0	51	0
Grand Island (T)	21,047	0	0	343	5	343	5
Hamburg (T)	45,985	64	0	905	21	969	21

Jurisdiction	American Community Survey (2015-2019) Population	1 Percent Annual Chance Flood Event (V Zones)		1 Percent Annual Chance Flood Event (A Zones)		1 percent Annual Chance Flood Event (All A and V Zones)	
		Displaced Population	Persons Seeking Short-Term Sheltering	Displaced Population	Persons Seeking Short-Term Sheltering	Displaced Population	Persons Seeking Short-Term Sheltering
Hamburg (V)	9,636	0	0	69	1	69	1
Holland (T)	3,355	0	0	81	0	81	0
Kenmore (V)	15,132	0	0	0	0	0	0
Lackawanna (C)	17,831	0	0	1,899	102	1,899	102
Lancaster (T)	27,625	0	0	981	25	981	25
Lancaster (V)	10,144	0	0	353	13	353	13
Marilla (T)	5,378	0	0	122	4	122	4
Newstead (T)	5,804	0	0	265	3	265	3
North Collins (T)	2,130	0	0	0	0	0	0
North Collins (V)	1,370	0	0	0	0	0	0
Orchard Park (T)	26,361	0	0	229	2	229	2
Orchard Park (V)	3,148	0	0	57	1	57	1
Sardinia (T)	2,780	0	0	44	0	44	0
Sloan (V)	3,562	0	0	0	0	0	0
Springville (V)	4,298	0	0	63	0	63	0
Tonawanda (C)	14,830	0	0	47	0	47	0
Tonawanda (T)	57,027	0	0	159	7	159	7
Wales (T)	3,020	0	0	120	1	120	1
West Seneca (T)	45,344	0	0	1,322	57	1,322	57
Williamsville (V)	5,233	0	0	334	17	334	17
Erie County Total	**917,296**	**182**	**2**	**21,191**	**983**	**21,373**	**985**

Source: Hazus v4.2; FEMA 2019
C = City; T = Town; V = Village
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

The total number of injuries and casualties resulting from flooding is generally limited based on advance weather forecasting, blockades, and warnings. More likely, persons could become displaced from their homes or may seek shelter due to the impacts of a flood event. Therefore, injuries and deaths generally are not anticipated if proper warning and precautions are in place. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which results from persons trying to cross flooded roadways or channels during a flood. Dam failure can cause, in the most extreme case, loss of life and extensive property damage, or in the least extreme case, no loss of life or significant property damage. Dam failure can cause persons to become displaced if flooding of structures occurs. Dam failure may mimic flood events, depending on the size of the dam reservoir and breach. Dam failure inundation modeling estimates the potential impacts of a failure; however, this data is considered sensitive information and is not displayed or discussed further in the HMP.

Cascading impacts of flooding and dam failure inundation may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly, and pregnant women. The degree of impact will vary and is not strictly measurable. Mold spores can grow in as short a period as 24–48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC 2020).

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

Impact on General Building Stock

Exposure to the flood hazard includes those buildings located in the flood zone or those that are built downstream in other flood inundation areas such as dam failure inundation areas. Potential damage is the modeled loss that could occur to the exposed inventory measured by the structural and content replacement cost value. There are an estimated 3,923 and 17,522 buildings located in the 1 percent and 0.2 percent annual chance flood event hazard area, respectively. This represents approximately 1.1 percent and 4.9 percent of the county's total general building stock inventory replacement cost value, respectively (approximately $222.5 billion). The Town of Amherst has the greatest number of its buildings located in the 1 percent annual chance floodplain (927 buildings or 2.4 percent of its total building stock). The Town of Amherst also has the greatest number of its buildings located in the 0.2 percent annual chance floodplain (7,800 buildings or 20.2 percent of its total building stock). Refer to Table 5.4.6-13. for the estimated exposure of 1 percent and 0.2 percent flood events by jurisdiction. Refer to Table 5.4.6-14 through Table 5.4.6-17. for the Hazus estimated losses by jurisdiction, for residential, commercial, and other occupancy structures, respectively.

Table 5.4.6-13. Estimated General Building Stock Exposure to the 1 percent and 0.2 percent Annual Chance Flood Event

			Estimated Building Stock Exposed to 1 percent Annual Chance Flood												Estimated Building Stock Exposed to 0.2 percent Annual Chance Flood			
			V Zones (VE Zones)				A Zones (A, AE, AH, AO Zones)				Total (All Flood Zones)				Total (All Flood Zones)			
Jurisdiction	No. of Bldgs.	Total RCV	No. of Bldgs.	% of Bldgs.	RCV	% of RCV	No. of Bldgs.	% of Bldgs.	RCV	% of RCV	No. of Bldgs.	% of Bldgs.	RCV	% of RCV	No. of Bldgs.	% of Bldgs.	RCV	% of RCV
Akron (V)	1,275	$866,609,574	0	0.0%	$0	0.0%	11	0.9%	$4,505,225	0.5%	11	0.9%	$4,505,225	0.5%	20	1.6%	$8,825,784	1.0%
Alden (T)	3,400	$1,748,473,245	0	0.0%	$0	0.0%	8	0.2%	$2,787,385	0.2%	8	0.2%	$2,787,385	0.2%	13	0.4%	$4,767,461	0.3%
Alden (V)	1,102	$602,655,574	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Amherst (T)	38,528	$27,372,255,690	0	0.0%	$0	0.0%	927	2.4%	$605,412,946	2.2%	927	2.4%	$605,412,946	2.2%	7,800	20.2%	$5,153,025,365	18.8%
Angola (V)	874	$525,704,230	0	0.0%	$0	0.0%	1	0.1%	$312,694	0.1%	1	0.1%	$312,694	0.1%	1	0.1%	$312,694	0.1%
Aurora (T)	4,280	$2,496,885,036	0	0.0%	$0	0.0%	18	0.4%	$13,568,298	0.5%	18	0.4%	$13,568,298	0.5%	47	1.1%	$35,460,638	1.4%
Blasdell (V)	1,026	$638,571,953	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Boston (T)	4,040	$1,702,475,276	0	0.0%	$0	0.0%	1	<0.1%	$272,457	<0.1%	1	<0.1%	$272,457	<0.1%	2	<0.1%	$636,576	<0.1%
Brant (T)	1,325	$657,594,060	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Buffalo (C)	83,471	$58,603,851,634	0	0.0%	$0	0.0%	299	0.4%	$382,542,873	0.7%	299	0.4%	$382,542,873	0.7%	1,287	1.5%	$1,042,139,689	1.8%
Cheektowaga (T)	30,938	$17,530,893,277	0	0.0%	$0	0.0%	92	0.3%	$160,728,670	0.9%	92	0.3%	$160,728,670	0.9%	2,152	7.0%	$1,119,394,827	6.4%
Clarence (T)	13,660	$9,866,246,863	0	0.0%	$0	0.0%	568	4.2%	$292,942,837	3.0%	568	4.2%	$292,942,837	3.0%	1,092	8.0%	$587,033,738	5.9%
Colden (T)	2,110	$854,417,381	0	0.0%	$0	0.0%	10	0.5%	$2,867,971	0.3%	10	0.5%	$2,867,971	0.3%	13	0.6%	$3,488,550	0.4%
Collins (T)	2,521	$1,189,158,504	0	0.0%	$0	0.0%	15	0.6%	$6,141,846	0.5%	15	0.6%	$6,141,846	0.5%	17	0.7%	$6,368,497	0.5%
Concord (T)	3,245	$1,338,570,261	0	0.0%	$0	0.0%	17	0.5%	$4,658,097	0.3%	17	0.5%	$4,658,097	0.3%	18	0.6%	$5,351,555	0.4%
Depew (V)	6,532	$3,841,823,815	0	0.0%	$0	0.0%	26	0.4%	$28,327,637	0.7%	26	0.4%	$28,327,637	0.7%	93	1.4%	$62,816,464	1.6%
East Aurora (V)	2,441	$1,723,816,550	0	0.0%	$0	0.0%	41	1.7%	$26,584,702	1.5%	41	1.7%	$26,584,702	1.5%	419	17.2%	$421,069,283	24.4%
Eden (T)	4,290	$2,180,455,513	0	0.0%	$0	0.0%	2	<0.1%	$642,523	<0.1%	2	0.0%	$642,523	<0.1%	2	<0.1%	$642,523	<0.1%
Elma (T)	6,093	$3,775,039,302	0	0.0%	$0	0.0%	28	0.5%	$12,843,428	0.3%	28	0.5%	$12,843,428	0.3%	71	1.2%	$40,361,699	1.1%
Evans (T)	7,952	$3,335,060,692	7	0.1%	$1,771,642	0.1%	290	3.6%	$91,591,351	2.7%	297	3.7%	$93,362,993	2.8%	353	4.4%	$109,426,408	3.3%
Farnham (V)	189	$87,990,422	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Gowanda (V)	396	$249,516,940	0	0.0%	$0	0.0%	9	2.3%	$7,454,163	3.0%	9	2.3%	$7,454,163	3.0%	17	4.3%	$15,280,796	6.1%
Grand Island (T)	8,426	$4,674,517,058	0	0.0%	$0	0.0%	108	1.3%	$80,615,175	1.7%	108	1.3%	$80,615,175	1.7%	112	1.3%	$82,285,448	1.8%
Hamburg (T)	19,130	$11,911,210,828	1	<0.1%	$744,790	<0.1%	172	0.9%	$59,988,742	0.5%	173	0.9%	$60,733,532	0.5%	233	1.2%	$158,122,956	1.3%
Hamburg (V)	3,794	$2,005,172,252	0	0.0%	$0	0.0%	1	<0.1%	$940,589	<0.1%	1	<0.1%	$940,589	<0.1%	1	<0.1%	$940,589	<0.1%
Holland (T)	2,182	$1,151,194,342	0	0.0%	$0	0.0%	18	0.8%	$5,916,245	0.5%	18	0.8%	$5,916,245	0.5%	24	1.1%	$17,001,403	1.5%
Kenmore (V)	6,017	$2,305,529,001	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Lackawanna (C)	6,751	$4,030,622,400	0	0.0%	$0	0.0%	646	9.6%	$202,694,909	5.0%	646	9.6%	$202,694,909	5.0%	1,648	24.4%	$624,409,048	15.5%
Lancaster (T)	10,973	$6,845,493,469	0	0.0%	$0	0.0%	158	1.4%	$107,902,069	1.6%	158	1.4%	$107,902,069	1.6%	244	2.2%	$191,789,058	2.8%
Lancaster (V)	4,323	$2,217,331,122	0	0.0%	$0	0.0%	21	0.5%	$6,124,309	0.3%	21	0.5%	$6,124,309	0.3%	37	0.9%	$12,583,479	0.6%

Jurisdiction	No. of Bldgs.	Total RCV	Estimated Building Stock Exposed to 1 percent Annual Chance Flood – V Zones (VE Zones)				A Zones (A, AE, AH, AO Zones)				Total (All Flood Zones)				Estimated Building Stock Exposed to 0.2 percent Annual Chance Flood – Total (All Flood Zones)			
			No. of Bldgs.	% of Bldgs.	RCV	% of RCV	No. of Bldgs.	% of Bldgs.	RCV	% of RCV	No. of Bldgs.	% of Bldgs.	RCV	% of RCV	No. of Bldgs.	% of Bldgs.	RCV	% of RCV
Marilla (T)	2,956	$1,099,846,031	0	0.0%	$0	0.0%	68	2.3%	$9,812,100	0.9%	68	2.3%	$9,812,100	0.9%	80	2.7%	$11,941,817	1.1%
Newstead (T)	4,202	$2,181,758,974	0	0.0%	$0	0.0%	59	1.4%	$20,825,212	1.0%	59	1.4%	$20,825,212	1.0%	113	2.7%	$43,034,770	2.0%
North Collins (T)	1,898	$889,517,676	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
North Collins (V)	551	$383,968,909	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Orchard Park (T)	10,748	$8,174,650,530	0	0.0%	$0	0.0%	13	0.1%	$5,557,556	0.1%	13	0.1%	$5,557,556	0.1%	34	0.3%	$16,241,968	0.2%
Orchard Park (V)	1,211	$867,347,745	0	0.0%	$0	0.0%	5	0.4%	$2,282,910	0.3%	5	0.4%	$2,282,910	0.3%	11	0.9%	$5,869,748	0.7%
Sardinia (T)	2,184	$1,068,523,829	0	0.0%	$0	0.0%	8	0.4%	$1,767,269	0.2%	8	0.4%	$1,767,269	0.2%	8	0.4%	$1,767,269	0.2%
Sloan (V)	1,674	$634,998,253	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Springville (V)	1,816	$1,354,905,864	0	0.0%	$0	0.0%	7	0.4%	$4,967,514	0.4%	7	0.4%	$4,967,514	0.4%	13	0.7%	$11,327,770	0.8%
Tonawanda (C)	6,452	$3,291,492,557	0	0.0%	$0	0.0%	8	0.1%	$1,348,225	<0.1%	8	0.1%	$1,348,225	<0.1%	349	5.4%	$277,911,127	8.4%
Tonawanda (T)	23,999	$14,694,684,404	0	0.0%	$0	0.0%	32	0.1%	$35,436,231	0.2%	32	0.1%	$35,436,231	0.2%	650	2.7%	$237,796,690	1.6%
Wales (T)	1,923	$833,853,270	0	0.0%	$0	0.0%	9	0.5%	$2,976,569	0.4%	9	0.5%	$2,976,569	0.4%	13	0.7%	$4,821,832	0.6%
West Seneca (T)	17,970	$9,583,482,689	0	0.0%	$0	0.0%	145	0.8%	$147,042,604	1.5%	145	0.8%	$147,042,604	1.5%	398	2.2%	$285,723,843	3.0%
Williamsville (V)	2,057	$1,126,868,443	0	0.0%	$0	0.0%	74	3.6%	$72,522,993	6.4%	74	3.6%	$72,522,993	6.4%	137	6.7%	$119,587,703	10.6%
Erie County Total	**360,925**	**$222,515,035,436**	**8**	**<0.1%**	**$2,516,432**	**0.1%**	**3,915**	**1.1%**	**$2,412,906,323**	**1.1%**	**3,923**	**1.1%**	**$2,415,422,755**	**1.1%**	**17,522**	**4.9%**	**$10,719,559,063**	**4.8%**

Source: FEMA 2019; Erie County GIS 2020; RS Means 2020
C = City; T = Town; V = Village
No. = Number Bldgs. = Buildings RCV = Replacement Cost Value % = Percent
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.6-14. Estimated General Building Stock Potential Loss to the 1 percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value	Estimated Loss to the General Building Stock (All Occupancies) Located Within the 1 Percent Annual Chance Event Flood Hazard Area					
		V Zones (VE Zones)		A Zones (A, AE, AH, AO Zones)		Total (All Flood Zones)	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Akron (V)	$866,609,574	$0	0.0%	$377,446	<0.1%	$377,446	<0.1%
Alden (T)	$1,748,473,245	$0	0.0%	$37,107	<0.1%	$37,107	<0.1%
Alden (V)	$602,655,574	$0	0.0%	$0	0.0%	$0	0.0%
Amherst (T)	$27,372,255,690	$0	0.0%	$12,969,013	<0.1%	$12,969,013	<0.1%
Angola (V)	$525,704,230	$0	0.0%	$35,653	<0.1%	$35,653	<0.1%
Aurora (T)	$2,496,885,036	$0	0.0%	$2,057,320	0.1%	$2,057,320	0.1%
Blasdell (V)	$638,571,953	$0	0.0%	$0	0.0%	$0	0.0%
Boston (T)	$1,702,475,276	$0	0.0%	$35,689	<0.1%	$35,689	<0.1%
Brant (T)	$657,594,060	$0	0.0%	$0	0.0%	$0	0.0%
Buffalo (C)	$58,603,851,634	$0	0.0%	$33,701,397	0.1%	$33,701,397	0.1%
Cheektowaga (T)	$17,530,893,277	$0	0.0%	$11,124,892	0.1%	$11,124,892	0.1%
Clarence (T)	$9,866,246,863	$0	0.0%	$5,706,595	0.1%	$5,706,595	0.1%
Colden (T)	$854,417,381	$0	0.0%	$62,964	<0.1%	$62,964	<0.1%
Collins (T)	$1,189,158,504	$0	0.0%	$246,689	<0.1%	$246,689	<0.1%
Concord (T)	$1,338,570,261	$0	0.0%	$784,791	0.1%	$784,791	0.1%
Depew (V)	$3,841,823,815	$0	0.0%	$441,883	<0.1%	$441,883	<0.1%
East Aurora (V)	$1,723,816,550	$0	0.0%	$3,796,024	0.2%	$3,796,024	0.2%
Eden (T)	$2,180,455,513	$0	0.0%	$40,578	<0.1%	$40,578	<0.1%
Elma (T)	$3,775,039,302	$0	0.0%	$1,128,643	<0.1%	$1,128,643	<0.1%
Evans (T)	$3,335,060,692	$633,667	<0.1%	$7,786,947	0.2%	$8,420,614	0.3%
Farnham (V)	$87,990,422	$0	0.0%	$0	0.0%	$0	0.0%
Gowanda (V)	$249,516,940	$0	0.0%	$1,197,209	0.5%	$1,197,209	0.5%
Grand Island (T)	$4,674,517,058	$0	0.0%	$5,765,468	0.1%	$5,765,468	0.1%
Hamburg (T)	$11,911,210,828	$83,332	<0.1%	$5,759,825	<0.1%	$5,843,158	<0.1%
Hamburg (V)	$2,005,172,252	$0	0.0%	$3,243	<0.1%	$3,243	<0.1%
Holland (T)	$1,151,194,342	$0	0.0%	$452,073	<0.1%	$452,073	<0.1%
Kenmore (V)	$2,305,529,001	$0	0.0%	$0	0.0%	$0	0.0%
Lackawanna (C)	$4,030,622,400	$0	0.0%	$28,327,456	0.7%	$28,327,456	0.7%
Lancaster (T)	$6,845,493,469	$0	0.0%	$8,608,363	0.1%	$8,608,363	0.1%
Lancaster (V)	$2,217,331,122	$0	0.0%	$278,318	<0.1%	$278,318	<0.1%
Marilla (T)	$1,099,846,031	$0	0.0%	$2,466,111	0.2%	$2,466,111	0.2%
Newstead (T)	$2,181,758,974	$0	0.0%	$856,832	<0.1%	$856,832	<0.1%
North Collins (T)	$889,517,676	$0	0.0%	$0	0.0%	$0	0.0%
North Collins (V)	$383,968,909	$0	0.0%	$0	0.0%	$0	0.0%

Jurisdiction	Total Replacement Cost Value	Estimated Loss to the General Building Stock (All Occupancies) Located Within the 1 Percent Annual Chance Event Flood Hazard Area					
		V Zones (VE Zones)		A Zones (A, AE, AH, AO Zones)		Total (All Flood Zones)	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Orchard Park (T)	$8,174,650,530	$0	0.0%	$186,649	<0.1%	$186,649	<0.1%
Orchard Park (V)	$867,347,745	$0	0.0%	$98,818	<0.1%	$98,818	<0.1%
Sardinia (T)	$1,068,523,829	$0	0.0%	$245,523	<0.1%	$245,523	<0.1%
Sloan (V)	$634,998,253	$0	0.0%	$0	0.0%	$0	0.0%
Springville (V)	$1,354,905,864	$0	0.0%	$155,746	<0.1%	$155,746	<0.1%
Tonawanda (C)	$3,291,492,557	$0	0.0%	$447,134	<0.1%	$447,134	<0.1%
Tonawanda (T)	$14,694,684,404	$0	0.0%	$4,295,039	<0.1%	$4,295,039	<0.1%
Wales (T)	$833,853,270	$0	0.0%	$87,524	<0.1%	$87,524	<0.1%
West Seneca (T)	$9,583,482,689	$0	0.0%	$10,654,762	0.1%	$10,654,762	0.1%
Williamsville (V)	$1,126,868,443	$0	0.0%	$5,451,598	0.5%	$5,451,598	0.5%
Erie County Total	**$222,515,035,436**	**$716,999**	**<0.1%**	**$155,671,321**	0.1%	**$156,388,321**	**0.1%**

Source: Hazusv4.2, FEMA 2019; Erie County GIS 2020; RS Means 2020
C = City; T = Town; V = Village
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.6-15. Estimated Residential General Building Stock Potential Loss to the 1 percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value	Estimated Loss to the General Building Stock (Residential Occupancy) Located within the 1 percent Annual Chance Event Flood Hazard Area					
		V Zones (VE Zones)		A Zones (A, AE, AH, AO Zones)		Total (All Flood Zones)	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Akron (V)	$408,367,905	$0	0.0%	$33,743	<0.1%	$33,743	<0.1%
Alden (T)	$1,069,428,654	$0	0.0%	$35,401	<0.1%	$35,401	<0.1%
Alden (V)	$395,847,903	$0	0.0%	$0	0.0%	$0	0.0%
Amherst (T)	$16,727,353,474	$0	0.0%	$4,645,669	<0.1%	$4,645,669	<0.1%
Angola (V)	$267,129,260	$0	0.0%	$35,653	<0.1%	$35,653	<0.1%
Aurora (T)	$1,873,492,624	$0	0.0%	$519,865	<0.1%	$519,865	<0.1%
Blasdell (V)	$289,015,144	$0	0.0%	$0	0.0%	$0	0.0%
Boston (T)	$1,379,165,647	$0	0.0%	$35,689	<0.1%	$35,689	<0.1%
Brant (T)	$411,942,061	$0	0.0%	$0	0.0%	$0	0.0%
Buffalo (C)	$29,380,809,385	$0	0.0%	$4,716,078	<0.1%	$4,716,078	<0.1%
Cheektowaga (T)	$8,765,908,598	$0	0.0%	$777,561	<0.1%	$777,561	<0.1%
Clarence (T)	$7,127,011,673	$0	0.0%	$4,330,265	0.1%	$4,330,265	0.1%
Colden (T)	$706,333,156	$0	0.0%	$62,964	<0.1%	$62,964	<0.1%

Jurisdiction	Total Replacement Cost Value	Estimated Loss to the General Building Stock (Residential Occupancy) Located within the 1 percent Annual Chance Event Flood Hazard Area					
		V Zones (VE Zones)		A Zones (A, AE, AH, AO Zones)		Total (All Flood Zones)	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Collins (T)	$785,134,852	$0	0.0%	$246,689	<0.1%	$246,689	<0.1%
Concord (T)	$953,242,955	$0	0.0%	$402,189	<0.1%	$402,189	<0.1%
Depew (V)	$1,777,424,829	$0	0.0%	$102,970	<0.1%	$102,970	<0.1%
East Aurora (V)	$921,213,925	$0	0.0%	$396,183	<0.1%	$396,183	<0.1%
Eden (T)	$1,381,283,349	$0	0.0%	$40,578	<0.1%	$40,578	<0.1%
Elma (T)	$2,508,868,803	$0	0.0%	$399,628	<0.1%	$399,628	<0.1%
Evans (T)	$2,324,723,996	$605,534	<0.1%	$6,008,422	0.3%	$6,613,955	0.3%
Farnham (V)	$58,371,286	$0	0.0%	$0	0.0%	$0	0.0%
Gowanda (V)	$128,781,498	$0	0.0%	$31,243	<0.1%	$31,243	<0.1%
Grand Island (T)	$3,259,141,639	$0	0.0%	$2,505,997	0.1%	$2,505,997	0.1%
Hamburg (T)	$6,868,261,787	$83,332	<0.1%	$4,533,114	0.1%	$4,616,446	0.1%
Hamburg (V)	$1,297,913,317	$0	0.0%	$0	0.0%	$0	0.0%
Holland (T)	$659,570,296	$0	0.0%	$442,744	0.1%	$442,744	0.1%
Kenmore (V)	$1,803,866,517	$0	0.0%	$0	0.0%	$0	0.0%
Lackawanna (C)	$2,080,257,793	$0	0.0%	$21,180,591	1.0%	$21,180,591	1.0%
Lancaster (T)	$4,259,431,610	$0	0.0%	$4,676,797	0.1%	$4,676,797	0.1%
Lancaster (V)	$1,254,181,390	$0	0.0%	$278,318	<0.1%	$278,318	0.0%
Marilla (T)	$915,745,109	$0	0.0%	$2,466,111	0.3%	$2,466,111	<0.1%
Newstead (T)	$1,151,078,041	$0	0.0%	$530,585	<0.1%	$530,585	<0.1%
North Collins (T)	$494,763,766	$0	0.0%	$0	0.0%	$0	0.0%
North Collins (V)	$166,981,586	$0	0.0%	$0	0.0%	$0	0.0%
Orchard Park (T)	$5,215,766,189	$0	0.0%	$174,544	<0.1%	$174,544	<0.1%
Orchard Park (V)	$503,877,556	$0	0.0%	$98,818	<0.1%	$98,818	<0.1%
Sardinia (T)	$640,451,468	$0	0.0%	$245,523	<0.1%	$245,523	<0.1%
Sloan (V)	$430,086,727	$0	0.0%	$0	0.0%	$0	0.0%
Springville (V)	$636,234,153	$0	0.0%	$13,451	<0.1%	$13,451	<0.1%
Tonawanda (C)	$1,742,973,931	$0	0.0%	$447,134	<0.1%	$447,134	<0.1%
Tonawanda (T)	$7,741,209,135	$0	0.0%	$5,096	<0.1%	$5,096	<0.1%
Wales (T)	$615,054,386	$0	0.0%	$87,524	<0.1%	$87,524	<0.1%
West Seneca (T)	$6,099,460,803	$0	0.0%	$2,702,786	<0.1%	$2,702,786	<0.1%
Williamsville (V)	$797,180,973	$0	0.0%	$411,466	0.1%	$411,466	0.1%
Erie County Total	**$128,274,339,150**	**$688,866**	**<0.1%**	**$63,621,389**	**<0.1%**	**$64,310,255**	**0.1%**

Source: Hazusv4.2, FEMA 2019; Erie County GIS 2020; RS Means 2020
C = City; T = Town; V = Village
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.6-16. Estimated Commercial General Building Stock Potential Loss to the 1 percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value	Estimated Loss to the General Building Stock (Commercial Occupancy) Located within the 1 percent Annual Chance Event Flood Hazard Area					
		V Zones (VE Zones)		A Zones (A, AE, AH, AO Zones)		Total (All Flood Zones)	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Akron (V)	$153,671,895	$0	0.0%	$343,704	0.2%	$343,704	0.2%
Alden (T)	$211,835,618	$0	0.0%	$0	0.0%	$0	0.0%
Alden (V)	$120,190,739	$0	0.0%	$0	0.0%	$0	0.0%
Amherst (T)	$6,767,561,778	$0	0.0%	$7,089,883	0.1%	$7,089,883	0.1%
Angola (V)	$117,664,285	$0	0.0%	$0	0.0%	$0	0.0%
Aurora (T)	$353,538,415	$0	0.0%	$644,730	0.2%	$644,730	0.2%
Blasdell (V)	$99,116,494	$0	0.0%	$0	0.0%	$0	0.0%
Boston (T)	$160,262,380	$0	0.0%	$0	0.0%	$0	0.0%
Brant (T)	$87,379,906	$0	0.0%	$0	0.0%	$0	0.0%
Buffalo (C)	$15,956,810,248	$0	0.0%	$15,799,013	0.1%	$15,799,013	0.1%
Cheektowaga (T)	$5,892,442,351	$0	0.0%	$10,268,859	0.2%	$10,268,859	0.2%
Clarence (T)	$1,767,854,669	$0	0.0%	$1,320,203	0.1%	$1,320,203	0.1%
Colden (T)	$69,053,024	$0	0.0%	$0	0.0%	$0	0.0%
Collins (T)	$134,699,721	$0	0.0%	$0	0.0%	$0	0.0%
Concord (T)	$155,449,324	$0	0.0%	$382,602	0.2%	$382,602	0.2%
Depew (V)	$1,080,665,332	$0	0.0%	$326,621	<0.1%	$326,621	<0.1%
East Aurora (V)	$408,769,691	$0	0.0%	$2,257,783	0.6%	$2,257,783	0.6%
Eden (T)	$197,862,200	$0	0.0%	$0	0.0%	$0	0.0%
Elma (T)	$659,385,803	$0	0.0%	$729,015	0.1%	$729,015	0.1%
Evans (T)	$569,442,151	$28,133	<0.1%	$1,778,525	0.3%	$1,806,658	0.3%
Farnham (V)	$12,214,610	$0	0.0%	$0	0.0%	$0	0.0%
Gowanda (V)	$55,622,139	$0	0.0%	$1,165,965	2.1%	$1,165,965	2.1%
Grand Island (T)	$644,364,874	$0	0.0%	$3,259,471	0.5%	$3,259,471	0.5%
Hamburg (T)	$2,405,982,895	$0	0.0%	$968,041	<0.1%	$968,041	<0.1%
Hamburg (V)	$357,867,160	$0	0.0%	$3,243	<0.1%	$3,243	<0.1%
Holland (T)	$154,858,888	$0	0.0%	$9,329	<0.1%	$9,329	<0.1%
Kenmore (V)	$353,514,895	$0	0.0%	$0	0.0%	$0	0.0%
Lackawanna (C)	$574,982,748	$0	0.0%	$1,831,614	0.3%	$1,831,614	0.3%
Lancaster (T)	$1,579,789,344	$0	0.0%	$1,447,456	0.1%	$1,447,456	0.1%
Lancaster (V)	$390,420,591	$0	0.0%	$0	0.0%	$0	0.0%
Marilla (T)	$53,112,315	$0	0.0%	$0	0.0%	$0	0.0%
Newstead (T)	$500,085,392	$0	0.0%	$0	0.0%	$0	0.0%
North Collins (T)	$79,531,595	$0	0.0%	$0	0.0%	$0	0.0%
North Collins (V)	$108,146,566	$0	0.0%	$0	0.0%	$0	0.0%
Orchard Park (T)	$1,912,950,232	$0	0.0%	$0	0.0%	$0	0.0%

Jurisdiction	Total Replacement Cost Value	Estimated Loss to the General Building Stock (Commercial Occupancy) Located within the 1 percent Annual Chance Event Flood Hazard Area					
		V Zones (VE Zones)		A Zones (A, AE, AH, AO Zones)		Total (All Flood Zones)	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Orchard Park (V)	$186,187,663	$0	0.0%	$0	0.0%	$0	0.0%
Sardinia (T)	$209,206,001	$0	0.0%	$0	0.0%	$0	0.0%
Sloan (V)	$121,138,398	$0	0.0%	$0	0.0%	$0	0.0%
Springville (V)	$478,079,508	$0	0.0%	$142,295	<0.1%	$142,295	<0.1%
Tonawanda (C)	$935,960,265	$0	0.0%	$0	0.0%	$0	0.0%
Tonawanda (T)	$3,459,940,259	$0	0.0%	$4,155,986	0.1%	$4,155,986	0.1%
Wales (T)	$64,209,749	$0	0.0%	$0	0.0%	$0	0.0%
West Seneca (T)	$2,199,302,929	$0	0.0%	$7,503,994	0.3%	$7,503,994	0.3%
Williamsville (V)	$266,225,547	$0	0.0%	$5,040,132	1.9%	$5,040,132	1.9%
Erie County Total	**$52,067,350,588**	**$28,133**	**<0.1%**	**$66,468,464**	**0.1%**	**$66,496,597**	**0.1%**

Source: Hazusv4.2, FEMA 2019; Erie County GIS 2020; RS Means 2020
C = City; T = Town; V = Village
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.6-17. Estimated Other General Building Stock Potential Loss to the 1 percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value	Estimated Loss to the General Building Stock (Agricultural, Industrial, Religious, Education and Government Occupancies) Located within the 1 percent Annual Chance Event Flood Hazard Area					
		V Zones (VE Zones)		A Zones (A, AE, AH, AO Zones)		Total (All Flood Zones)	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Akron (V)	$304,569,773	$0	0.0%	$0	0.0%	$0	0.0%
Alden (T)	$467,208,972	$0	0.0%	$1,705	<0.1%	$1,705	<0.1%
Alden (V)	$86,616,933	$0	0.0%	$0	0.0%	$0	0.0%
Amherst (T)	$3,877,340,438	$0	0.0%	$1,233,461	<0.1%	$1,233,461	<0.1%
Angola (V)	$140,910,684	$0	0.0%	$0	0.0%	$0	0.0%
Aurora (T)	$269,853,997	$0	0.0%	$892,725	0.3%	$892,725	0.3%
Blasdell (V)	$250,440,314	$0	0.0%	$0	0.0%	$0	0.0%
Boston (T)	$163,047,249	$0	0.0%	$0	0.0%	$0	0.0%
Brant (T)	$158,272,093	$0	0.0%	$0	0.0%	$0	0.0%
Buffalo (C)	$13,266,232,001	$0	0.0%	$13,186,306	0.1%	$13,186,306	0.1%
Cheektowaga (T)	$2,872,542,328	$0	0.0%	$78,472	<0.1%	$78,472	<0.1%
Clarence (T)	$971,380,522	$0	0.0%	$56,127	<0.1%	$56,127	<0.1%
Colden (T)	$79,031,202	$0	0.0%	$0	0.0%	$0	0.0%
Collins (T)	$269,323,931	$0	0.0%	$0	0.0%	$0	0.0%

Jurisdiction	Total Replacement Cost Value	Estimated Loss to the General Building Stock (Agricultural, Industrial, Religious, Education and Government Occupancies) Located within the 1 percent Annual Chance Event Flood Hazard Area					
		V Zones (VE Zones)		A Zones (A, AE, AH, AO Zones)		Total (All Flood Zones)	
		Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value	Estimated Loss	Percent of Total Replacement Cost Value
Concord (T)	$229,877,982	$0	0.0%	$0	0.0%	$0	0.0%
Depew (V)	$983,733,654	$0	0.0%	$12,291	<0.1%	$12,291	<0.1%
East Aurora (V)	$393,832,933	$0	0.0%	$1,142,059	0.3%	$1,142,059	0.3%
Eden (T)	$601,309,964	$0	0.0%	$0	0.0%	$0	0.0%
Elma (T)	$606,784,697	$0	0.0%	$0	0.0%	$0	0.0%
Evans (T)	$440,894,545	$0	0.0%	$0	0.0%	$0	0.0%
Farnham (V)	$17,404,525	$0	0.0%	$0	0.0%	$0	0.0%
Gowanda (V)	$65,113,302	$0	0.0%	$0	0.0%	$0	0.0%
Grand Island (T)	$771,010,545	$0	0.0%	$0	0.0%	$0	0.0%
Hamburg (T)	$2,636,966,146	$0	0.0%	$258,670	<0.1%	$258,670	<0.1%
Hamburg (V)	$349,391,775	$0	0.0%	$0	0.0%	$0	0.0%
Holland (T)	$336,765,159	$0	0.0%	$0	0.0%	$0	0.0%
Kenmore (V)	$148,147,588	$0	0.0%	$0	0.0%	$0	0.0%
Lackawanna (C)	$1,375,381,858	$0	0.0%	$5,315,252	0.4%	$5,315,252	0.4%
Lancaster (T)	$1,006,272,515	$0	0.0%	$2,484,109	0.2%	$2,484,109	0.2%
Lancaster (V)	$572,729,141	$0	0.0%	$0	0.0%	$0	0.0%
Marilla (T)	$130,988,607	$0	0.0%	$0	0.0%	$0	0.0%
Newstead (T)	$530,595,541	$0	0.0%	$326,247	0.1%	$326,247	0.1%
North Collins (T)	$315,222,315	$0	0.0%	$0	0.0%	$0	0.0%
North Collins (V)	$108,840,757	$0	0.0%	$0	0.0%	$0	0.0%
Orchard Park (T)	$1,045,934,109	$0	0.0%	$12,105	<0.1%	$12,105	<0.1%
Orchard Park (V)	$177,282,527	$0	0.0%	$0	0.0%	$0	0.0%
Sardinia (T)	$218,866,360	$0	0.0%	$0	0.0%	$0	0.0%
Sloan (V)	$83,773,128	$0	0.0%	$0	0.0%	$0	0.0%
Springville (V)	$240,592,203	$0	0.0%	$0	0.0%	$0	0.0%
Tonawanda (C)	$612,558,361	$0	0.0%	$0	0.0%	$0	0.0%
Tonawanda (T)	$3,493,535,010	$0	0.0%	$133,958	<0.1%	$133,958	<0.1%
Wales (T)	$154,589,135	$0	0.0%	$0	0.0%	$0	0.0%
West Seneca (T)	$1,284,718,958	$0	0.0%	$447,982	<0.1%	$447,982	<0.1%
Williamsville (V)	$63,461,923	$0	0.0%	$0	0.0%	$0	0.0%
Erie County Total	**$42,173,345,698**	**$0**	**0.0%**	**$25,581,469**	**0.1%**	$25,581,469	0.1%

Source: Hazusv4.2, FEMA 2019; Erie County GIS 2020; RS Means 2020
C = City; T = Town; V = Village
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

NFIP Statistics

FEMA Region 2 provided a list of NFIP policies, past claims, and repetitive loss properties (RL) in Erie County. According to FEMA, a RL property is a NFIP-insured structure that has had at least two paid flood losses of more than $1,000 in any 10-year period since 1978. A SRL property is a NFIP-insured structure that has had four or more separate claim payments made under a standard flood insurance policy, with the amount of each claim exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000 or at least two separate claims payments made under a standard flood insurance policy with the cumulative amount of such claim payments exceed the fair market value of the insured building on the day before each loss (FEMA 2018).

Table 5.4.6-18. summarizes the NFIP policies, claims, and repetitive loss statistics for Erie County. Note that specific locations of repetitive loss properties were not made available for this plan.

Table 5.4.6-18. Repetitive Loss Properties and NFIP Data for Erie County

Jurisdiction	Number of Repetitive Loss Properties	Number of Policies	Number of Claims	Total Losses Claimed
Akron (V)	Data Not Provided by FEMA	1	4	$8,104
Alden (T)	Data Not Provided by FEMA	9	19	$187,358
Alden (V)	Data Not Provided by FEMA	0	5	$4,711
Amherst (T)	Data Not Provided by FEMA	846	448	$1,417,565
Angola (V)	Data Not Provided by FEMA	1	18	$83,162
Aurora (T)	Data Not Provided by FEMA	12	12	$96,661
Blasdell (V)	Data Not Provided by FEMA	1	25	$150,556
Boston (T)	Data Not Provided by FEMA	11	19	$180,739
Brant (T)	Data Not Provided by FEMA	1	99	$287,387
Buffalo (C)	Data Not Provided by FEMA	94	403	$927,901
Cheektowaga (T)	Data Not Provided by FEMA	76	211	$1,197,869
Clarence (T)	Data Not Provided by FEMA	108	41	$77,190
Colden (T)	Data Not Provided by FEMA	5	8	$6,758
Collins (T)	Data Not Provided by FEMA	3	6	$74,714
Concord (T)	Data Not Provided by FEMA	4	8	$58,398
Depew (V)	Data Not Provided by FEMA	14	33	$23,675
East Aurora (V)	Data Not Provided by FEMA	27	37	$184,988
Eden (T)	Data Not Provided by FEMA	4	6	$35,311
Elma (T)	Data Not Provided by FEMA	16	21	$52,116
Evans (T)	Data Not Provided by FEMA	106	100	$450,489
Farnham (V)	Data Not Provided by FEMA	1	5	$20,817
Gowanda (V)	Data Not Provided by FEMA	80	135	$2,332,781
Grand Island (T)	Data Not Provided by FEMA	46	30	$62,488
Hamburg (T)	Data Not Provided by FEMA	90	202	$1,854,818
Hamburg (V)	Data Not Provided by FEMA	5	26	$214,636
Holland (T)	Data Not Provided by FEMA	3	2	$2,738
Kenmore (V)	Data Not Provided by FEMA	1	8	$3,379
Lackawanna (C)	Data Not Provided by FEMA	184	94	$110,735
Lancaster (T)	Data Not Provided by FEMA	74	52	$366,231
Lancaster (V)	Data Not Provided by FEMA	16	5	$4,698
Marilla (T)	Data Not Provided by FEMA	2	1	$15,190
Newstead (T)	Data Not Provided by FEMA	11	8	$26,190
North Collins (T)	Data Not Provided by FEMA	0	0	$0
North Collins (V)	Data Not Provided by FEMA	0	0	$0
Orchard Park (T)	Data Not Provided by FEMA	20	14	$8,609
Orchard Park (V)	Data Not Provided by FEMA	7	7	$59,650
Sardinia (T)	Data Not Provided by FEMA	4	6	$114,205
Sloan (V)	Data Not Provided by FEMA	0	1	$ 0
Springville (V)	Data Not Provided by FEMA	5	18	$320,646
Tonawanda (C)	Data Not Provided by FEMA	4	9	$26,665
Tonawanda (T)	Data Not Provided by FEMA	32	56	$73,198

Jurisdiction	Number of Repetitive Loss Properties	Number of Policies	Number of Claims	Total Losses Claimed
Wales (T)	Data Not Provided by FEMA	1	4	$2,133
West Seneca (T)	Data Not Provided by FEMA	123	186	$786,473
Williamsville (V)	Data Not Provided by FEMA	26	134	$518,994
Erie County Total	**Data Not Provided by FEMA**	**2,074**	**2,526**	**$12,430,926**

Source: FEMA Region 2, 2020
Note: NFIP = National Flood Insurance Program, V = Village, T = Town, C = City
The Village of Gowanda is partially in both Erie and Cattaraugus Counties. Totals may be inflated as they are for the entire Village, not just Erie County.

Impact on Land Uses

An exposure analysis was completed to determine the acres of developed residential land and developed non-residential land use types located in the 1 percent and 0.2 percent flood hazard areas. To estimate exposure for developed residential and nonresidential land use types to the 1 percent flood hazard area, the floodplain boundary was overlaid upon land use data. Across Erie County, natural land has the highest percentage in flood areas. Approximately 7.9 percent and 9.8 percent of natural land use area is in the 1 percent (A and V Zones combined) and 0.2% annual chance flood zone, respectively. Non-residential land the greatest area in flood areas. Approximately 34,426 acres of non-residential land area are in the 1 percent annual chance flood zone, and 44,479 acres of non-residential land area are in the 0.2 percent annual chance flood zone. Refer to Table 5.4.6-19 for a complete summary of this analysis.

Table 5.4.6-19. Developed Residential and Non-Residential Land Use Exposed to 1 Percent and 0.2 Percent Annual Chance Flood Event Hazard Areas

Land Use Type	Total Acres for County	1 percent Annual Chance Flood Event - A Zones		1 percent Annual Chance Flood Event - V Zones		0.2 percent Annual Chance Flood Event	
		Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
Residential Land	103,575	2,825	2.7%	73	0.1%	7,419	7.2%
Non-Residential Land	544,586	34,318	6.3%	107	<0.1%	44,479	8.2%
Natural Land	304,039	24,098	7.9%	19	<0.1%	29,826	9.8%
Erie County Total	**652,056**	**38,814**	**6.0%**	**383**	**0.1%**	**53,849**	**8.3%**

Source: FEMA 2021; Erie County GIS 2021; USGS 2016
C = City; T = Town; V = Village
Notes: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.
The area presented includes the area of inland waterways.

Impact on Critical Facilities

It is important to determine the critical facilities and infrastructure within the county that may be at risk to flooding (riverine, dam failure, flash/stormwater flooding) and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to get to vulnerable populations or to make repairs. Utilities such as overhead power, cable, and phone lines could also be vulnerable due to utility poles damaged by standing water or the surge of water from a dam failure event. Loss of these utilities could create additional isolation issues for the inundation zones.

Major roadways that may be impacted by the 1 percent annual chance flood event include Interstates I-90, I-990, I-190, State Roads NY-266, NY-277, NY-270, NY-324, NY-33, NY-354, NY-384, NY-39, NY-391, NY-425, NY-5, NY-75, NY-78, NY-93, and NY-93, US Routes 20, 20A, 219, and 62 and various county roads.

Approximately 2.7 percent (both A and V Zones) and 6.3 percent of all roadways are located in the 1 percent and 0.2 percent annual chance flood event, respectively. Table 5.4.6-20 summarizes the total number of miles of exposed roadways. There are several issues associated with transportation routes flooding, including isolation caused by bridges being washed out or blocked by floods or debris, health problems caused by water and sewer systems that are flooded or backed up, drinking water contamination caused by floodwaters carrying pollutants in water supplies, and localized urban flooding caused by culverts blocked with debris.

Table 5.4.6-20. Road Miles Located in the 1 percent Annual Chance Flood Hazard Area

Road Type	Total Miles for County	1 Percent Annual Chance Flood Event - A Zones		1 Percent Annual Chance Flood Event - V Zones		0.2 Percent Annual Chance Flood Event	
		Miles	Percent of Total	Miles	Percent of Total	Miles	Percent of Total
Local and Private Roads	3,693	95.3	2.6%	0.2	<0.1%	251.4	6.8%
County Roads	1,221	38.1	3.1%	0.0	0.0%	69.2	5.7%
State Routes	542	18.4	3.4%	0.0	0.0%	34.9	6.4%
US Highways	195	1.6	0.8%	0.0	0.0%	3.1	1.6%
Interstate	168	2.0	1.2%	0.0	0.0%	5.5	3.3%
Erie County Total	**5,818**	**155.4**	**2.7%**	**0.2**	**<0.1%**	**364.1**	**6.3%**

Source: FEMA 2019; NYS DOT 2013

Critical facility exposure to the 1 percent and 0.2 percent annual chance flood hazard event boundary was examined. In addition, Hazus was used to estimate the flood loss potential to critical facilities located in the FEMA mapped floodplains. Table 5.4.6-21. separated by A and V Zones and Table 5.4.6-22. summarize the number of critical facilities exposed to the 1 percent and 0.2 percent flood inundation areas by jurisdiction. Of the 496 critical facilities located in the 1 percent annual chance flood event boundary, 468 are considered lifelines for the county out of the 585 critical facilities located in the 0.2 percent annual chance flood event boundary, 554 are considered lifelines for the county. Table 5.4.6-23.and Table 5.4.6-24. the distribution of critical facilities in the 1 percent and 0.2 percent annual chance flood event boundary. Refer to Section 4 (County Profile) for more information about the critical facilities and lifelines in Erie County.

Table 5.4.6-21. Number of Critical Facilities Located in the 1 Percent Annual Chance Flood Hazard Area

Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to 1 percent Annual Chance Flood Event (A Zones)				Number of Critical Facilities and Lifeline Facilities Exposed to 1 percent Annual Chance Flood Event (V Zones)				Number of Critical Facilities and Lifeline Facilities Exposed to 1 percent Annual Chance Flood Event (All A and V Zones)			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	8	26.7%	8	30.8%	0	0.0%	0	0.0%	8	26.7%	8	30.8%
Alden (T)	76	68	15	19.7%	14	20.6%	0	0.0%	0	0.0%	15	19.7%	14	20.6%
Alden (V)	19	17	1	5.3%	1	5.9%	0	0.0%	0	0.0%	1	5.3%	1	5.9%
Amherst (T)	391	387	44	11.3%	43	11.1%	0	0.0%	0	0.0%	44	11.3%	43	11.1%
Angola (V)	20	18	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Aurora (T)	95	81	17	17.9%	17	21.0%	0	0.0%	0	0.0%	17	17.9%	17	21.0%
Blasdell (V)	22	22	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Boston (T)	81	75	9	11.1%	9	12.0%	0	0.0%	0	0.0%	9	11.1%	9	12.0%
Brant (T)	39	39	3	7.7%	3	7.7%	0	0.0%	0	0.0%	3	7.7%	3	7.7%
Buffalo ©	751	748	41	5.5%	39	5.2%	0	0.0%	0	0.0%	41	5.5%	39	5.2%
Cheektowaga (T)	224	221	14	6.3%	14	6.3%	0	0.0%	0	0.0%	14	6.3%	14	6.3%
Clarence (T)	121	115	31	25.6%	31	27.0%	0	0.0%	0	0.0%	31	25.6%	31	27.0%
Colden (T)	67	56	10	14.9%	9	16.1%	0	0.0%	0	0.0%	10	14.9%	9	16.1%
Collins (T)	71	55	11	15.5%	10	18.2%	0	0.0%	0	0.0%	11	15.5%	10	18.2%
Concord (T)	84	68	6	7.1%	5	7.4%	0	0.0%	0	0.0%	6	7.1%	5	7.4%
Depew (V)	63	63	5	7.9%	5	7.9%	0	0.0%	0	0.0%	5	7.9%	5	7.9%
East Aurora (V)	42	41	6	14.3%	6	14.6%	0	0.0%	0	0.0%	6	14.3%	6	14.6%
Eden (T)	78	72	6	7.7%	4	5.6%	0	0.0%	0	0.0%	6	7.7%	4	5.6%
Elma (T)	83	75	13	15.7%	13	17.3%	0	0.0%	0	0.0%	13	15.7%	13	17.3%
Evans (T)	112	109	23	20.5%	23	21.1%	1	0.9%	1	0.9%	24	21.4%	24	22.0%
Farnham (V)	10	10	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Gowanda (V)	7	7	1	14.3%	1	14.3%	0	0.0%	0	0.0%	1	14.3%	1	14.3%
Grand Island (T)	69	66	12	17.4%	11	16.7%	0	0.0%	0	0.0%	12	17.4%	11	16.7%
Hamburg (T)	189	181	30	15.9%	30	16.6%	1	0.5%	0	0.0%	31	16.4%	30	16.6%
Hamburg (V)	27	23	2	7.4%	1	4.3%	0	0.0%	0	0.0%	2	7.4%	1	4.3%
Holland (T)	90	70	12	13.3%	12	17.1%	0	0.0%	0	0.0%	12	13.3%	12	17.1%
Kenmore (V)	14	13	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Lackawanna ©	94	93	18	19.1%	18	19.4%	0	0.0%	0	0.0%	18	19.1%	18	19.4%
Lancaster (T)	109	103	25	22.9%	24	23.3%	0	0.0%	0	0.0%	25	22.9%	24	23.3%
Lancaster (V)	58	53	10	17.2%	7	13.2%	0	0.0%	0	0.0%	10	17.2%	7	13.2%

Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to 1 percent Annual Chance Flood Event (A Zones)				Number of Critical Facilities and Lifeline Facilities Exposed to 1 percent Annual Chance Flood Event (V Zones)				Number of Critical Facilities and Lifeline Facilities Exposed to 1 percent Annual Chance Flood Event (All A and V Zones)			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines	Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Marilla (T)	48	37	6	12.5%	6	16.2%	0	0.0%	0	0.0%	6	12.5%	6	16.2%
Newstead (T)	64	61	10	15.6%	10	16.4%	0	0.0%	0	0.0%	10	15.6%	10	16.4%
North Collins (T)	69	56	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
North Collins (V)	14	13	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Orchard Park (T)	141	129	22	15.6%	21	16.3%	0	0.0%	0	0.0%	22	15.6%	21	16.3%
Orchard Park (V)	21	18	5	23.8%	3	16.7%	0	0.0%	0	0.0%	5	23.8%	3	16.7%
Sardinia (T)	78	57	6	7.7%	3	5.3%	0	0.0%	0	0.0%	6	7.7%	3	5.3%
Sloan (V)	8	8	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Springville (V)	35	32	1	2.9%	0	0.0%	0	0.0%	0	0.0%	1	2.9%	0	0.0%
Tonawanda ©	61	60	13	21.3%	13	21.7%	0	0.0%	0	0.0%	13	21.3%	13	21.7%
Tonawanda (T)	266	265	8	3.0%	8	3.0%	0	0.0%	0	0.0%	8	3.0%	8	3.0%
Wales (T)	82	68	13	15.9%	12	17.6%	0	0.0%	0	0.0%	13	15.9%	12	17.6%
West Seneca (T)	145	140	30	20.7%	28	20.0%	0	0.0%	0	0.0%	30	20.7%	28	20.0%
Williamsville (V)	16	14	7	43.8%	5	35.7%	0	0.0%	0	0.0%	7	43.8%	5	35.7%
Erie County Total	**4,184**	**3,933**	**494**	**11.8%**	**467**	**11.9%**	**2**	**<0.1%**	**1**	**<0.1%**	**496**	**11.9%**	**468**	**11.9%**

Source: FEMA 2019; Erie County GIS 2020
C = City; T = Town; V = Village % = Percent
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.6-22. Distribution of Critical Facilities in the 1 percent Annual Chance Flood Event Floodplain by Type and Jurisdiction

Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to 0.2 percent Annual Chance Flood Event			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	8	26.7%	8	30.8%
Alden (T)	76	68	15	19.7%	14	20.6%
Alden (V)	19	17	1	5.3%	1	5.9%
Amherst (T)	391	387	74	18.9%	72	18.6%
Angola (V)	20	18	0	0.0%	0	0.0%
Aurora (T)	95	81	17	17.9%	17	21.0%
Blasdell (V)	22	22	0	0.0%	0	0.0%
Boston (T)	81	75	9	11.1%	9	12.0%

Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to 0.2 percent Annual Chance Flood Event			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Brant (T)	39	39	3	7.7%	3	7.7%
Buffalo (C)	751	748	44	5.9%	42	5.6%
Cheektowaga (T)	224	221	30	13.4%	30	13.6%
Clarence (T)	121	115	33	27.3%	33	28.7%
Colden (T)	67	56	10	14.9%	9	16.1%
Collins (T)	71	55	11	15.5%	10	18.2%
Concord (T)	84	68	6	7.1%	5	7.4%
Depew (V)	63	63	8	12.7%	8	12.7%
East Aurora (V)	42	41	10	23.8%	10	24.4%
Eden (T)	78	72	6	7.7%	4	5.6%
Elma (T)	83	75	14	16.9%	14	18.7%
Evans (T)	112	109	24	21.4%	24	22.0%
Farnham (V)	10	10	0	0.0%	0	0.0%
Gowanda (V)	7	7	3	42.9%	3	42.9%
Grand Island (T)	69	66	12	17.4%	11	16.7%
Hamburg (T)	189	181	33	17.5%	32	17.7%
Hamburg (V)	27	23	2	7.4%	1	4.3%
Holland (T)	90	70	12	13.3%	12	17.1%
Kenmore (V)	14	13	0	0.0%	0	0.0%
Lackawanna (C)	94	93	26	27.7%	26	28.0%
Lancaster (T)	109	103	30	27.5%	29	28.2%
Lancaster (V)	58	53	11	19.0%	7	13.2%
Marilla (T)	48	37	6	12.5%	6	16.2%
Newstead (T)	64	61	11	17.2%	10	16.4%
North Collins (T)	69	56	0	0.0%	0	0.0%
North Collins (V)	14	13	0	0.0%	0	0.0%
Orchard Park (T)	141	129	22	15.6%	21	16.3%
Orchard Park (V)	21	18	5	23.8%	3	16.7%
Sardinia (T)	78	57	6	7.7%	3	5.3%
Sloan (V)	8	8	0	0.0%	0	0.0%
Springville (V)	35	32	1	2.9%	0	0.0%
Tonawanda (C)	61	60	15	24.6%	15	25.0%

Jurisdiction	Total CFs Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to 0.2 percent Annual Chance Flood Event			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Tonawanda (T)	266	265	13	4.9%	13	4.9%
Wales (T)	82	68	13	15.9%	12	17.6%
West Seneca (T)	145	140	33	22.8%	31	22.1%
Williamsville (V)	16	14	8	50.0%	6	42.9%
Erie County Total	**4,184**	**3,933**	**585**	**14.0%**	**554**	**14.1%**

Source: FEMA 2021; Erie County GIS 2021
C = City; T = Town; V = Village % = Percent
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.6-23. Lifelines Exposed to the 1 Percent Annual Chance Flood Event Boundary

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to 1 percent Annual Chance Flood Event
Communications	59	0
Energy	176	5
Food, Water, and Shelter	951	31
Hazardous Materials	398	5
Health and Medical	144	0
Safety and Security	1,047	13
Transportation	1,158	414
Erie County Total	**3,933**	**468**

Source: FEMA 2019; Erie County GIS 2020; FEMA 2020

Table 5.4.6-24. Lifelines Exposed to the 0.2 Percent Annual Chance Flood Event Boundary

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to 0.2 percent Annual Chance Flood Event
Communications	59	1
Energy	176	10
Food, Water, and Shelter	951	51
Hazardous Materials	398	19
Health and Medical	144	2
Safety and Security	1,047	30
Transportation	1,158	441
Erie County Total	**3,933**	**554**

Source: FEMA 2019; Erie County GIS 2020

In cases where short-term functionality is impacted by a hazard, other facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce impact to critical facilities and ensure enough emergency and school services remain when a significant event occurs. Actions addressing shared services agreements are included in Section 9, Mitigation Strategies, of this plan.

Impact on the Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts to utilities and infrastructure, business interruption, and impacts on tourism. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. Subsection of Section 5.4.6.2, Impact on General Building Stock, discusses direct impacts to buildings in Erie County.

Debris management may also be a large expense after a flood event. HAZUS estimates the amount of structural debris generated during a flood event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.); and (3) foundations (concrete slab and block, rebar, etc.). These distinctions are necessary because of the different types of equipment needed to handle debris. Table 5.4.6-25. summarizes the Hazus v4.2 countywide debris estimates for the 1 percent annual chance flood event. This table only estimates structural debris generated by flooding and does not include non-structural debris or additional potential damage and debris possibly generated by wind that may be associated with a flood event or storm that causes flooding. Overall, Hazus estimates that there will be 40,750 tons of debris generated during the 1 percent annual chance flood event in Erie County.

Table 5.4.6-25. Estimated Debris Generated from the 1 percent Annual Chance Flood Event

Jurisdiction	1 percent Coastal Annual Chance Flood Event				1 percent Riverine Annual Chance Flood Event				1 percent All Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Akron (V)	0	0	0	0	63	63	0	0	63	63	0	0
Alden (T)	0	0	0	0	300	242	36	23	300	242	36	23
Alden (V)	0	0	0	0	10	9	0	0	10	9	0	0
Amherst (T)	0	0	0	0	6,439	4,710	1,025	704	6,439	4,710	1,025	704
Angola (V)	0	0	0	0	54	32	14	9	54	32	14	9
Aurora (T)	0	0	0	0	296	191	54	50	296	191	54	50
Blasdell (V)	0	0	0	0	0	0	0	0	0	0	0	0
Boston (T)	0	0	0	0	170	124	23	23	170	124	23	23
Brant (T)	273	74	80	119	6	6	0	0	279	79	81	119
Buffalo (C)	923	241	287	395	2,859	1,374	798	687	3,782	1,615	1,085	1,082
Cheektowaga (T)	0	0	0	0	3,806	1,623	1,145	1,039	3,806	1,623	1,145	1,039
Clarence (T)	0	0	0	0	1,565	1,113	256	197	1,565	1,113	256	197
Colden (T)	0	0	0	0	148	124	10	14	148	124	10	14
Collins (T)	0	0	0	0	162	58	59	45	162	58	59	45
Concord (T)	0	0	0	0	111	47	35	30	111	47	35	30
Depew (V)	0	0	0	0	2,357	1,062	705	590	2,357	1,062	705	590
East Aurora (V)	0	0	0	0	352	287	38	27	352	287	38	27
Eden (T)	0	0	0	0	145	76	39	31	145	76	39	31
Elma (T)	0	0	0	0	811	528	172	111	811	528	172	111
Evans (T)	3,045	871	993	1,181	1,316	1,069	149	99	4,361	1,940	1,141	1,280
Farnham (V)	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	0	0	0	171	60	61	50	171	60	61	50
Grand Island (T)	0	0	0	0	993	961	19	12	993	961	19	12
Hamburg (T)	2,062	477	621	964	2,802	1,800	558	443	4,864	2,278	1,180	1,407
Hamburg (V)	0	0	0	0	85	56	17	11	85	56	17	11
Holland (T)	0	0	0	0	101	91	6	4	101	91	6	4
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0
Lackawanna (C)	0	0	0	0	3,892	2,269	843	780	3,892	2,269	843	780
Lancaster (T)	0	0	0	0	1,274	1,016	155	102	1,274	1,016	155	102
Lancaster (V)	0	0	0	0	3,814	1,009	1,549	1,257	3,814	1,009	1,549	1,257
Marilla (T)	0	0	0	0	225	76	53	96	225	76	53	96
Newstead (T)	0	0	0	0	138	138	0	0	138	138	0	0
North Collins (T)	0	0	0	0	0	0	0	0	0	0	0	0
North Collins (V)	0	0	0	0	0	0	0	0	0	0	0	0
Orchard Park (T)	0	0	0	0	275	263	8	5	275	263	8	5
Orchard Park (V)	0	0	0	0	70	44	15	11	70	44	15	11

Jurisdiction	1 percent Coastal Annual Chance Flood Event				1 percent Riverine Annual Chance Flood Event				1 percent All Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Sardinia (T)	0	0	0	0	60	47	8	6	60	47	8	6
Sloan (V)	0	0	0	0	0	0	0	0	0	0	0	0
Springville (V)	0	0	0	0	28	24	3	2	28	24	3	2
Tonawanda (C)	0	0	0	0	113	105	5	3	113	105	5	3
Tonawanda (T)	0	0	0	0	185	185	0	0	185	185	0	0
Wales (T)	0	0	0	0	517	224	165	128	517	224	165	128
West Seneca (T)	0	0	0	0	4,402	2,097	1,331	974	4,402	2,097	1,331	974
Williamsville (V)	0	0	0	0	633	587	28	18	633	587	28	18
Erie County Total	**0**	**0**	**0**	**0**	**40,750**	**23,788**	**9,381**	**7,582**	**40,750**	**23,788**	**9,381**	**7,582**

Source: HAZUS V4.2
Notes: V = Village, T = Town, C = City

Impact on the Environment

As Erie County and its jurisdictions evolve with changes in population and density, flood events may increase in frequency and/or severity as land use changes, more structures are built, and impervious surfaces expand. Furthermore, flood extents for the 1 percent annual chance flood event will continue to evolve alongside natural occurrences such as climate change and/or severe weather events. These flood events will inevitably impact Erie County's natural and local environment.

Furthermore, the environmental impacts of a dam failure can include significant water quality and debris-disposal issues. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion is likely; such erosion can negatively impact local ecosystems.

The acreage of natural land makes up 46.6 percent of the county's total land area (NLCD 2016). Natural land areas from the 2016 land use type dataset includes areas of forested land and wetlands. Severe flooding will not only influence the habitat of these natural land areas, it can be disruptive to species that reside in these natural habitats. Overall, 7.9 percent and 9.8 percent of the natural land area in the county is exposed to the 1 percent and 0.2 percent annual chance flood events, respectively.

Cascading Impacts on Other Hazards

Flood events can exacerbate the impacts of land sliding and utility failure. The New York City (NYC) 2019 Hazard Mitigation Plan suggests that flooding may cause a loss of stabilizing plant material caused by inundation and erosion (NYC 2019). Flooding of contaminated waters and flood water containing debris may also cause failure of utilities, particularly if the utilities are disrupted by debris clogging treatment systems or flood waters inundating power sources. More information about these hazards of concern can be found in Sections 5.4.8 and 5.4.12.

Future Changes That May Impact Vulnerability

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

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

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the county. Any areas of growth located in the flood inundation areas could be potentially impacted by flooding. It is recommended that the county and municipal partners implement design strategies that mitigate against the risk of flooding. The maps in the jurisdictional annexes in Section 9 illustrate the new development locations throughout the county and their proximity to the 1 percent annual chance flood hazard event boundary.

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has increased by a negligible amount between 2010 and 2019 (American Community Survey 2019). Estimated population projections provided by the Cornell Program on Applied Demographics indicate that the county's population will increase into 2040, bringing total population to approximately 945,891 persons (Cornell Program on Applied Demographics 2018). As population increases, new residents may move into locations that are more susceptible than others to flooding. This includes areas that are directly impacted by flood events and those that are indirectly impacted (i.e., isolated neighborhoods, flood-prone roadways, etc.). Section 4, County Profile, includes additional discussion on population trends.

Climate Change

As discussed earlier, annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to increase the risk to flash flooding and riverine flooding, and flood critical transportation corridors and infrastructure (NYSERDA 2014). Increases in precipitation may alter and expand the floodplain boundaries and runoff patterns, resulting in the exposure of populations, buildings, and critical facilities and infrastructure that were previously outside the floodplain. This increase in exposure would result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by future flooding events due to loss of service or access.

Existing dams may not be able to retain and manage increases in water flow from more frequent, heavy rainfall events. Heavy rainfalls may result in more frequent overtopping of these dams and flooding of the county's assets in adjacent inundation areas. However, the probable maximum flood used to design each dam may be able to accommodate changes in climate.

Change of Vulnerability Since 2015 HMP

Since the 2015 HMP analysis, population statistics have been updated using the 5-Year 2015–2019 American Community Survey Population Estimates (American Community Survey 2019). The general building stock was also established using RS Means 2020 building valuations that estimated replacement cost value for each building in the inventory. Additionally, a critical facility dataset was provided from the county. A Hazus riverine flood analysis of Erie County was based on the most current and best available data, including building and critical facility inventories and 2012 FEMA effective DFIRM.

Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2015 HMP. This information provides more accurate exposure and potential loss estimates for Erie County.

5.4.7 Hazardous Materials

This section provides a hazard profile and vulnerability assessment of the hazardous materials (hazmat) hazard for the Erie County Hazard Mitigation Plan (HMP).

5.4.7.1 Hazard Profile

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

Hazard Description

Hazardous substances include materials and wastes that are considered severely harmful to human health and the environment, as defined by the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (also known as Superfund). Many hazardous materials are commonly-used substances, which are harmless in their normal uses, but are quite dangerous if released. EPA designates more than 800 substances as hazardous and identifies many more as potentially hazardous due to their characteristics and the circumstances of their release (EPA 2020).

Superfund's definition of a hazardous substance includes the following:

- Any element, compound, mixture, solution, or substance designated as hazardous under Section 102 of CERCLA.
- Any hazardous substance designated under Section 311(b)(2)(a) of the Clean Water Act (CWA), or any toxic pollutant listed under Section 307(a) of the CWA. More than 400 substances are designated as either hazardous or toxic under the CWA.
- Any hazardous waste having the characteristics identified or listed under section 3001 of the Resource Conservation and Recovery Act (RCRA).
- Any hazardous air pollutant listed under Section 112 of the Clean Air Act (CAA), as amended. More than 200 substances are listed as hazardous air pollutants under the CAA.
- Any imminently hazardous chemical substance or mixture that the EPA Administrator has "taken action" under Section 7 of the Toxic Substances Control Act (TSCA) (EPA 2020).

If released or misused, hazardous substances can cause death, serious injury, long-lasting health effects, and damage to structures and other properties, as well as the environment. Many products containing hazardous substances are used and stored in homes and these products are shipped daily on highways, railroads, waterways, and pipelines. For the purpose of this HMP update, hazardous substance incidents occurring at fixed sites and those that occur during transport will be discussed in this profile.

Hazardous Materials at Fixed Sites

A fixed-site hazardous substance (materials and waste) incident is the uncontrolled release of materials from a fixed site, capable of posing a risk to health, safety, and property as determined by RCRA. It is possible to identify and prepare for a fixed-site incident because federal and state laws require those facilities to notify state and local authorities about the materials being used or produced at the site. Hazardous materials at fixed sites are regulated by EPA.

EPA chooses to specifically list substances as hazardous and extremely hazardous, rather than providing objective definitions. Hazardous substances (as listed) are generally materials that, if released into the environment, tend to persist for long periods and pose long-term health hazards for living organisms. Extremely hazardous substances, while also generally toxic materials, represent acute health hazards that, when released, are immediately dangerous to the lives of humans and animals and cause serious damage to the environment. When facilities contain these materials in quantities at or above the threshold planning quantity (TPQ), they must submit "Tier II" information to appropriate state and/or local agencies to facilitate emergency planning.

Nuclear power-generating stations, research reactors, or other stationary sources of radioactivity present the threat of release of radiological material. This type of event could threaten a large, multi-jurisdictional area, and result in property damage, contamination of farm and water supplies, and economic damage. This could be a concern to Erie County because Erie County is within 50 miles of the AES Somerset LLC Nuclear Power Plant. Erie County is well outside the emergency planning zones of the rest of the New York nuclear power-generating stations (U.S. Nuclear Regulatory Commission [NRC] 2020).

Hazardous Materials in Transit

As defined in regulations by the U.S. Department of Transportation (DOT) Materials Transport, a hazardous materials transportation incident is any event resulting in an uncontrolled release of materials during transport that can pose a risk to health, safety, and property. Transportation incidents are difficult to prepare for because there is little, if any, notice about the types of materials involved should an accident happen.

Hazardous materials transportation incidents can occur anywhere within the United States. Transportation of hazardous materials on highways involves tanker trucks or trailers, and these are responsible for the greatest number of hazardous substance release incidents. Potential also exists for hazardous substance releases to occur along rail lines, as collisions and derailments of train cars can result in large spills. Hazardous materials in transit are regulated by DOT.

DOT regulations define hazardous materials as a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has been designated as hazardous under Section 5103 of Federal Hazardous Materials Transportation Law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (Title 49 of the *Code of Federal Regulations* [CFR] 172.101), and materials that meet the defining criteria for hazard classes and divisions. When a substance meets DOT's definition of a hazardous material, it must be transported in accordance with safety regulations, which provide guidelines for appropriate packaging, communication of hazards, and proper shipping controls.

Approximately 5,818 miles of roads are present through Erie County (New York State Department of Transportation [NYSDOT] 2020). These roads cross rivers and streams; hazardous substance spills on roads could pollute watersheds that serve as domestic water supplies for areas within Erie County and other parts of the state. Hazardous substance releases also could occur along rail lines, as collisions and derailments of train cars can result in large spills.

Location

Hazardous materials are widely stored and transported throughout Erie County. An event involving hazardous materials can occur anywhere; however, they usually occur at facilities that store and/or use hazardous materials (fixed site) or along major highways and railways (in transit).

Hazardous Materials at Fixed Sites

Erie County has 399 fixed facilities that store or use hazardous materials and that fall under Superfund Amendments and Reauthorization Act (SARA) Title III Tier II reporting requirements. For security purposes, fixed facilities are not mapped in this profile. However, SARA site potential release vulnerability areas are presented in Figure 5.4.7-1.

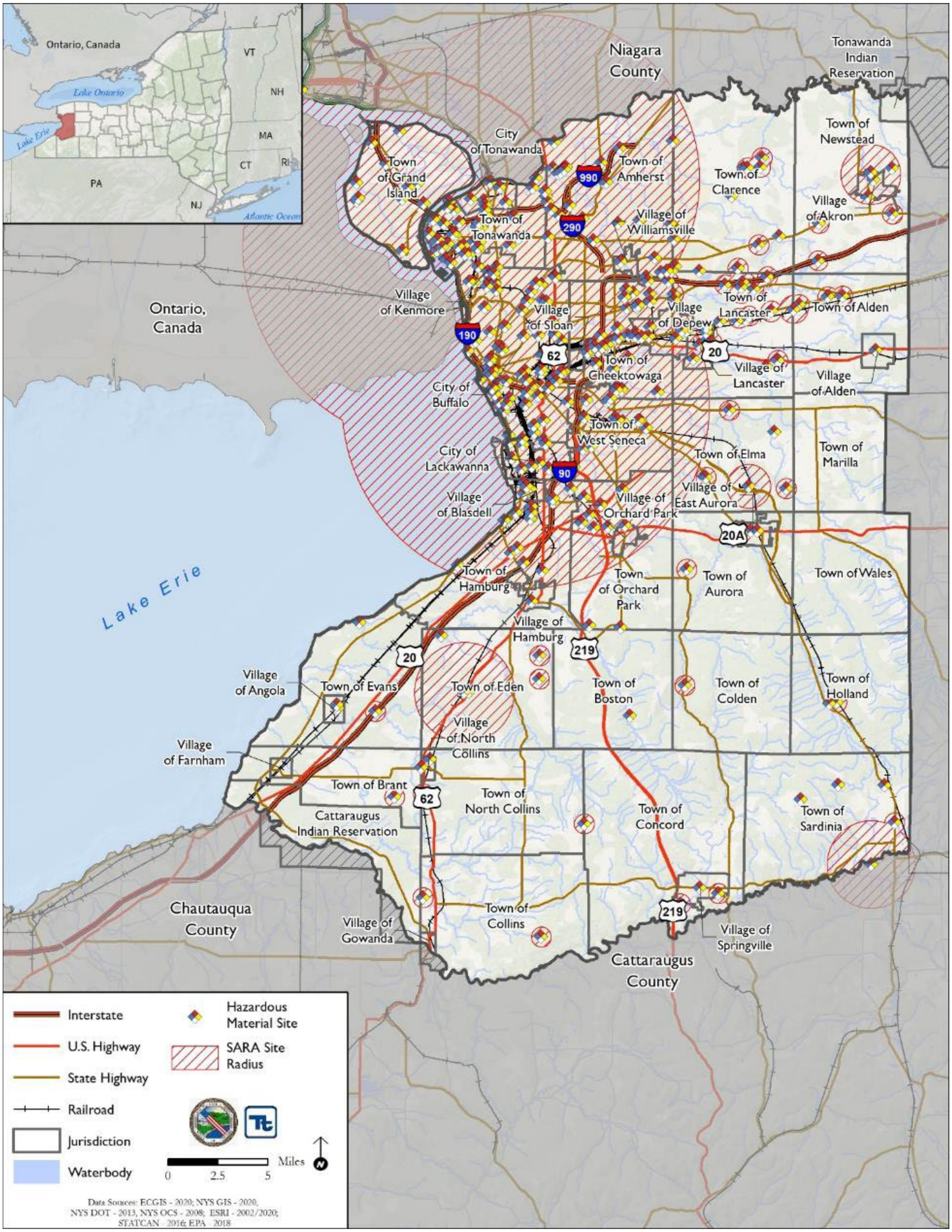
EPA also requires these facilities to be registered with their Facility Registry Service (FRS). FRS is a national database organized by facility industrial classification and geographic location. Erie County reports 142 facilities to the FRS (EPA 2020).

Additionally, EPA identifies 60 Erie County facilities under the Toxic Release Inventory (TRI). These facilities are required to annually report how much of each chemical is recycled, combusted for energy recovery, treated for destruction, and disposed of or otherwise released on and off site. In 2019 (most recent data available), the TRI facilities in Erie County reported a total of 1,094,432 pounds (lbs.) of hazardous waste designated for on-site and off-site disposal or other releases, with the following breakdown:

- Total On-Site: 653,100 lbs.
  - Air: 643,831 lbs.
  - Water: 2,839 lbs.
  - Land: 6,430 lbs.
- Total Off-Site: 441,332 lbs.

The majority of chemicals released into the air in Erie County (as recorded in 2019) includes carbon disulfide (29.2 percent), zinc and zinc compounds (19.8 percent), and nitrate compounds (16.9 percent) (EPA 2019).

Figure 5.4.7-1. SARA Site Potential Release Areas in Erie County



Hazardous Materials In Transit

Incidents involving hazardous materials in transit can occur anywhere in Erie County. Transportation corridors within Erie County that carry hazardous materials include highways, railroads, air/flight paths, pipelines, and navigable waterways. Major highways are more likely to be settings for this type of hazard because of interstate and local commercial transport of hazardous materials. Transport vehicles do not typically travel through residential areas unless they are en route to gasoline service stations or storage facilities.

Hazardous substance releases in navigable waterways are not a significant concern for Erie County; per U.S. Coast Guard (USCG) determinations, there are no navigable waterways within the county (USCG 2017).

Major transportation routes through Erie County include a framework of Interstate (I) and US highways including I-990, 290, 190, and 90, and US Highways 20, 20A, 62, and 219. The potential for a spill also exists on routes used for industrial and business purposes. Section 4 of this HMP discusses roadways in the county. Figure 5.4.7-2 shows the major transportation routes and railways in Erie County.

Hazardous material incidents may also occur along railways in Erie County. Rail lines that may carry hazardous materials include the CSX Corporation, Norfolk Southern, and two short lines: New York & Lake Erie Railroad and Buffalo Southern Railroad Inc.

NYSDOT has a vital interest in preserving and improving the rail freight part of its transportation network. Rail shipments allow cost-effective movement of goods and thus decrease stress on the state's highway system. Major commodities shipped by rail include petrochemicals (including plastic pellets), construction materials, food products, raw materials, and finished goods for manufacturers. An accident involving a rail car carrying hazardous materials could pose a public safety hazard to the community. Figure 5.4.7-2 shows railways that run throughout Erie County. Figure 5.4.7-3 illustrates the transportation routes and railways with a 0.5-mile buffer.

Hazardous materials can also be transported via underground petroleum and gas (natural and propane) pipelines across the state. New York State has an extensive network of natural gas and petroleum pipelines, some of which pass through Erie County. Figure 5.4.7-4 shows the extent and location of gas and hazardous liquid pipelines in the county (National Pipeline Mapping System [NPMS] 2020). Figure 5.4.7-5 illustrates the pipelines with a 0.5-mile buffer zone.

Figure 5.4.7-2. Major Transportation Routes and Railways in Erie County

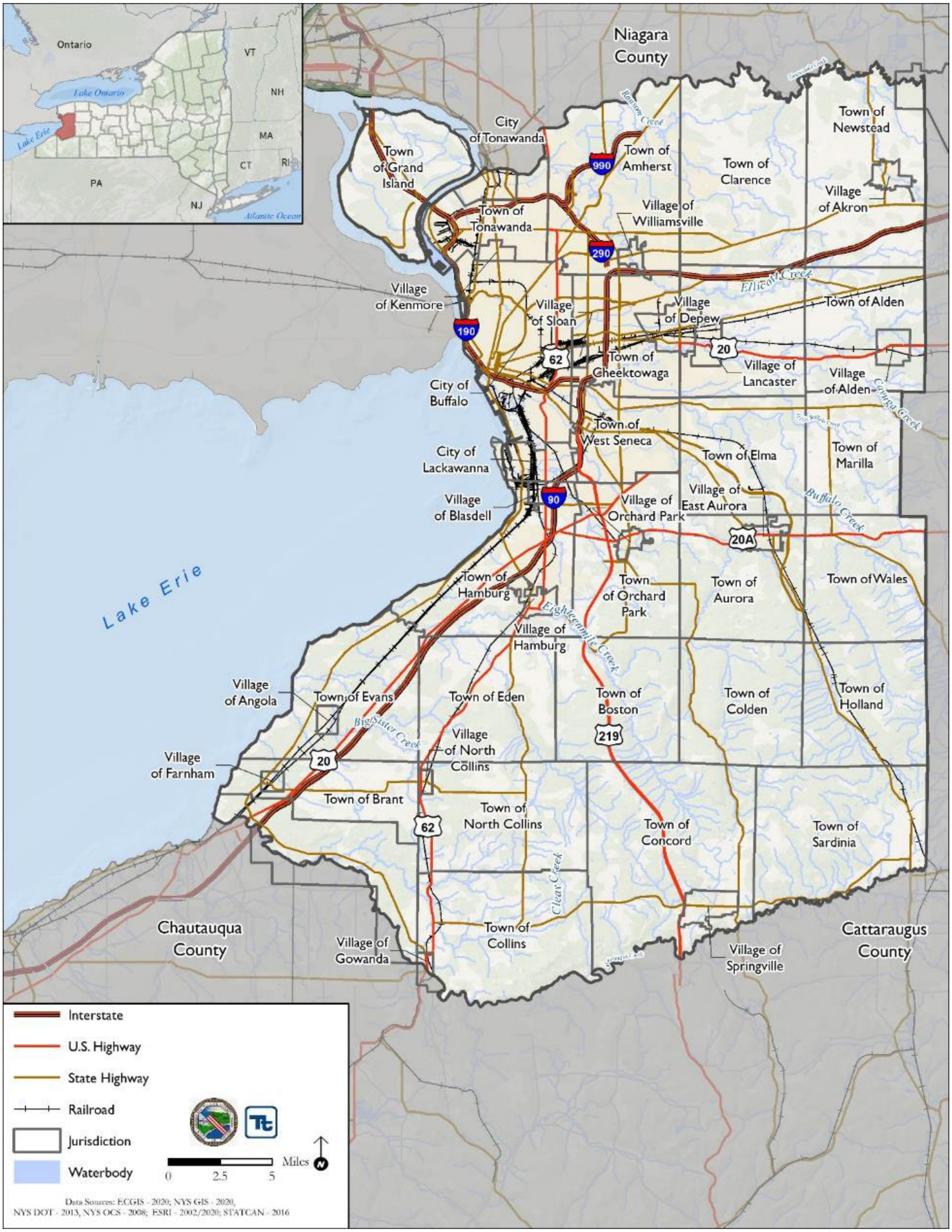


Figure 5.4.7-3. Surrounding 0.5 Mile of Roadways and Railways in Erie County

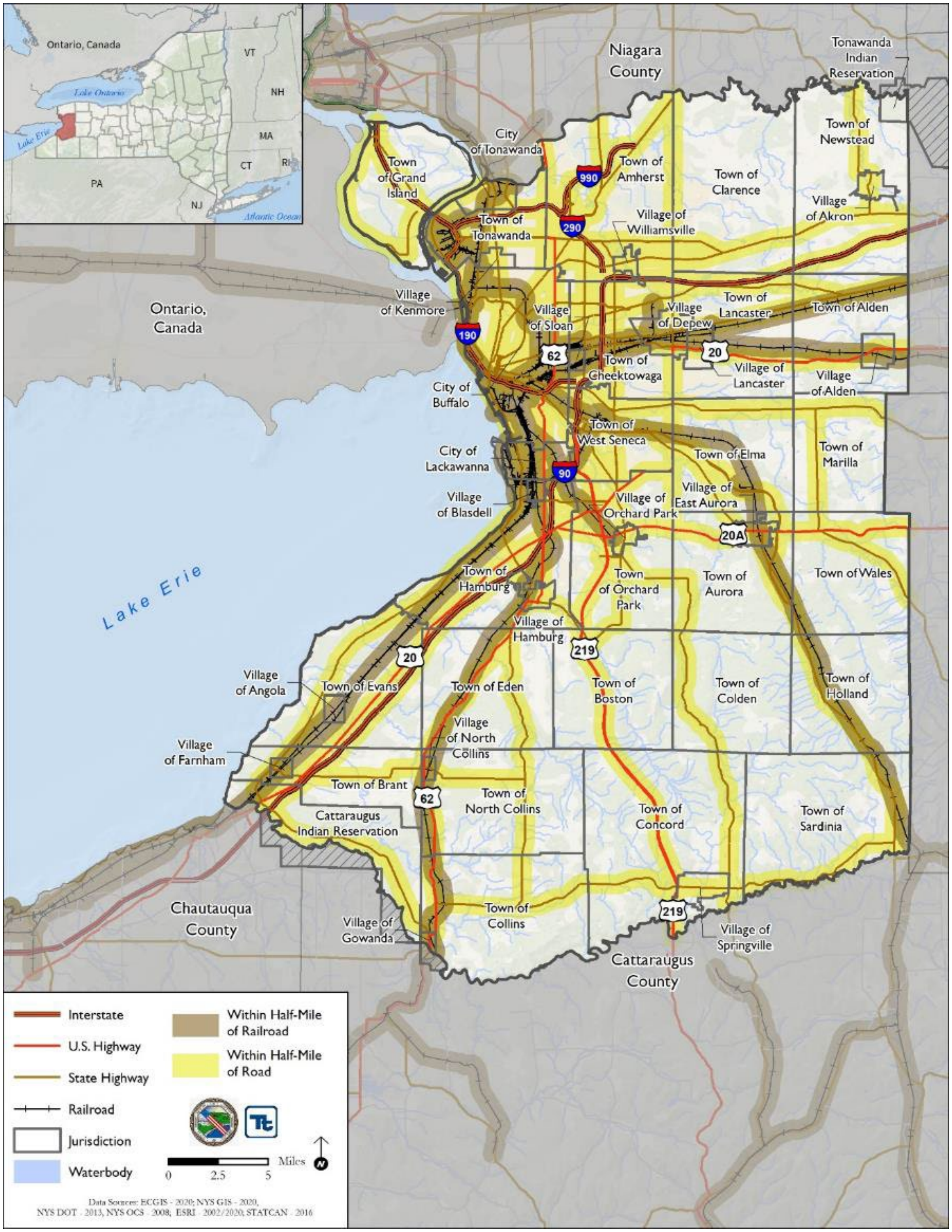


Figure 5.4.7-4. Gas Transmission and Hazardous Liquid Pipelines in Erie County

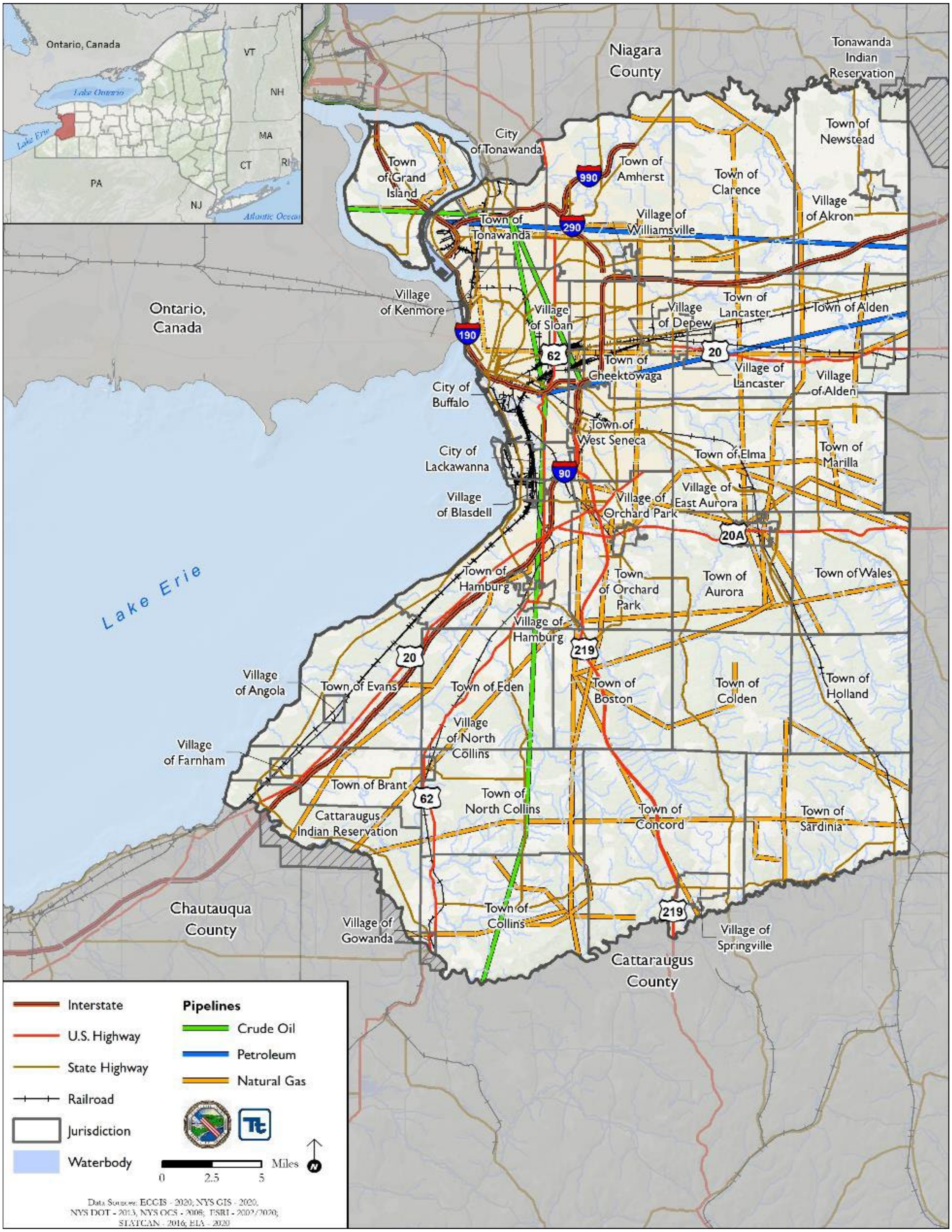
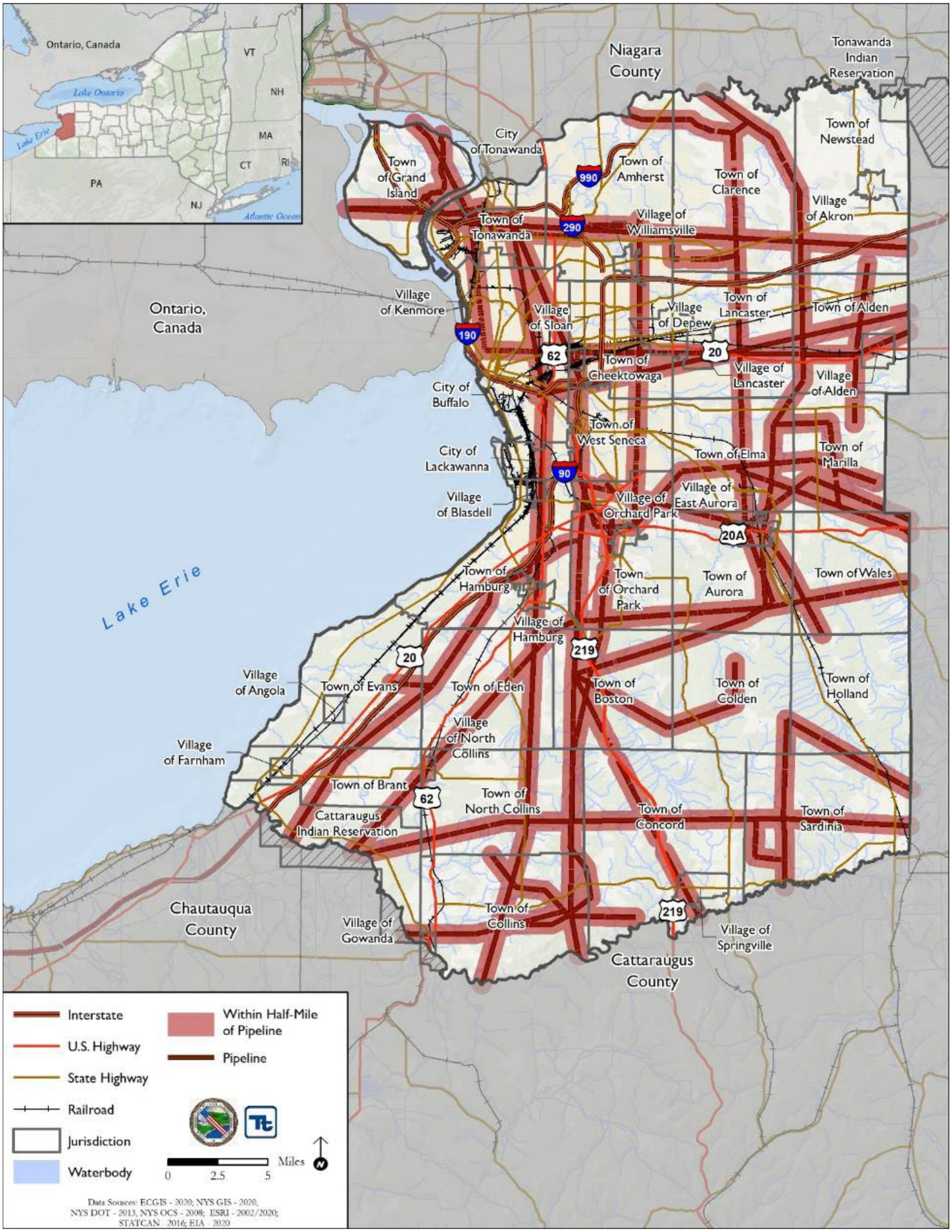


Figure 5.4.7-5. Surrounding 0.5 Mile of Petroleum, Natural Gas, and Crude Oil Pipelines in Erie County



Extent

The extent of a hazardous substance release depends on (1) whether the substance is released from a fixed or mobile source, (2) the size of the impacted area, (3) the toxicity and properties of the substance, (4) the duration of the release, and (5) environmental conditions (for example, wind and precipitation, terrain, etc.).

Hazardous substance releases can contaminate air, water, and soils, possibly resulting in death or injuries. Dispersion can occur rapidly when the hazardous substance is transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. Hazardous releases caused by natural hazards are known as secondary events. Hazardous materials can include toxic chemicals, radioactive substances, infectious substances, and hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

The severity or impact of a hazardous substance release, whether accidental or intentional, depends on several potentially mitigating or exacerbating circumstances. Mitigation involves precautionary measures taken in advance to reduce the impact of a release on the surrounding environment. For example, primary and secondary containment, or shielding by sheltering in place, protects people and property from the harmful effects of a hazardous substance release. Exacerbating conditions—characteristics that can enhance or magnify the effects of a hazardous substance release—include the following:

- Weather conditions, which affect the ways in which the hazard occurs and develops
- Micro-meteorological effects of buildings and terrain, which alter dispersion of hazardous materials
- Maintenance failures (such as fire protection and containment features), which can substantially increase damage to a facility and to surrounding buildings

The severity of an incident depends not only on the circumstances described above, but also on the type of substance released and the distance from the incident and related response time of emergency response teams. Areas closest to a release are generally at greatest risk; however, depending on the substance, a release can travel great distances or remain present in the environment for a long period of time (for example, centuries to millennia).

The occurrence of a hazardous materials incident can be sudden and without any warning, such an explosion, or may slowly develop, as in the case of a leaking container for example. Facilities that store extremely hazardous substances are required to notify local officials when an incident occurs. Local emergency responders and emergency management officials would determine whether they need to evacuate the public or to advise to shelter in place. Similar to on-site hazardous substances incidents, the amount of warning time for incidents associated with hazardous substances in transit varies based on the nature and scope of the incident. If an explosion did not occur immediately following an accident, officials may have time to warn adjacent neighborhoods and facilitate appropriate protective actions.

Previous Occurrences and Losses

Hazardous materials incidents, both on site or in transit, occur frequently across the state and in Erie County. These incidents are typically small, localized events. FEMA disaster declarations and other previous events in the county are discussed in the sections below.

FEMA Disaster Declarations

Between 1954 and 2019, New York State was included in two FEMA emergency declarations (EM) related to a hazardous substance incident. On August 7, 1978, and May 21, 1980, emergency declarations (EM-3066 and

EM-3080) for New York State were issued related to the Love Canal incident. Erie County was not included in this declaration (FEMA 2020).

Previous Events

The Erie County Local Emergency Planning Committee (LEPC) provided an incident report database with information on hazmat incidents throughout the county. According to this database, 228 incidents occurred in Erie County between 2010 and 2020 (Erie County 2021). For this 2022 HMP update, known hazardous substances incidents that have impacted Erie County between 2010 and 2020 are identified in Table 5.4.7-1. It should be noted that not all events that have occurred in Erie County are included in Table 5.4.7-1 because of the extent of documentation, and the fact that not all sources may have been identified or researched.

Table 5.4.7-1. Hazardous Materials Incidents in Erie County, 2010 to 2020

Municipality	Year											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Akron (V)	0	0	0	0	0	4	0	0	0	0	0	4
Alden (T)	0	0	0	0	0	0	0	0	0	0	1	1
Alden (V)	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	0	0	0	0	2	0	0	0	0	0	0	2
Angola (V)	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	0	0	0	0	0	0	1	0	0	0	1
Blasdell (V)	0	0	0	0	1	0	0	0	0	0	0	1
Boston (T)	0	0	0	0	0	0	0	0	0	0	1	1
Brant (T)	0	0	0	0	0	0	0	0	0	0	0	0
Buffalo (C)	0	0	1	1	2	1	9	8	19	5	6	52
Cheektowaga (T)	0	1	3	5	5	7	7	7	8	7	6	56
Clarence (T)	0	1	1	0	0	0	0	1	0	0	1	4
Colden (T)	0	1	0	1	1	0	1	1	0	0	0	5
Collins (T)	0	0	0	0	0	1	2	0	0	0	0	3
Concord (T)	0	0	0	0	1	0	0	0	0	0	0	1
Depew (V)	0	0	0	0	0	2	1	1	0	0	0	4
East Aurora (V)	0	0	0	0	0	0	0	0	0	1	1	2
Eden (T)	0	0	0	0	0	0	0	0	0	0	1	1
Elma (T)	0	0	0	0	0	0	0	0	1	1	0	2
Evans (T)	0	0	3	0	0	2	1	0	1	0	0	7
Farnham (V)	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	0	0	0	0	0	0	0	0	0	0	0
Grand Island (T)	0	0	0	1	1	0	1	1	0	0	0	4
Hamburg (T)	0	0	3	2	1	0	0	0	0	1	0	7
Hamburg (V)	0	0	0	0	0	1	0	0	0	0	0	1
Holland (T)	1	0	1	0	0	0	0	0	1	1	0	4
Kenmore (V)	0	0	0	0	0	0	1	1	0	0	0	2
Lackawanna (C)	0	0	0	2	0	0	2	0	0	0	0	4
Lancaster (T)	0	0	0	0	0	0	0	0	0	0	0	0
Lancaster (V)	0	0	0	0	1	0	0	0	0	0	0	1
Marilla (T)	0	0	0	0	1	0	0	0	0	0	0	1
Newstead (T)	0	0	0	0	0	0	0	0	0	0	0	0

Municipality	Year											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
North Collins (T)	0	0	0	0	1	1	0	0	0	0	1	3
North Collins (V)	0	0	0	0	0	0	0	0	0	0	0	1
Orchard Park (T)	0	0	2	0	6	0	3	1	3	4	3	22
Orchard Park (V)	0	0	1	0	0	0	0	0	0	0	0	1
Sardinia (T)	0	0	0	0	0	0	1	0	1	0	0	2
Sloan (V)	0	0	0	0	0	0	0	0	0	0	0	0
Springville (V)	0	0	0	0	0	1	0	0	0	1	0	2
Tonawanda (C)	0	0	0	0	1	3	0	1	1	0	0	6
Tonawanda (T)	0	0	0	0	4	0	0	0	0	0	0	4
Wales (T)	0	0	0	0	0	0	0	0	0	0	0	0
West Seneca (T)	0	0	2	2	3	2	1	1	2	4	1	18
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1**	**3**	**17**	**14**	**32***	**25**	**30**	**24**	**37**	**25**	**22**	**230**

Sources: Erie County 2021
** One incident occurred on the Cattaraugus Reservation, and is not counted in the municipal totals.*

Erie County categorizes the hazardous materials incidents reflected in Table 5.4.7-1 by the following "call type":

- Overdose/ Ingestion/ Poison – overdoses on medication or narcotics, and/or ingestion of poisons
- Traffic Accidents – Emergency Support Unit (ESU) personnel assisted at the scene of a motor vehicle accident
- EMS Special Operations – hazmat support of EMS units
- CPC Response – Chemical Protective Clothing (CPC) for a City of Buffalo Fire/Hazmat response
- Erie County HMRT – Requests for the Erie County Hazardous Materials Response Team and leaders
- Level I Hazmat – City of Buffalo Fire/Hazmat response
- Spill Response Hazmat – City of Buffalo Fire/Hazmat response to a chemical spill
- Asset Request – any other request of hazmat assets
- Other

Incidents are broken down by response category (call type) in Table 5.4.7-2.

Table 5.4.7-2. Hazardous Materials Incidents by Call Type in Erie County, 2010 to 2020

Call Type	Year											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Overdose/ Ingestion/ Poison	0	0	0	0	0	0	0	0	0	0	1	**1**
Traffic Accidents	0	0	0	0	0	0	1	0	0	0	0	**1**
Asset Request	0	0	0	0	0	0	2	0	0	0	0	**2**
EMS Special Operations	0	0	0	0	0	0	0	1	0	1	0	**2**
CPC Response	0	0	0	0	1	0	0	0	0	0	0	**1**
Erie County HMRT	0	0	1	3	0	3	6	5	5	19	20	**62**
Level I Hazmat	1	0	6	3	7	8	10	7	1	0	1	**44**
Spill Response Hazmat	0	0	3	2	5	2	3	2	5	0	0	**22**
Other	0	3	7	6	19	12	8	9	26	5	0	**95**
Total	**1**	**3**	**17**	**14**	**32**	**25**	**30**	**24**	**37**	**25**	**22**	**230**

Probability of Future Occurrences

Predicting future hazardous substance incidents in Erie County is difficult. Hazmat incidents can occur at any time and any location in the county. Incidents can occur suddenly without any warning, or develop slowly. Small spills at both fixed sites and in transit occur throughout the year, and the probability of occurrences of these events is high. Risk of a major incident within a given year is small. The county is expected to continue to undergo direct and indirect impacts of hazardous substance incidents annually that may induce secondary hazards such as infrastructure deterioration or failure; potential decreases in water quality and supply; and transportation delays, accidents, and inconveniences.

For the 2022 HMP update, the most up-to-date data were collected to calculate the probability of future occurrence of both in-transit and fixed-site hazardous material incidents for Erie County. Information from the New York State Department of Environmental Conservation (NYS DEC), Pipeline and Hazardous Materials Safety Administration (PHMSA), FEMA and the Federal Railroad Administration (FRA) was used to identify the number of events that occurred between 1975 and 2020. Table 5.4.7-3 below provides statistics based on specific county records. Based on these statistics, Erie County has a 100-percent chance of a hazardous material incident occurring in any given year.

Table 5.4.7-3. Probability of Future Occurrence of Hazardous Material Incidents in Erie County

Hazard Type	Number of Occurrences Between 2010 and 2020	Percent chance of occurrence in any given year
Hazardous Materials Incident	230	100%

Sources: NYS DEC 2020; PHMSA 2018; FRA 2020; FEMA 2020; Erie County 2020

The identified hazards of concern within Erie County were ranked in Section 5.3 of this HMP. The probability of occurrence, or likelihood of an event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Partnership, the probability of occurrence of hazardous materials spills within the county is considered *frequent* (100-percent annual probability, occurring multiple times a year), as presented in Table 5.3-1.

Climate Change Impacts

Non-natural incidents such as hazardous substance incidents are not typically considered vulnerable to climate change; however, climate change may have some impact. Climate change and its impact on hazardous materials sites, particularly waste sites, is a growing concern. According to the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) State Climate Summaries for New York State, the mean annual temperature has increased approximately 2 ºF. This temperature change is likely to indirectly affect the county's vulnerability to hazmat incidents.

ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2011). Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Erie County is part of Region 1, Western New York and the Great Lakes Plain. In Region 1, temperatures are estimated to increase by 4.3 to 6.3 ºF by the 2050s, and 5.7 to 9.6 ºF by the 2080s (baseline of 47.7 ºF, middle range projection). Precipitation totals will increase between 4 and 10 percent by the 2050s and 6 to 13 percent by the 2080s (baseline of 34.0 inches, middle-range projection).

As temperatures change, excessive heat on aging structures and/or infrastructure may be adversely affected. Excessive heat on structures or containers containing hazardous materials may alter the material properties.

In addition, hazardous substances stored at fixed locations in the floodplain may experience an increase in flood events due to the projected changes in increased precipitation events, specifically related to magnitude and frequency. Hazardous waste sites near rivers are tentatively at highest risk because extreme storms and higher water levels could release pollution into the environment. Many of these sites were built in locations believed to be removed from potential contamination or exposure-increasing factors. However, development, floodplain boundary change, and an increase in extreme events from climate change are increasing the possibility that water may reach hazardous material and waste sites.

5.4.7.2 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable within the identified hazard area. For the purposes of the assessment, an asset (population, structures, critical facilities, and lifelines) is considered exposed and potentially vulnerable to the hazardous materials hazard if it is located within the hazmat buffer areas. The analysis looked at four different hazardous material buffer areas:

1. 0.5 mile from a major highway
2. 0.5 mile from a rail line
3. 0.5 mile from a pipeline
4. Unique radius for each SARA Title III facility

This section discusses the potential impact of the hazardous materials hazard on the county. Specifically, this section addresses:

- Impacts on (1) life, health, and safety of residents; (2) general building stock; (3) critical facilities; (4) economy; and (5) the environment
- Future changes that may impact vulnerability
- Change in vulnerability as compared to information presented in the 2015 Erie County HMP

Impact on Life, Health, and Safety

Depending on the type and quantity of chemicals released and the weather conditions, an incident can affect larger areas that cross jurisdictional boundaries. When hazardous substances are released in the air, water, or on land, they may contaminate the environment and pose greater danger to human health. Exposure may be either acute or chronic, depending on the nature of the substance and extent of release and contamination.

Potential losses from hazardous substances incidences include human health and life and property resources. These types of incidents can lead to injury, illnesses, and/or death from both the involved persons and those living in the impacted areas. Human safety and welfare can become compromised from negative health effects of poisoning or exposure to toxic substances, fires, or explosions.

An exposure analysis of Erie County estimates that 674,447 persons, 268,216 persons, and 753,056 persons reside within 0.5 mile of roads, 0.5 mile of railways, and within unique buffer areas of SARA sites, respectively (Table 5.4.7-4). Additionally, 166,772 persons, 78,711 persons, 274,963 persons reside within 0.5 mile of crude oil, petroleum, and natural gas pipelines, respectively (Table 5.4.7-5).

Table 5.4.7-4. Estimated Number of Persons Living Near Hazardous Materials Hazard Areas

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population within 0.5 Mile of Major Roadways		Estimated Population within 0.5 Mile of Major Railways		Estimated Population within SARA Site Hazard Areas	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Akron (V)	2,871	2,187	76.2%	0	0.0%	2,818	98.2%
Alden (T)	7,418	3,619	48.8%	2,055	27.7%	569	7.7%
Alden (V)	2,577	2,219	86.1%	1,999	77.6%	132	5.1%
Amherst (T)	120,276	82,023	68.2%	0	0.0%	120,276	100.0%
Angola (V)	2,373	411	17.3%	2,024	85.3%	161	6.8%
Aurora (T)	7,599	3,613	47.5%	1,041	13.7%	202	2.7%
Blasdell (V)	2,645	2,645	100.0%	2,645	100.0%	2,645	100.0%
Boston (T)	8,042	2,435	30.3%	0	0.0%	49	0.6%
Brant (T)	1,541	824	53.5%	187	12.1%	64	4.1%
Buffalo (C)	256,480	221,701	86.4%	120,939	47.2%	256,457	100.0%
Cheektowaga (T)	73,129	56,677	77.5%	14,392	19.7%	73,152	100.0%
Clarence (T)	32,440	13,252	40.8%	0	0.0%	10,190	31.4%
Colden (T)	3,328	1,045	31.4%	0	0.0%	133	4.0%
Collins (T)	5,418	2,946	54.4%	1,541	28.4%	450	8.3%
Concord (T)	4,186	1,570	37.5%	0	0.0%	45	1.1%
Depew (V)	15,102	12,195	80.8%	9,800	64.9%	14,673	97.2%
East Aurora (V)	6,184	5,867	94.9%	3,589	58.0%	1,756	28.4%
Eden (T)	7,631	3,324	43.6%	2,171	28.4%	5,107	66.9%
Elma (T)	11,732	5,618	47.9%	2,557	21.8%	4,509	38.4%
Evans (T)	13,782	6,522	47.3%	1,350	9.8%	131	1.0%
Farnham (V)	459	459	100.0%	432	94.1%	0	0.0%
Gowanda (V)	1,043	1,043	100.0%	1,040	99.7%	0	0.0%
Grand Island (T)	21,047	9,609	45.7%	0	0.0%	21,047	100.0%
Hamburg (T)	45,985	35,048	76.2%	25,626	55.7%	33,148	72.1%
Hamburg (V)	9,636	9,105	94.5%	3,748	38.9%	2,855	29.6%
Holland (T)	3,355	1,349	40.2%	1,105	32.9%	396	11.8%
Kenmore (V)	15,132	12,791	84.5%	3,763	24.9%	15,135	100.0%
Lackawanna (C)	17,831	14,174	79.5%	16,599	93.1%	17,831	100.0%
Lancaster (T)	27,625	11,820	42.8%	4,579	16.6%	10,075	36.5%
Lancaster (V)	10,144	6,566	64.7%	4,811	47.4%	8,615	84.9%
Marilla (T)	5,378	2,465	45.8%	0	0.0%	45	0.8%
Newstead (T)	5,804	2,703	46.6%	0	0.0%	1,572	27.1%
North Collins (T)	2,130	865	40.6%	312	14.6%	65	3.0%
North Collins (V)	1,370	1,370	100.0%	1,370	100.0%	113	8.2%
Orchard Park (T)	26,361	17,046	64.7%	2,920	11.1%	17,984	68.2%
Orchard Park (V)	3,148	2,970	94.4%	614	19.5%	3,148	100.0%
Sardinia (T)	2,780	1,101	39.6%	365	13.1%	737	26.5%

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population within 0.5 Mile of Major Roadways		Estimated Population within 0.5 Mile of Major Railways		Estimated Population within SARA Site Hazard Areas	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Sloan (V)	3,562	3,351	94.1%	3,562	100.0%	3,562	100.0%
Springville (V)	4,298	3,857	89.8%	0	0.0%	776	18.1%
Tonawanda (C)	14,830	13,572	91.5%	9,384	63.3%	14,830	100.0%
Tonawanda (T)	57,027	44,495	78.0%	8,113	14.2%	57,024	100.0%
Wales (T)	3,020	1,369	45.3%	357	11.8%	0	0.0%
West Seneca (T)	45,344	41,469	91.5%	13,229	29.2%	45,344	100.0%
Williamsville (V)	5,233	5,159	98.6%	0	0.0%	5,233	100.0%
Erie County Total	**917,296**	**674,447**	**73.5%**	**268,216**	**29.2%**	**753,056**	**82.1%**

Source: Erie County Geographic Information System (GIS) 2020; RSMeans 2020; New York State Geographic Information System (NYSGIS) 2020; NYSDOT 2013
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-5 Estimated Number of Persons Living Near Pipeline Hazard Areas

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population within 0.5 Mile of Pipelines					
		Crude Oil Pipelines		Petroleum Pipelines		Natural Gas Pipelines	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Akron (V)	2,871	0	0.0%	0	0.0%	0	0.0%
Alden (T)	7,418	0	0.0%	1,233	16.6%	3,548	47.8%
Alden (V)	2,577	0	0.0%	0	0.0%	2,037	79.0%
Amherst (T)	120,276	0	0.0%	21,747	18.1%	30,306	25.2%
Angola (V)	2,373	0	0.0%	0	0.0%	0	0.0%
Aurora (T)	7,599	0	0.0%	0	0.0%	3,820	50.3%
Blasdell (V)	2,645	2,642	99.9%	0	0.0%	0	0.0%
Boston (T)	8,042	0	0.0%	0	0.0%	5,430	67.5%
Brant (T)	1,541	0	0.0%	0	0.0%	400	26.0%
Buffalo (C)	256,480	102,718	40.0%	9,848	3.8%	63,075	24.6%
Cheektowaga (T)	73,129	4,360	6.0%	10,058	13.8%	19,367	26.5%
Clarence (T)	32,440	0	0.0%	6,595	20.3%	11,124	34.3%
Colden (T)	3,328	0	0.0%	0	0.0%	817	24.5%
Collins (T)	5,418	615	11.3%	0	0.0%	1,312	24.2%
Concord (T)	4,186	0	0.0%	0	0.0%	1,147	27.4%
Depew (V)	15,102	0	0.0%	118	0.8%	4,889	32.4%
East Aurora (V)	6,184	0	0.0%	0	0.0%	5,830	94.3%
Eden (T)	7,631	1,292	16.9%	0	0.0%	1,755	23.0%
Elma (T)	11,732	0	0.0%	0	0.0%	6,530	55.7%
Evans (T)	13,782	0	0.0%	0	0.0%	358	2.6%
Farnham (V)	459	0	0.0%	0	0.0%	0	0.0%

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population within 0.5 Mile of Pipelines					
		Crude Oil Pipelines		Petroleum Pipelines		Natural Gas Pipelines	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Gowanda (V)	1,043	0	0.0%	0	0.0%	709	68.0%
Grand Island (T)	21,047	2,962	14.1%	0	0.0%	6,413	30.5%
Hamburg (T)	45,985	8,996	19.6%	0	0.0%	6,841	14.9%
Hamburg (V)	9,636	4,339	45.0%	0	0.0%	2,262	23.5%
Holland (T)	3,355	0	0.0%	0	0.0%	218	6.5%
Kenmore (V)	15,132	2,134	14.1%	0	0.0%	2,185	14.4%
Lackawanna (C)	17,831	8,179	45.9%	0	0.0%	605	3.4%
Lancaster (T)	27,625	0	0.0%	4,175	15.1%	6,120	22.2%
Lancaster (V)	10,144	0	0.0%	6,235	61.5%	5,651	55.7%
Marilla (T)	5,378	0	0.0%	0	0.0%	3,617	67.3%
Newstead (T)	5,804	0	0.0%	643	11.1%	542	9.3%
North Collins (T)	2,130	346	16.3%	0	0.0%	631	29.6%
North Collins (V)	1,370	0	0.0%	0	0.0%	1,339	97.7%
Orchard Park (T)	26,361	0	0.0%	0	0.0%	17,600	66.8%
Orchard Park (V)	3,148	0	0.0%	0	0.0%	2,155	68.5%
Sardinia (T)	2,780	0	0.0%	0	0.0%	924	33.2%
Sloan (V)	3,562	2,679	75.2%	0	0.0%	3,562	100.0%
Springville (V)	4,298	0	0.0%	0	0.0%	991	23.1%
Tonawanda (C)	14,830	2,734	18.4%	2	0.0%	4,397	29.7%
Tonawanda (T)	57,027	22,774	39.9%	16,934	29.7%	22,481	39.4%
Wales (T)	3,020	0	0.0%	0	0.0%	790	26.2%
West Seneca (T)	45,344	3	0.0%	1,123	2.5%	20,819	45.9%
Williamsville (V)	5,233	0	0.0%	0	0.0%	2,366	45.2%
Erie County Total	**917,296**	**166,772**	**18.2%**	**78,711**	**8.6%**	**274,963**	**30.0%**

Source: Erie County GIS 2020; American Community Survey 2018; U.S. Energy Information Administration (EIA) 2020
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Impact on General Building Stock

Potential losses to the general building stock caused by a hazardous substance releases, whether in transit or at fixed sites, is difficult to quantify. The degree of damage depends on the scale of the incident. Potential losses may include inaccessibility, loss of service, contamination, and/or potential structural and content losses if an explosion occurs. The closure of waterways, railroads, airports, and highways as a result of a hazardous substance incident has the potential to impact the ability to deliver goods and services efficiently. Potential impacts may be local, regional, or statewide depending on the magnitude of the event and level of service disruptions.

An exposure analysis estimates the county contains 104,423 buildings (worth approximately $79.6 billion), 260,912 buildings (worth approximately $171.1 billion), and 280,200 buildings (worth approximately $181.1 billion) within 0.5 mile of railways, 0.5 mile of major roadways, and within unique buffer areas of SARA sites, respectively (Table 5.4.7-6 through Table 5.4.7-11).

To estimate the buildings exposed to a pipeline event, the 0.5-mile buffer areas were overlaid upon the building level. The replacement cost value of the structures with centers in the buffer areas were totaled (Table 5.4.7-9 through Table 5.4.7-11). The City of Buffalo has the greatest number of buildings and the greatest replacement cost values that would be impacted by a pipeline event. However, if a pipeline release were to occur, the incident would not be located along all pipelines in the county, but instead only a section of the total pipeline exposure area. Therefore, the total exposure does not represent a complete vulnerability, should a hazard event occur.

Table 5.4.7-6. Estimated Number of Buildings and Replacement Cost Value Within 0.5 Mile of Rail Lines

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Railways			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	0	0.0%	$0	0.0%
Alden (T)	3,400	$1,748,473,245	1,050	30.9%	$758,187,448	43.4%
Alden (V)	1,102	$602,655,574	869	78.9%	$507,215,085	84.2%
Amherst (T)	38,528	$27,372,255,690	0	0.0%	$0	0.0%
Angola (V)	874	$525,704,230	754	86.3%	$487,067,288	92.7%
Aurora (T)	4,280	$2,496,885,036	600	14.0%	$341,669,281	13.7%
Blasdell (V)	1,026	$638,571,953	1,026	100.0%	$638,571,953	100.0%
Boston (T)	4,040	$1,702,475,276	0	0.0%	$0	0.0%
Brant (T)	1,325	$657,594,060	147	11.1%	$50,151,407	7.6%
Buffalo (C)	83,471	$58,603,851,634	40,162	48.1%	$33,038,200,026	56.4%
Cheektowaga (T)	30,938	$17,530,893,277	6,402	20.7%	$5,736,803,076	32.7%
Clarence (T)	13,660	$9,866,246,863	0	0.0%	$0	0.0%
Colden (T)	2,110	$854,417,381	0	0.0%	$0	0.0%
Collins (T)	2,521	$1,189,158,504	693	27.5%	$376,441,572	31.7%
Concord (T)	3,245	$1,338,570,261	0	0.0%	$0	0.0%
Depew (V)	6,532	$3,841,823,815	4,324	66.2%	$2,867,777,990	74.6%
East Aurora (V)	2,441	$1,723,816,550	1,426	58.4%	$1,085,829,661	63.0%
Eden (T)	4,290	$2,180,455,513	1,289	30.0%	$767,271,240	35.2%
Elma (T)	6,093	$3,775,039,302	1,341	22.0%	$937,250,294	24.8%
Evans (T)	7,952	$3,335,060,692	754	9.5%	$378,356,112	11.3%
Farnham (V)	189	$87,990,422	177	93.7%	$84,420,637	95.9%
Gowanda (V)	396	$249,516,940	394	99.5%	$237,733,984	95.3%
Grand Island (T)	8,426	$4,674,517,058	0	0.0%	$0	0.0%
Hamburg (T)	19,130	$11,911,210,828	10,670	55.8%	$6,638,526,441	55.7%
Hamburg (V)	3,794	$2,005,172,252	1,515	39.9%	$997,717,311	49.8%
Holland (T)	2,182	$1,151,194,342	852	39.0%	$604,727,763	52.5%
Kenmore (V)	6,017	$2,305,529,001	1,514	25.2%	$528,112,903	22.9%
Lackawanna (C)	6,751	$4,030,622,400	6,257	92.7%	$3,762,669,594	93.4%
Lancaster (T)	10,973	$6,845,493,469	1,908	17.4%	$1,713,243,273	25.0%
Lancaster (V)	4,323	$2,217,331,122	2,159	49.9%	$1,530,468,284	69.0%
Marilla (T)	2,956	$1,099,846,031	0	0.0%	$0	0.0%
Newstead (T)	4,202	$2,181,758,974	0	0.0%	$0	0.0%
North Collins (T)	1,898	$889,517,676	287	15.1%	$189,580,653	21.3%

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Railways			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
North Collins (V)	551	$383,968,909	551	100.0%	$383,968,909	100.0%
Orchard Park (T)	10,748	$8,174,650,530	1,318	12.3%	$1,402,261,339	17.2%
Orchard Park (V)	1,211	$867,347,745	253	20.9%	$269,282,093	31.0%
Sardinia (T)	2,184	$1,068,523,829	344	15.8%	$228,594,964	21.4%
Sloan (V)	1,674	$634,998,253	1,674	100.0%	$634,998,253	100.0%
Springville (V)	1,816	$1,354,905,864	0	0.0%	$0	0.0%
Tonawanda (C)	6,452	$3,291,492,557	4,141	64.2%	$2,338,086,236	71.0%
Tonawanda (T)	23,999	$14,694,684,404	3,938	16.4%	$6,540,994,786	44.5%
Wales (T)	1,923	$833,853,270	220	11.4%	$81,565,915	9.8%
West Seneca (T)	17,970	$9,583,482,689	5,414	30.1%	$3,511,923,984	36.6%
Williamsville (V)	2,057	$1,126,868,443	0	0.0%	$0	0.0%
Erie County Total	**360,925**	**$222,515,035,436**	**104,423**	**28.9%**	**$79,649,669,753**	**35.8%**

Source: Erie County GIS 2020; RSMeans 2020; NYSDOT 2013
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-7. Estimated Number of Buildings and Replacement Cost Value Within 0.5 Mile of a Major Roadway

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Major Roadways			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	981	76.9%	$631,814,360	72.9%
Alden (T)	3,400	$1,748,473,245	1,721	50.6%	$1,103,436,931	63.1%
Alden (V)	1,102	$602,655,574	957	86.8%	$551,576,076	91.5%
Amherst (T)	38,528	$27,372,255,690	26,616	69.1%	$19,464,550,092	71.1%
Angola (V)	874	$525,704,230	141	16.1%	$44,568,741	8.5%
Aurora (T)	4,280	$2,496,885,036	2,126	49.7%	$1,342,361,485	53.8%
Blasdell (V)	1,026	$638,571,953	1,024	99.8%	$635,374,909	99.5%
Boston (T)	4,040	$1,702,475,276	1,218	30.1%	$504,790,125	29.7%
Brant (T)	1,325	$657,594,060	713	53.8%	$380,834,864	57.9%
Buffalo (C)	83,471	$58,603,851,634	72,479	86.8%	$52,068,584,784	88.8%
Cheektowaga (T)	30,938	$17,530,893,277	24,177	78.1%	$14,925,442,819	85.1%
Clarence (T)	13,660	$9,866,246,863	5,847	42.8%	$4,480,836,220	45.4%
Colden (T)	2,110	$854,417,381	666	31.6%	$290,066,664	33.9%
Collins (T)	2,521	$1,189,158,504	1,344	53.3%	$638,415,886	53.7%
Concord (T)	3,245	$1,338,570,261	1,256	38.7%	$580,549,495	43.4%
Depew (V)	6,532	$3,841,823,815	5,312	81.3%	$3,323,311,360	86.5%
East Aurora (V)	2,441	$1,723,816,550	2,318	95.0%	$1,665,512,707	96.6%
Eden (T)	4,290	$2,180,455,513	1,932	45.0%	$1,065,245,376	48.9%
Elma (T)	6,093	$3,775,039,302	3,030	49.7%	$2,243,069,526	59.4%
Evans (T)	7,952	$3,335,060,692	3,751	47.2%	$1,656,844,660	49.7%

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Major Roadways			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Farnham (V)	189	$87,990,422	189	100.0%	$87,990,422	100.0%
Gowanda (V)	396	$249,516,940	396	100.0%	$249,516,940	100.0%
Grand Island (T)	8,426	$4,674,517,058	3,962	47.0%	$2,383,829,685	51.0%
Hamburg (T)	19,130	$11,911,210,828	14,696	76.8%	$9,583,144,122	80.5%
Hamburg (V)	3,794	$2,005,172,252	3,596	94.8%	$1,937,424,766	96.6%
Holland (T)	2,182	$1,151,194,342	996	45.6%	$675,122,345	58.6%
Kenmore (V)	6,017	$2,305,529,001	5,106	84.9%	$1,981,833,276	86.0%
Lackawanna (C)	6,751	$4,030,622,400	5,343	79.1%	$3,400,764,042	84.4%
Lancaster (T)	10,973	$6,845,493,469	4,932	44.9%	$4,140,423,585	60.5%
Lancaster (V)	4,323	$2,217,331,122	2,847	65.9%	$1,701,504,152	76.7%
Marilla (T)	2,956	$1,099,846,031	1,362	46.1%	$542,156,034	49.3%
Newstead (T)	4,202	$2,181,758,974	1,904	45.3%	$1,015,027,186	46.5%
North Collins (T)	1,898	$889,517,676	806	42.5%	$438,200,361	49.3%
North Collins (V)	551	$383,968,909	551	100.0%	$383,968,909	100.0%
Orchard Park (T)	10,748	$8,174,650,530	7,145	66.5%	$6,100,683,897	74.6%
Orchard Park (V)	1,211	$867,347,745	1,150	95.0%	$827,985,955	95.5%
Sardinia (T)	2,184	$1,068,523,829	936	42.9%	$543,904,709	50.9%
Sloan (V)	1,674	$634,998,253	1,561	93.2%	$549,853,309	86.6%
Springville (V)	1,816	$1,354,905,864	1,645	90.6%	$1,212,199,021	89.5%
Tonawanda (C)	6,452	$3,291,492,557	5,940	92.1%	$3,150,107,337	95.7%
Tonawanda (T)	23,999	$14,694,684,404	18,844	78.5%	$12,327,012,971	83.9%
Wales (T)	1,923	$833,853,270	921	47.9%	$453,474,385	54.4%
West Seneca (T)	17,970	$9,583,482,689	16,445	91.5%	$8,656,494,214	90.3%
Williamsville (V)	2,057	$1,126,868,443	2,030	98.7%	$1,119,391,017	99.3%
Erie County Total	**360,925**	**$222,515,035,436**	**260,912**	**72.3%**	**$171,059,199,718**	**76.9%**

Source: Erie County GIS 2020; RSMeans 2020; NYSGIS 2020
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-8. Estimated Number of Buildings and Replacement Cost Value Within Unique Buffer Areas of Hazardous Materials Facilities

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within Sara Site Hazard Areas			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	1,254	98.4%	$856,110,300	98.8%
Alden (T)	3,400	$1,748,473,245	311	9.1%	$322,146,358	18.4%
Alden (V)	1,102	$602,655,574	62	5.6%	$31,084,596	5.2%
Amherst (T)	38,528	$27,372,255,690	38,528	100.0%	$27,372,255,690	100.0%
Angola (V)	874	$525,704,230	73	8.4%	$50,466,949	9.6%

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within Sara Site Hazard Areas			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Aurora (T)	4,280	$2,496,885,036	122	2.9%	$53,349,984	2.1%
Blasdell (V)	1,026	$638,571,953	1,026	100.0%	$638,571,953	100.0%
Boston (T)	4,040	$1,702,475,276	32	0.8%	$27,386,670	1.6%
Brant (T)	1,325	$657,594,060	52	3.9%	$24,929,586	3.8%
Buffalo (C)	83,471	$58,603,851,634	83,464	100.0%	$58,601,845,652	100.0%
Cheektowaga (T)	30,938	$17,530,893,277	30,945	100.0%	$17,532,899,259	100.0%
Clarence (T)	13,660	$9,866,246,863	4,397	32.2%	$3,611,520,735	36.6%
Colden (T)	2,110	$854,417,381	80	3.8%	$36,163,543	4.2%
Collins (T)	2,521	$1,189,158,504	202	8.0%	$100,884,120	8.5%
Concord (T)	3,245	$1,338,570,261	56	1.7%	$56,332,089	4.2%
Depew (V)	6,532	$3,841,823,815	6,361	97.4%	$3,783,955,539	98.5%
East Aurora (V)	2,441	$1,723,816,550	741	30.4%	$537,678,534	31.2%
Eden (T)	4,290	$2,180,455,513	2,833	66.0%	$1,493,885,599	68.5%
Elma (T)	6,093	$3,775,039,302	2,448	40.2%	$1,897,152,089	50.3%
Evans (T)	7,952	$3,335,060,692	72	0.9%	$27,350,442	0.8%
Farnham (V)	189	$87,990,422	0	0.0%	$0	0.0%
Gowanda (V)	396	$249,516,940	0	0.0%	$0	0.0%
Grand Island (T)	8,426	$4,674,517,058	8,426	100.0%	$4,674,517,058	100.0%
Hamburg (T)	19,130	$11,911,210,828	13,903	72.7%	$9,400,754,558	78.9%
Hamburg (V)	3,794	$2,005,172,252	1,095	28.9%	$647,579,398	32.3%
Holland (T)	2,182	$1,151,194,342	275	12.6%	$304,070,648	26.4%
Kenmore (V)	6,017	$2,305,529,001	6,018	100.0%	$2,305,727,486	100.0%
Lackawanna (C)	6,751	$4,030,622,400	6,751	100.0%	$4,030,622,400	100.0%
Lancaster (T)	10,973	$6,845,493,469	4,075	37.1%	$3,120,141,431	45.6%
Lancaster (V)	4,323	$2,217,331,122	3,654	84.5%	$1,889,015,874	85.2%
Marilla (T)	2,956	$1,099,846,031	23	0.8%	$2,851,173	0.3%
Newstead (T)	4,202	$2,181,758,974	1,006	23.9%	$609,405,005	27.9%
North Collins (T)	1,898	$889,517,676	87	4.6%	$63,522,898	7.1%
North Collins (V)	551	$383,968,909	44	8.0%	$56,847,949	14.8%
Orchard Park (T)	10,748	$8,174,650,530	7,424	69.1%	$5,987,804,626	73.2%
Orchard Park (V)	1,211	$867,347,745	1,211	100.0%	$867,347,746	100.0%
Sardinia (T)	2,184	$1,068,523,829	637	29.2%	$436,540,153	40.9%
Sloan (V)	1,674	$634,998,253	1,674	100.0%	$634,998,253	100.0%
Springville (V)	1,816	$1,354,905,864	361	19.9%	$340,742,637	25.1%
Tonawanda (C)	6,452	$3,291,492,557	6,452	100.0%	$3,291,492,557	100.0%
Tonawanda (T)	23,999	$14,694,684,404	23,998	100.0%	$14,694,485,918	100.0%
Wales (T)	1,923	$833,853,270	0	0.0%	$0	0.0%
West Seneca (T)	17,970	$9,583,482,689	17,970	100.0%	$9,583,482,689	100.0%
Williamsville (V)	2,057	$1,126,868,443	2,057	100.0%	$1,126,868,443	100.0%
Erie County Total	**360,925**	**$222,515,035,436**	**280,200**	**77.6%**	**$181,124,788,589**	**81.4%**

Source: Erie County GIS 2020; RSMeans 2020
% = Percent; C = City; T = Town; V = Village

* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-9 Estimated Number of Buildings and Replacement Cost Value Within 0.5 Mile of Crude Oil Pipelines

			Estimated Building Stock within 0.5 Mile of Crude Oil Pipelines			
Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	0	0.0%	$0	0.0%
Alden (T)	3,400	$1,748,473,245	0	0.0%	$0	0.0%
Alden (V)	1,102	$602,655,574	0	0.0%	$0	0.0%
Amherst (T)	38,528	$27,372,255,690	0	0.0%	$0	0.0%
Angola (V)	874	$525,704,230	0	0.0%	$0	0.0%
Aurora (T)	4,280	$2,496,885,036	0	0.0%	$0	0.0%
Blasdell (V)	1,026	$638,571,953	1,010	98.4%	$515,295,324	80.7%
Boston (T)	4,040	$1,702,475,276	0	0.0%	$0	0.0%
Brant (T)	1,325	$657,594,060	0	0.0%	$0	0.0%
Buffalo (C)	83,471	$58,603,851,634	32,965	39.5%	$19,743,832,915	33.7%
Cheektowaga (T)	30,938	$17,530,893,277	1,876	6.1%	$730,595,365	4.2%
Clarence (T)	13,660	$9,866,246,863	0	0.0%	$0	0.0%
Colden (T)	2,110	$854,417,381	0	0.0%	$0	0.0%
Collins (T)	2,521	$1,189,158,504	281	11.1%	$116,513,765	9.8%
Concord (T)	3,245	$1,338,570,261	0	0.0%	$0	0.0%
Depew (V)	6,532	$3,841,823,815	0	0.0%	$0	0.0%
East Aurora (V)	2,441	$1,723,816,550	0	0.0%	$0	0.0%
Eden (T)	4,290	$2,180,455,513	716	16.7%	$312,319,015	14.3%
Elma (T)	6,093	$3,775,039,302	0	0.0%	$0	0.0%
Evans (T)	7,952	$3,335,060,692	0	0.0%	$0	0.0%
Farnham (V)	189	$87,990,422	0	0.0%	$0	0.0%
Gowanda (V)	396	$249,516,940	0	0.0%	$0	0.0%
Grand Island (T)	8,426	$4,674,517,058	1,150	13.6%	$579,348,646	12.4%
Hamburg (T)	19,130	$11,911,210,828	3,786	19.8%	$2,363,355,745	19.8%
Hamburg (V)	3,794	$2,005,172,252	1,761	46.4%	$1,066,837,375	53.2%
Holland (T)	2,182	$1,151,194,342	0	0.0%	$0	0.0%
Kenmore (V)	6,017	$2,305,529,001	830	13.8%	$294,610,199	12.8%
Lackawanna (C)	6,751	$4,030,622,400	3,057	45.3%	$1,353,101,411	33.6%
Lancaster (T)	10,973	$6,845,493,469	0	0.0%	$0	0.0%
Lancaster (V)	4,323	$2,217,331,122	0	0.0%	$0	0.0%
Marilla (T)	2,956	$1,099,846,031	0	0.0%	$0	0.0%
Newstead (T)	4,202	$2,181,758,974	0	0.0%	$0	0.0%
North Collins (T)	1,898	$889,517,676	324	17.1%	$172,400,358	19.4%
North Collins (V)	551	$383,968,909	0	0.0%	$0	0.0%
Orchard Park (T)	10,748	$8,174,650,530	0	0.0%	$0	0.0%
Orchard Park (V)	1,211	$867,347,745	0	0.0%	$0	0.0%
Sardinia (T)	2,184	$1,068,523,829	0	0.0%	$0	0.0%

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Crude Oil Pipelines			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Sloan (V)	1,674	$634,998,253	1,272	76.0%	$498,627,197	78.5%
Springville (V)	1,816	$1,354,905,864	0	0.0%	$0	0.0%
Tonawanda (C)	6,452	$3,291,492,557	1,146	17.8%	$481,296,070	14.6%
Tonawanda (T)	23,999	$14,694,684,404	9,480	39.5%	$4,569,031,716	31.1%
Wales (T)	1,923	$833,853,270	0	0.0%	$0	0.0%
West Seneca (T)	17,970	$9,583,482,689	11	0.1%	$7,382,156	0.1%
Williamsville (V)	2,057	$1,126,868,443	0	0.0%	$0	0.0%
Erie County Total	**360,925**	**$222,515,035,436**	**59,665**	**16.5%**	**$32,804,547,257**	**14.7%**

Source: Erie County GIS 2020; RSMeans 2020; EIA 2020
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-10 Estimated Number of Buildings and Replacement Cost Value Within 0.5 Mile of Petroleum Pipelines

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Petroleum Pipelines			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	0	0.0%	$0	0.0%
Alden (T)	3,400	$1,748,473,245	541	15.9%	$214,210,171	12.3%
Alden (V)	1,102	$602,655,574	0	0.0%	$0	0.0%
Amherst (T)	38,528	$27,372,255,690	6,911	17.9%	$4,245,009,050	15.5%
Angola (V)	874	$525,704,230	0	0.0%	$0	0.0%
Aurora (T)	4,280	$2,496,885,036	0	0.0%	$0	0.0%
Blasdell (V)	1,026	$638,571,953	0	0.0%	$0	0.0%
Boston (T)	4,040	$1,702,475,276	0	0.0%	$0	0.0%
Brant (T)	1,325	$657,594,060	0	0.0%	$0	0.0%
Buffalo (C)	83,471	$58,603,851,634	3,270	3.9%	$2,512,654,192	4.3%
Cheektowaga (T)	30,938	$17,530,893,277	4,230	13.7%	$2,028,027,148	11.6%
Clarence (T)	13,660	$9,866,246,863	2,846	20.8%	$2,203,577,975	22.3%
Colden (T)	2,110	$854,417,381	0	0.0%	$0	0.0%
Collins (T)	2,521	$1,189,158,504	0	0.0%	$0	0.0%
Concord (T)	3,245	$1,338,570,261	0	0.0%	$0	0.0%
Depew (V)	6,532	$3,841,823,815	53	0.8%	$96,369,116	2.5%
East Aurora (V)	2,441	$1,723,816,550	0	0.0%	$0	0.0%
Eden (T)	4,290	$2,180,455,513	0	0.0%	$0	0.0%
Elma (T)	6,093	$3,775,039,302	0	0.0%	$0	0.0%
Evans (T)	7,952	$3,335,060,692	0	0.0%	$0	0.0%
Farnham (V)	189	$87,990,422	0	0.0%	$0	0.0%
Gowanda (V)	396	$249,516,940	0	0.0%	$0	0.0%
Grand Island (T)	8,426	$4,674,517,058	0	0.0%	$0	0.0%
Hamburg (T)	19,130	$11,911,210,828	0	0.0%	$0	0.0%

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Petroleum Pipelines			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Hamburg (V)	3,794	$2,005,172,252	0	0.0%	$0	0.0%
Holland (T)	2,182	$1,151,194,342	0	0.0%	$0	0.0%
Kenmore (V)	6,017	$2,305,529,001	0	0.0%	$0	0.0%
Lackawanna (C)	6,751	$4,030,622,400	0	0.0%	$0	0.0%
Lancaster (T)	10,973	$6,845,493,469	1,659	15.1%	$869,577,152	12.7%
Lancaster (V)	4,323	$2,217,331,122	2,541	58.8%	$882,055,193	39.8%
Marilla (T)	2,956	$1,099,846,031	0	0.0%	$0	0.0%
Newstead (T)	4,202	$2,181,758,974	406	9.7%	$235,487,860	10.8%
North Collins (T)	1,898	$889,517,676	0	0.0%	$0	0.0%
North Collins (V)	551	$383,968,909	0	0.0%	$0	0.0%
Orchard Park (T)	10,748	$8,174,650,530	0	0.0%	$0	0.0%
Orchard Park (V)	1,211	$867,347,745	0	0.0%	$0	0.0%
Sardinia (T)	2,184	$1,068,523,829	0	0.0%	$0	0.0%
Sloan (V)	1,674	$634,998,253	0	0.0%	$0	0.0%
Springville (V)	1,816	$1,354,905,864	0	0.0%	$0	0.0%
Tonawanda (C)	6,452	$3,291,492,557	1	0.0%	$239,253	0.0%
Tonawanda (T)	23,999	$14,694,684,404	7,093	29.6%	$3,909,137,213	26.6%
Wales (T)	1,923	$833,853,270	0	0.0%	$0	0.0%
West Seneca (T)	17,970	$9,583,482,689	497	2.8%	$286,986,258	3.0%
Williamsville (V)	2,057	$1,126,868,443	0	0.0%	$0	0.0%
Erie County Total	**360,925**	**$222,515,035,436**	**30,048**	**8.3%**	**$17,483,330,582**	**7.9%**

Source: Erie County GIS 2020; RSMeans 2020; EIA 2020
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-11 Estimated Number of Buildings and Replacement Cost Value Within 0.5 Mile of Natural Gas Pipelines

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Natural Gas Pipelines			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	0	0.0%	$0	0.0%
Alden (T)	3,400	$1,748,473,245	1,628	47.9%	$800,591,522	45.8%
Alden (V)	1,102	$602,655,574	881	79.9%	$483,752,721	80.3%
Amherst (T)	38,528	$27,372,255,690	9,769	25.4%	$6,866,752,175	25.1%
Angola (V)	874	$525,704,230	0	0.0%	$0	0.0%
Aurora (T)	4,280	$2,496,885,036	2,169	50.7%	$1,284,869,860	51.5%
Blasdell (V)	1,026	$638,571,953	0	0.0%	$0	0.0%
Boston (T)	4,040	$1,702,475,276	2,722	67.4%	$1,136,966,332	66.8%
Brant (T)	1,325	$657,594,060	331	25.0%	$138,725,461	21.1%
Buffalo (C)	83,471	$58,603,851,634	20,795	24.9%	$15,812,465,859	27.0%
Cheektowaga (T)	30,938	$17,530,893,277	8,293	26.8%	$5,346,226,742	30.5%

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock within 0.5 Mile of Natural Gas Pipelines			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Clarence (T)	13,660	$9,866,246,863	4,818	35.3%	$3,861,773,244	39.1%
Colden (T)	2,110	$854,417,381	535	25.4%	$217,819,652	25.5%
Collins (T)	2,521	$1,189,158,504	671	26.6%	$279,944,898	23.5%
Concord (T)	3,245	$1,338,570,261	885	27.3%	$380,959,007	28.5%
Depew (V)	6,532	$3,841,823,815	2,206	33.8%	$1,383,823,468	36.0%
East Aurora (V)	2,441	$1,723,816,550	2,293	93.9%	$1,526,119,791	88.5%
Eden (T)	4,290	$2,180,455,513	966	22.5%	$394,686,055	18.1%
Elma (T)	6,093	$3,775,039,302	3,338	54.8%	$1,977,130,117	52.4%
Evans (T)	7,952	$3,335,060,692	240	3.0%	$122,938,304	3.7%
Farnham (V)	189	$87,990,422	0	0.0%	$0	0.0%
Gowanda (V)	396	$249,516,940	261	65.9%	$164,040,677	65.7%
Grand Island (T)	8,426	$4,674,517,058	2,496	29.6%	$1,381,374,491	29.6%
Hamburg (T)	19,130	$11,911,210,828	2,808	14.7%	$1,556,901,425	13.1%
Hamburg (V)	3,794	$2,005,172,252	855	22.5%	$421,897,711	21.0%
Holland (T)	2,182	$1,151,194,342	144	6.6%	$70,220,518	6.1%
Kenmore (V)	6,017	$2,305,529,001	879	14.6%	$270,970,029	11.8%
Lackawanna (C)	6,751	$4,030,622,400	215	3.2%	$86,506,255	2.1%
Lancaster (T)	10,973	$6,845,493,469	2,490	22.7%	$1,866,540,491	27.3%
Lancaster (V)	4,323	$2,217,331,122	2,355	54.5%	$999,328,957	45.1%
Marilla (T)	2,956	$1,099,846,031	1,974	66.8%	$713,317,624	64.9%
Newstead (T)	4,202	$2,181,758,974	356	8.5%	$349,736,483	16.0%
North Collins (T)	1,898	$889,517,676	595	31.3%	$315,743,815	35.5%
North Collins (V)	551	$383,968,909	540	98.0%	$381,123,274	99.3%
Orchard Park (T)	10,748	$8,174,650,530	7,230	67.3%	$5,474,309,601	67.0%
Orchard Park (V)	1,211	$867,347,745	846	69.9%	$622,395,676	71.8%
Sardinia (T)	2,184	$1,068,523,829	756	34.6%	$327,080,473	30.6%
Sloan (V)	1,674	$634,998,253	1,674	100.0%	$634,998,253	100.0%
Springville (V)	1,816	$1,354,905,864	469	25.8%	$371,951,088	27.5%
Tonawanda (C)	6,452	$3,291,492,557	1,855	28.8%	$827,067,361	25.1%
Tonawanda (T)	23,999	$14,694,684,404	9,539	39.7%	$5,925,479,795	40.3%
Wales (T)	1,923	$833,853,270	501	26.1%	$208,863,758	25.0%
West Seneca (T)	17,970	$9,583,482,689	8,064	44.9%	$3,980,782,469	41.5%
Williamsville (V)	2,057	$1,126,868,443	899	43.7%	$436,985,915	38.8%
Erie County Total	**360,925**	**$222,515,035,436**	**110,341**	**30.6%**	**$69,403,161,346**	**31.2%**

Source: Erie County GIS 2020; RSMeans 2020; EIA 2020
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Impact on Critical Facilities

Potential losses to critical facilities caused by a hazardous substances incident is difficult to quantify. Potential losses may include inaccessibility, loss of service, contamination and/or potential structural and content losses if an explosion occurs.

An exposure analysis estimates that 1,553 critical facilities or 1,510 lifelines, 3,149 critical facilities or 3,030 lifelines, and 2,591 critical facilities or 2,547 lifelines are built within 0.5 mile of railways, 0.5 mile of major roadways, and with unique buffer areas of SARA sites, respectively. Table 5.4.7-12 through Table 5.4.7-14 summarizes the number of critical facilities and lifelines built within the hazardous materials hazard areas by jurisdiction.

Furthermore, an exposure analysis was conducted on critical facilities vulnerable to a pipeline release event. Table 5.4.7-15 through Table 5.4.7-17 summarize critical facilities and lifelines located within 0.5 mile of crude oil, petroleum, and natural gas pipelines. The exposure analysis estimates that 507 critical facilities or 493 lifelines, 292 critical facilities or 282 lifelines, and 1,297 critical facilities or 1,195 lifelines are located within 0.5 mile of crude oil, petroleum, and natural gas pipelines, respectively.

Table 5.4.7-18 through Table 5.4.7-23 summarize the distribution of critical facilities by critical facility type exposed to the hazardous material hazard by jurisdiction. The majority of critical facilities exposed to the hazardous materials hazard are bridges, shelters, and schools. Furthermore, critical facilities that provide transportation lifeline services are the most exposed in the hazardous materials hazard areas (Table 5.4.7-24 and Table 5.4.7-25).

Table 5.4.7-12. Estimated Number of Critical Facilities and Lifelines Built Within 0.5 Mile of Rail Lines

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Major Railways			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	0	0.0%	0	0.0%
Alden (T)	76	68	30	39.5%	29	42.6%
Alden (V)	19	17	17	89.5%	15	88.2%
Amherst (T)	391	387	0	0.0%	0	0.0%
Angola (V)	20	18	20	100.0%	18	100.0%
Aurora (T)	95	81	18	18.9%	18	22.2%
Blasdell (V)	22	22	22	100.0%	22	100.0%
Boston (T)	81	75	0	0.0%	0	0.0%
Brant (T)	39	39	7	17.9%	7	17.9%
Buffalo (C)	751	748	459	61.1%	457	61.1%
Cheektowaga (T)	224	221	74	33.0%	74	33.5%
Clarence (T)	121	115	0	0.0%	0	0.0%
Colden (T)	67	56	0	0.0%	0	0.0%
Collins (T)	71	55	16	22.5%	15	27.3%
Concord (T)	84	68	0	0.0%	0	0.0%
Depew (V)	63	63	52	82.5%	52	82.5%
East Aurora (V)	42	41	26	61.9%	25	61.0%
Eden (T)	78	72	20	25.6%	19	26.4%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Major Railways			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Elma (T)	83	75	22	26.5%	21	28.0%
Evans (T)	112	109	13	11.6%	13	11.9%
Farnham (V)	10	10	10	100.0%	10	100.0%
Gowanda (V)	7	7	7	100.0%	7	100.0%
Grand Island (T)	69	66	0	0.0%	0	0.0%
Hamburg (T)	189	181	127	67.2%	122	67.4%
Hamburg (V)	27	23	12	44.4%	12	52.2%
Holland (T)	90	70	49	54.4%	39	55.7%
Kenmore (V)	14	13	5	35.7%	5	38.5%
Lackawanna (C)	94	93	91	96.8%	90	96.8%
Lancaster (T)	109	103	29	26.6%	26	25.2%
Lancaster (V)	58	53	45	77.6%	41	77.4%
Marilla (T)	48	37	0	0.0%	0	0.0%
Newstead (T)	64	61	0	0.0%	0	0.0%
North Collins (T)	69	56	19	27.5%	18	32.1%
North Collins (V)	14	13	14	100.0%	13	100.0%
Orchard Park (T)	141	129	29	20.6%	29	22.5%
Orchard Park (V)	21	18	6	28.6%	5	27.8%
Sardinia (T)	78	57	11	14.1%	8	14.0%
Sloan (V)	8	8	8	100.0%	8	100.0%
Springville (V)	35	32	0	0.0%	0	0.0%
Tonawanda (C)	61	60	43	70.5%	42	70.0%
Tonawanda (T)	266	265	168	63.2%	167	63.0%
Wales (T)	82	68	8	9.8%	8	11.8%
West Seneca (T)	145	140	76	52.4%	75	53.6%
Williamsville (V)	16	14	0	0.0%	0	0.0%
Erie County Total	**4,184**	**3,933**	**1,553**	**37.1%**	**1,510**	**38.4%**

Source: Erie County GIS 2020; NYSDOT 2013
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-13. Estimated Number of Critical Facilities and Lifelines Built Within 0.5 Mile of Major Roadways

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Major Roadways			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	22	73.3%	19	73.1%
Alden (T)	76	68	41	53.9%	38	55.9%
Alden (V)	19	17	17	89.5%	16	94.1%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Major Roadways			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Amherst (T)	391	387	335	85.7%	332	85.8%
Angola (V)	20	18	0	0.0%	0	0.0%
Aurora (T)	95	81	50	52.6%	45	55.6%
Blasdell (V)	22	22	19	86.4%	19	86.4%
Boston (T)	81	75	22	27.2%	20	26.7%
Brant (T)	39	39	22	56.4%	22	56.4%
Buffalo (C)	751	748	700	93.2%	697	93.2%
Cheektowaga (T)	224	221	200	89.3%	200	90.5%
Clarence (T)	121	115	48	39.7%	46	40.0%
Colden (T)	67	56	33	49.3%	29	51.8%
Collins (T)	71	55	31	43.7%	29	52.7%
Concord (T)	84	68	37	44.0%	29	42.6%
Depew (V)	63	63	56	88.9%	56	88.9%
East Aurora (V)	42	41	38	90.5%	37	90.2%
Eden (T)	78	72	38	48.7%	34	47.2%
Elma (T)	83	75	48	57.8%	45	60.0%
Evans (T)	112	109	51	45.5%	50	45.9%
Farnham (V)	10	10	10	100.0%	10	100.0%
Gowanda (V)	7	7	7	100.0%	7	100.0%
Grand Island (T)	69	66	45	65.2%	44	66.7%
Hamburg (T)	189	181	165	87.3%	158	87.3%
Hamburg (V)	27	23	27	100.0%	23	100.0%
Holland (T)	90	70	52	57.8%	42	60.0%
Kenmore (V)	14	13	13	92.9%	12	92.3%
Lackawanna (C)	94	93	82	87.2%	81	87.1%
Lancaster (T)	109	103	85	78.0%	80	77.7%
Lancaster (V)	58	53	52	89.7%	47	88.7%
Marilla (T)	48	37	22	45.8%	17	45.9%
Newstead (T)	64	61	23	35.9%	23	37.7%
North Collins (T)	69	56	32	46.4%	25	44.6%
North Collins (V)	14	13	14	100.0%	13	100.0%
Orchard Park (T)	141	129	113	80.1%	107	82.9%
Orchard Park (V)	21	18	21	100.0%	18	100.0%
Sardinia (T)	78	57	34	43.6%	29	50.9%
Sloan (V)	8	8	8	100.0%	8	100.0%
Springville (V)	35	32	31	88.6%	28	87.5%
Tonawanda (C)	61	60	61	100.0%	60	100.0%
Tonawanda (T)	266	265	244	91.7%	243	91.7%
Wales (T)	82	68	41	50.0%	40	58.8%
West Seneca (T)	145	140	143	98.6%	138	98.6%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Major Roadways			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Williamsville (V)	16	14	16	100.0%	14	100.0%
Erie County Total	**4,184**	**3,933**	**3,149**	**75.3%**	**3,030**	**77.0%**

Source: Erie County GIS 2020; NYSDOT 2013
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-14. Estimated Number of Critical Facilities and Lifelines Built Within Unique Buffer Areas of Hazardous Materials Facilities

Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Sara Site Hazard Areas			
		Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	26	28	93.3%	24	92.3%
Alden (T)	68	13	17.1%	13	19.1%
Alden (V)	17	2	10.5%	2	11.8%
Amherst (T)	387	359	91.8%	355	91.7%
Angola (V)	18	5	25.0%	5	27.8%
Aurora (T)	81	3	3.2%	2	2.5%
Blasdell (V)	22	22	100.0%	22	100.0%
Boston (T)	75	3	3.7%	3	4.0%
Brant (T)	39	4	10.3%	4	10.3%
Buffalo (C)	748	751	100.0%	748	100.0%
Cheektowaga (T)	221	215	96.0%	212	95.9%
Clarence (T)	115	20	16.5%	20	17.4%
Colden (T)	56	6	9.0%	6	10.7%
Collins (T)	55	2	2.8%	2	3.6%
Concord (T)	68	2	2.4%	2	2.9%
Depew (V)	63	30	47.6%	30	47.6%
East Aurora (V)	41	19	45.2%	18	43.9%
Eden (T)	72	39	50.0%	37	51.4%
Elma (T)	75	25	30.1%	25	33.3%
Evans (T)	109	9	8.0%	9	8.3%
Farnham (V)	10	0	0.0%	0	0.0%
Gowanda (V)	7	0	0.0%	0	0.0%
Grand Island (T)	66	69	100.0%	66	100.0%
Hamburg (T)	181	148	78.3%	143	79.0%
Hamburg (V)	23	6	22.2%	6	26.1%
Holland (T)	70	15	16.7%	15	21.4%
Kenmore (V)	13	14	100.0%	13	100.0%
Lackawanna (C)	93	94	100.0%	93	100.0%
Lancaster (T)	103	39	35.8%	37	35.9%

Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Sara Site Hazard Areas			
		Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Lancaster (V)	53	30	51.7%	28	52.8%
Marilla (T)	37	0	0.0%	0	0.0%
Newstead (T)	61	17	26.6%	17	27.9%
North Collins (T)	56	7	10.1%	7	12.5%
North Collins (V)	13	3	21.4%	3	23.1%
Orchard Park (T)	129	79	56.0%	77	59.7%
Orchard Park (V)	18	3	14.3%	3	16.7%
Sardinia (T)	57	22	28.2%	21	36.8%
Sloan (V)	8	8	100.0%	8	100.0%
Springville (V)	32	6	17.1%	6	18.8%
Tonawanda (C)	60	61	100.0%	60	100.0%
Tonawanda (T)	265	266	100.0%	265	100.0%
Wales (T)	68	0	0.0%	0	0.0%
West Seneca (T)	140	132	91.0%	127	90.7%
Williamsville (V)	14	15	93.8%	13	92.9%
Erie County Total	**3,933**	**2,591**	**61.9%**	**2,547**	**64.8%**

Source: Erie County GIS 2020
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-15 Estimated Number of Critical Facilities and Lifelines Built Within 0.5 Mile of Crude Oil Pipelines

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Crude Oil Pipeline			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	0	0.0%	0	0.0%
Alden (T)	76	68	0	0.0%	0	0.0%
Alden (V)	19	17	0	0.0%	0	0.0%
Amherst (T)	391	387	0	0.0%	0	0.0%
Angola (V)	20	18	0	0.0%	0	0.0%
Aurora (T)	95	81	0	0.0%	0	0.0%
Blasdell (V)	22	22	17	77.3%	17	77.3%
Boston (T)	81	75	0	0.0%	0	0.0%
Brant (T)	39	39	0	0.0%	0	0.0%
Buffalo (C)	751	748	197	26.2%	197	26.3%
Cheektowaga (T)	224	221	17	7.6%	17	7.7%
Clarence (T)	121	115	0	0.0%	0	0.0%
Colden (T)	67	56	0	0.0%	0	0.0%
Collins (T)	71	55	7	9.9%	5	9.1%
Concord (T)	84	68	0	0.0%	0	0.0%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Crude Oil Pipeline			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Depew (V)	63	63	0	0.0%	0	0.0%
East Aurora (V)	42	41	0	0.0%	0	0.0%
Eden (T)	78	72	13	16.7%	13	18.1%
Elma (T)	83	75	0	0.0%	0	0.0%
Evans (T)	112	109	0	0.0%	0	0.0%
Farnham (V)	10	10	0	0.0%	0	0.0%
Gowanda (V)	7	7	0	0.0%	0	0.0%
Grand Island (T)	69	66	5	7.2%	5	7.6%
Hamburg (T)	189	181	53	28.0%	52	28.7%
Hamburg (V)	27	23	22	81.5%	18	78.3%
Holland (T)	90	70	0	0.0%	0	0.0%
Kenmore (V)	14	13	1	7.1%	1	7.7%
Lackawanna (C)	94	93	40	42.6%	39	41.9%
Lancaster (T)	109	103	0	0.0%	0	0.0%
Lancaster (V)	58	53	0	0.0%	0	0.0%
Marilla (T)	48	37	0	0.0%	0	0.0%
Newstead (T)	64	61	0	0.0%	0	0.0%
North Collins (T)	69	56	10	14.5%	4	7.1%
North Collins (V)	14	13	0	0.0%	0	0.0%
Orchard Park (T)	141	129	0	0.0%	0	0.0%
Orchard Park (V)	21	18	0	0.0%	0	0.0%
Sardinia (T)	78	57	0	0.0%	0	0.0%
Sloan (V)	8	8	7	87.5%	7	87.5%
Springville (V)	35	32	0	0.0%	0	0.0%
Tonawanda (C)	61	60	4	6.6%	4	6.7%
Tonawanda (T)	266	265	114	42.9%	114	43.0%
Wales (T)	82	68	0	0.0%	0	0.0%
West Seneca (T)	145	140	0	0.0%	0	0.0%
Williamsville (V)	16	14	0	0.0%	0	0.0%
Erie County Total	**4,184**	**3,933**	**507**	**12.1%**	**493**	**12.5%**

Source: Erie County GIS 2020; EIA 2020
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-16 Estimated Number of Critical Facilities and Lifelines Built Within 0.5 Mile of Petroleum Pipelines

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Petroleum Pipeline			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	0	0.0%	0	0.0%
Alden (T)	76	68	14	18.4%	13	19.1%
Alden (V)	19	17	0	0.0%	0	0.0%
Amherst (T)	391	387	41	10.5%	41	10.6%
Angola (V)	20	18	0	0.0%	0	0.0%
Aurora (T)	95	81	0	0.0%	0	0.0%
Blasdell (V)	22	22	0	0.0%	0	0.0%
Boston (T)	81	75	0	0.0%	0	0.0%
Brant (T)	39	39	0	0.0%	0	0.0%
Buffalo (C)	751	748	35	4.7%	35	4.7%
Cheektowaga (T)	224	221	31	13.8%	29	13.1%
Clarence (T)	121	115	18	14.9%	16	13.9%
Colden (T)	67	56	0	0.0%	0	0.0%
Collins (T)	71	55	0	0.0%	0	0.0%
Concord (T)	84	68	0	0.0%	0	0.0%
Depew (V)	63	63	2	3.2%	2	3.2%
East Aurora (V)	42	41	0	0.0%	0	0.0%
Eden (T)	78	72	0	0.0%	0	0.0%
Elma (T)	83	75	0	0.0%	0	0.0%
Evans (T)	112	109	0	0.0%	0	0.0%
Farnham (V)	10	10	0	0.0%	0	0.0%
Gowanda (V)	7	7	0	0.0%	0	0.0%
Grand Island (T)	69	66	0	0.0%	0	0.0%
Hamburg (T)	189	181	0	0.0%	0	0.0%
Hamburg (V)	27	23	0	0.0%	0	0.0%
Holland (T)	90	70	0	0.0%	0	0.0%
Kenmore (V)	14	13	0	0.0%	0	0.0%
Lackawanna (C)	94	93	0	0.0%	0	0.0%
Lancaster (T)	109	103	11	10.1%	10	9.7%
Lancaster (V)	58	53	16	27.6%	12	22.6%
Marilla (T)	48	37	0	0.0%	0	0.0%
Newstead (T)	64	61	2	3.1%	2	3.3%
North Collins (T)	69	56	0	0.0%	0	0.0%
North Collins (V)	14	13	0	0.0%	0	0.0%
Orchard Park (T)	141	129	0	0.0%	0	0.0%
Orchard Park (V)	21	18	0	0.0%	0	0.0%
Sardinia (T)	78	57	0	0.0%	0	0.0%
Sloan (V)	8	8	0	0.0%	0	0.0%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Petroleum Pipeline			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Springville (V)	35	32	0	0.0%	0	0.0%
Tonawanda (C)	61	60	0	0.0%	0	0.0%
Tonawanda (T)	266	265	116	43.6%	116	43.8%
Wales (T)	82	68	0	0.0%	0	0.0%
West Seneca (T)	145	140	6	4.1%	6	4.3%
Williamsville (V)	16	14	0	0.0%	0	0.0%
Erie County Total	**4,184**	**3,933**	**292**	**7.0%**	**282**	**7.2%**

Source: Erie County GIS 2020; EIA 2020
% = Percent; C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-17 Estimated Number of Critical Facilities and Lifelines Built Within 0.5 Mile of Natural Gas Pipelines

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Natural Gas Pipeline			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	0	0.0%	0	0.0%
Alden (T)	76	68	28	36.8%	24	35.3%
Alden (V)	19	17	16	84.2%	15	88.2%
Amherst (T)	391	387	47	12.0%	47	12.1%
Angola (V)	20	18	0	0.0%	0	0.0%
Aurora (T)	95	81	51	53.7%	44	54.3%
Blasdell (V)	22	22	0	0.0%	0	0.0%
Boston (T)	81	75	43	53.1%	41	54.7%
Brant (T)	39	39	12	30.8%	12	30.8%
Buffalo (C)	751	748	159	21.2%	158	21.1%
Cheektowaga (T)	224	221	90	40.2%	88	39.8%
Clarence (T)	121	115	59	48.8%	56	48.7%
Colden (T)	67	56	23	34.3%	19	33.9%
Collins (T)	71	55	22	31.0%	12	21.8%
Concord (T)	84	68	29	34.5%	23	33.8%
Depew (V)	63	63	24	38.1%	24	38.1%
East Aurora (V)	42	41	37	88.1%	36	87.8%
Eden (T)	78	72	12	15.4%	10	13.9%
Elma (T)	83	75	50	60.2%	44	58.7%
Evans (T)	112	109	13	11.6%	12	11.0%
Farnham (V)	10	10	0	0.0%	0	0.0%
Gowanda (V)	7	7	5	71.4%	5	71.4%
Grand Island (T)	69	66	16	23.2%	16	24.2%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Within 0.5 Mile of Natural Gas Pipeline			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Hamburg (T)	189	181	37	19.6%	36	19.9%
Hamburg (V)	27	23	0	0.0%	0	0.0%
Holland (T)	90	70	8	8.9%	3	4.3%
Kenmore (V)	14	13	1	7.1%	1	7.7%
Lackawanna (C)	94	93	0	0.0%	0	0.0%
Lancaster (T)	109	103	35	32.1%	32	31.1%
Lancaster (V)	58	53	32	55.2%	28	52.8%
Marilla (T)	48	37	32	66.7%	24	64.9%
Newstead (T)	64	61	0	0.0%	0	0.0%
North Collins (T)	69	56	28	40.6%	24	42.9%
North Collins (V)	14	13	14	100.0%	13	100.0%
Orchard Park (T)	141	129	104	73.8%	99	76.7%
Orchard Park (V)	21	18	16	76.2%	14	77.8%
Sardinia (T)	78	57	26	33.3%	15	26.3%
Sloan (V)	8	8	8	100.0%	8	100.0%
Springville (V)	35	32	7	20.0%	7	21.9%
Tonawanda (C)	61	60	13	21.3%	13	21.7%
Tonawanda (T)	266	265	112	42.1%	112	42.3%
Wales (T)	82	68	26	31.7%	18	26.5%
West Seneca (T)	145	140	60	41.4%	60	42.9%
Williamsville (V)	16	14	2	12.5%	2	14.3%
Erie County Total	**4,184**	**3,933**	**1,297**	**31.0%**	**1,195**	**30.4%**

Source: Erie County GIS 2020; EIA 2020
% = Percent; C = City; T = Town; V = Village
**Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-18 Critical Facility Type Within 0.5 Mile of Railways

Jurisdiction	Critical Facilities within 0.5 Mile of Railways																																		
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Railway Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Akron (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (T)	0	0	0	4	0	0	0	0	2	2	0	0	0	2	4	1	0	0	0	0	2	0	0	1	0	0	5	1	0	0	0	0	3	1	0	2
Alden (V)	0	0	1	1	0	0	1	0	0	1	0	0	0	1	1	1	0	1	0	0	0	0	1	0	0	0	1	3	0	0	0	1	2	1	0	0
Amherst (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Angola (V)	0	0	0	3	0	0	2	0	0	1	1	0	0	2	2	1	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	3	1	0	0
Aurora (T)	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	1
Blasdell (V)	0	0	0	7	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	2	1	0	1	0	0	2	1	1	3
Boston (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brant (T)	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0
Buffalo (C)	0	0	0	177	3	0	11	32	1	2	8	0	1	16	74	4	1	1	8	0	3	7	6	5	0	0	3	53	1	0	21	2	14	1	2	2
Cheektowaga (T)	0	0	0	14	0	1	0	0	0	0	3	0	1	7	24	0	0	0	0	0	0	1	0	6	0	0	0	7	0	0	0	1	7	1	0	1
Clarence (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colden (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collins (T)	0	0	0	6	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	1	3	0	0	1	0	0	0	0	1	0	1	0	0
Concord (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Depew (V)	0	0	0	16	0	0	0	1	0	1	0	0	0	3	11	2	0	0	0	0	0	1	1	0	0	0	1	2	1	0	0	1	3	1	0	7
East Aurora (V)	0	0	0	7	0	0	1	1	0	0	0	0	0	2	2	0	0	1	0	0	0	1	0	1	0	0	0	3	0	0	0	2	0	2	0	3
Eden (T)	0	0	0	3	0	0	1	1	0	1	0	1	0	1	2	1	0	0	0	0	0	1	1	0	0	0	2	2	0	0	0	0	1	1	0	1
Elma (T)	0	0	0	12	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	2
Evans (T)	0	0	0	10	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Farnham (V)	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	2
Gowanda (V)	0	0	0	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Grand Island (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Critical Facilities within 0.5 Mile of Railways																																		
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Railway Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Hamburg (T)	0	0	0	46	0	0	1	0	0	5	0	0	0	7	13	1	0	0	0	1	0	0	2	1	0	0	2	8	0	0	16	0	0	0	1	23
Hamburg (V)	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	3	0	0	0
Holland (T)	0	0	1	7	0	0	1	1	0	10	0	0	0	1	2	2	0	0	0	0	0	0	1	3	0	1	9	5	0	0	0	0	3	1	1	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Lackawanna (C)	0	0	0	21	0	0	1	2	0	0	6	0	0	3	9	1	0	1	0	0	0	1	1	0	0	0	0	15	0	0	0	2	7	1	2	18
Lancaster (T)	1	2	0	7	0	0	0	0	0	3	1	0	0	1	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Lancaster (V)	0	0	0	8	0	0	2	1	0	4	2	1	0	2	6	2	0	1	0	0	0	0	1	2	0	0	0	4	0	0	0	0	5	2	1	1
Marilla (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newstead (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Collins (T)	0	0	0	3	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0	0	2	0	1	1	0	0	4	2	0	0	0	1	1	0	0	0
North Collins (V)	0	0	0	1	0	0	1	0	0	0	0	1	0	1	2	0	0	1	0	0	0	1	1	0	0	0	0	2	0	0	0	0	1	2	0	0
Orchard Park (T)	0	0	0	19	0	0	0	0	0	0	0	0	0	1	4	1	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Orchard Park (V)	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0
Sardinia (T)	0	0	0	1	0	0	0	0	0	3	1	0	0	1	2	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0
Sloan (V)	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3	1	0	0
Springville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonawanda (C)	0	0	0	23	0	0	1	1	0	0	0	1	0	2	4	2	0	1	0	0	0	0	1	0	0	0	0	2	0	0	0	1	4	0	0	0
Tonawanda (T)	0	0	0	21	0	0	0	2	0	1	11	0	0	4	43	3	0	0	0	1	69	0	0	7	0	0	0	4	0	0	0	1	1	0	0	0
Wales (T)	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	1	0	0	0
West Seneca (T)	0	0	0	32	0	0	0	0	0	2	1	0	0	2	12	1	0	0	0	0	6	0	0	0	0	0	0	12	0	0	0	0	6	0	0	2
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**1**	**2**	**3**	**472**	**3**	**1**	**24**	**45**	**3**	**40**	**35**	**5**	**2**	**68**	**231**	**34**	**2**	**10**	**8**	**3**	**82**	**16**	**23**	**31**	**1**	**1**	**41**	**138**	**2**	**1**	**37**	**14**	**75**	**20**	**8**	**71**

Source: Erie County GIS 2020; NYSDOT 2013

C = City; T = Town; V = Village

** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-19 Critical Facility Type Within 0.5 Mile of Roads

Jurisdiction	Critical Facilities within 0.5 Mile of Major Roads																																			
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
Akron (V)	0	0	0	5	0	0	1	0	0	2	0	0	0	1	4	1	0	1	0	0	0	1	1	1	0	0	1	0	0	0	0	1	2	0	0	0
Alden (T)	0	0	0	8	0	0	0	0	2	4	0	0	0	3	4	1	0	0	0	0	2	0	0	1	0	0	7	2	0	0	0	4	1	0	2	0
Alden (V)	0	0	1	1	0	0	1	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	1	0	0	0	1	3	0	0	1	2	1	0	0	0
Amherst (T)	0	0	0	76	0	0	3	6	0	3	6	0	0	13	20	0	0	0	0	0	0	0	3	5	0	0	5	27	0	150	0	16	0	0	2	0
Angola (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	0	0	22	0	1	0	0	0	5	0	0	0	1	1	2	0	0	0	0	0	0	2	2	0	0	7	2	0	0	0	0	0	0	5	0
Blasdell (V)	0	0	0	6	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	2	1	0	0	0	2	1	1	3	0
Boston (T)	0	0	0	10	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	1	0	1	0	0	0	4	1	0	0	0	1	0	0	0	0
Brant (T)	0	0	1	8	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	0	0	5	0	0	0	1	1	1	0	0	0
Buffalo (C)	0	0	0	207	8	0	18	51	2	4	9	1	1	23	88	6	6	1	13	0	4	10	6	10	0	0	4	108	1	86	4	24	1	2	2	0
Cheektowaga (T)	0	4	0	61	0	1	1	3	0	0	4	0	1	13	39	3	1	0	0	0	0	2	2	8	0	2	2	29	0	3	1	10	1	0	9	0
Clarence (T)	0	1	0	7	0	0	1	0	0	2	0	0	0	3	6	1	0	0	0	0	0	1	3	1	0	0	5	5	0	0	2	3	0	0	7	0
Colden (T)	0	0	0	9	0	0	0	0	0	4	0	0	0	1	1	1	0	0	0	1	0	0	2	0	0	0	10	1	0	0	1	1	1	0	0	0
Collins (T)	0	0	1	9	0	0	0	0	0	2	0	0	0	2	0	1	0	1	0	0	0	0	2	4	0	0	5	1	0	0	1	1	1	0	0	0
Concord (T)	0	0	0	15	0	0	0	0	0	8	0	0	0	2	0	1	0	0	0	0	0	0	1	1	0	0	9	0	0	0	0	0	0	0	0	0
Depew (V)	0	0	0	16	0	0	0	1	0	1	0	0	0	2	11	3	0	0	0	0	0	1	1	0	0	0	1	6	1	0	1	3	1	0	7	0
East Aurora (V)	0	0	0	10	0	0	1	1	0	2	0	0	0	2	3	1	0	1	0	0	0	1	0	1	0	0	0	6	0	0	2	0	2	1	4	0
Eden (T)	0	0	0	11	0	0	1	1	0	3	0	1	0	1	3	1	0	1	0	0	0	1	1	2	1	0	3	2	0	0	0	1	1	0	3	0
Elma (T)	0	0	0	22	0	0	0	0	0	3	0	0	0	3	4	0	0	0	0	0	0	0	1	0	4	2	0	0	0	0	2	2	1	0	4	0
Evans (T)	0	0	0	22	0	0	0	0	0	1	0	0	0	5	1	0	0	0	0	0	0	1	2	0	0	0	4	5	0	0	2	3	1	0	4	0
Farnham (V)	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	2	0

Jurisdiction	Critical Facilities within 0.5 Mile of Major Roads																																		
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
Gowanda (V)	0	0	0	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Grand Island (T)	0	0	0	15	0	0	1	0	0	1	1	0	0	3	10	1	0	0	0	0	0	1	1	2	0	0	1	3	0	0	2	1	1	1	0	0
Hamburg (T)	1	1	0	54	0	0	1	0	0	7	0	0	0	10	14	2	0	0	0	1	0	1	4	4	0	0	3	9	0	18	0	2	1	1	31	0
Hamburg (V)	0	0	0	1	0	0	1	1	0	3	0	0	0	1	1	2	0	1	0	0	0	1	0	0	0	0	0	6	0	0	0	6	1	0	2	0
Holland (T)	0	0	1	9	0	0	1	1	0	10	0	0	0	1	2	2	0	0	0	0	0	0	1	3	0	0	9	5	0	0	0	4	1	1	1	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	2	2	0	0	0
Lackawanna (C)	0	0	0	19	0	0	1	2	0	0	5	0	0	3	8	1	0	1	0	0	0	1	1	0	0	0	0	14	0	0	2	6	1	2	15	0
Lancaster (T)	1	2	0	26	0	0	2	0	0	5	1	0	0	4	18	1	0	0	0	0	0	1	2	4	0	0	0	2	0	1	0	4	0	0	11	0
Lancaster (V)	0	0	0	12	0	0	2	1	0	5	0	1	0	2	7	2	0	1	0	0	0	0	1	2	0	0	0	5	0	0	0	7	2	1	1	0
Marilla (T)	0	0	0	5	0	0	0	1	0	4	0	0	0	1	0	2	0	1	0	0	0	0	1	0	0	0	4	1	0	0	0	1	1	0	0	0
Newstead (T)	0	0	1	7	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	1	0	0	0	0	0	6	0	0	0	2	2	0	0	0	0
North Collins (T)	0	0	0	3	0	0	0	0	0	8	0	0	0	2	1	0	0	0	0	0	2	0	1	1	0	0	10	2	0	0	1	1	0	0	0	0
North Collins (V)	0	0	0	1	0	0	1	0	0	0	0	1	0	1	2	0	0	1	0	0	0	1	1	0	0	0	0	2	0	0	0	1	2	0	0	0
Orchard Park (T)	0	0	0	52	0	0	1	1	0	7	3	0	0	5	11	1	1	0	0	1	0	1	0	4	1	2	2	7	0	5	0	1	0	0	7	0
Orchard Park (V)	0	0	0	4	0	0	0	1	0	2	0	0	0	2	0	1	0	1	0	0	0	1	1	0	0	0	0	3	0	0	1	2	2	0	0	0
Sardinia (T)	0	0	0	7	0	2	0	0	0	5	3	0	0	2	2	1	0	0	0	0	0	0	2	0	0	0	9	0	0	0	0	0	1	0	0	0
Sloan (V)	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3	1	0	0	0
Springville (V)	0	0	0	2	0	0	1	1	0	2	0	0	0	3	3	2	1	1	0	0	0	1	1	1	0	0	0	2	0	0	1	3	2	0	0	4
Tonawanda (C)	0	0	0	25	0	0	1	1	0	0	0	1	0	4	6	2	0	1	0	0	0	2	1	3	0	0	0	5	0	0	2	6	1	0	0	0
Tonawanda (T)	0	0	0	38	0	0	1	2	0	2	16	1	0	7	48	3	1	0	0	1	84	1	1	8	0	0	0	20	0	0	1	9	0	0	0	0
Wales (T)	0	0	0	12	0	0	0	1	0	1	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	19	1	0	0	0	2	1	0	0	0

Jurisdiction	Critical Facilities within 0.5 Mile of Major Roads																																			
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
West Seneca (T)	1	1	0	47	0	0	1	1	0	5	2	0	0	7	16	1	0	1	0	0	6	1	1	2	0	0	1	24	0	0	2	11	1	0	11	0
Williamsville (V)	0	0	0	5	0	0	1	0	0	2	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	2	0	0	0
Erie County Total	**3**	**9**	**5**	**876**	**8**	**4**	**43**	**79**	**4**	**115**	**50**	**7**	**2**	**146**	**342**	**50**	**10**	**16**	**13**	**4**	**100**	**35**	**54**	**71**	**6**	**6**	**139**	**315**	**2**	**263**	**33**	**151**	**41**	**10**	**133**	**4**

Source: Erie County GIS 2020; NYSGIS 2020
C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-20 Critical Facility Type Within Unique Buffer Areas of Hazardous Materials Facilities

Juris.	Critical Facilities within Sara Site Radius																																			
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Railway Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Akron (V)	0	0	0	6	0	0	1	0	0	3	0	0	0	1	4	1	0	1	0	0	0	1	1	1	0	0	1	3	0	0	0	0	2	2	0	0
Alden (T)	0	0	0	1	0	0	0	0	1	1	0	0	0	0	4	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1
Alden (V)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	0	0	0	83	0	0	4	5	0	4	7	0	0	12	28	1	1	1	0	0	0	1	3	5	0	0	4	34	0	0	147	0	17	0	1	1
Angola (V)	0	0	0	0	0	0	2	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Blasdell (V)	0	0	0	7	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	2	1	0	1	0	0	2	1	1	3
Boston (T)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

Juris.	Critical Facilities within Sara Site Radius																																			
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Railway Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Brant (T)	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Buffalo (C)	0	0	0	225	8	0	18	56	2	4	9	1	1	25	94	6	6	1	13	0	4	10	9	11	0	0	4	118	1	0	86	4	30	1	2	2
Cheektowaga (T)	1	3	0	64	0	1	2	3	0	2	5	0	1	16	45	3	1	1	0	0	0	2	2	8	0	2	2	27	0	0	3	1	10	1	0	9
Clarence (T)	0	0	0	2	0	0	2	0	0	0	0	0	0	0	13	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Colden (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0
Collins (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concord (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Depew (V)	0	0	0	7	0	0	0	0	0	0	0	0	0	1	11	1	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	1	0	0	5
East Aurora (V)	0	0	0	3	0	0	1	1	0	1	0	0	0	1	3	0	0	1	0	0	0	1	0	0	0	0	0	4	0	0	0	0	0	1	1	1
Eden (T)	0	0	0	3	0	0	1	1	0	1	0	1	0	2	5	1	0	1	0	0	0	1	1	6	1	0	5	3	0	0	0	0	3	1	0	2
Elma (T)	0	0	0	9	0	0	0	0	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	2	3	0	0	1
Evans (T)	0	0	0	4	0	0	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Farnham (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Island (T)	0	0	0	23	0	0	1	0	0	3	2	0	0	4	13	1	0	1	0	0	0	1	1	2	0	0	3	7	0	0	0	2	2	1	2	0
Hamburg (T)	0	0	0	49	0	0	1	0	0	5	0	0	0	9	18	0	0	0	0	1	0	1	3	4	0	0	2	8	0	0	18	0	4	1	1	23
Hamburg (V)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0
Holland (T)	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	3	0	1	0	4	0	0	0	0	1	1	0	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	0	1	0	0	0	1	1	0	0	0	0	2	0	0	0	0	2	2	0	0
Lackawanna (C)	0	0	0	22	0	0	1	2	0	0	6	0	0	4	9	1	0	1	0	0	0	1	1	0	0	0	0	15	0	0	0	2	7	1	2	19
Lancaster (T)	0	1	0	8	0	0	1	0	0	2	1	0	0	1	19	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0	1

Juris.	Critical Facilities within Sara Site Radius																																		
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Railway Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Lancaster (V)	0	0	0	0	0	0	2	0	0	3	2	0	0	0	7	1	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	2	6	1	1	0
Marilla (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newstead (T)	1	9	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
North Collins (T)	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
North Collins (V)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchard Park (T)	0	0	0	31	0	0	1	1	0	3	3	0	0	2	11	1	1	0	0	1	0	0	0	3	1	0	0	10	0	0	5	1	0	0	0	4
Orchard Park (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0
Sardinia (T)	0	0	0	3	0	3	1	0	0	1	0	0	0	1	4	1	0	0	0	0	0	0	1	0	0	0	6	0	0	0	0	0	0	1	0	0
Sloan (V)	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3	1	0	0
Springville (V)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Tonawanda (C)	0	0	0	25	0	0	1	1	0	0	0	1	0	4	6	2	0	1	0	0	0	2	1	3	0	0	0	5	0	0	0	2	6	1	0	0
Tonawanda (T)	0	0	0	40	0	0	1	3	0	2	16	1	0	10	52	4	1	0	0	1	85	1	1	9	0	0	0	24	0	0	0	1	12	0	2	0
Wales (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Seneca (T)	1	1	0	45	0	0	1	0	0	5	2	0	0	8	16	1	0	1	0	0	6	1	1	0	0	0	1	25	0	0	0	2	11	1	0	3
Williamsville (V)	0	0	0	4	0	0	1	0	0	2	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	2	0	0
Erie County Total	**3**	**14**	**1**	**669**	**8**	**4**	**50**	**74**	**3**	**43**	**54**	**4**	**2**	**110**	**397**	**29**	**10**	**11**	**13**	**5**	**101**	**26**	**27**	**57**	**5**	**4**	**36**	**307**	**2**	**1**	**259**	**22**	**130**	**21**	**13**	**76**

Source: Erie County GIS 2020; NYSGIS 2020
C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-21 Critical Facility Types Within 0.5 Mile of Crude Oil Pipelines

Jurisdiction	Critical Facilities within 0.5 Mile of Crude Oil Pipelines																											
	Bridge	Bus Stop	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
Akron (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Angola (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blasdell (V)	7	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	1	0	0	2	1	1	0	0
Boston (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brant (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buffalo (C)	58	2	5	10	1	0	3	1	8	31	1	1	0	2	0	0	4	5	5	2	38	4	1	15	0	0	0	0
Cheektowaga (T)	6	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	0	1	2	1	0	2	0	0	0	0
Clarence (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colden (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collins (T)	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0
Concord (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Depew (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Aurora (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eden (T)	4	0	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	1	1
Elma (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evans (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnham (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Island (T)	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Hamburg (T)	11	0	0	0	0	1	0	0	3	6	0	0	0	0	1	0	1	1	1	2	5	12	0	1	1	0	7	0
Hamburg (V)	1	0	1	1	0	3	0	0	1	1	0	0	1	0	0	0	1	0	0	0	5	0	0	4	1	0	2	0
Holland (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Lackawanna (C)	11	0	1	1	0	0	1	0	2	4	1	0	1	0	0	0	1	1	0	0	9	0	1	3	1	0	2	0
Lancaster (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Critical Facilities within 0.5 Mile of Crude Oil Pipelines																											
	Bridge	Bus Stop	Communications Facility	Community Center	Correctional Facility	Dam	Electric Power Station	EMS	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
Lancaster (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marilla (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newstead (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Collins (T)	0	0	0	0	0	6	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
North Collins (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchard Park (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchard Park (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sardinia (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sloan (V)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	0
Springville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonawanda (C)	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Tonawanda (T)	16	0	1	1	0	0	3	0	3	17	1	0	0	0	1	57	0	1	1	0	7	0	0	5	0	0	0	0
Wales (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Seneca (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**117**	**2**	**8**	**14**	**1**	**13**	**7**	**1**	**25**	**64**	**5**	**1**	**2**	**2**	**2**	**57**	**8**	**9**	**10**	**14**	**71**	**17**	**3**	**35**	**5**	**1**	**12**	**1**

Source: Erie County GIS 2020; EIA 2020
C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-22 Critical Facility Types Within 0.5 Mile of Petroleum Pipelines

Jurisdiction	Critical Facilities within 0.5 Mile of Petroleum Pipelines																			
	Bridge	Communications Facility	Community Center	Dam	Electric Power Station	Fire Station	Hazardous Material	Highway Garage	Library	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Wastewater Pump Station
Akron (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (T)	5	0	0	1	0	0	0	0	0	0	0	0	0	0	7	1	0	0	0	0
Alden (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	12	1	1	0	1	3	3	1	0	0	0	0	1	0	0	6	10	0	2	0
Angola (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blasdell (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boston (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brant (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buffalo (C)	13	0	2	0	0	2	9	0	0	0	0	1	0	0	1	3	0	1	3	0
Cheektowaga (T)	10	0	1	1	1	1	2	2	1	0	0	0	0	0	1	4	0	0	1	6
Clarence (T)	0	1	0	2	0	1	4	1	0	0	0	1	1	1	3	1	0	0	2	0
Colden (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collins (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Concord (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Depew (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
East Aurora (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eden (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elma (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evans (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Farnham (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Island (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hamburg (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hamburg (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holland (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lackawanna (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lancaster (T)	5	0	0	1	0	1	0	2	0	0	0	0	1	0	0	0	0	0	0	1
Lancaster (V)	4	0	0	3	0	0	1	0	1	0	0	0	0	0	0	3	0	2	2	0
Marilla (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newstead (T)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
North Collins (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Collins (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchard Park (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Critical Facilities within 0.5 Mile of Petroleum Pipelines																			
	Bridge	Communications Facility	Community Center	Dam	Electric Power Station	Fire Station	Hazardous Material	Highway Garage	Library	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Wastewater Pump Station
Orchard Park (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sardinia (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sloan (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Springville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonawanda (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonawanda (T)	15	0	1	0	0	4	14	2	0	1	66	0	0	0	0	7	0	1	5	0
Wales (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Seneca (T)	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**68**	**2**	**5**	**8**	**2**	**12**	**33**	**8**	**2**	**1**	**66**	**2**	**3**	**1**	**13**	**29**	**10**	**4**	**15**	**8**

Source: Erie County GIS 2020; EIA 2020
C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-23 Critical Facility Types Within 0.5 Mile of Natural Gas Pipelines

Jurisdiction	Critical Facilities within 0.5 Mile of Natural Gas Pipelines																															
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Pump Station
Akron (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (T)	0	0	0	3	0	0	0	0	4	0	0	0	1	2	1	0	0	0	0	2	0	0	1	0	0	10	1	0	0	0	2	0	1
Alden (V)	0	0	1	2	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	3	0	0	1	2	1	0
Amherst (T)	0	0	0	10	0	0	2	1	0	1	0	0	3	6	1	1	0	0	0	0	0	1	0	0	0	3	7	0	9	0	2	0	0
Angola (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Critical Facilities within 0.5 Mile of Natural Gas Pipelines																																
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Pump Station
Aurora (T)	0	0	0	17	0	0	0	0	7	0	0	0	1	0	1	0	0	0	0	0	0	0	2	0	1	17	2	0	0	0	0	0	3
Blasdell (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boston (T)	0	0	0	12	0	0	1	0	2	1	0	0	1	1	0	0	0	0	0	1	0	2	3	0	1	16	1	0	0	0	1	0	0
Brant (T)	0	0	1	4	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	0	0	0
Buffalo (C)	0	0	0	40	1	0	4	26	1	2	0	0	5	16	1	2	0	1	0	0	3	4	0	0	0	1	34	0	10	1	7	0	0
Cheektowaga (T)	1	4	0	27	0	1	0	0	2	3	0	1	10	21	2	0	0	0	0	0	1	0	6	0	0	0	4	0	0	1	4	1	1
Clarence (T)	0	2	0	12	0	0	1	0	2	0	0	0	2	5	3	0	1	0	1	0	0	1	1	0	0	5	6	0	0	2	5	1	9
Colden (T)	0	0	0	2	0	0	0	0	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0
Collins (T)	0	0	1	1	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0
Concord (T)	0	0	0	9	0	0	0	0	6	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	10	0	0	0	0	0	0	0
Depew (V)	0	0	0	6	0	0	0	0	0	0	0	0	2	2	3	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	4
East Aurora (V)	0	0	0	10	0	0	1	1	2	0	0	0	2	3	0	0	1	0	0	0	1	0	1	0	0	0	6	0	0	2	0	2	5
Eden (T)	0	0	0	1	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	3	1	0	3	0	0	0	0	0	0	0
Elma (T)	0	0	0	15	0	0	0	2	5	1	0	0	3	4	1	0	1	0	0	0	0	2	0	3	0	0	5	0	0	2	4	1	1
Evans (T)	0	0	0	8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
Farnham (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	0	0	2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Grand Island (T)	0	0	0	5	0	0	1	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	1	0	0
Hamburg (T)	0	0	0	9	0	0	0	0	1	0	0	0	2	1	0	0	0	0	1	0	0	1	2	0	0	1	1	0	16	0	1	0	1
Hamburg (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holland (T)	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lackawanna (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lancaster (T)	0	0	0	12	0	0	0	0	3	0	0	0	2	7	2	0	0	0	0	0	1	1	2	0	0	1	0	0	0	0	2	0	2
Lancaster (V)	0	0	0	8	0	0	1	1	3	0	0	0	1	2	1	0	1	0	0	0	0	1	2	0	0	0	5	0	0	0	3	2	1
Marilla (T)	0	0	0	10	0	0	0	0	7	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	11	1	0	0	0	1	1	0
Newstead (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Critical Facilities within 0.5 Mile of Natural Gas Pipelines																															
	Airport	Airport Runway	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Dam	Electric Power Station	EMS	EOC	Fire Station	Hazardous Material	Highway Garage	Hospital	Library	Metro Station	Natural Gas Facility	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Rail Station	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Pump Station
North Collins (T)	0	0	0	7	0	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	0	1	3	0	0	9	2	0	0	0	1	0	0
North Collins (V)	0	0	0	1	0	0	1	0	0	0	1	0	1	2	0	0	1	0	0	0	1	1	0	0	0	0	2	0	0	0	1	2	0
Orchard Park (T)	0	0	0	45	0	0	1	0	6	3	0	0	2	11	1	1	0	0	1	0	0	0	4	1	2	3	9	0	4	1	1	0	8
Orchard Park (V)	0	0	0	2	0	0	0	1	2	0	0	0	2	0	0	0	0	0	0	0	1	1	0	0	0	0	2	0	0	1	2	2	0
Sardinia (T)	0	0	0	4	0	1	0	0	11	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
Sloan (V)	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3	1	0
Springville (V)	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0
Tonawanda (C)	0	0	0	2	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	3	0	0
Tonawanda (T)	0	0	0	15	0	0	1	2	0	0	1	0	4	21	4	0	0	0	1	48	1	0	0	0	0	0	8	0	0	1	5	0	0
Wales (T)	0	0	0	3	0	0	0	1	8	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	1	0	0
West Seneca (T)	0	0	0	27	0	0	0	0	0	1	0	0	3	8	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	2	3	0	2
Williamsville (V)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Erie County Total	**1**	**6**	**3**	**334**	**1**	**2**	**15**	**37**	**100**	**12**	**3**	**1**	**55**	**125**	**26**	**4**	**7**	**1**	**4**	**51**	**9**	**17**	**34**	**5**	**4**	**147**	**128**	**1**	**39**	**17**	**56**	**14**	**38**

Source: Erie County GIS 2020; EIA 2020
C = City; T = Town; V = Village
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-24 FEMA Lifelines Within 0.5 Mile of Hazardous Material Release Areas

FEMA Lifeline Category	Total Number of Lifelines	Estimated Lifeline Exposed to Hazmat Areas		
		Estimated Population within SARA Site Hazard Areas	Estimated Population within 0.5 Mile of Major Roadways	Estimated Population within 0.5 Mile of Major Railways
		Number of Lifelines	Number of Lifelines	Number of Lifelines
Communications	59	54	47	25
Energy	176	161	156	121
Food, Water, Shelter	951	324	530	234
Hazardous Material	398	397	342	231
Health and Medical	144	110	129	66
Safety and Security	1,047	789	913	343
Transportation	1,158	712	913	490
Erie County Total	**3,933**	**2,547**	**3,030**	**1,510**

Source: Erie County GIS 2020; FEMA 2020; NYSDOT 2013; NYSGIS 2020

* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-25 FEMA Lifelines Within 0.5 Mile of Pipelines

FEMA Lifeline Category	Total Number of Lifelines	Estimated Lifelines within 0.5 Mile of Pipelines		
		Crude Oil Pipelines	Petroleum Pipelines	Natural Gas Pipelines
		Number of Lifelines	Number of Lifelines	Number of Lifelines
Communications	59	8	2	17
Energy	176	67	69	68
Food, Water, Shelter	951	73	37	290
Hazardous Material	398	64	33	125
Health and Medical	144	19	9	61
Saftey and Security	1,047	141	64	290
Transportation	1,158	121	68	344
Erie County Total	**3,933**	**493**	**282**	**1,195**

Source: Erie County GIS 2020; EIA 2020; FEMA 2020

* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

In addition to critical facilities and lifelines, an analysis was performed on the number of miles of major transportation routes that are exposed within unique SARA site buffer areas and within 0.5 mile of railways (Table 5.4.7-26). Out of the 5,818 miles of roadway in the county, 3,644.3 miles are exposed to SARA sites and 1,468.4 miles are exposed to a railway release. Additionally, the number of miles of major transportation routes exposed to 0.5 mile of pipelines is summarized in Table 5.4.7-27. A total of 598.6 miles, 425.2 miles, and 1,871.1 miles of roadway are exposed to crude oil pipelines, petroleum pipelines, and natural gas pipelines, respectively.

Table 5.4.7-26 Major Transportation Routes Built Within Unique SARA Site Hazard Areas and Within 0.5 Mile of Railways

		Within Sara Site Hazard Areas		Within 0.5 Mile of Railways	
Road Type	Total Miles	Miles	Percent of Total	Miles	Percent of Total
Local and Private Roads	3,692.5	2,678.9	72.5%	1,050.2	28.4%
County Roads	1,221.3	373.4	30.6%	135.0	11.1%
State Routes	541.7	367.8	67.9%	179.8	33.2%
US Highways	195.0	98.5	50.5%	60.3	30.9%
Interstate	167.5	125.8	75.1%	43.1	25.7%
Erie County Total	**5,818.0**	**3,644.3**	**62.6%**	**1,468.4**	**25.2%**

Source: Erie County GIS 2020; NYSGIS 2020; NYSDOT 2013

* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.7-27 Major Transportation Routes Built Within 0.5 Mile of Pipelines

		Roadways within 0.5 Mile of Pipelines					
		Crude Oil Pipelines		Petroleum Pipelines		Natural Gas Pipelines	
Road Type	Total Miles	Miles	Percent of Total	Miles	Percent of Total	Miles	Percent of Total
Local and Private Roads	3,692.5	473.2	12.8%	290.4	7.9%	1,107.9	30.0%
County Roads	1,221.3	44.2	3.6%	67.8	5.5%	452.7	37.1%
State Routes	541.7	44.4	8.2%	30.6	5.6%	172.6	31.9%
US Highways	195.0	19.6	10.0%	11.3	5.8%	94.9	48.7%
Interstate	167.5	17.2	10.2%	25.2	15.0%	43.0	25.7%
Erie County Total	**5,818.0**	**598.6**	**10.3%**	**425.2**	**7.3%**	**1,871.1**	**32.2%**

Source: Erie County GIS 2020; NYSGIS 2020; EIA 2020

* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Impact on Economy

If a significant hazardous substances incident occurred, not only would life, safety, and building stock be at risk, but the economy of Erie County may be impacted as well. A significant incident in an urban area may force businesses to close for an extended period of time because of contamination or direct damage caused by an explosion, if one occurred. The exact impact on the economy is difficult to determine given the uncertain nature of the size and scope of incidents.

Hazardous substance incidents have the potential to lead to major transportation route closures in Erie County. According to the county, roadways that are considered major transit routes for hazardous materials (and are therefore most at risk for closure) include Interstate 90, Interstate 190, US Route 20, US Route 62, and State Route 5. The closure of waterways, railroads, airports, and highways as a result of these incidents has the potential to impact the ability to deliver goods and services efficiently. Potential impacts may be local, regional, or statewide, depending on the magnitude of the event and the level of service disruptions.

The greatest risk associated with pipelines is the possibility of a fire or explosion, which could potentially damage and destroy infrastructure. In 2019, New York State experienced $1.8 million in damages from pipeline incidents (PHMSA 2019).

Impact on Environment

Hazardous wastes that are released into the environment can be harmful to species and their habitats (EPA 2020). Wastes that get into waterways will be disruptive and sometimes deadly to aquatic species. Consequentially, wastes that get into waterways can also contaminate drinking water supplies. Hazardous wastes can also leach into soils and travel with wind, which not only impacts the local habitat, but can create issues for surrounding communities. Strict disposal regulations have been defined by organizations like EPA to ensure that the environment and community is protected from these types of events.

In addition, pipeline incidents and explosion incidents can profoundly affect the surrounding environment. Contamination of soil, surface water, and groundwater can result in many direct impacts on surrounding populations and ecosystems. When a large volume of product is released, much of it remains unrecovered as product disperses into the environment (Belvederesi, et al. 2018). This can have an immense and lasting impact on the local flora and fauna.

Future Changes That May Impact Vulnerability

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

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

Projected Development

Any areas of growth could be potentially impacted by the hazardous materials hazard. Development near the transit routes for hazardous materials and facilities will increase the county's overall risk. Therefore, the county should take precautions when determining the location of new development to consider the development's proximity to hazardous material facilities and transit routes. The county may also want to consider implementing designs into the new development that enable improved evacuation or protection from residual impacts from the hazardous materials. Section 4, County Profile, includes more information about the county's anticipated and recent new development plans.

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has increased by a negligible amount between 2010 and 2019 (American Community Survey 2019). Estimated population projections provided by the Cornell Program on Applied Demographics indicate that the county's population will increase into 2040, bringing the total population to approximately 945,891 persons (Cornell Program on Applied Demographics 2018). Any changes in the density of population can impact the number of persons living near hazardous materials facilities, transit routes, and pipelines.

Climate Change

As temperatures change, excessive heat on hazardous materials containers may alter the properties of the material. In addition, fixed hazmat storage locations in the floodplain may experience an increase in flood events due to the projected changes in increased precipitation events, such as changes in magnitude and frequency.

Change of Vulnerability Since the 2015 HMP

Overall, the county's vulnerability has not changed, and the entire county will continue to be exposed and vulnerable to hazardous substance incidents. For this HMP update, any additional information regarding localized concerns and past impacts have been collected. Unique buffer areas were established surrounding hazardous material sites. Additionally, exposure regarding railways, major roadways, and pipelines were all documented and analyzed.

5.4.8 Landslide

This section provides a profile and vulnerability assessment of the landslide hazard for the Erie County Hazard Mitigation Plan (HMP).

5.4.8.1 Hazard Profile

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

Description

Landslides are composed of natural rock, soil, artificial fill, or a combination and move along a downward slope. They flow rapidly, striking at avalanche speeds that can travel several miles, growing as they pick up trees, boulders, cars, and other materials (New York State Division of Homeland Security and Emergency Services [NYS DHSES] 2019).

Landslides occur when the slope or soil stability changes from stable to unstable, which may be caused by earthquakes, storms, volcanic eruptions, erosion, fire, or additional human-induced activities. Typically, the steeper the slope, the higher the risk for landslide occurrence. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high. However, landslides can occur with very little slope, sometimes classified as earth slumping or earth flow (NYS DHSES 2019).

Several different types of landslides include:

- *Rock Falls:* Blocks of rock that fall away from a bedrock unit without a rotational component
- *Rock Topples:* Blocks of rock that fall away from a bedrock unit with a rotational component
- *Rotational Slump:* Blocks of fine-grained sediment that rotate and move down slope
- *Transitional Slide:* Sediments that move along a flat surface without a rotational component
- *Earth Flows:* Fine-grained sediments that flow downhill and typically form a fan structure
- *Creep:* A slow-moving landslide often noticed only by presence of crooked trees and disturbed structures
- *Block Slides:* Blocks of rock that slide along a slip plane as a unit down a slope
- *Debris Avalanche:* Predominantly gravel, cobble, boulder, and sediment portions, and trees that move quickly down slope
- *Debris Flows:* Coarse sediments that flow downhill and spread out over relatively flat areas (NYS DHSES 2019)

Extent

Extent of a landslide hazard is determined by identifying affected areas and assessing probability of a landslide occurring within a time period. Natural variables that contribute to overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions. As a result, the landslide hazard is often represented by landslide incidence and susceptibility, defined as follows:

- *Landslide incidence:* Categorized by percentage of a given geographic area that has undergone landslides. High incidence means greater than 15 percent of a given area has been involved in landsliding, medium incidence means that 1.5 to 15 percent of an area has been involved, and low incidence means that less than 1.5 percent of an area has been involved. (Radbruch-Hall et al. 1982).

- *Landslide susceptibility:* Defined as the probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. Assumedly, unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have been involved with landslides in the past. Landslide susceptibility depends on slope angle and geologic material underlying the slope. Landslide susceptibility applies only to areas potentially affected and does not imply a time frame within which a landslide might occur. High, medium, and low susceptibility are delimited by the same percentages used for classifying incidence of landslides (Radbruch-Hall et al. 1982).

Location

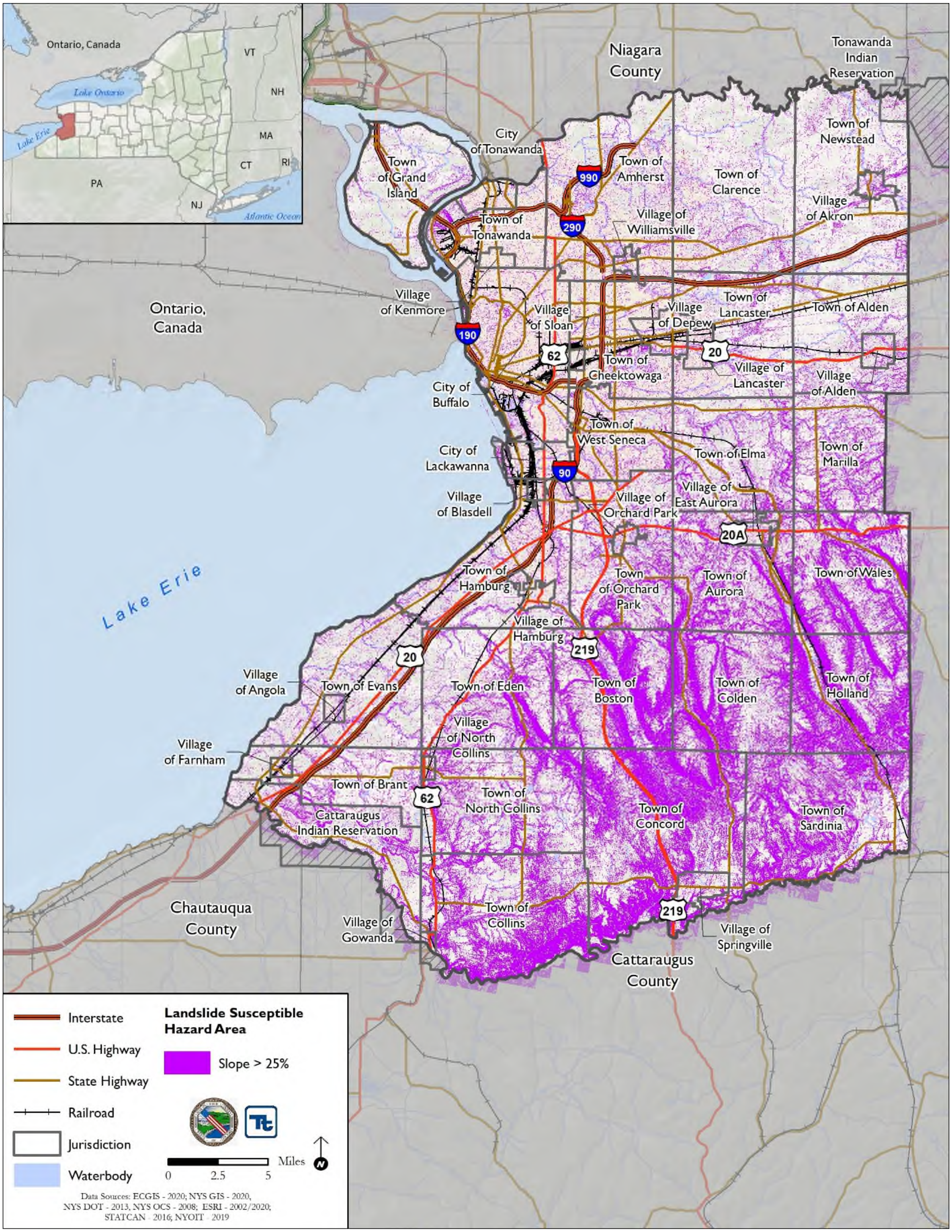
The potential for landslides exists throughout New York State (NYS), including Erie County. Generally, the highest potential for landslides is located along major rivers and lake valleys that were previously glacial lakes resulting in glacial lake deposits (glacial lake clays) and areas associated with steeper slopes.

Landslides in Erie County occur after heavy rains when steep banks wash down into the roadways. Information contained in Erie County's 2015 HMP indicate that the northwestern region of the County is moderately susceptible to landslides. According to New York State Geological Survey's (NYSGS) Landslide Inventory Map of New York, Erie County has had 11 landslide incidences between 1837 to 1989 (NYSGS 1989).

In the 2015 HMP, there are three areas noted as areas of slumping and landslides where individual slides are too numerous to map. Locations included: along Buffalo Creek in East Aurora; Springville/Route 39; Sardinia; Scajaquada Creek in Cheektowaga; and Cayuga Creek in Lancaster.

Figure 5.4.8-1 shows landslide susceptibility based upon areas with slopes greater than 25-percent degrees. Overall, the southern and southeastern portions of the County have the greatest amount of areas with slopes greater than or equal to 25-percent degrees, indicating these areas are more susceptible to landslides than other portions of the County.

Figure 5.4.8-1. Landslide Susceptibility in Erie County



Previous Occurrences and Losses

Descriptive data on historic events are limited. The NYS HMP contained no records of any events from 1996–2017 (NYS DHSES 2019). Between 1837 to 1989, there have been 11 landslides that have occurred within the state (NYSGS 1989). Between 1954 and 2020, the Federal Emergency Management Agency (FEMA) issued one disaster declaration (DR) for landslides in NYS (DR-487), but Erie County was not included in the DR. Annualized loss is negligible for landslide damage.

Probability of Future Occurrences

As indicated in the 2019 NYS HMP, and given the history of landslides in the state, future landslides certainly will occur, but the severity of these landslides cannot be determined. Therefore, probability of future landslides in the state is considered high; however, because documentation on landslides in Erie County is sparse, predicting the extent of future landslides in the County is difficult.

According to the NYSGS Landslide Inventory Study to estimate probability of future landslides (based on documented historical occurrences), NYS can expect on average approximately two major landslides each year, a greater number of smaller but still significant slides, slumps, or flows each year, and at least one landslide causing a fatality once every 12 years.

It is extremely difficult to predict landslide hazards in absolute terms since landslides can occur as a result of many factors within the County, including past landslides and their distribution, bedrock, slope steepness or inclination, hydrologic factor, and human-initiated effects. However, a sufficient understanding of landslide processes within the County exists through various studies and mapping sources to be able to make an estimation of landslide hazard potential. The potential increase in the risk posed by the landslide hazard can be curbed through a continued understanding and mapping of the hazards and improved capabilities to mitigate and respond to the landslide hazard (Spiker and Gori, 2000).

Based on historical records and input from the Planning Partnership, probability of occurrence of landslides in Erie County is considered “rare” (1 to 10 percent annual probability of a hazard event occurring).

Climate Change Impacts

Projecting future climate change within a specific region is challenging. Shorter-term projections are more closely tied to existing trends, rendering longer-term projections even more challenging. The further into the future a prediction extends, the more it is subject to change.

Through the 2020s, average annual temperature is expected to increase by 1.8°F in the region of NYS, where Erie County is located. By the 2050s, this increase will be 3.6 °F, and by 2100, it will be 4.5 °F (New York State Energy Research and Development Authority [NYSERDA] 2014). Future climate change may impact storm patterns, increasing probability of more frequent, intense storms with varying duration. Global temperature increase could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase occurrence and duration of droughts, which could increase probability of wildfire and likely reduce the vegetation that helps support steep slopes. All these factors could increase the probability of landslide occurrence.

5.4.8.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and/or vulnerable to the identified hazard. Because of the lack of spatially delineated landslide hazard areas in the County, a spatial analysis referenced areas with slopes greater than 25 percent to delineate the landslide hazard area. Slope degrees greater than 25 percent are categorized as the most at-risk slopes in the study.

Impact on Life, Health, and Safety

Generally, a landslide event would be an isolated incidence and impact the populations within the immediate area of the incident. Specifically, the population located downslope of the landslide hazard areas are particularly vulnerable to this hazard. In addition to causing damages to residential buildings and displacing residents, landslide events can block off or damage major roadways and inhibit travel for emergency responders or populations trying to evacuate the area.

Table 5.4.8-1 summarizes the population located in the landslide-susceptible hazard area or areas where slopes have degree angles greater than 25 percent. The City of Buffalo has the greatest number of persons located in the landslide-susceptible hazard area with 3,726 people, or 1.5 percent of its total population. The Town of Holland has the greatest percentage of its population located in the landslide-susceptible hazard area (24.7 percent of its total population).

Table 5.4.8-1. Estimated Population Located in the Landslide-Susceptible Hazard Area

Jurisdiction	American Community Survey (2015–2019) Population	Estimated Population Located in the Landslide Hazard Area (Over 25-Percent Grade)	
		Persons Exposed	Percent of Total
Akron (V)	2,871	381	13.3%
Alden (T)	7,418	495	6.7%
Alden (V)	2,577	107	4.1%
Amherst (T)	120,276	2,370	2.0%
Angola (V)	2,373	150	6.3%
Aurora (T)	7,599	1,296	17.1%
Blasdell (V)	2,645	69	2.6%
Boston (T)	8,042	1,637	20.4%
Brant (T)	1,541	109	7.1%
Buffalo (C)	256,480	3,726	1.5%
Cheektowaga (T)	73,129	949	1.3%
Clarence (T)	32,440	2,135	6.6%
Colden (T)	3,328	718	21.6%
Collins (T)	5,418	857	15.8%
Concord (T)	4,186	979	23.4%
Depew (V)	15,102	161	1.1%
East Aurora (V)	6,184	435	7.0%
Eden (T)	7,631	792	10.4%
Elma (T)	11,732	1,198	10.2%
Evans (T)	13,782	1,051	7.6%
Farnham (V)	459	11	2.4%
Gowanda (V)	1,043	90	8.6%
Grand Island (T)	21,047	787	3.7%
Hamburg (T)	45,985	2,121	4.6%
Hamburg (V)	9,636	400	4.2%
Holland (T)	3,355	828	24.7%
Kenmore (V)	15,132	55	0.4%
Lackawanna (C)	17,831	322	1.8%
Lancaster (T)	27,625	843	3.1%
Lancaster (V)	10,144	231	2.3%
Marilla (T)	5,378	720	13.4%
Newstead (T)	5,804	253	4.4%

Jurisdiction	American Community Survey (2015–2019) Population	Estimated Population Located in the Landslide Hazard Area (Over 25-Percent Grade)	
		Persons Exposed	Percent of Total
North Collins (T)	2,130	289	13.6%
North Collins (V)	1,370	118	8.6%
Orchard Park (T)	26,361	2,615	9.9%
Orchard Park (V)	3,148	402	12.8%
Sardinia (T)	2,780	460	16.5%
Sloan (V)	3,562	0	0.0%
Springville (V)	4,298	510	11.9%
Tonawanda (C)	14,830	125	0.8%
Tonawanda (T)	57,027	298	0.5%
Wales (T)	3,020	614	20.3%
West Seneca (T)	45,344	1,544	3.4%
Williamsville (V)	5,233	276	5.3%
Erie County Total	**917,296**	**33,525**	**3.7%**

Source: New York Office of Information Technology Services (NYOIT) 2019; American Community Survey 2019
C = City; T = Town; V = Village; % = Percent
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Socially vulnerable populations (e.g., the elderly and low-income populations) are particularly vulnerable to a landslide event. There are approximately 161,498 persons over 65 and 126,041 persons living below the poverty level in Erie County. The City of Buffalo, which also has the greatest number of people in the steep-slope area, also has the greatest elderly and low-income population (i.e., 31,818 and 74,552 people, respectively).

Impact on General Building Stock

In general, the built environment located in the landslide susceptibility area and the population, structures, and infrastructure located downslope are vulnerable to this hazard. Landslides also have the potential of destabilizing the foundation of structures, which may result in monetary losses to businesses and residents. There are 15,416 buildings with a replacement cost value of $10 billion located in the landslide hazard area countywide. The City of Buffalo has the greatest number of buildings and estimated replacement cost value located in landslide-susceptible hazard area where slopes are greater than 25 percent; there are approximately 1,390 buildings with a total replacement cost value of $2 billion built in the landslide-susceptible hazard area within this city. Table 5.4.8-2 summarizes the exposed building stock located in the landslide susceptibility area throughout the County by jurisdiction.

Table 5.4.8-2. Estimated Number of Buildings in the Landslide Hazard Area

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Located in the Landslide Hazard Area (Over 25-Percent Grade)			
			Number of Buildings Exposed	Percent of Total	Replacement Cost Value Exposed	Percent of Total
Akron (V)	1,275	$866,609,574	170	13.3%	$117,401,954	13.5%
Alden (T)	3,400	$1,748,473,245	221	6.5%	$93,267,906	5.3%
Alden (V)	1,102	$602,655,574	45	4.1%	$26,954,094	4.5%
Amherst (T)	38,528	$27,372,255,690	800	2.1%	$912,304,720	3.3%
Angola (V)	874	$525,704,230	56	6.4%	$25,280,372	4.8%
Aurora (T)	4,280	$2,496,885,036	701	16.4%	$352,913,703	14.1%

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Located in the Landslide Hazard Area (Over 25-Percent Grade)			
			Number of Buildings Exposed	Percent of Total	Replacement Cost Value Exposed	Percent of Total
Blasdell (V)	1,026	$638,571,953	27	2.6%	$8,174,380	1.3%
Boston (T)	4,040	$1,702,475,276	810	20.0%	$327,059,951	19.2%
Brant (T)	1,325	$657,594,060	90	6.8%	$46,067,429	7.0%
Buffalo (C)	83,471	$58,603,851,634	1,390	1.7%	$2,129,933,182	3.6%
Cheektowaga (T)	30,938	$17,530,893,277	411	1.3%	$263,607,732	1.5%
Clarence (T)	13,660	$9,866,246,863	860	6.3%	$606,366,356	6.1%
Colden (T)	2,110	$854,417,381	434	20.6%	$159,653,405	18.7%
Collins (T)	2,521	$1,189,158,504	395	15.7%	$155,847,114	13.1%
Concord (T)	3,245	$1,338,570,261	713	22.0%	$255,837,114	19.1%
Depew (V)	6,532	$3,841,823,815	72	1.1%	$29,857,073	0.8%
East Aurora (V)	2,441	$1,723,816,550	172	7.0%	$137,488,512	8.0%
Eden (T)	4,290	$2,180,455,513	431	10.0%	$191,345,150	8.8%
Elma (T)	6,093	$3,775,039,302	601	9.9%	$314,669,752	8.3%
Evans (T)	7,952	$3,335,060,692	591	7.4%	$200,184,321	6.0%
Farnham (V)	189	$87,990,422	5	2.6%	$2,093,480	2.4%
Gowanda (V)	396	$249,516,940	34	8.6%	$16,484,507	6.6%
Grand Island (T)	8,426	$4,674,517,058	310	3.7%	$195,053,961	4.2%
Hamburg (T)	19,130	$11,911,210,828	866	4.5%	$565,352,691	4.7%
Hamburg (V)	3,794	$2,005,172,252	152	4.0%	$108,984,956	5.4%
Holland (T)	2,182	$1,151,194,342	508	23.3%	$219,050,203	19.0%
Kenmore (V)	6,017	$2,305,529,001	24	0.4%	$15,690,832	0.7%
Lackawanna (C)	6,751	$4,030,622,400	141	2.1%	$84,858,014	2.1%
Lancaster (T)	10,973	$6,845,493,469	338	3.1%	$214,056,427	3.1%
Lancaster (V)	4,323	$2,217,331,122	105	2.4%	$108,123,110	4.9%
Marilla (T)	2,956	$1,099,846,031	392	13.3%	$154,392,271	14.0%
Newstead (T)	4,202	$2,181,758,974	202	4.8%	$114,240,225	5.2%
North Collins (T)	1,898	$889,517,676	245	12.9%	$98,083,140	11.0%
North Collins (V)	551	$383,968,909	47	8.5%	$22,199,405	5.8%
Orchard Park (T)	10,748	$8,174,650,530	1,027	9.6%	$749,658,871	9.2%
Orchard Park (V)	1,211	$867,347,745	155	12.8%	$148,094,403	17.1%
Sardinia (T)	2,184	$1,068,523,829	338	15.5%	$135,243,967	12.7%
Sloan (V)	1,674	$634,998,253	1	0.1%	$537,703	0.1%
Springville (V)	1,816	$1,354,905,864	205	11.3%	$163,147,532	12.0%
Tonawanda (C)	6,452	$3,291,492,557	62	1.0%	$33,783,167	1.0%
Tonawanda (T)	23,999	$14,694,684,404	153	0.6%	$198,182,202	1.3%
Wales (T)	1,923	$833,853,270	389	20.2%	$165,068,400	19.8%
West Seneca (T)	17,970	$9,583,482,689	612	3.4%	$352,447,522	3.7%
Williamsville (V)	2,057	$1,126,868,443	115	5.6%	$84,431,469	7.5%
Erie County Total	**360,925**	**$222,515,035,436**	**15,416**	**4.3%**	**$10,303,472,674**	**4.6%**

Source: New York Office of Information Technology Services (NYOIT) 2019; RS Means 2020; Erie County GIS 2020

C = City; T = Town; V = Village; % = Percent

** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Impact on Critical Facilities and Lifelines

Landslides can also impact the critical facilities in Erie County. There are 567 critical facilities located in the identified landslide susceptibility hazard area, 472 of which are considered lifelines (Table 5.4.8-3). The distribution of critical facilities built within the landslide hazard area are summarized in Table 5.4.8-4. Most of the critical facilities built within the landslide hazard areas are bridges (175 total). Furthermore, ; % *= Percent*

**Please note that only critical facilities exposed to the landslide hazard area are represented in this table. Critical facility types that are found within each municipality but are not exposed to the landslide hazard area may not be listed in the table.*

Table 5.4.8-5 shows the number of lifelines exposed to the landslide-susceptible hazard area in the County. Of the 472 lifelines in the landslide susceptibility area, a majority fall under the Transportation and Food, Water, and Shelter categories (i.e., 179 for each). Section 4 (County Profile) provides more information about these critical facilities and lifelines.

Table 5.4.8-3. Critical Facilities Located in the Landslide-Susceptible Hazard Areas (Slope Degrees >25%)

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Landslide Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	9	30.0%	6	23.1%
Alden (T)	76	68	12	15.8%	9	13.2%
Alden (V)	19	17	0	0.0%	0	0.0%
Amherst (T)	391	387	25	6.4%	25	6.5%
Angola (V)	20	18	2	10.0%	2	11.1%
Aurora (T)	95	81	17	17.9%	12	14.8%
Blasdell (V)	22	22	4	18.2%	4	18.2%
Boston (T)	81	75	18	22.2%	16	21.3%
Brant (T)	39	39	3	7.7%	3	7.7%
Buffalo (C)	751	748	69	9.2%	67	9.0%
Cheektowaga (T)	224	221	11	4.9%	10	4.5%
Clarence (T)	121	115	20	16.5%	20	17.4%
Colden (T)	67	56	24	35.8%	20	35.7%
Collins (T)	71	55	22	31.0%	15	27.3%
Concord (T)	84	68	26	31.0%	18	26.5%
Depew (V)	63	63	2	3.2%	2	3.2%
East Aurora (V)	42	41	5	11.9%	5	12.2%
Eden (T)	78	72	15	19.2%	12	16.7%
Elma (T)	83	75	4	4.8%	2	2.7%
Evans (T)	112	109	18	16.1%	18	16.5%
Farnham (V)	10	10	2	20.0%	2	20.0%
Gowanda (V)	7	7	1	14.3%	1	14.3%
Grand Island (T)	69	66	4	5.8%	3	4.5%
Hamburg (T)	189	181	19	10.1%	17	9.4%
Hamburg (V)	27	23	5	18.5%	3	13.0%
Holland (T)	90	70	34	37.8%	22	31.4%
Kenmore (V)	14	13	1	7.1%	1	7.7%
Lackawanna (C)	94	93	13	13.8%	13	14.0%
Lancaster (T)	109	103	15	13.8%	11	10.7%
Lancaster (V)	58	53	9	15.5%	8	15.1%
Marilla (T)	48	37	11	22.9%	7	18.9%
Newstead (T)	64	61	7	10.9%	7	11.5%
North Collins (T)	69	56	13	18.8%	8	14.3%
North Collins (V)	14	13	0	0.0%	0	0.0%
Orchard Park (T)	141	129	28	19.9%	23	17.8%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Landslide Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Orchard Park (V)	21	18	3	14.3%	3	16.7%
Sardinia (T)	78	57	32	41.0%	20	35.1%
Sloan (V)	8	8	0	0.0%	0	0.0%
Springville (V)	35	32	3	8.6%	1	3.1%
Tonawanda (C)	61	60	5	8.2%	5	8.3%
Tonawanda (T)	266	265	13	4.9%	13	4.9%
Wales (T)	82	68	22	26.8%	20	29.4%
West Seneca (T)	145	140	17	11.7%	16	11.4%
Williamsville (V)	16	14	4	25.0%	2	14.3%
Erie County Total	**4,184**	**3,933**	**567**	**13.6%**	**472**	**12.0%**

Source: New York Office of Information Technology Services (NYOIT) 2019; Erie County GIS 2020

C = City; T = Town; V = Village; % = Percent

** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.8-4. Distribution of Critical Facilities in the Landslide-Susceptible Hazard Area (Slope Degrees >25%) by Type and Jurisdiction

Jurisdiction	Critical Facilities Located in the Landslide Hazard Area (Over 25-Percent Grade)																									
	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Dam	Electric Power Station	EMS	Fire Station	Hazardous Material	Hospital	Library	Metro Station	Oil Facility	Police Station	Potable Water Facility	Potable Water Pumping Station	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Akron (V)	0	2	0	0	0	0	2	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	2	0	0
Alden (T)	0	1	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	6	0	0	0	1	0	0	0
Alden (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	0	9	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	10	0	1	0	0	1
Angola (V)	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	2	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	1
Blasdell (V)	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Boston (T)	0	3	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0
Brant (T)	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buffalo (C)	0	26	1	0	1	3	2	0	0	0	11	0	0	3	1	0	2	0	0	10	7	1	1	0	0	0
Cheektowaga (T)	0	7	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Clarence (T)	0	15	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Colden (T)	0	6	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0
Collins (T)	1	7	0	0	0	0	7	0	0	0	0	0	0	0	0	0	1	0	6	0	0	0	0	0	0	0
Concord (T)	0	5	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0
Depew (V)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
East Aurora (V)	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
Eden (T)	0	1	0	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	4
Elma (T)	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evans (T)	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	0	0	0	0	0	0	3

Jurisdiction	Critical Facilities Located in the Landslide Hazard Area (Over 25-Percent Grade)																									
	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Dam	Electric Power Station	EMS	Fire Station	Hazardous Material	Hospital	Library	Metro Station	Oil Facility	Police Station	Potable Water Facility	Potable Water Pumping Station	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Farnham (V)	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Island (T)	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Hamburg (T)	0	7	0	0	0	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	6
Hamburg (V)	0	1	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Holland (T)	1	1	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	1	0	1	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lackawanna (C)	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	2	2
Lancaster (T)	0	6	0	0	0	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Lancaster (V)	0	3	0	0	0	0	2	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marilla (T)	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
Newstead (T)	0	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
North Collins (T)	0	3	0	0	0	0	5	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0
North Collins (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchard Park (T)	0	16	0	0	0	0	5	1	0	0	4	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
Orchard Park (V)	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Sardinia (T)	0	6	0	2	1	0	12	1	0	0	2	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
Sloan (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Springville (V)	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Critical Facilities Located in the Landslide Hazard Area (Over 25-Percent Grade)																								
	Aquifer	Bridge	Bus Stop	Communication Tower	Communications Facility	Community Center	Dam	Electric Power Station	EMS	Fire Station	Hazardous Material	Hospital	Library	Metro Station	Oil Facility	Police Station	Potable Water Facility	Potable Water Pumping Station	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Tonawanda (C)	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Tonawanda (T)	0	2	0	0	0	0	0	0	0	1	6	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0
Wales (T)	0	3	0	0	0	1	2	0	0	1	0	0	0	0	0	0	0	0	14	0	0	0	1	0	0	0
West Seneca (T)	0	3	0	0	0	0	1	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	6
Williamsville (V)	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**3**	**175**	**1**	**2**	**4**	**4**	**97**	**3**	**1**	**6**	**45**	**1**	**1**	**3**	**2**	**3**	**7**	**1**	**118**	**13**	**18**	**4**	**12**	**5**	**5**	**33**

Source: NYOIT 2017; Erie County GIS 2020

Notes: C = City; T = Town; V = Village; EMS = Emergency Medical Services; % = Percent

**Please note that only critical facilities exposed to the landslide hazard area are represented in this table. Critical facility types that are found within each municipality but are not exposed to the landslide hazard area may not be listed in the table.*

Table 5.4.8-5. Lifelines Located in the Landslide-Susceptible Hazard Area (Slope Degrees >25%)

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Landslide Hazard Area
Communications	59	6
Energy	176	7
Food, Water, and Shelter	951	179
Hazardous Materials	398	45
Health and Medical	144	10
Safety and Security	1,047	46
Transportation	1,158	179
Erie County Total	**3,933**	**472**

Source: NYOIT 2019; Erie County GIS 2020; FEMA 2020

Notes: % = Percent

In addition to critical facilities, a significant amount of infrastructure can be exposed to mass movements of geological material:

- *Roads*—Access to major roads is crucial to life-safety after a disaster event and to response and recovery operations. Landslides can block egress and ingress on roads, causing isolation for neighborhoods, traffic problems, and delays for public and private transportation. This can result in economic losses for businesses.
- *Bridges*—Landslides can significantly impact road bridges. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.
- *Power Lines*—Power lines are generally elevated above steep slopes, but the towers supporting them can be subject to landslides. A landslide could trigger failure of the soil underneath a tower, causing it to collapse and ripping down the lines. Power and communication failures due to landslides can create problems for vulnerable populations and businesses.
- *Rail Lines*—Similar to roads, rail lines are important for response and recovery operations after a disaster. Landslides can block travel along the rail lines, which would become especially troublesome because it would not be as easy to detour a rail line as it is on a local road or highway. Many residents rely on public transport to get to work around the County and into Philadelphia and New York City, and a landslide event could prevent travel to and from work.

Impact on the Economy

The impact of a landslide on the economy and estimated dollar losses are difficult to measure. As stated earlier, landslides can exert direct and indirect effects on society. Direct costs include actual damage sustained by buildings, property, and infrastructure and estimated costs to repair or replace damaged buildings. Indirect costs include clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity. The 2019 NYS HMP shows that Erie County has experienced zero economic damages from landslide events between 1996 and 2017 (NYS HMP 2019). Historic losses discussed earlier in this section also show that Erie County has not experienced any economic losses from landslides besides one event that was reported to have caused $250,000 in damages (1980s dollars). Therefore, the impact landslides have on the economy for Erie County is minimal.

Impact on the Environment

A landslide event alters the landscape. In addition to changes in topography, vegetation and wildlife habitats may be damaged or destroyed. Soil and sediment runoff will accumulate downslope, potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Additional environmental impacts include loss of forest productivity.

Furthermore, soil and sediment runoff can accumulate downslope potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Mudflows that erode into downstream waterways can threaten the life of freshwater species (USGS 2020). The impacts of eroded landscape can travel for miles downstream into adjacent waterways and create issues for surrounding watersheds.

Cascading Impacts on Other Hazards

Landslide events can have cascading impacts on utility failure in Erie County. As discussed in earlier sections, landslides may disrupt the functionality of utilities if the debris falls, topples, or spreads over the utilities providing services to the County. For example, electric utilities may become disconnected if power lines are broken from displaced geologic material. Water utilities may become breached with excess debris and/or contaminants carried by landslide events. More information about utility interruptions can be found in Section 5.4.12, Utility Failure.

Future Changes that May Impact Vulnerability

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

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

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth located in the landslide-susceptible hazard areas could be potentially impacted by the geologic ground movement caused by landslides. It is recommended that the County and jurisdictional partners implement design strategies that mitigate against the risk of landslides. The maps in the jurisdictional annexes in Section 9 show new development locations throughout the county and their proximity to the landslide-susceptible hazard areas (i.e., where slope degrees are greater than 25 percent).

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has remained stable between 2010 and 2019 (919,040 persons in 2010 and 919,355 persons in 2019). Estimated population projections provided by the 2017 Cornell Program on Applied Demographics indicate that the County's population will decrease into 2040, decreasing the total population to approximately 769,396 persons (Cornell Program on Applied Demographics 2017). While fewer people will reside in the County, those that remain may move into areas that are susceptible to landslide events. Section 4, County Profile, provides additional discussion on population trends.

Climate Change

A direct impact of climate change on landslides is difficult to determine. However, as discussed earlier, multiple secondary effects of climate change have the potential to increase the likelihood of landslides. Warming temperatures resulting in wildfires would reduce vegetative cover along steep slopes and destabilize the soils due to destruction of the root system; increased intensity of rainfall events would increase saturation of soils on steep slopes. Under these future conditions, the County's assets located on or at the base of these steep slopes will have an increased risk to landslides. Roadways and other transportation infrastructure located in these areas will also be at an increased risk of closure, which would impact the County's risk as described above.

Change of Vulnerability Since 2015 HMP

The 2015 HMP included a quantitative assessment of the historical occurrences, areas of slumping, and land sliding areas identified by USGS and NYSGS. For this HMP, slope data was derived from the 2019 New York Office of Information Technology Services (NYOIT) Digital Elevation Model (DEM). Areas within Erie County that have slope degrees greater than 25 percent were selected as areas with landslide susceptibility. Population statistics have also been updated using the 5-Year 2015-2019 American Community Survey Population Estimates. The general building stock was updated using RSMeans 2020 building valuations that estimated replacement cost value for each building in the inventory.

5.4.9 Pandemic

This section provides profile information, including description, location, extent, previous occurrences and losses, probability of future occurrences, and climate change impacts as well as the vulnerability assessment for the epidemic hazard in Erie County.

5.4.9.1 Hazard Profile

Description

An outbreak or an epidemic exists when there are more cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time. An aggregation of cases in a given area over a particular period, regardless of the number of cases, is called a cluster. In an outbreak or epidemic, it is presumed that the cases are related to one another or that they have a common cause (Center for Disease Control and Prevention [CDC] 2004). Diseases that impact Erie County include foodborne illness, vaccine-preventable disease, and vector-borne diseases (tick-borne and mosquito-borne). However, for the disease outbreak profile, the county identified influenza, the Ebola virus, and COVID-19 as the diseases that may lead to an epidemic.

Influenza

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

Pandemic influenza is different from seasonal influenza (or "the flu") because outbreaks of seasonal flu are caused by viruses that are already among people. Pandemic influenza is caused by an influenza virus that is new to people and is likely to affect many more people than seasonal influenza. In addition, seasonal flu occurs every year, usually during the winter season, while the timing of an influenza pandemic is difficult to predict. Pandemic influenza is likely to affect more people than the seasonal flu, including young adults. A severe pandemic changes daily life for some time, including limitations on travel and public gatherings (CDC 2016).

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

Ebola Virus

Ebola, previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by infection with one of the Ebola virus strains. According to the CDC, the 2014 Ebola epidemic was the largest in history, affecting multiple countries in West Africa. From 2014–2016, 11 people were treated in the United States, two of whom died (CDC 2019).

COVID-19 Virus

Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness (WHO 2020). With the virus being relatively new, information regarding transmission and symptoms of the virus is still fresh. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Illnesses have ranged from mild symptoms to severe illness and death. Reported symptoms include flu-like symptoms, trouble breathing, persistent pain or pressure in the chest, headaches, and loss of taste. Symptoms may appear 2–14 days after exposure to the virus (based on the incubation period of MERS-CoV viruses) (CDC 2020).

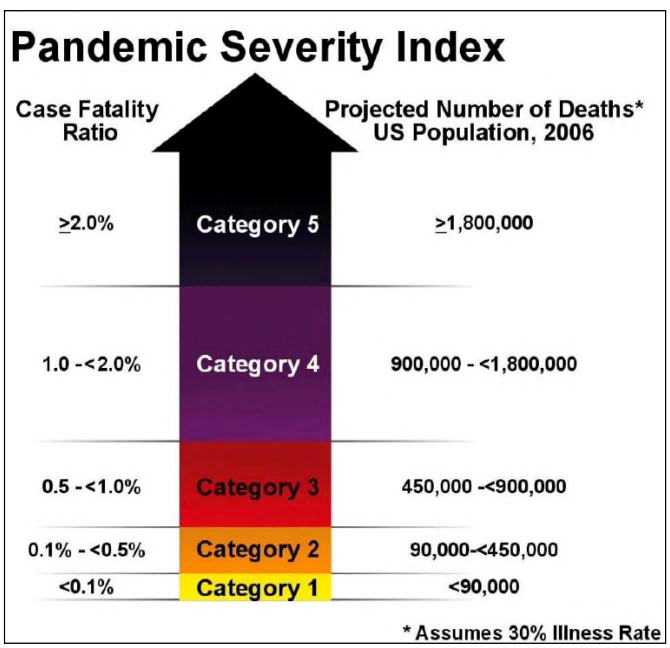
In order to slow the spread of the virus, the federal government and states have urged the public to avoid touching of the face, properly wash hands often, wear a face mask in public areas, and use various social distancing measures. Vaccines and treatments have been developed and are continuing to be refined for COVID-19. Many ongoing clinical trials are evaluating potential treatments (WHO 2020).

Extent

The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness. The Ebola virus is spread to others through direct contact; it is not spread through the air like influenza or COVID-19.

The CDC and Prevention Community Strategy for Pandemic Influenza Mitigation guidance introduced a Pandemic Severity Index (PSI), which uses the case fatality ratio as the critical driver for categorizing the severity of a pandemic. The index is designed to estimate the severity of a pandemic on a population to allow better forecasting of the impact of a pandemic and to enable recommendations on the use of mitigation interventions that are matched to the severity of influenza pandemic. Pandemics are assigned to one of five discrete categories of increasing severity (Category 1 to Category 5) (CDC 2016). Figure 5.4.9-1 illustrates the five categories of the PSI.

Figure 5.4.9-1. Pandemic Severity Index



Source: CDC 2016

WHO and CDC identify pandemics according to a number of pandemic classification levels. Additionally, New York State Department of Health (NYSDOH) and State Emergency Operations Center (EOC) have their own activation levels in response to a pandemic event. Multiple waves of a pandemic can be anticipated throughout the life cycle of an event. Refer to https://www.health.ny.gov/diseases/communicable/influenza/pandemic/ for information regarding the various levels in New York State.

Location

Erie County's geographic location and demographic characteristics make it vulnerable to importation and spread of infectious diseases. The county has experienced the effects of a pandemic or diseases outbreak, including influenza and COVID-19. There are some densely populated municipalities in the county, which can lead to the spread of influenza and COVID-19 more quickly than less densely populated communities. See Section 4 (County Profile) for a population density map of Erie County.

Previous Occurrences and Losses

Between 1954 and 2020, New York State was included in two disease outbreak-related emergency (EM) declarations, classified as a virus threat due to both West Nile Virus (EM-3155, May–November 2000) and COVID-19 (EM-3434, January 2020–Ongoing) impacting the State. Generally, epidemic disasters cover a wide region of the State; therefore, they may have impacted many, but not all, counties. Erie County was included in these two declarations (Federal Emergency Management Agency [FEMA] 2020). Table 5.4.9-1 provides details on epidemic episodes that occurred in Erie County between 2015 and 2020.

Table 5.4.9-1. Influenza, Ebola and COVID-19 Epidemics Affecting Erie County, 2015 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
2020 & ongoing	COVID-19	EM-3434	Yes	COVID-19 epidemic. 1,600 deaths in county reported (as of March 5, 2021
2019–(June) 2020 Season	Influenza	N/A	N/A	454 cases of influenza reported
2015–2016 Season	Influenza	N/A	N/A	117 cases of influenza reported
2016–2017 Season	Influenza	N/A	N/A	63 cases of influenza reported
2017–2018 Season	Influenza	N/A	N/A	284 cases of influenza reported
2018–2019 Season	Influenza	N/A	N/A	288 cases of influenza reported
2015–2019	Ebola	N/A	N/A	0 confirmed cases of Ebola

Source: NYSDOH 2021
*Note: *COVID-19 count as of March 5, 2021*

Probability of Future Events

Predicting the future occurrences of disease outbreaks is difficult; however, based on the history of occurrences in Erie County, it is possible to predict the likelihood of a disease outbreak impacting the County. Additionally, increases in population and population density in the county have the potential to increase exposure and susceptibility of its residents to outbreaks.

In Section 5.3, the identified hazards of concern for Erie County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for disease outbreaks in the county is considered "occasional" (likely to occur within 100 years, as presented in Table 5.3-1).

Impacts of Climate Change

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea-level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the State's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Erie County is part of geographical Region 1, Western New York and the Great Lakes Plain. Some of the issues in this region affected by climate change include: relatively low seasonal rainfall and increased summer drought risk, high-value crops could need irrigation, and growing conditions will improve for some crops, such as grapes. (NYSERDA 2014). The relationship between climate change and increase in infectious diseases is difficult to predict with certainty; there are scientific linkages between the two. As warm habitats that host insects such as mosquitoes increase, more of the population becomes exposed to potential virus threats (The Washington Post, 2017).

Temperatures and precipitation amounts are expected to increase throughout the State as well as within Region 1. Within Region 1, temperatures are anticipated to increase between 4.3 to 6.3 ºF by the 2050s and 5.7 to 9.6 ºF by the 2080s (baseline of 47.7 ºF, middle-range projection). Precipitation totals will increase between 4 and 10 percent by the 2050s and 6 to 13 percent by the 2080s (baseline of 34.0 inches, middle-range projection).

Annual temperatures have been rising throughout New York State since the start of the 20th century. State average temperatures have increased by approximately 0.6 °F since 1970, with winter warming exceeding 1.1 °F per decade. Extreme heat events are likely to increase throughout New York State, and short-duration warm season droughts will become more common (NYSERDA 2014).

With the increase in temperatures, heat waves will become more frequent and intense, as shown in Table 5.4.9-2 below. Heat waves are defined as three or more consecutive days with maximum temperatures at or above 90 ˚F. Summer droughts are projected to increase under these conditions, affecting water supply, agriculture, ecosystems, and energy projects (NYSERDA 2014).

Table 5.4.9-2. Extreme Event Projections for Region 1

Middle Range (25th to 75th Percentile)	2020s	2050s	2080s
Days over 90 °F (8 days)	14 to 17	22 to 34	27 to 57
# of Heat Waves (0.7 heat waves)	2 to 2	3 to 4	3 to 8
Duration of Heat Waves (4 days)	4 to 4	4 to 5	5 to 6
Days below 32 °F (133 days)	103 to 111	84 to 96	68 to 88
Days over 1" Rainfall (5 days)	5 to 5	5 to 5	5 to 6
Days over 2" Rainfall (0.6 days)	0.6 to 0.7	0.6 to 0.8	0.6 to 0.9

Source: NYSERDA 2014

Warmer temperatures and changing rainfall patterns provide an environment where mosquitoes can remain active longer, greatly increasing the risk for animals and humans. Lyme disease could also expand throughout the United States as temperatures warm, allowing ticks to move into new areas of the country. The changes in climate can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resources Defense Council 2017).

An increase in temperature and humidity may also lead to a larger number of influenza outbreaks. Studies have shown that warmer winters lead to an increase in influenza cases. During warm winters, fewer people contract influenza, which causes a large number in population to remain vulnerable into the next season. This causes an early and strong occurrence of the virus (Natural Resources Defense Council 2018).

5.4.9.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For disease outbreaks, all of Erie County is considered exposed to the hazard. Therefore, all assets in the county, as described in the County Profile (Section 4), are exposed and potentially vulnerable.

Impact on Life, Health, and Safety

The entire population of Erie County is vulnerable to the epidemic hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. As of February 27, 2021, the total confirmed cases of COVID within the county over the past year was 64,838 and the death toll was 1,651.

Most recently with COVID-19, the CDC has indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as cancer, chronic kidney disease, severe obesity, serious heart conditions, immunocompromised, etc. are at a higher risk of getting severely ill (CDC 2020). Population data from the 2019 U.S. Census Population Estimates indicates that 161,806 persons over 65 years old in Erie County would be considered at risk for getting severely ill from the COVID-19 virus. While the statistics of this virus are subject to change during the publication of this Hazard Mitigation Plan (HMP), the New York Department of Health dashboard shows that there is a higher percentage of illnesses within this particular age group.

Impact on General Building Stock, Critical Facilities, and Lifelines

No structures are anticipated to be directly affected by epidemics. An important secondary impact of a pandemic is that health care facilities can become overwhelmed with patient numbers and intensity of care needs.

Impact on Economy

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

Most recently, the New York State Health Department has played an active role in maintaining and controlling COVID-19 protocols across the state. This activity requires additional costs from the State and Erie County to manage COVID-19 in the communities. Further, there has been secondary economic impact of closing non-essential facilities to reduce the spread of the virus. At the time of this HMP Update, the final costs of this virus are yet to be determined.

Impact on Environment

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

Cascading Impacts on Other Hazards

There are no known cascading impacts that disease outbreaks can cause to other hazards of concern for Erie County.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the county can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and how they interact can also provide insight about ways to plan.

Project Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the county. Any areas of growth could be potentially impacted by the epidemic hazard because the entire planning area is exposed and vulnerable.

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has increased by a negligible amount between 2010 and 2019 (U.S. Census Bureau 2020). Estimated population projections provided by the Cornell Program on Applied Demographics indicate that the county's population will grow overall up to 2040, resulting in a projected population of 945,891 persons. (Cornell Program on Applied Demographics 2017). While fewer people will reside in the county, those who remain are still vulnerable to an epidemic or pandemic event. Section 4, County Profile, presents additional discussion on population trends.

Climate Change

The relationship between climate change and infectious diseases is somewhat controversial. The notion that rising temperatures will increase the number of mosquitoes that can transmit diseases among humans (rather than just shift their range) has been the subject of debate over the past decade. Climate change may affect the spread of disease. However, many researchers point out that climate is not the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. Climate change accelerations may likely work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (American Journal of Epidemiology 2019).

Changes in Vulnerability Since the 2015 HMP

An epidemics analysis was not conducted as part of the 2015 HMP risk assessment. Therefore, it is not possible to compare the change in vulnerability to the pandemic hazard.

5.4.10 Severe Storm

This section provides a hazard profile and vulnerability assessment of the severe storm hazard for the Erie County Hazard Mitigation Plan (HMP).

5.4.10.1 Hazard Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, and probability of future occurrences for the severe storm hazard.

Description

For the purpose of this HMP update and as deemed appropriate by Erie County, the severe storm hazard includes thunderstorms, lightning, hailstorms, windstorms, tornadoes, and hurricanes/tropical storms, which are defined in the sections below.

Thunderstorms

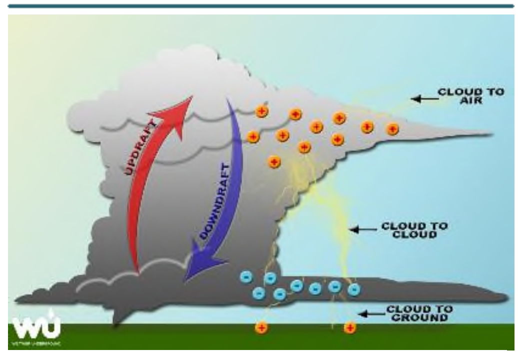
A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (National Weather Service [NWS] 2009). A thunderstorm forms from a combination of moisture; rapidly rising warm air; and a force capable of lifting air, such as a warm front, cold front, a sea breeze, or a mountain. Thunderstorms form from the equator to as far north as Alaska. Although thunderstorms generally affect a small area when they occur, they have the potential to become dangerous due to their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and lightning.

Thunderstorms can lead to heavy rain-induced flooding, landslides, strong winds, and lightning. Roads may become impassable from flooding, downed trees or power lines, or a landslide. Downed power lines can lead to loss of utility services, such as water, phone, and electricity. Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. During the summer, thunderstorms are responsible for most of the rainfall.

Lightning

Lighting is a bright flash of electrical energy produced by a thunderstorm. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel. All thunderstorms produce lightning and are very dangerous. Lightning ranks as one of the top weather killers in the United States, killing approximately 50 people and injuring hundreds each year. Lightning can occur anywhere there is a thunderstorm. Lightning can be cloud to air, cloud to cloud, and cloud to ground. Figure 5.4.10-1 illustrates the variety of lightning types.

Figure 5.4.10-1. Types of Lightning

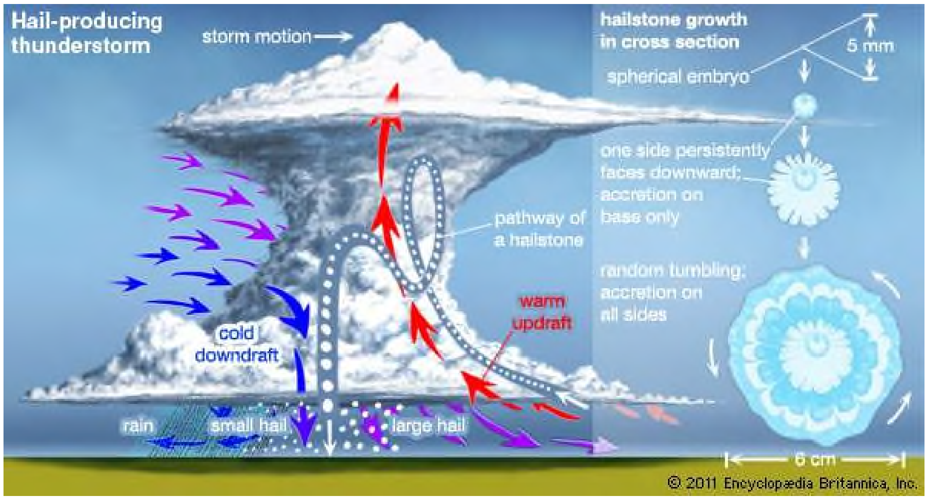


Source: Weather Underground n.d.

Hailstorms

Hail forms inside a thunderstorm or other storms with strong updrafts of warm air and downdrafts of cold water. If a water droplet is picked up by the updrafts, it can be carried well above the freezing level. Water droplets freeze when temperatures reach 32 degrees Fahrenheit (°F) or colder. As the frozen droplet begins to fall, it may thaw as it moves into warmer air toward the bottom of the thunderstorm. However, the droplet may be picked up again by another updraft and carried back into the cold air and re-freeze. With each trip above and below the freezing level, the frozen droplet adds another layer of ice. The frozen droplet, with many layers of ice, falls to the ground as hail. Most hail is small and typically less than 2 inches in diameter (NWS 2010). Figure 5.4.10-2 shows how hail is formed within thunderstorms.

Figure 5.4.10-2. Hail Formation in Thunderstorms



Source: Encyclopedia Britannica 2011

Windstorms

Wind begins with differences in air pressures and occurs through rough horizontal movement of air caused by uneven heating of the earth's surface. Wind occurs at all scales, from local breezes lasting a few minutes to global winds resulting from solar heating of the earth. High winds are often associated with other severe weather events such as thunderstorms, derechos, tornadoes, nor'easters, hurricanes, and tropical storms (all discussed further in this section).

Tornadoes

A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 250 miles per hour (mph). Damage paths can be greater than 1 mile wide and 50 miles long. Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes typically move at speeds between 30 and 125 mph and can generate combined wind speeds (forward motion and speed of the whirling winds) exceeding 300 mph. The lifespan of a tornado rarely is longer than 30 minutes (Federal Emergency Management Agency [FEMA] 1997). Tornadoes can occur at any time of the year, with peak seasons at different times for different states (National Oceanic and Atmospheric Administration [NOAA] National Severe Storms Laboratory [NSSL] 2013).

Hurricanes and Tropical Storms

Tropical cyclones (hurricanes) are fueled by a different heat mechanism than other cyclonic windstorms such as nor'easters and polar lows. The characteristic that separates a tropical storm from another cyclonic system is that at any height in the atmosphere, the center of a tropical storm will be warmer than its surroundings, a phenomenon called "warm core" storm systems (NOAA 2013). Tropical cyclones strengthen when water evaporated from the ocean is released as the saturated air rises, resulting in condensation of water vapor contained in the moist air. Tropical cyclones begin as disturbed areas of weather, often referred to as tropical waves. As the storm organizes, it is designated as a tropical depression.

A tropical storm system is characterized by a low-pressure center and numerous thunderstorms that produce strong winds of 39 to 73 mph and heavy rain. A hurricane is a tropical storm that attains hurricane status when its wind speed reaches 74 mph or higher. Tropical systems may develop in the Atlantic between the Lesser Antilles and the African coast or may develop in the warm tropical waters of the Caribbean and Gulf of Mexico. These storms may move up the Atlantic coast of the United States and impact the eastern seaboard or move into the United States through the states along the Gulf Coast, bringing wind and rain as far north as New England before moving offshore and heading east.

Despite Erie County's inland location, coastal storms, such as hurricanes and tropical storms, can impact the County (New York State [NYS] Division of Homeland Security and Emergency Services [DHSES] 2014). Hurricanes and tropical storms can impact Erie County from June to November, the official eastern U.S. hurricane season; however, late July to early October is the most likely period for hurricanes and tropical storms to impact the county due to the cooling of the North Atlantic Ocean waters (NYS DHSES 2019). Although one of the most severe impacts associated with hurricanes is storm surge, due to Erie County's location, storm surge is not a concern for the county and has not been detailed in this profile.

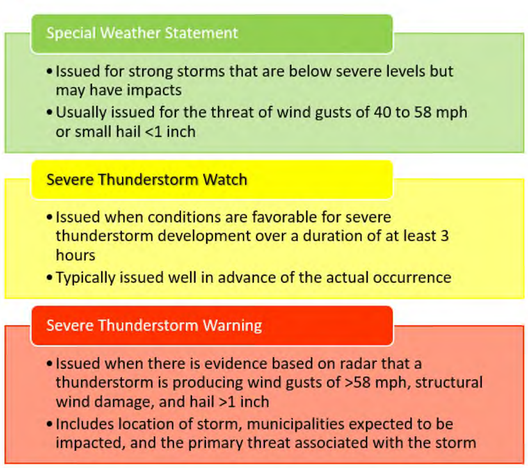
Extent

The extent (severity or magnitude) of a severe storm is largely dependent upon the most damaging aspects of each type of severe weather. This section describes the extent of thunderstorms, lighting, hail, windstorms, tornadoes, and hurricanes and tropical storms in Erie County. Historical data presented in Table 5.4.10-1 show the most powerful severe weather records in Erie County.

Table 5.4.10-1. Severe Storm Extent in Erie County

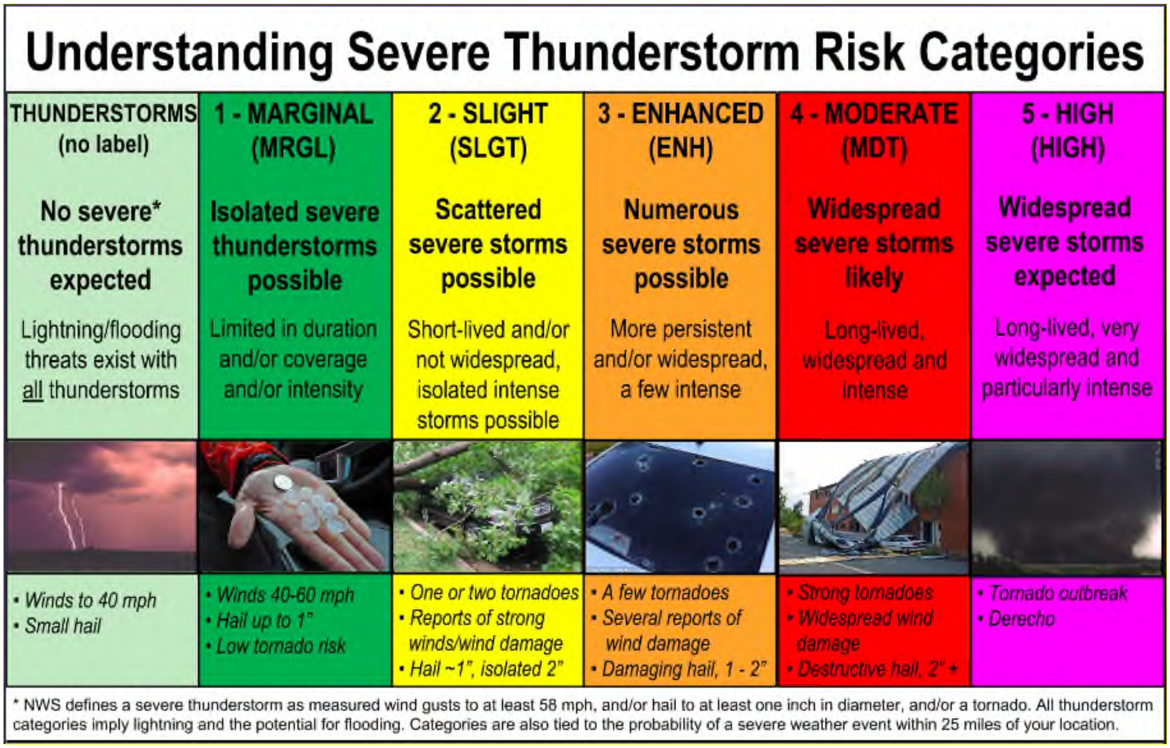
Extent of Severe Storms in Erie County	
Largest Hailstone on Record	2.0 inches
Highest Wind Speed on Record	75 mph
Strongest Tropical Storm/Hurricane on Record	No events in the county

Thunderstorms



NWS considers a thunderstorm severe if it produces damaging wind gusts of 58 mph or higher, hail 1 inch (quarter size) in diameter or larger, or tornadoes (NWS 2010). Severe thunderstorm watches and warnings are issued by the local NWS office and NOAA's Storm Prediction Center (SPC). NWS and SPC will update the watches and warnings and will notify the public when they are no longer in effect. In addition, the SPC issues severe thunderstorm risk maps based on the likelihood of different severities of thunderstorms. Figure 5.4.10-3 shows the SPC's severe thunderstorm risk categories.

Figure 5.4.10-3. Severe Thunderstorm Risk Categories



Source: NOAA SPC 2017

Lightning

Lightning is most often associated with moderate to severe thunderstorms. The severity of lightning refers to the frequency of lightning strikes during a storm. The New York City Office of Emergency Management (NYC OEM) notes that lightning strikes occur with moderate frequency in the State of New York, with 3.8 strikes occurring per square mile each year. Multiple devices are available to track and monitor the frequency of lightning.

Hail

The severity of a hailstorm is measured by duration, hail size, and geographic extent. Most hail stones from hailstorms are made up of variety of sizes. Only the very largest hail stones pose serious risk to people, if exposed (NYS DHSES 2014). The size of hail is estimated by comparing it to a known object. Table 5.4.10-2 describes the different sizes of hail as compared to real-world objects and lists approximate measurements.

Table 5.4.10-2. Hail Size

Description	Diameter (in inches)	Description	Diameter (in inches)
Pea	0.25	Golf ball	1.75
Marble or mothball	0.50	Hen's egg	2.00
Penny or dime	0.75	Tennis ball	2.75
Nickel	0.88	Baseball	2.75
Quarter	1.00	Tea cup	3.00
Half dollar	1.25	Grapefruit	4.00

Description	Diameter (in inches)		Description	Diameter (in inches)
Walnut or ping pong ball	1.50		Softball	4.50

Source: NYS DHSES 2014

Tornado

The magnitude or severity of a tornado is categorized using the Enhanced Fujita Tornado Intensity Scale (EF Scale). Figure 5.4.10-4 illustrates the relationship between EF Scale ratings, wind speed, and expected tornado damage.

Figure 5.4.10-4. Enhanced Fujita Tornado Intensity Scale Ratings, Wind Speeds, and Expected Damage

Source: NWS 2018

Tornado watches and warning are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar. The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible (NOAA 2011).

Windstorms

Table 5.4.10-3 provides the NWS descriptions of winds during wind-producing events.

Table 5.4.10-3. NWS Wind Descriptions

Descriptive Term	Sustained Wind Speed (mph)
Strong, dangerous, or damaging	≥40
Very windy	30-40
Windy	20-30
Breezy, brisk, or blustery	15-25

Descriptive Term	Sustained Wind Speed (mph)
None	5-15 or 10-20
Light or light and variable wind	0-5

Source: NWS 2015

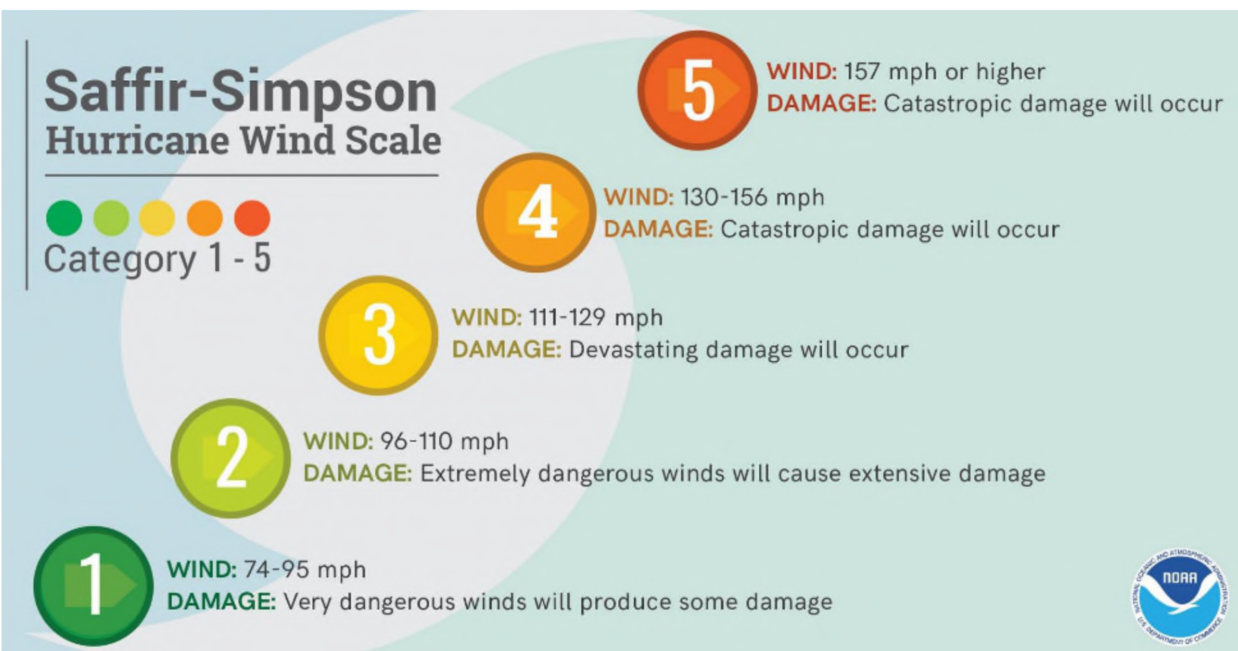
NWS issues advisories and warnings for winds, which are normally site-specific. High wind advisories, watches, and warnings are issued by the NWS when wind speeds may pose a hazard or may be life-threatening. The criterion for each of these varies from state to state. Wind warnings and advisories for New York State are as follows:

- *High Wind Warnings* are issued when sustained winds of 40 mph or greater are forecast for 1 hour or longer, or wind gusts of 58 mph or greater are forecast for any duration.
- *Wind Advisories* are issued when sustained winds of 30 to 39 mph are forecast for one 1 hour or longer, or wind gusts of 46 to 57 mph are forecast for any duration (NWS n.d.).

Hurricanes and Tropical Storms

The extent of a hurricane or tropical storm is commonly categorized in accordance with the Saffir-Simpson Hurricane Wind Scale, which assigns a designation of tropical storm for storms with sustained wind speeds below 74 mph and a hurricane category rating of 1 to 5 based on a hurricane's increasing sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Tropical storms and Category 1 and 2 hurricanes are dangerous and require preventative measures (NOAA 2013). Figure 5.4.10-5 presents this scale, which is used to estimate the potential property damage and flooding expected when a hurricane makes landfall.

Figure 5.4.10-5. The Saffir-Simpson Hurricane Wind Scale

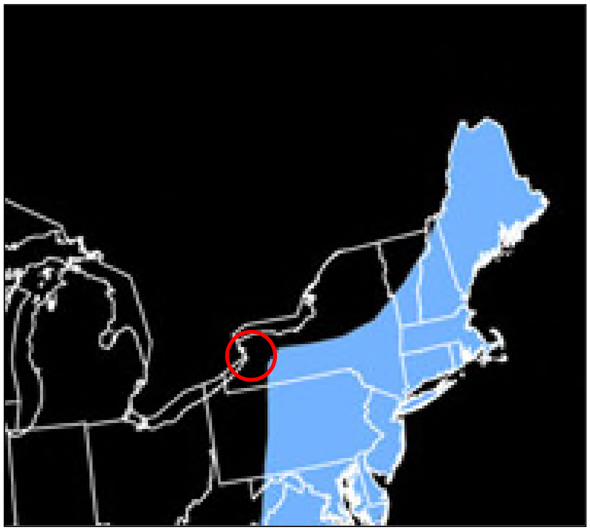


Source: NOAA - Disaster Preparedness Portal 2017

Mean Return Period

In evaluating the potential for hazard events of a given magnitude, a mean return period (MRP) is often used. The MRP provides an estimate of the magnitude of an event that may occur within any given year based on past recorded events. MRP is the average period, in years, between occurrences of a hazard event, equal to the inverse of the annual frequency of exceedance (Dinicola 2009). Figure 5.4.10-6 shows the number of hurricanes expected for the 100-year MRP in the northeast region. Erie County is on the edge of the area that could expect 20–40 hurricanes in a 100-year period.

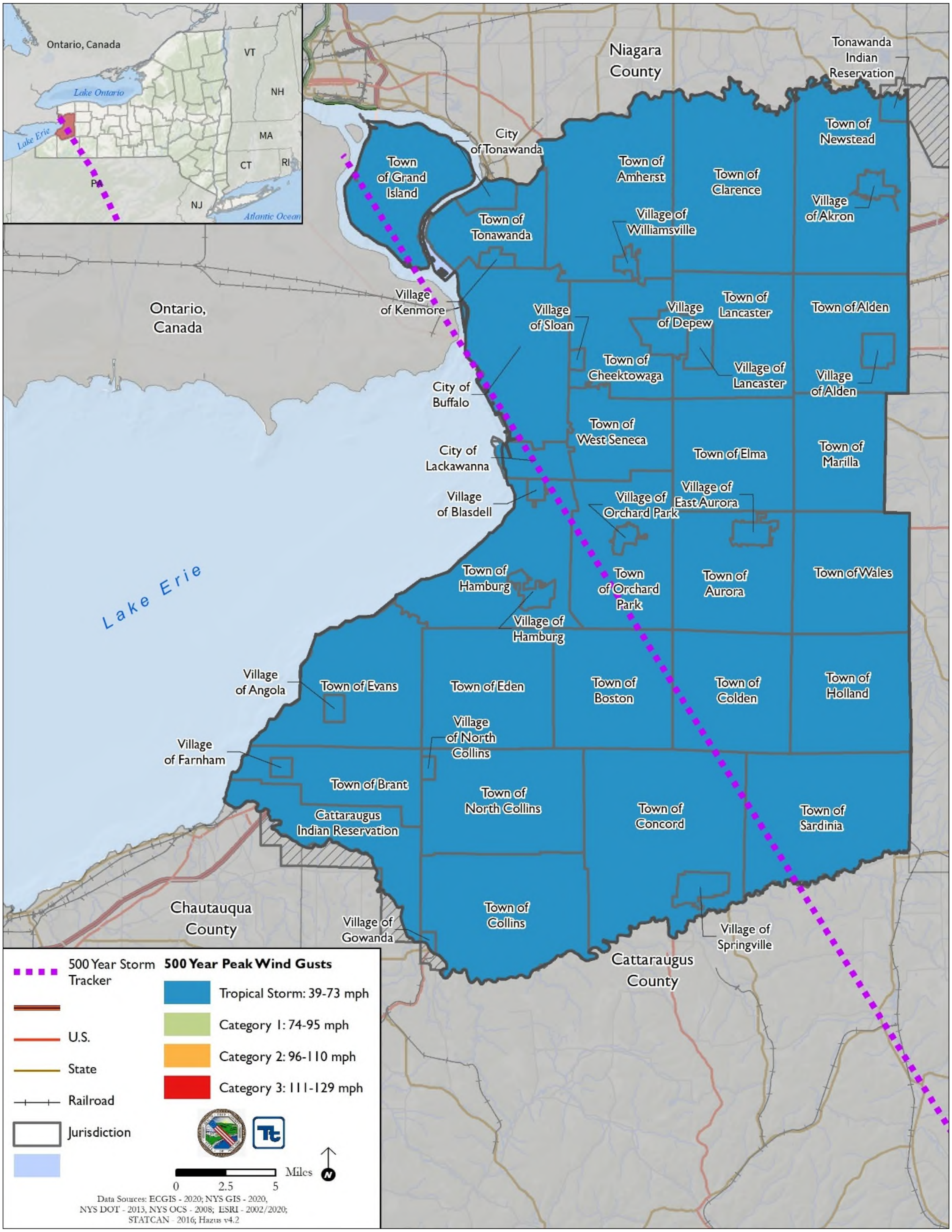
Figure 5.4.10-6. Number of Hurricanes for a 100-Year Mean Return Period



Source: U.S. Geological Survey (USGS) 2005
Notes:
Red circle indicates Erie County's approximate location within the region.
The map shows the number of hurricanes expected to occur during a 100-year MRP based on historical data using the following scale:
Light blue area: 20 to 40 hurricanes expected in a 100-year period.

Figure 5.4.10-7 shows the estimated maximum 3-second gust wind speeds that can be anticipated in the study area associated with the 500-year MRP event. These peak wind speed projections were generated using Hazards U.S. Multi-Hazard (Hazus) model runs. Hazus v 4.2 estimated the maximum 3-second gust wind speeds for Erie County to be below 39 mph for the 100-year MRP event and not strong enough to be considered a tropical storm. The maximum 3-second gust wind speeds for Erie County range from 39–73 mph for the 500-year MRP event, which are wind speeds categorizing this event as a tropical storm. The associated impacts and losses from the 500-year MRP hurricane event modeled event is reported in the Vulnerability Assessment section for this hazard presented below.

Figure 5.4.10-7. Wind Speeds for the 500-Year Mean Return Period Event

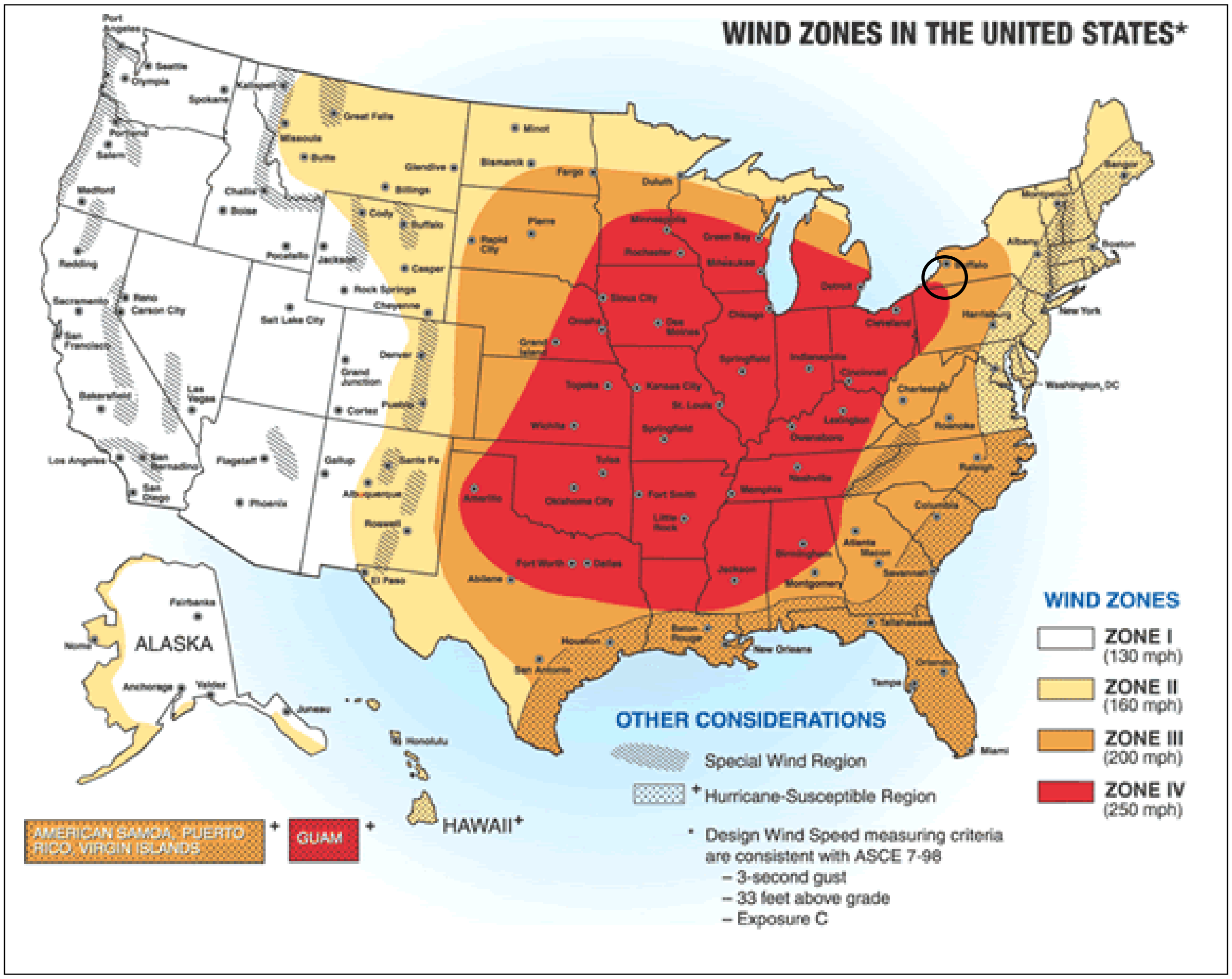


Location

All of Erie County is exposed to hail, lightning, windstorms and high wind, thunderstorms, and hurricanes and tropical storms, and all the county is subject to high winds from severe weather events. Erie County is located in far Western New York State; its entire western border is Lake Erie. As storm fronts reach increased elevations inland, greater amounts of rainfall and winds are experienced.

According to the FEMA Winds Zones of the United States map, Erie County is located within Wind Zone III where wind speeds can reach up to 200 mph. Figure 5.4.10-8 illustrates wind zones across the United States, which indicate the impacts of the strength and frequency of wind activity per region. The information on the figure is based on 40 years of tornado data and 100 years of hurricane data collected by FEMA.

Figure 5.4.10-8. Wind Zones in the United States



Source: FEMA 2012
Note: The black oval indicates the approximate location of Erie County.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe storms throughout New York State and Erie County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

FEMA Disaster Declarations

Between 1954 and 2020, Erie County has been included in seven declarations for severe storm-related events classified as one or a combination of the following disaster types: severe storm, straight-line winds, coastal storm, hurricane/tropical storm, and tornado (FEMA 2020). Table 5.4.10-4 lists these events.

Table 5.4.10-4. Severe Storm-Related FEMA Declarations for Erie County, 1954–2020

FEMA Declaration Number	Date(s) Of Event	Event Type	Details
494	March 19, 1976	Severe Ice Storm	Ice Storm, Severe Storms, & Flooding
1233	June 25, 1998 - July 10, 1998	Severe Storm(s)	Severe Storms and Flooding
1335	May 3, 2000 - August 12, 2000	Severe Storm(s)	Severe Storms and Flooding
1534	May 13, 2004 - June 17, 2004	Severe Storm(s)	Severe Storms and Flooding
1665	October 12, 2006 - October 25, 2006	Severe Storm(s)	Severe Storms and Flooding
1857	August 8, 2009 - August 10, 2009	Severe Storm(s)	Severe Storms and Flooding
4472	October 31, 2019 - November 1, 2019	Severe Storm(s)	Severe Storms, Straight-line Winds, and Flooding

Source: FEMA 2021

U.S. Department of Agriculture Agricultural Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. There have been two USDA agricultural disasters since 2013 attributed to severe weather:

- S3593 – 2013 Excessive rain and related flooding, high winds, and hail
- S3885 – 2015 Excessive Rain, High Winds, Hail, Lightning, and Tornado

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Erie County has experienced crop losses from severe storm events. Table 5.4.10-5 provides details regarding crop losses in Erie County according to USDA records.

Table 5.4.10-5. USDA Crop Losses from Severe Storms in Erie County (2014–2019)

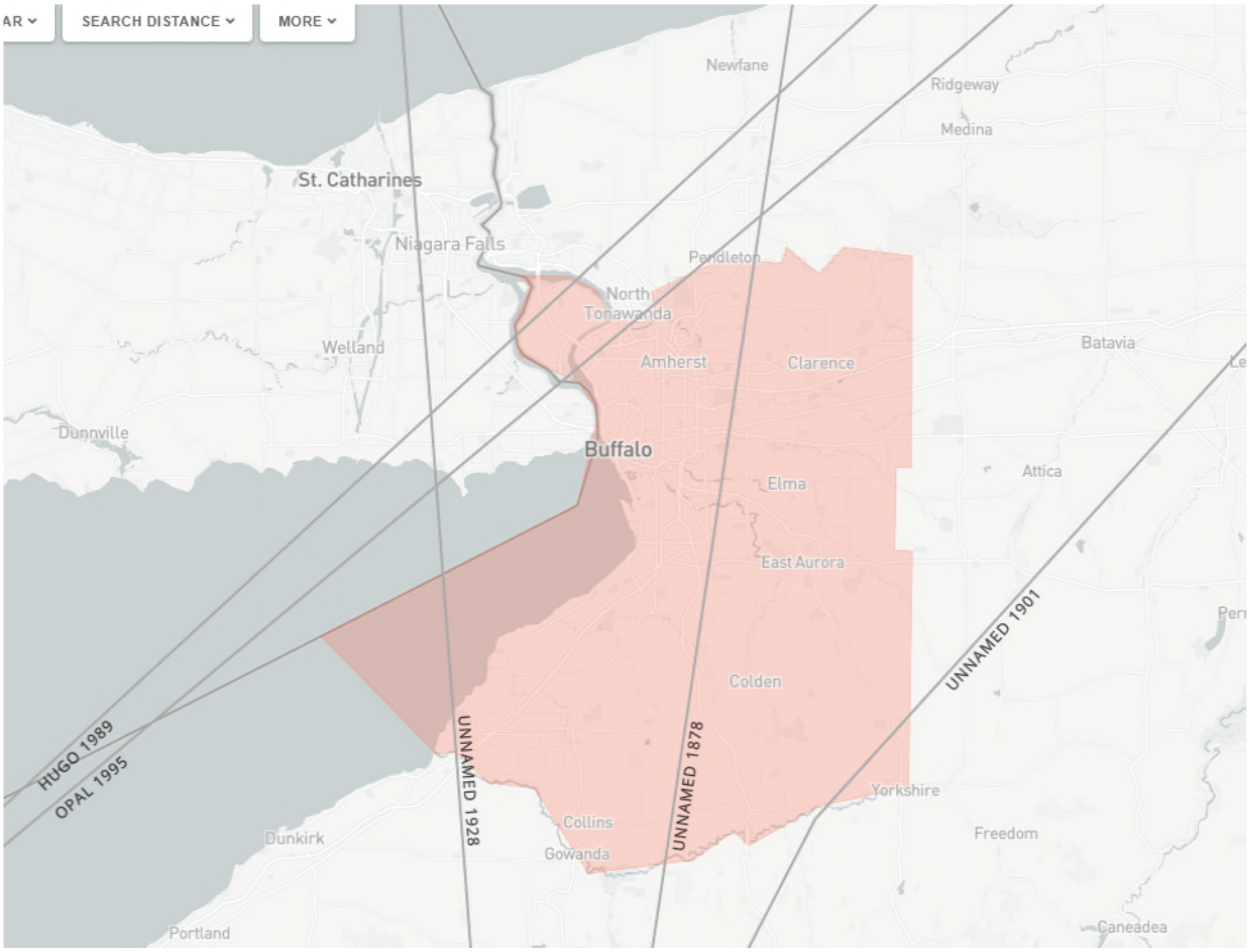
Year	Crop Type	Cause of Loss	Losses
2014	Wheat, corn, oats, beans, soybeans, all cover crops	Excess Moisture/Precipitation/Rain	$2 million
2015	Wheat, corn, oats, beans, soybeans	Excess Moisture/Precipitation/Rain	$1.6 million
2016	Wheat, corn, oats, beans, soybeans, oats	Excess Moisture/Precipitation/Rain	$1.2 million
2017	Wheat, corn, oats, beans, soybeans, grapes	Excess Moisture/Precipitation/Rain	$1.6 million
2018	Wheat, corn, oats, beans, soybeans	Excess Moisture/Precipitation/Rain	$1.1 million
2019	Wheat, corn, oats, beans, soybeans, oats	Excess Moisture/Precipitation/Rain	$2.1 million

Source: USDA 2021

Previous Events

Figure 5.4.10-9, from the NOAA Historical Hurricane Tracker, illustrates the tracks of storms between 1842 and 2018 that passed through Erie County. Erie County is not frequently impacted by hurricanes, tropical storms, or tropical depressions but has recently experienced the direct and indirect landward effects associated with hurricanes and tropical storms.

Figure 5.4.10-9. Historical Hurricane Tracks within 65 miles of Erie County, 1842–2018



Source: NOAA Historical Hurricane Tracks 2018
Notes: Category refers to tropical cyclone strength. ET = Extra-tropical Storm; H1 = Category 1 Hurricane; H2 = Category 2 Hurricane; H3 = Category 3 Hurricane; H4 = Category 4 Hurricane; TS = Tropical Storm; TD = Tropical Depression

The NOAA National Centers for Environmental Information (NCEI) Storm Events database records severe storm events. For this 2022 HMP Update, known severe storm events that have impacted Erie County between 2013 and 2020 are identified in Table 5.4.10-6. With severe storm documentation for New York State and Erie County being so extensive, not all sources have been identified or researched. Therefore, Table 5.4.10-6 may not include all events that have occurred in the county.

Table 5.4.10-6. Severe Storm Events in Erie County, 2015–2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details
5/11/15	Thunderstorm Wind	-	-	A line of thunderstorms moved across the Niagara Frontier during the late evening hours. The thunderstorms produced strong wind gusts estimated to near 60 mph. Trees and power lines were downed in East Aurora, Darien, and Pembroke. In Millgrove, five trees fell onto and caused damage to sheds. Damages from the event were estimated at $25,000.
5/11/15	Thunderstorm Wind	-	-	A line of thunderstorms moved across the Niagara Frontier during the late evening hours. The thunderstorms produced strong wind gusts estimated to near 60 mph. Trees and power lines were downed in East Aurora, Darien, and Pembroke. In Millgrove, five trees fell onto and caused damage to sheds.
6/12/15	Thunderstorm Wind	-	-	Two lines of showers and thunderstorms moved across the region during the afternoon and early evening hours. The strong thunderstorms produced damaging winds that downed trees and powers lines across the western southern tier and Finger Lakes Region. Damages from the event were estimated at $30,000.
6/23/15	Thunderstorm Wind	-	-	An area of showers and thunderstorms moved across the lower Great Lakes region during the overnight and very early morning hours. The thunderstorms produced strong winds that downed trees and power lines. Several of the downed trees damaged structures and cars. Some roads were temporarily blocked by debris. Damage from the storm was estimated to be approximately $35,000.
8/11/15	Flash Flood	-	-	Showers and thunderstorms developed along the leading edge of a well-defined shortwave moving from Southern Ontario into Western New York. The storms moved across southern Erie county and rapidly intensified. Instantaneous rainfall rates of four to six inches per hour were observed on radar. Damage from the storm was estimated to be approximately $100,000.
8/15/15	Flash Flood	-	-	Thunderstorms developed and tracked along a stalled frontal boundary across Niagara and northern Erie counties. The slow-moving thunderstorms produced intense rainfall with reports of five to eight inches in just a couple of hours. Damage from the storm was estimated to be approximately $45,000.
06/20/16	Thunderstorm Wind	-	-	Thunderstorms developed ahead of an approaching cold front. The first round of storms developed across Southern Ontario just west of the St. Lawrence River and moved east across Jefferson and northern Lewis counties producing fairly widespread wind damage. Damages from the storm were estimated to be approximately $65,000.
07/14/16	Thunderstorm Wind	-	-	Thunderstorms moved across Southern Ontario and the eastern Great Lakes crossing Western New York during the early morning hours of the 14th. Damage from the storm was estimated to be approximately $35,000.
07/25/16	Thunderstorm Wind	-	-	Several rounds of strong to severe storms developed during the morning and early afternoon hours ahead of an approaching cold front. Storms first developed along a line from the east end of Lake Erie to the west end of Lake Ontario, shifting south and east through the morning then pushing east of the region during the early afternoon. The thunderstorm winds downed trees and power lines throughout the region. Several thousand power outages were reported. Damage from the storm was estimated to be approximately $39,000.
09/10/16	Thunderstorm Wind	-	-	A strong cold front crossed the region during the evening hours. Thunderstorms that accompanied the front produced damaging wind gusts. Damage from the storm was estimated to be approximately $50,000

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details
4/20/17	Flood	-		Several rounds of thunderstorms brought one to three inches of rain to the area in just a couple of hours. This resulted in ponding of water on area roadways. Several roads were closed by flood waters. Debris flowing in Tonawanda creek jammed near Royalton. Water backed up because of the log jam, and Foote Road between Ditch and Wolcottsville Road was closed. Damage from the storm was estimated to be $55,000.
5/1/17	Thunderstorm Wind	-	-	A strong cold front moved across the region during the afternoon and evening hours. A line of thunderstorms just ahead of the front produced damaging winds that downed trees and wires across Western New York through the Finger Lakes Region as well as areas east of Lake Ontario. Damage from the storm was estimated to be $105,000.
5/28/17	Thunderstorm Wind	-	-	A convective complex moved across Western New York late in the morning. This produced a quick 2 to 4 inches of rain which covered a significant portion of the region and resulted in flash flooding that impacted the Buffalo metro area, the Boston/Wyoming hills, and parts of the northern Finger Lakes Region. Damages from the storm were estimated to be $50,000.
7/13/17	Flash Flood	-	-	A convective complex moved across Western New York late in the morning. This produced a quick 2 to 4 inches of rain which covered a significant portion of the region and resulted in flash flooding that impacted the Buffalo metro area, the Boston/Wyoming hills, and parts of the northern Finger Lakes Region. Damage from the storm was estimated to be $55,000.
7/20/17	Thunderstorm Wind	-	-	This storm was responsible for all four tornadoes across Western NY. |The storms moved onshore from Lake Erie with damage beginning in Hamburg before moving across Orchard Park. Windows of hundreds of car windows were blown out at the Hamburg Fairgrounds, where trees were downed and several buildings including the Grandstand sustained damage. Damage from the storm was estimated to be $138,000.
8/4/17	Thunderstorm Wind	-		Showers and thunderstorms developed along and ahead of an advancing cold front. The thunderstorms produced damaging winds that downed trees and power lines. In Buffalo, the winds partially tore the roof off a building at Utica Street and Massachusetts Avenue. In Weedsport, a trampoline was lifted and landed on a house. The thunderstorms also produced hail up to one inch in diameter near Adams. Damage from the storm was estimated to be $90,000.
9/4/17	Thunderstorm Wind	-		Thunderstorms ahead of an approaching strong cold front produced damaging winds during the late evening and early overnight hours. The thunderstorm winds downed trees and power lines throughout parts of the western southern tier and Finger Lakes Region. Damage from the storm was estimated to be $35,000.
11/5/17	Flood	-	-	After a warm front brought soaking rains to the region, a cold front brought additional rain. Damage from the storm was estimated to be $25,000
6/13/2018	Thunderstorm Wind	-		A strong shortwave passed to the north of the area late afternoon into early evening. Damages from this event were estimated to be approximately $55,000
10/6/2018	Flash Flood	-		A weakening surface low tracked northeast across Lake Huron during the afternoon hours with its corresponding warm front extending to the east across Lake Ontario then snaking south ahead of the higher terrain east of Syracuse. Damage from this event was estimated to be approximately $210,000.
8/21/2019	Flash Flood	-		Well ahead of an approaching cold front and more tied to convective enhanced shortwave, strong thunderstorms developed in clusters early morning. Damage from this event is estimated at $52,000.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details
10/31/2019	Lakeshore Flood/High Wind	4472	Yes	A deepening area of consolidated low pressure tracked from the north shoreline of Lake Erie to Toronto, and then along the northern shoreline of Lake Ontario Thursday evening, October 31st. Heavy rain also brought flooding concerns. All three climate stations broke their daily October 31 records with 1 to 3 inches of rain falling across the CWA. High winds and lakeshore flooding continued into November 1.
3/29/2020	Thunderstorm Wind	-		A strong, nearly vertically stacked low moved into the western Great Lakes. Downstream of the low, a warm front moved northeast across the area during the storm. Damage from this event was estimated to be approximately $70,000
6/2/2020	Thunderstorm Wind	-		A low-level boundary pushed southeast ahead of a mesoscale convective system late in the afternoon. This boundary followed the passage of a warm front with effective shear values jumping to 50-60 knots as the low-level boundary made its way across Southern Ontario and into Western New York. Damage from this event was estimated to be approximately $75,000.
8/15/2020	Flash Flood	-		Scattered thunderstorms developed by midafternoon, with new storm development and subsequent storm motion then driven mainly by outflow boundaries, resulting in slow and chaotic storm motion over the event. A few storms pulsed high enough and long enough to produce severe weather. A few storms also latched onto outflow boundaries and remained nearly stationary or trained for one to two hours, producing isolated flash flooding from northeast Cattaraugus County to the Buffalo Metro area. Damage from this event was estimated to be approximately $140,000.

Sources: FEMA 2020; NOAA-NCEI 2020; SPC 2020

Notes: Due to the large number of events present in the NOAA-NCEI database for thunderstorm wind, only events resulting in $25K in property damage or greater have been included.

FEMA Federal Emergency Management Agency

mph miles per hour

Table 5.4.10-7 documents the total number of severe storm events that have occurred between 1950 and 2020, based on the NOAA-NCEI database and National Hurricane Center (NHC) records.

Table 5.4.10-7. Severe Storm Events 1950–2020

Hazard Type	Number of Occurrences Between 1950 and 2020	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Thunderstorm	199	0	12	$4.5 million	$0
Lightning	14	0	7	$1.3 million	$0
Hailstorms	70	0	1	$1.3 million	$1.8 million
Windstorms	79	0	16	$11.2 million	$0
Tornadoes	22	0	6	$4.7 million	$0
Hurricanes/ Tropical Storms	0	0	0	0	$0
TOTAL	**384**	**0**	**42**	**$23 million**	$1.8 million

Source: NOAA-NCEI 2021; NHC 2020
Notes: Number of events were collected from NHC and includes events that occurred within 65 nautical miles of Erie County. K = Thousand;. M = Million
** Based on NHC historical storm tracks, fatalities, injuries, property damage, and crop damage unavailable.*

Probability of Future Occurrences

Erie County is expected to continue experiencing direct and indirect impacts of severe storms annually. These storms may induce secondary hazards such as flooding and utility failure. Table 5.4.10-8 summarizes data regarding the probability of occurrences of severe storm events in Erie County. Based on historic occurrences, thunderstorm events are the most common in Erie County, followed by windstorms. The information used to calculate the probability of occurrences is based solely on NOAA-NCEI storm events database results.

Table 5.4.10-8. Probability of Occurrence of Severe Storm Events in Erie County

Hazard Type	Number of Occurrences Between 1950 and 2020	% Chance of Occurring in Any Given Year
Thunderstorm	199	100.00
Lightning	14	20.00
Hailstorms	70	100.00
Windstorms	79	100.00
Tornadoes	22	31.43
Hurricanes/ Tropical Storms	0	0
Total	**384**	**100.00**

Source: NOAA-NCDC 2021; NHC 2020
Notes: Probability was calculated using the available data provided in the NOAA-NCDC storm events database and the NHC Historical Hurricane Tracks database and includes events that occurred within 65 nautical miles of Erie County
* *Any probability greater than 100 percent was rounded to 100 percent.*

In Section 5.3, the identified hazards of concern for Erie County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Partnership, the probability of occurrence for severe storms in the county is considered *frequent* (100 percent annual probability, occurring multiple times a year).

Climate Change Impacts

Climate change is beginning to affect both people and resources in Erie County, and these impacts are projected to continue growing. The Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Erie County is part of Region 1, Western New York and Great Lakes Plain. In Region 1, it is estimated that temperatures will increase by 4.3 ºF to 6.3 ºF by the 2050s and 5.7 ºF to 9.6 ºF by the 2080s (baseline of 47.7 ºF, middle-range projection).

Erie County is part of Region 1, Western New York, Great Lakes Plain. In Region 1, it is estimated that temperatures will increase by 3.0 ºF to 5.5 ºF by the 2050s and 4.5 ºF to 8.5 ºF by the 2080s (baseline of 48.0 ºF, mid-range projection). Precipitation totals will increase between 0 and 10% by the 2050s and 0 to 15% by the 2080s (baseline of 37.0 inches, mid-range projection). Table 5.4.10-9 displays the projected seasonal precipitation change for ClimAID Region 1 (NYSERDA 2014).

Table 5.4.10-9. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

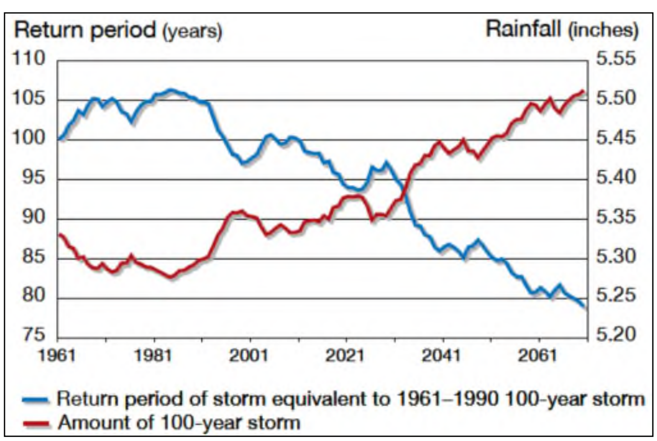
Winter	Spring	Summer	Fall
+5 to +15	0 to +10	-5 to +10	-5 to +10

Source: NYSERDA 2014

The projected increase in precipitation is expected to fall in heavy downpours and less in light rains. Downpours are very likely to increase in frequency and intensity, a change which has the potential to affect drinking water; heighten the risk of riverine flooding; flood key rail lines, roadways, and transportation hubs; and increase delays and hazards related to extreme weather events (NYSERDA 2011). Less frequent rainfall during the summer months may impact the ability of water supply systems. Increasing water temperatures in rivers and streams will affect aquatic health and reduce the capacity of streams to assimilate effluent wastewater treatment plants (NYSERDA 2011).

Figure 5.4.10-10 displays the project rainfall and frequency of extreme storms in New York State. The amount of rainfall in a 100-year event is projected to increase, while the number of years between such storms (return period) is projected to decrease. Rainstorms will become more severe and more frequent (NYSERDA 2011).

Figure 5.4.10-10. Projected Rainfall and Frequency of Extreme Storms



Source: NYSERDA 2011

5.4.10.2 Vulnerability Assessment

A probabilistic assessment was conducted for the 100- year and 500-year MRP hurricane wind event through a Level 2 analysis in Hazus v4.2 to analyze the severe storm hazard and provide a range of loss estimates due to wind impacts. Section 5.1, Methodology includes additional details on the methodology used to assess the severe storm risk.

Impact on Life, Health, and Safety

The impact of a severe weather event and wind on life, health, and safety is dependent upon several factors, including the severity of the event and whether adequate warning time was provided to residents. For the purposes of this HMP, all of Erie County is considered vulnerable to a severe weather event and wind impacts (i.e., 919,355 persons total, American Community Survey 2019). Hazus estimates that zero persons will be displaced from their homes or will seek shelter during a 500-year MRP hurricane wind event. Secondary impacts caused by extreme wind events include downed trees, damaged buildings, and debris carried by high winds, which can lead to injury or loss of life.

Socially vulnerable populations are most susceptible to severe weather events based on several factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Vulnerable populations include homeless persons, elderly (over 65 years old), low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. The population over the age of 65 is also more vulnerable and, physically, they may have more difficulty evacuating. They may require extra time or outside assistance during evacuations and are more likely to seek or need medical attention, which may not be available due to isolation during a storm event. According to the 5-Year 2018 American Community Survey Population Estimates, there are 161,806 persons over 65 and 126,806 persons living in poverty in Erie County (American Community Survey 2019).

Additionally, people located outdoors (i.e., recreational activities and farming) are considered most vulnerable to hailstorms, thunderstorms, and tornadoes. This is because there is little to no warning, and shelter may not be available. Moving to a lower risk location will decrease a person's vulnerability. See Section 4, County Profile for population statistics for each participating jurisdiction.

Impact on General Building Stock

Damage to buildings is dependent upon several factors, including wind speed, storm duration, and path of the storm track. Building construction also plays a major role in the extent of damage resulting from a coastal storm. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. Furthermore, high-rise buildings are also very vulnerable structures.

Hazus estimates that there will be no damages in the event of a 100-year MRP wind event. There will be $41,265 of replacement cost damages caused by the 500-year MRP hurricane wind event (Table 5.4.10-12). These damages would occur primarily in residential buildings.

To better understand these risks, Hazus was used to estimate the expected wind-related building damages. Table 5.4.10-10 summarizes the definitions of the damage categories. Hazus estimates that there is only one commercial structure that would experience minor damage during a 500-year MRP hurricane wind event (Table 5.4.10-11). Furthermore, Hazus estimated damages are summarized by general occupancy classes in Table 5.4.10-12. Hazus estimates that all the damages caused by severe wind will occur to residential structures in the county for the 500-year MRP wind events, causing approximately $41,265 in damages. These cumulative damages are minute, which accounts for the difference in number of buildings and cost of damages between occupancy classes.

Table 5.4.10-10. Description of Damage Categories

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very Limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No
Moderate Damage Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	>15% and ≤50%	> one and ≤ the larger of 20% & 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% & 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
Destruction Complete roof failure and/or failure of wall frame. Loss of more than 50% of roof sheathing.	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

Source: FEMA 2020

Table 5.4.10-11. Damage State Categories for Buildings During 500-Year MRP Hurricane Wind Event in Erie County

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	500-year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	334,595	None	334,595	100.0%
		Minor	0	0.0%
		Moderate	0	0.0%
		Severe	0	0.0%
		Complete Destruction	0	0.0%
Commercial Buildings	18,761	None	18,760	>99.9%
		Minor	1	<0.1%
		Moderate	0	0.0%
		Severe	0	0.0%
		Complete Destruction	0	0.0%
Industrial Buildings	1,759	None	1,759	100.0%
		Minor	0	0.0%
		Moderate	0	0.0%
		Severe	0	0.0%

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	500-year	
			Building Count	Percent Buildings in Occupancy Class
		Complete Destruction	0	0.0%
Government, Religion, Agricultural, and Education Buildings	5,810	None	5,810	100.0%
		Minor	0	0.0%
		Moderate	0	0.0%
		Severe	0	0.0%
		Complete Destruction	0	0.0%

Source: HAZUS v4.2

Table 5.4.10-12. Expected Building Damage for All Occupancies for 500-Year MRP Hurricane Wind Events for Erie County

Jurisdiction	Total Replacement Cost Value (All Occupancies)	Estimated Total Damages 500-Year	Percent of Total Building and Contents Replacement Cost Value 500-Year	Estimated Residential Damages 500-Year	Estimated Commercial Damages 500-Year	Estimated Damages for All Other Occupancies 500-Year
Akron (V)	$628,463,030	$2,071	0.1%	$2,071	$0	$0
Alden (T)	$3,609,679,724	$31	0.1%	$31	$0	$0
Alden (V)	$6,590,896,419	$31,709	0.1%	$31,709	$0	$0
Amherst (T)	$9,572,113,113	$0	0.1%	$0	$0	$0
Angola (V)	$12,553,329,808	$0	0.2%	$0	$0	$0
Aurora (T)	$15,534,546,502	$0	0.2%	$0	$0	$0
Blasdell (V)	$18,515,763,197	$0	0.2%	$0	$0	$0
Boston (T)	$21,496,979,891	$0	0.2%	$0	$0	$0
Brant (T)	$24,478,196,586	$0	0.2%	$0	$0	$0
Buffalo (C)	$27,459,413,280	$0	0.2%	$0	$0	$0
Cheektowaga (T)	$30,440,629,974	$0	0.3%	$0	$0	$0
Clarence (T)	$33,421,846,669	$0	0.3%	$0	$0	$0
Colden (T)	$36,403,063,363	$0	0.3%	$0	$0	$0
Collins (T)	$39,384,280,058	$0	0.3%	$0	$0	$0
Concord (T)	$42,365,496,752	$0	0.3%	$0	$0	$0
Depew (V)	$45,346,713,447	$0	0.4%	$0	$0	$0
East Aurora (V)	$48,327,930,141	$0	0.4%	$0	$0	$0
Eden (T)	$51,309,146,836	$0	0.4%	$0	$0	$0
Elma (T)	$54,290,363,530	$0	0.4%	$0	$0	$0
Evans (T)	$57,271,580,224	$0	0.4%	$0	$0	$0
Farnham (V)	$60,252,796,919	$0	0.5%	$0	$0	$0
Gowanda (V)	$63,234,013,613	$0	0.5%	$0	$0	$0
Grand Island (T)	$66,215,230,308	$0	0.5%	$0	$0	$0
Hamburg (T)	$69,196,447,002	$0	0.5%	$0	$0	$0
Hamburg (V)	$72,177,663,697	$0	0.5%	$0	$0	$0
Holland (T)	$75,158,880,391	$0	0.5%	$0	$0	$0
Kenmore (V)	$78,140,097,086	$0	0.6%	$0	$0	$0
Lackawanna (C)	$81,121,313,780	$0	0.6%	$0	$0	$0
Lancaster (T)	$84,102,530,474	$0	0.6%	$0	$0	$0

Jurisdiction	Total Replacement Cost Value (All Occupancies)	Estimated Total Damages 500-Year	Percent of Total Building and Contents Replacement Cost Value 500-Year	Estimated Residential Damages 500-Year	Estimated Commercial Damages 500-Year	Estimated Damages for All Other Occupancies 500-Year
Lancaster (V)	$87,083,747,169	$0	0.6%	$0	$0	$0
Marilla (T)	$90,064,963,863	$0	0.6%	$0	$0	$0
Newstead (T)	$93,046,180,558	$7,455	0.7%	$7,455	$0	$0
North Collins (T)	$96,027,397,252	$0	0.7%	$0	$0	$0
North Collins (V)	$99,008,613,947	$0	0.7%	$0	$0	$0
Orchard Park (T)	$101,989,830,641	$0	0.7%	$0	$0	$0
Orchard Park (V)	$104,971,047,336	$0	0.7%	$0	$0	$0
Sardinia (T)	$107,952,264,030	$0	0.8%	$0	$0	$0
Sloan (V)	$110,933,480,724	$0	0.8%	$0	$0	$0
Springville (V)	$113,914,697,419	$0	0.8%	$0	$0	$0
Tonawanda (C)	$116,895,914,113	$0	0.8%	$0	$0	$0
Tonawanda (T)	$119,877,130,808	$0	0.8%	$0	$0	$0
Wales (T)	$122,858,347,502	$0	0.8%	$0	$0	$0
West Seneca (T)	$125,839,564,197	$0	0.9%	$0	$0	$0
Williamsville (V)	$128,820,780,891	$0	0.9%	$0	$0	$0
Erie County Total	**$131,801,997,586**	**$41,265**	**0.9%**	**$41,265**	**$0**	**$0**

Sources: HAZUS v4.2; Erie County GIS 2020; RSMeans 2020
C = City; T = Town; V = Village % = Percent
* Note: *Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Impact on Critical Facilities

Critical facilities are at risk of being impacted by high winds associated with structural damage or falling tree limbs/flying debris, which can result in the loss of power. Power loss can greatly impact households, business operations, public utilities, and emergency personnel. For example, vulnerable populations in Erie County are at risk if power loss results in interruption of heating and cooling services, stagnated hospital operations, and potable water supplies. Emergency personnel such as police, fire, and emergency medical services (EMS) will not be able to effectively respond in a power loss event to maintain the safety of its citizens.

Hazus estimates the probability that critical facilities (i.e., medical facilities, fire/EMS, police, emergency operation centers [EOC], schools, and user-defined facilities such as shelters and municipal buildings) may sustain damage as a result of the 100-year or 500-year MRP hurricane wind events. Additionally, Hazus estimates the loss of use for each facility in number of days. Overall, Hazus estimates that none of the critical facilities in Erie County are estimated to experience damage or loss of functionality due to a 100-year or a 500-year MRP hurricane wind event.

Impact on Economy

Severe storm events can have short- and long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees.

Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings.

Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure (power lines, gas lines, electrical systems) could suffer damage and impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to the population.

Hazus estimates the total economic loss associated with the 100-year and 500-year MRP hurricane wind events (direct building losses and business interruption losses). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" section discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event. Hazus estimates that there would be $55,020 in building and content losses in the event of a 500-year MRP wind event.

Debris management can be costly and may also impact the local economy. Hazus estimates the amount of building and tree debris that may be produced as a result of the 100-year and 500-year MRP hurricane wind events. Because the estimated debris production does not include flooding, this is likely a conservative estimate and may be higher if multiple impacts occur. According to the Hazus Hurricane User Manual, estimates of weight and volume of eligible tree debris consist of downed trees that would likely be collected and disposed at public expense. Hazus estimates that the 100-year and 500-year MRP hurricane wind event will not cause any debris for Erie County.

Impact on the Environment

The impact of severe weather events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long-term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. (USGS 2020). For example, severe weather that creates longer periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. Tornadoes can tear apart habitats, causing fragmentation across ecosystems. Researchers also believe that a greater number of diseases will spread across ecosystems because of impacts that severe weather and climate change will have on water supplies (NOAA 2019). Overall, as the physical environment becomes more altered, species will begin to contract or migrate in response, which may cause additional stressors to the entire ecosystem within Erie County.

Cascading Impacts on Other Hazards

Severe weather events and severe wind events can escalate the impacts of flooding and utility failure. Severe winds can be destructive to the functionality of utilities by breaching power lines and disconnecting the utility systems. Severe weather may carry extreme rainfall that could exacerbate flooding. More information about flooding and utility failure can be found in Section 5.4.6 and Section 5.4.12 of this HMP, respectively.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the county can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and how they interact can also provide insight about ways to plan.

Projected Development

Any areas of growth could be potentially impacted by the severe storm hazard because the entire county is exposed and vulnerable to the wind hazard associated with severe storms. However, due to increased standards and codes, new development may be less vulnerable to the severe storm hazard compared to the aging building stock in the county. Please refer to Section 4 and Section 9 for additional information regarding the areas targeted for future growth and development in the county.

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has increased by a negligible amount between 2010 and 2019 (U.S. Census Bureau 2020). Estimated population projections provided by the Cornell Program on Applied Demographics indicates that the county's population will grow overall up to 2040, resulting in a projected population of 945,891 persons. (Cornell Program on Applied Demographics 2017). While fewer people will reside in the county, those who remain are still vulnerable to severe weather and severe wind events. Section 4, County Profile presents additional discussion on population trends.

Climate Change

As displayed in Figure 5.4.10-10, the entire State of New York is projected to experience an increase in the frequency and severity of extreme storms and rainfall. Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, unleashing far more rain and posing a greater threat of flooding across wide areas (NASA 2013). Section 5.4.6, Flood, includes a discussion related to the impact of climate change due to increases in rainfall. An increase in storms will produce more wind events and may increase tornado activity. Additionally, an increase in temperature will provide more energy to produce storms that generate tornadoes (NASA 2013). With an increased likelihood of strong winds and tornado events, all the county's assets will experience additional risk for losses as a result of extreme wind events.

Changes in Vulnerability Since the 2015 HMP

Since the 2015 HMP analysis, population statistics have been updated using the 5-Year 2015-2019 American Community Survey Population Estimates (American Community Survey 2019). The general building stock was also established using RS Means 2020 building valuations that estimated replacement cost value for each building in the inventory. Additionally, a critical facility dataset was provided from the county. The updated building stock inventory was imported into Hazus v4.2 to complete a hurricane wind analysis for the 100-year and 500-year MRP hurricane wind event.

Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2015 HMP. This information provides more accurate exposure and potential loss estimates for Erie County.

5.4.11 Severe Winter Storm

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the severe winter storm hazard for the Erie County Hazard Mitigation Plan (HMP).

5.4.11.1 Hazard Profile

Hazard Description

A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain. They can be a combination of heavy snow, blowing snow, and dangerous wind chills. According to the National Oceanic and Atmospheric Administration (NOAA) National Severe Storms Laboratory (NSSL), the three basic components needed to make a winter storm include the following:

- Below freezing temperatures (cold air) in the clouds and near the ground to make snow and ice.
- Lift, something to raise the moist air to form clouds and cause precipitation, such as warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside (oleographic lifting).
- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean (NOAA-NSSL n.d.).

In Erie County, winter storms include blizzards, snowstorms, sleet, freezing rain, and ice storms. Extreme cold temperatures and wind chills are associated with winter storms. Important issues associated with a severe winter storm in the planning area include the following:

- Older building stock in Erie County might be more vulnerable to the aftermath of a winter storm event. Heavy snow loads on the roofs of buildings might not be able to withstand the extra weight.
- Ice and freezing temperatures can lead to frost heaving, damaging roads, bridges, buildings, home foundations, and railroad tracks.
- The impacts of drought and invasive species can lead to dead or dying trees. These trees are more susceptible to falling during winter storm events from the weight of snow and ice, causing power outages, closed roadways, and damage to buildings and property.
- Downed power lines from the weight of snow and ice lead to power outages, leaving many homes without a source of heat.
- Loss of economic activity when travel is restricted.

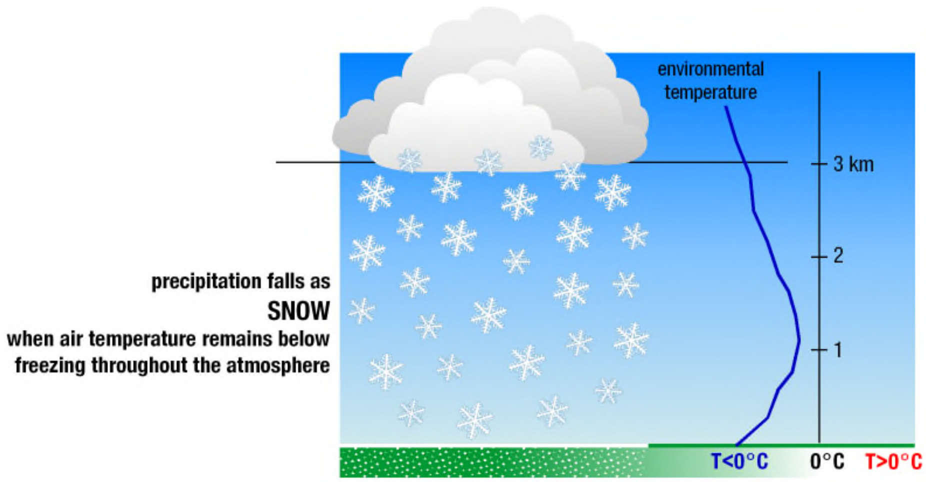
Blizzards

A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to or below 0.25 mile. These conditions must be predominant over a 3-hour period to be considered a blizzard. Extremely cold temperatures are often associated with blizzard conditions but are not a formal part of the definition. The hazard created by the combination of snow, wind, and low visibility significantly increases with temperatures below 20 °F. A severe blizzard is categorized as having temperatures near or below 10 °F, winds exceeding 45 mph, and visibility reduced by snow to near 0 mile. Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm air from the south (The Weather Channel 2012).

Heavy Snow

According to the National Snow and Ice Data Center (NSIDC), snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32 °F) and water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into snow crystals or a snow pellet, which then falls to the earth. Snow falls in different forms: snowflakes, snow pellets, or sleet. Snowflakes are clusters of ice crystals that form from a cloud. Figure 5.4.11-1 depicts snow creation.

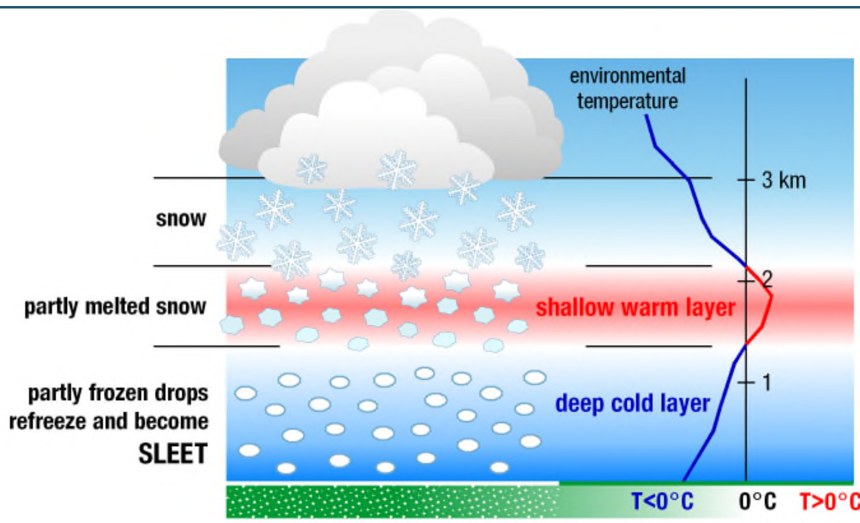
Figure 5.4.11-1. Snow Creation



Source: NOAA-NSSL 2015

Snow pellets are opaque ice particles in the atmosphere. They form as ice crystals fall through super-cooled cloud droplets, which are below freezing but remain a liquid. The cloud droplets then freeze to the crystals. Sleet is made up of drops of rain that freeze into ice as they fall through colder air layers. They are usually smaller than 0.30 inch in diameter (NSIDC 2013). Figure 5.4.11-2 depicts sleet creation.

Figure 5.4.11-2. Sleet Creation

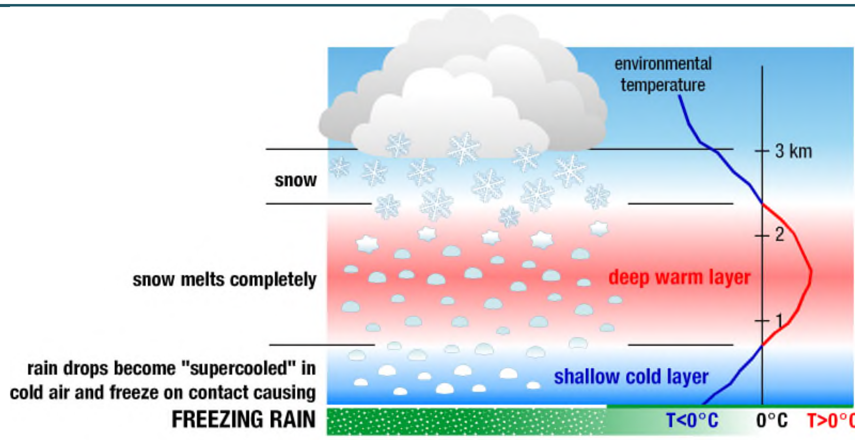


Source: NOAA-NSSL 2015

Ice Storms

An ice storm describes those events when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations typically are accumulations of 0.25 inch or greater (National Weather Service [NWS] 2013). Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (NWS 2008). Figure 5.4.11-3 shows the process of freezing rain creation.

Figure 5.4.11-3. Freezing Rain Creation



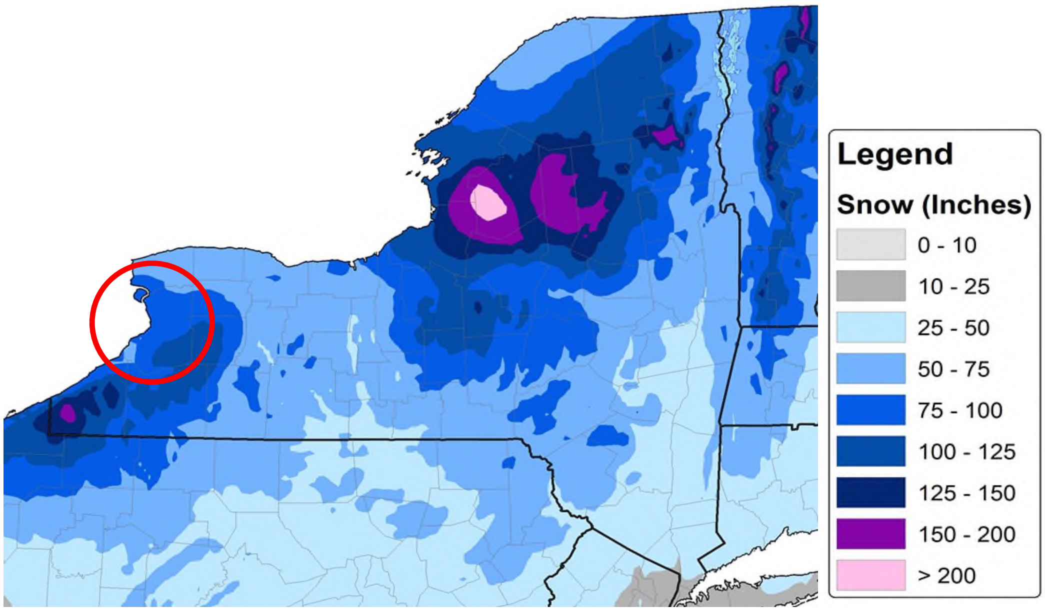
Source: NOAA-NSSL 2015

Location

Portions of northern Erie County are located within the snowbelt, a region near the Great Lakes where lake-effect snow is very common. Most of the severe winter storms in Erie County result from lake-effect snow from Lake Erie. Lake-effect snow is produced when cold winds move across Lake Erie (primarily from west–to–east, generally along the main axis of the lake) picking up water vapor and depositing it as snow on the lake's eastern (leeward) shores. This includes the entirety of Erie County. As a lake gradually freezes over, its ability to produce lake-effect precipitation decreases. Lake-effect snow tends to be most common from November to February. Towns and cities at higher elevations can expect even larger amounts of lake-effect snow. The heaviest lake-effect snows rarely occur right at the shoreline. Lake-effect snows extend further inland for events with higher wind speeds, with the most dramatic effects normally extending up to 70 miles inland. Lake-effect snowfalls tend to be most significant for higher fetches across open, unfrozen water.

Figure 5.4.11-4 provides the historical annual average snowfall in New York State through 2012. The figure shows that Erie County's average snowfall ranges from 25 to 125 inches.

Figure 5.4.11-4. Average Snowfall in New York State, 1960–2012



Source: Cornell University, NYSkiBlog.com
Note: The red circle indicates the location of Erie County.

Extent

The magnitude or severity of a severe winter storm depends on several factors, including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day and week (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified by meteorological measurements and by evaluating its societal impacts. NOAA's National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5 (Table 5.4.11-1) and is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population (U.S. Census Bureau 2000). The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA 2015).

Table 5.4.11-1. RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1–3
2	Significant	3–6
3	Major	6–10
4	Crippling	10–18
5	Extreme	18.0+

Source: NOAA-NCEI 2021
Note: RSI = Regional Snowfall Index

The NWS operates a widespread network of observation systems, such as geostationary satellites, Doppler radars, and automated surface observing systems that feed into the current state-of-the-art numerical computer models to provide a look into future weather, ranging from hours to days. The models are then analyzed by NWS meteorologists, who then write and disseminate forecasts (NWS 2013). According to NWS, the magnitude of a severe winter storm can be qualified into five main categories by event type, as listed in Figure 5.4.11-5 (NWS 2018).

Figure 5.4.11-5. Winter Storm Category Thresholds

Heavy Snowstorm	Accumulations of 4 inches or more of snow in a 6-hour period, or 6 inches of snow in a 12-hour period.
Sleet Storm	Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces, posing a hazard to pedestrians and motorists.
Ice Storm	Significant accumulation of rain or drizzle freezing on objects (trees, power lines, roadways) as it strikes them, causing slippery surfaces and damage from sheer weight of ice accumulations.
Blizzard	Wind velocity of 35 mph or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period.
Severe Blizzard	Wind velocity of 45 mph, temperatures of 10 °F or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period.

Additionally, the NWS uses winter weather watches, warnings, and advisories, as shown in Figure 5.4.11-6, to help people anticipate what to expect in the days and hours prior to an approaching storm.

Figure 5.4.11-6. Winter Storm Warning Thresholds

Previous Occurrences and Losses

Many sources have provided historical information regarding previous occurrences and losses associated with severe winter storm events in Erie County. According to the NOAA National Centers for Environmental Information (NCEI) Storm Events Database, Erie County experienced 253 winter weather events between 1950 and 2020, including 97 heavy snow events and 97 lake-effect snow events (NOAA NCEI 2021). Table 5.4.11-2 shows these statistics.

Table 5.4.11-2. Severe Winter Events 1950–2020

Hazard Type	Number of Occurrences Between 1950 and 2020	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Blizzard	8	-	-	$219,000	-
Heavy Snow	97	-	1	$33.39 million	-
Ice Storm	4	-	-	$1.59 million	-
Lake-Effect Snow	97	2	1	$158.93 million	-
Winter Storm	47	-	-	$960,000	-
Winter Weather	-	-	-	-	-
TOTAL	**253**	**2**	**2**	**$195.1 million**	-

Source: NOAA-NCEI 2021

FEMA Disaster Declarations

Between 1954 and 2020, Federal Emergency Management Agency (FEMA) included New York State in 22 winter storm-related major disaster (DR) or emergency (EM) declarations classified as one or a combination of the following disaster types: severe winter storm, snowstorm, snow, ice storm, winter storm, blizzard, and flooding. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Erie County was included in 10 of these declarations (Table 5.4.11-3).

Table 5.4.11-3. FEMA Major Disasters and Emergency Declarations in Erie County

FEMA Declaration Number	Date(s) Of Event	Declaration Date	Incident Type	Event Title
DR-494	March 19, 1976	March 19, 1976	Severe Ice Storm	Ice storm, severe storms, and flooding
DR-527	February 5, 1977	February 5, 1977	Snow	Snowstorms
EM-3027	January 29, 1977	January 29, 1977	Snow	Snowstorms
EM-3107	March 13-17, 1993	March 17, 1993	Snow	Severe blizzard
EM-3136	January 1-15, 1999	January 15, 1999	Snow	Snow
EM-3157	November 19-21, 2000	December 4, 2000	Snow	Snow
DR-1404/EM-3170	December 24-29, 2001	March 1, 2002	Snow	Severe winter storm
EM-3268	October 12-25, 2006	October 15, 2006	Snow	Lake-effect snowstorm
DR-4204	November 17-26, 2014	December 22, 2014	Snow	Severe winter storm, snowstorm, and flooding

Source: FEMA 2021

USDA Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2020, Erie County was included in three USDA declarations related to severe winter weather, mainly involving freezes.

- S3886 - 2015 Frost, Freeze, and Excessive Snow
- S3666 - 2014 Freezing
- S3672 - 2014 Freezing

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Erie County has experienced crop losses from severe winter storm events. Table 5.4.11-4 provides details regarding crop losses in Erie County according to USDA records.

Table 5.4.11-4. USDA Crop Losses from Severe Winter Storms in Erie County (2014–2019)

Year	Crop Type	Cause of Loss	Losses
2014	Wheat, grapes, soybeans	Freeze, cold winter, cold wet weather	$1.8 million
2015	Wheat, grapes, soybeans, corn	Freeze, cold winter, cold wet weather	$927,000
2016	Oats, grapes	Frost, cold wet weather	$447,000
2017	Corn, grapes	Cold wet weather, frost	$190,000

Year	Crop Type	Cause of Loss	Losses
2018	Grapes	Cold winter, freeze	$1.1 million
2019	Wheat, corn, grapes, soybeans	Cold winter, cold wet weather	$2.1 million

Source: USDA 2021

Previous Events

In Erie County, severe winter snow and ice storms are considered normal and expected. Winter storms and ice storms typically occur from late October until mid-April in the planning area; peak months for these events for Erie County and its jurisdictions are generally December through March. Table 5.4.11-5 identifies known severe winter storm events that impacted Erie County between 2014 and 2020 and included events where damages exceeded $25,000. Detailed information on damages and impacts to each municipality are provided in Section 9, Jurisdictional Annexes.

Table 5.4.11-5. Severe Winter Storm Events in Erie County, 2016–2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details
1/12/2016	Lake-Effect Snow	-	-	This was the 5th lake event that impacted Erie County in 2016. In the City of Buffalo, between 3 and 6 inches fell through January 13th, with a total of 12 inches by the end of the storm. The county had approximately $25,000 in property damage from this event.
11/19/2016	Lake-Effect Snow	-	-	A strong cold front resulted in lake-effect rain mixed with wet snow developing off Lake Erie near Buffalo, changing to all snow across the higher terrain south of the city. Approximately $25,000 in damage was reported from the storm.
1/4/2017	Lake-Effect Snow	-	-	This lake-effect snow event was a long duration, high impact event; one that snarled traffic across the Buffalo Southtowns Thursday evening and ultimately produced 3 to 4 feet of snow east of Lake Erie and Lake Ontario. The county had approximately $28,000 in damages from the event.
3/13/2017	Winter Storm	-	-	Snowfall records were set at Buffalo and Rochester. Many flights in and out of Buffalo and Rochester were cancelled. The state enacted a travel ban on tractor trailers on the major interstates. The National Guard was called on to assist in snow removal in some locations. The county reported $50,000 in damages from the event.
12/11/2017	Lake-Effect Snow	-	-	A general snow across the region was enhanced by the Great Lakes before transitioning to lake-effect snow bands east and southeast of the lakes. The county reported $30,000 in damages from the event.
12/15/2017	Lake-Effect Snow	-	-	Cold air crossing the relatively warm waters of Lakes Erie and Ontario resulted in lake-effect snows. The county reported $30,000 in damages from the event.
12/24/2017	Lake-Effect Snow	-	-	Lake-effect snow developed early Christmas morning and continued continuously for about 72 hours before diminishing late in the day on Wednesday the 27th. ||Off Lake Erie, the heaviest lake-effect snows with this event were mainly confined to the classic snow belt directly east of Lake Erie due to the predominate westerly flow. The county experienced $45,000 in damages.
12/29/2017	Lake-Effect Snow	-	-	Tea kettle bands of lake-effect snow developed offshore over Lake Erie and Lake Ontario for an extended period of time prior to moving onshore, first on Lake Erie and eventually on Lake Ontario. Off Lake Erie, the tea kettle lake-effect snow moved onshore from Ripley all the way to South Buffalo. The county reported $40,000 in damages from the event.
1/2/2018	Blizzard	-	-	This storm was a rare lake-effect blizzard, producing a period of blizzard conditions northeast of Lakes Erie and Ontario. With wind

Table 5.4.11-5. Severe Winter Storm Events in Erie County, 2016–2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details
				gusts of 40 to 50 mph northeast of Lakes Erie and Ontario. |. The county experienced $100,000 in damages.
1/12/2018	Winter Storm	-	-	A developing winter storm brought first a wintry mix of precipitation during the evening of the 12th and then heavy snow through the morning of the 13th. Once the precipitation changed to snow, the heavy snow fell at 1–2 inches an hour during the overnight hours. The county experienced $25,000 damage in the event.
3/1/2018	Winter Storm	-	-	A weak low pressure strengthened as it moved across Pennsylvania and merged with a low along the eastern coast. The storm brought a blanket of heavy, wet snow across the entire region from late afternoon on the first through the late morning through early afternoon of the second. The county experienced $70,000 in damages from the event.

Sources: FEMA 2020; NOAA-NCEI 2020; SPC 2021

- *Because of the large number of reported storms, included here are only those storms that caused more than $25,000 in damage*

Note: Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table. Due to the large number of winter storm events in the NOAA-NCEI archive, only winter storm events over $10K in property damages were included.

DR Major Disaster Declaration (FEMA)
FEMA Federal Emergency Management Agency
Mph Miles per Hour
NCEI National Centers for Environmental Information
NOAA National Oceanic and Atmospheric Administration
N/A Not Applicable

Climate Change Projections

Each region in New York State, as defined by ClimAID: The Integrated Assessment for Effective Climate Change in New York State (ClimAID), has attributes that will be affected by climate change. Erie County is part of Region 1 Western New York and Great Lakes Plains. Some of the issues in this region that are affected by climate change include the dairy and agricultural economy, milk and crop production losses projected, increased flooding in major rivers and streams, and given the county's relative location, the county will experience some of the first impacts from invasive species moving north (New York State Energy Research and Development Authority [NYSERDA] 2014).

Per Middle Range predictions, temperatures are expected to increase throughout the state, by 4.3 to 6.3 °F by the 2050s and 5.7 to 9.6 °F by the 2080s. Annual average precipitation is projected to increase from 4 percent to up to 10 percent by the 2050s, and from 4 percent to up to 13 percent by the 2080s. By the end of the century, the greatest increases in precipitation are projected to be in the northern parts of the state. Although seasonal projections are less certain than annual results, this additional precipitation will most likely occur during the winter months. However, with temperatures rising, some of the increased winter precipitation may fall as rain as opposed to snow. In Region 1, the number of days with temperature below 32°F is projected to drop from a current average of 133 days below 32 degrees to as few as 99 such days in the 2080s, reducing the likelihood of precipitation falling as snow.

New York State is already experiencing the effects of climate change during the winter season. Annual ice cover has decreased 71 percent on the Great Lakes since 1973. This decrease may lead to increased lake-effect snow in Erie County in the next two decades through greater moisture availability. By mid-century, however, lake-effect snow will generally decrease as temperatures below freezing become less frequent (NYSERDA 2014). Winter snow cover is decreasing, and spring weather is seen, on average, about one week earlier than a few years ago. Night-time temperatures are measurably warmer, even during the colder months (NYSDEC n.d.). Overall winter temperatures in New York State are almost 5 °F warmer than in 1970 (NYSDEC n.d.). NYS has seen a decrease in the number of cold winter days (below 32 °F) and can expect to see a decrease in snow cover by as much as 25 to 50 percent by the end of the next century. The lack of snow cover may jeopardize winter sport businesses offering skiing, snowmobiling, and other types of winter recreation. Natural ecosystems will be affected by the changing snow cover (Cornell University College of Agriculture and Life Sciences 2011).

Probability of Future Occurrences

Table 5.4.11-6 summarizes data regarding the probability of occurrences of severe winter storm events in Erie County based on the historic record. Heavy snow events are the most common in Erie County, followed by winter storms. The information used to calculate the probability of occurrences is based solely on NOAA-NCEI storm events database results.

Table 5.4.11-6. Probability of Future Occurrence of Severe Winter Weather Events

Hazard Type	Number of Occurrences Between 1950 and 2020	% Chance of Occurrence in Any Given Year
Blizzard	8	11.3%
Heavy Snow	97	100%
Ice Storm	4	5.6%
Lake-Effect Snow	97	100%
Winter Storm	47	66.2%
Winter Weather	0	0%
Total	**253**	**100%**

Source: NOAA-NCEI 2020

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act (Public Law 81-875) and selected severe winter storm events since 1996. Due to limitations in data, not all severe winter storm events occurring between 1950 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based on historical data from NYSERDA, it is expected that the following will occur at least once per 100 years:

- Up to 4 inches of freezing rain in the ice band near central New York State, of which between 1–2 inches of accumulated ice will occur over a 24-hour period.
- Up to 2 feet of accumulated snow in the snow band in northern and western New York State over a 48-hour period (NYSERDA 2011).

In Section 5.3 of this HMP, the identified hazards of concern for Erie County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for severe winter storms in the county is considered ‘frequent’ (event has a 100-percent annual probability and may occur multiple times per year).

5.4.11.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the severe winter storm hazard, all of Erie County has been identified as the hazard area. Therefore, all assets in the county (population, structures, critical facilities, and lifelines), as described in Section 4 (County Profile), are vulnerable to a winter storm event.

Impact on Life, Health, and Safety

The entire population of Erie County (919,355 people) is exposed to severe winter storm events (American Community Survey 2018). The homeless and elderly are considered most susceptible to this hazard. The elderly are considered susceptible to this hazard due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice. According to the 2019 American Community Survey (ACS) 5-Year estimate, there are 161,744 persons over 65 years old that reside in the county that are considered vulnerable to severe winter weather. In addition, severe winter storm events can reduce the ability of these populations to access emergency services.

The homeless and residents below the poverty level may not have access to housing, or their housing could be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Residents with low incomes might not have access to housing, or their housing can be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). According to the 2019 American Community Survey (ACS) 5-Year estimate, there are 126,806 low-income persons that are considered vulnerable to severe winter weather. The jurisdiction with the highest concentration of population below the poverty level is the City of Buffalo (29.1-percent of total population in the Borough). Refer to Section 4 (County Profile) that displays the densities of low-income populations in Erie County.

According to the NOAA NSSL, every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion, and exposure (NSSL 2020). Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow, extreme cold temperatures, and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold. Heavy accumulations of ice can bring down trees and power lines, disabling electric power and communications for days or weeks. Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services. Storms near the coast can cause coastal flooding and beach erosion as well as sink ships at sea. The economic impact of winter weather each year is huge with costs for snow removal, damage, and loss of business in the millions (NOAA 2017).

Impact on General Building Stock

The entire general building stock inventory is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this plan considers percentage damages that could result from severe winter storm conditions. This allows planners and emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Table 5.4.11-7. below summarizes the estimated loss based on 1, 5, and 10 percent losses. Given professional knowledge and the currently available information, the potential loss for this hazard is many times considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place, etc.). Therefore, the following information should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Table 5.4.11-7. General Building Stock Exposure and Estimated Losses from Severe Winter Storm Events

Jurisdiction	Total Replacement Cost Value (RCV)	1 Percent Exposure/Loss	5 Percent Exposure/Loss	10 Percent Exposure/Loss
Akron (V)	$866,609,574	$8,666,096	$43,330,479	$86,660,957
Alden (T)	$1,748,473,245	$17,484,732	$87,423,662	$174,847,324
Alden (V)	$602,655,574	$6,026,556	$30,132,779	$60,265,557
Amherst (T)	$27,372,255,690	$273,722,557	$1,368,612,784	$2,737,225,569
Angola (V)	$525,704,230	$5,257,042	$26,285,211	$52,570,423
Aurora (T)	$2,496,885,036	$24,968,850	$124,844,252	$249,688,504
Blasdell (V)	$638,571,953	$6,385,720	$31,928,598	$63,857,195
Boston (T)	$1,702,475,276	$17,024,753	$85,123,764	$170,247,528
Brant (T)	$657,594,060	$6,575,941	$32,879,703	$65,759,406
Buffalo (C)	$58,603,851,634	$586,038,516	$2,930,192,582	$5,860,385,163
Cheektowaga (T)	$17,530,893,277	$175,308,933	$876,544,664	$1,753,089,328
Clarence (T)	$9,866,246,863	$98,662,469	$493,312,343	$986,624,686
Colden (T)	$854,417,381	$8,544,174	$42,720,869	$85,441,738
Collins (T)	$1,189,158,504	$11,891,585	$59,457,925	$118,915,850
Concord (T)	$1,338,570,261	$13,385,703	$66,928,513	$133,857,026
Depew (V)	$3,841,823,815	$38,418,238	$192,091,191	$384,182,381
East Aurora (V)	$1,723,816,550	$17,238,166	$86,190,828	$172,381,655
Eden (T)	$2,180,455,513	$21,804,555	$109,022,776	$218,045,551
Elma (T)	$3,775,039,302	$37,750,393	$188,751,965	$377,503,930
Evans (T)	$3,335,060,692	$33,350,607	$166,753,035	$333,506,069
Farnham (V)	$87,990,422	$879,904	$4,399,521	$8,799,042
Gowanda (V)	$249,516,940	$2,495,169	$12,475,847	$24,951,694
Grand Island (T)	$4,674,517,058	$46,745,171	$233,725,853	$467,451,706
Hamburg (T)	$11,911,210,828	$119,112,108	$595,560,541	$1,191,121,083
Hamburg (V)	$2,005,172,252	$20,051,723	$100,258,613	$200,517,225
Holland (T)	$1,151,194,342	$11,511,943	$57,559,717	$115,119,434
Kenmore (V)	$2,305,529,001	$23,055,290	$115,276,450	$230,552,900
Lackawanna (C)	$4,030,622,400	$40,306,224	$201,531,120	$403,062,240
Lancaster (T)	$6,845,493,469	$68,454,935	$342,274,673	$684,549,347
Lancaster (V)	$2,217,331,122	$22,173,311	$110,866,556	$221,733,112

Jurisdiction	Total Replacement Cost Value (RCV)	1 Percent Exposure/Loss	5 Percent Exposure/Loss	10 Percent Exposure/Loss
Marilla (T)	$1,099,846,031	$10,998,460	$54,992,302	$109,984,603
Newstead (T)	$2,181,758,974	$21,817,590	$109,087,949	$218,175,897
North Collins (T)	$889,517,676	$8,895,177	$44,475,884	$88,951,768
North Collins (V)	$383,968,909	$3,839,689	$19,198,445	$38,396,891
Orchard Park (T)	$8,174,650,530	$81,746,505	$408,732,526	$817,465,053
Orchard Park (V)	$867,347,745	$8,673,477	$43,367,387	$86,734,775
Sardinia (T)	$1,068,523,829	$10,685,238	$53,426,191	$106,852,383
Sloan (V)	$634,998,253	$6,349,983	$31,749,913	$63,499,825
Springville (V)	$1,354,905,864	$13,549,059	$67,745,293	$135,490,586
Tonawanda (C)	$3,291,492,557	$32,914,926	$164,574,628	$329,149,256
Tonawanda (T)	$14,694,684,404	$146,946,844	$734,734,220	$1,469,468,440
Wales (T)	$833,853,270	$8,338,533	$41,692,664	$83,385,327
West Seneca (T)	$9,583,482,689	$95,834,827	$479,174,134	$958,348,269
Williamsville (V)	$1,126,868,443	$11,268,684	$56,343,422	$112,686,844
Erie County Total	**$222,515,035,436**	**$2,225,150,354**	**$11,125,751,772**	**$22,251,503,544**

Source: Erie County GIS 2020; RS Means 2020
C = City; T = Town; V = Village
** Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. Severe winter storms can cause flooding through blockage of streams or through snowmelt. At-risk residential infrastructures are presented in the flood hazard profile (Section 5.4.5). Generally, losses resulting from flooding associated with severe winter storms should be less than that associated with the 1 percent annual chance flood. Please refer to the Severe Storms hazard profile (Section 5.4.10) for losses resulting from wind.

Impact on Critical Facilities

Full functionality of critical facilities such as police, fire, and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires the clearing of roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required.

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL 2020).

Impact on Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. Impacts on the economy also include commuter difficulties into or out of the area for work or school. The loss of power and closure of roads prevent commuters from traveling within the county. According to Erie County's 2021 Adopted Budget, the Town/Village Snow Contracts are $5.7 million. This is a 1.5 percent increase from the county's 2020 Adopted Budget.

Impact on the Environment

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources. Rain-on-snow events can also exacerbate runoff rates with warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals.

Furthermore, chemically based winter maintenance practices have their own effect on the natural environment. Melting snow and ice that carry deicing chemicals onto vegetation and into soils can contaminate the local waterways. Elevated salt levels may hinder vegetation from absorbing nutrients, slowing plant growth (UMass Extension 2020).

Future Changes That May Impact Vulnerability

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

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

Projected Development

Areas targeted for future growth and development have been identified across Erie County (refer to Sections 4 and 9). Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire planning area is exposed and vulnerable. However, due to increased standards and codes, new development may be less vulnerable to the severe winter weather hazard compared with the aging building stock in the county.

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has increased by a negligible amount between 2010 and 2019 (American Community Survey 2019). Estimated population projections provided by the Cornell Program on Applied Demographics indicate that the county's population will increase into 2040, bringing total population to approximately 945,891 persons (Cornell Program on Applied Demographics 2018). Any changes in the density of population can create issues for local residents during evacuation of a severe winter storm event. Furthermore, if the density or number of persons over 65 increases in the county, more persons will be vulnerable to severe winter weather events. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extreme events such as winter storms. While predicting changes of winter storm events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (U.S. Environmental Protection Agency [EPA], 2020).

An increase in the frequency and severity of severe winter storms could result in an increase of snow loads on the county's building stock and infrastructure, putting each building at risk to structural damage. More frequent and severe events also will result in increased resources spent to prepare for and clean-up after an event. However, as winter temperatures continue to rise, climate projections indicate the increase in precipitation is likely to occur during the winter months as rain. Increased rain on snowpack or frozen or saturated soils can lead to increased flooding and related impacts on the county's assets.

Vulnerability Change Since the 2016 HMP

Overall, the county's exposure and vulnerability have not changed, and the entire county will continue to be exposed and vulnerable to severe winter storm events.

Identified Issues

Snow storage has been identified as an issue, particularly after very large snow events. The town would like to dedicate certain areas to snow storage instead of relying upon ad hoc storage at town parks.

5.4.12 Utility Failure

The following sections provide the hazard profile (hazard description, extent, location, previous occurrences and losses, probability of future events, and climate change impacts) and vulnerability assessment for the utility failure hazard for the Erie County Hazard Mitigation Plan (HMP).

5.4.12.1 Hazard Profile

Description

Power failure is defined as any interruption or loss of electrical service caused by disruption of power transmission from accident, sabotage, natural hazards, or equipment failure (also referred to as a loss of power or power outage). A significant power failure is defined as any incident of a long duration, which would require the involvement of the local and/or state emergency management organizations to coordinate provision of food, water, heating, cooling, and shelter.

Widespread power outages can occur without warning or as a result of a natural disaster. Generally, warning times will be short in the case of technological failure, such as a fire at a sub-station, traffic accident, human error, or terrorist attack. In cases where a power failure is caused by natural hazards, greater warning time is possible. For example, high wind events (such as tornadoes and hurricanes) often cause widespread power failure, and are often forecasted before they affect a community. Additionally, severe winter weather conditions (such as ice storms, blizzards, and snowstorms) often cause power failure. These types of incidents are often preceded with warnings allowing power response crews to stage resources to prepare for power failure.

Power failures can lead to secondary hazards as well, leading to negative impacts on the health and safety of residents.

- During periods of extreme heat or extreme cold, vulnerable populations, such as the elderly and medically frail, can be affected and are susceptible to hypothermia or heat stroke. Additionally, power failure can lead to food spoilage, which can have negative impacts on public health.
- A secondary hazard from power failure is a loss of communications capability by first responders, which may in turn have negative impacts on public safety. Power outages can also lead to instances of civil disturbance, including looting.
- Power interruptions at chemical handling plants are of particular concern because of the potential for a chemical spill during restart (U.S. Environmental Protection Agency [EPA] 2001). Chemical spills can also have significant health and environmental impacts.
- Wastewater and potable water utility interruption may occur as a result of a power failure. These critical utilities are essential to community continuity and recovery and interruption of water service may have cascading economic and environmental impacts.
- Power failure may also lead to an increase in traffic accidents because of the lack of traffic control devices, such as stoplights and railroad crossing advisory signals. Power outages lasting a long duration will force law enforcement officials to man traffic control points to prevent accidents.

Location

Power failures in Erie County are usually localized and are frequently the result of a natural hazard event involving high winds or ice storms. Power failure is particularly problematic for homes that are heated with electricity. Widespread power outages during the winter months can directly impact vulnerable populations, such as the elderly and medically frail. According to the 2019 American Community Survey, 29,479 homes across Erie County are heated with electricity (American Community Survey 2019). This represents 7 percent of the total homes in the county. Gas and oil are transmitted through the county primarily by National Fuel Gas Distribution Company, Tennessee Gas, and Empire Pipeline Company.

Wastewater treatment for most municipalities is provided by municipal or private treatment facilities. There are 16 municipal wastewater treatment facilities and 187 pump stations in the county. Municipal wastewater treatment services are provided by wastewater treatment plants, wastewater treatment facilities, and sewage treatment plants. Private wastewater treatment within Erie County includes septic systems and sand filters. Where municipal sewage treatment is not available, on-site septic systems are used. Soil quality in the county is variable, resulting in many parts of the county being unsuitable for on-site wastewater treatment. Undersized or unmaintained on-site septic systems can be an issue, particularly in the drinking watersheds, where exposure and runoff can impair water quality. These wastewater facilities and pump stations are displayed in Figure 4-21 in Section 4, County Profile.

Erie County is served by a variety of communications systems, including traditional land line and cellular service provided by multiple companies, Verizon Wireless and AT&T, plus Sprint, T-Mobile and others offering 3G, 4G, and 4G LTE services (Erie County 2017). Wireless Broadband internet service is provided by Transwave and two predominant wire line broadband companies Verizon and Charter Spectrum (Erie County 2017). The Erie County Broadband Feasibility Study has outlined the development of a county broadband committee, community collaboration efforts, creation and adoption of a “dig once” policy, target broadband infrastructure projects for economic development zones or Erie County Industrial Development Agency focused sites, and development of an Open Access Network (Erie County 2017) . In addition to land line, fiber optic and cellular communications systems, Erie County has an extensive radio communications network that is utilized by emergency services agencies, hospitals, law enforcement, public works, transportation, and other supporting organizations.

The most common sources of potable water within Erie County are municipal and private sources. Private sources of water include drilled wells, driven point wells, and springs. Municipal water supplies (provided by towns and cities) include community water systems, noncommunity water systems, non-transient noncommunity water systems, and water systems regulated as a condition of a “Permit to Operate” issued by the Department of Health. The Erie County Water Authority (ECWA) is responsible for ensuring compliance with treatment, reporting, and water quality standards for all public water systems (ECWA 2019). The New York State Department of Environmental Conservation (NYSDEC) Water Well Information database has begun to document potable water wells as of the year 2000, and currently reports 443 new wells drilled in the county since that date (NYSDEC 2021).

Extent

The extent and severity of a power outage depends on the cause, location, duration, and time of year. It can range from a small, localized event to a countywide power outage. Impacts from an outage can be significant to the county and its residents.

Power failures often result from damage to or electrical hazards within an electric power system. System components include power generation plants, substations, circuits, switches, transformers, power lines, and power poles. Because the varied nature of power outages can range from vehicle accidents to severe weather, utility interruptions can happen at any time.

Power failures lead to the inability to use electric-powered equipment, such as: lighting; heating, ventilation, and air conditioning (HVAC) and necessary equipment; communications equipment (telephones, computers, etc.); fire and security systems; small appliances, such as refrigerators, sterilizers, etc.; and medical equipment. These types of failures can lead to food spoilage, loss of heating and cooling, basement flooding from sump pump failure, and loss of water from well pump failure.

Previous Occurrences and Losses

Many sources provided power outage information regarding previous occurrences and losses associated with events that caused outages throughout Erie County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

Between 1954 and 2020, FEMA included the State of New York in one power outage-related disaster (DR) or emergency (EM) declaration. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Erie County was included in this disaster (EM-3186 Power Outage).

For this 2022 plan update, power outage events were summarized from 2015 to 2020. Table 5.4.12-1 includes power outage events that occurred between 2013 and 2020. With documentation for New York and Erie County being so extensive, not all sources have been identified or researched. Therefore, Table 5.4.12-1 may not include all events that have occurred throughout the county.

Table 5.4.12-1. Power Failure Events in Erie County, 2015-2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Erie County Designated?	Description
January 4, 2015	High Wind	N/A	N/A	Both broadcast media and law enforcement reported incidences. Monetary property damage totaled $40K across the County. A low pressure tracked from western Lake Erie across far southern Ontario to Quebec and dragged a cold front across the region. Strong winds increased to near 60 mph about 2 to 3 hours after the cold front passage. The strong winds downed trees and wires across western New York. Scattered power outages resulted.
November 12, 2015	High Wind	N/A	N/A	Broadcast media reported power lines down in Erie County with $75K in property damage reported. A strong cold front crossed the region followed by a period of strong winds to the lower parts of Lakes Erie and Ontario. Wind gusts were measured to 60 mph. The winds downed trees and power lines with scattered power outages reported. Several roads were blocked by fallen trees.
July 25, 2016	Thunderstorm Wind Lightning	N/A	N/A	Law enforcement, County Emergency Manager, and broadcast media reported power lines down in Erie County with $49,000 in property damage. Storms first developed along a line from the east end of Lake Erie to the west end of Lake Ontario, which shifted south and east through the morning then pushing east of the region during the early afternoon. The thunderstorm winds downed trees and power lines throughout the region. Several thousand power outages were reported.
August 13, 2016	Thunderstorm Wind	N/A	N/A	Local fire departments reported power lines down in Erie County with $15K in property damage. Thunderstorms developed across the region in a moist unstable air mass. Numerous thunderstorms developed on outflow and lake breeze boundaries. Thunderstorms downed trees and wires throughout the region. Power outages were scattered throughout the region.
September 10, 2016	Thunderstorm Wind	N/A	N/A	Social media, trained spotters, and law enforcement reported power lines down in Erie County with $50K in property damage. Thunderstorms that accompanied a severe cold front produced damaging wind gusts. The winds downed trees and power lines across the region with scattered power outages reported. Several streets were reported blocked and closed by downed trees and wires.
January 4, 2017	High Wind	N/A	N/A	Broadcast media reported power lines down in Erie County with $40K in property damage. Deep cold air building across the region brought strong, gusty winds to the eastern end of Lake Erie. Winds gusted to between 50 and 60 mph. A building collapse occurred in in East Pembroke with no one inside. The strong winds downed trees and power lines. Several structures were damaged by falling trees. Power outages were reported by New York State Electric and Gas and National Grid.
April 14, 2018	Ice Storm	N/A	N/A	Law enforcement reported powerlines down in Erie County with $40K in property damage. Two rounds of mixed winter precipitation moved over the area with warm air aloft overriding a deep layer of cold air at the surface. This resulted in sleet initially that transitioned to freezing rain before temperatures eventually increased above freezing. Several areas saw nearly an inch of sleet combined with around one half of an inch of freezing rain. This resulted in thousands of power outages and substantial tree damage.

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Erie County Designated?	Description
October 31 – November 1, 2019	High Wind, Lakeshore Flood	YES DR-4472-NY	Yes	Official NWS Observations and river/stream gauges relayed data. Erie County had a total of $ 18,300,000 in property damage primarily from lakeshore flooding in downtown Buffalo. A deepening area of consolidated low pressure tracked across the region on Thursday evening, October 31. This system brought recorded breaking Halloween rains, damaging wind gusts, a large Lake Erie seiche. Thousands of power outages occurred across the area, and pervasive wind-related damage closed hundreds of roads and did countless tree damage across a vast swath of the area. Enough damage was done across New York to have a Presidential Disaster Declaration. Heavy rain also brought flooding concerns.

Source: *National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) 2020; FEMA 2020*
FEMA *Federal Emergency Management Agency*
K *Thousand ($)*
M *Million ($)*
N/A *Not applicable*

Probability of Future Occurrences

While the probability of future power failure incidents in Erie County is difficult to predict, historical records indicate that significant power failures have occurred as a result of high winds, lightning, winter weather, and technological failures. Data were not readily available on the frequency of smaller power outages across the county; however, it is reasonable to assume that power failure events of shorter duration will continue to occur in the future. In addition, future changes in climate may also impact the frequency and probability of future power failure occurrences.

Section 5.3 provides a ranking of the identified hazards of concern for Erie County. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for utility failures in the county is considered *frequent* (hazard event has a 100 percent probability of occurring and may occur multiple times a year), and the probability for major utility failures is considered *occasional* (hazard has a 10 to 100 percent annual probability of occurring), as presented in Table 5.3-1.

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue and become more significant. Impacts related to increasing temperatures and sea level rise are already evident in the state. The Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision makers with information on the state's vulnerability to climate change, and to facilitate development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Erie County is part of Region 1, Great Lakes Plains. Some characteristics of and issues affecting this region associated with climate change include water temperature related to nuclear powerplant cooling, water availability for hydropower, and high availability of wind power (NYSERDA 2011).

Temperatures are expected to increase throughout the state by 2 ºF to 3.4 ºF by the 2020s, 4.1 °F to 6.8 °F by the 2050s, and 5.3 °F to 10.1 °F by the 2080s. The lower ends of these ranges assume lower greenhouse gas emissions scenarios, and the higher ends assume higher greenhouse gas emissions scenarios. Annual average precipitation is projected to increase from 1 to 8 percent by the 2020s, and from 3 to 12 percent by the 2050s, and from 4 to 15 percent by the 2080s. By the end of the century, the greatest increases in precipitation are projected to be in the northern parts of the state. Although seasonal projections are less certain than annual results, this additional precipitation will most likely occur during the winter months, with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.12-2 lists projected precipitation changes within the Great Lake Plains ClimAID Region (NYSERDA 2014).

Table 5.4.12-2. Projected Seasonal Precipitation Change in Region 1, 2020-2100 (% change)

Baseline (1971-2000) 37.0 inches	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
2020s	0%	2 – 7%	8%
2050s	2%	4 – 10%	12%
2080s	1%	4 – 13%	17%
2100	-3%	4 – 19%	24%

Source: NYSERDA 2014

Annual temperatures throughout New York State have been rising since the start of the 20th century. The state's average temperatures have increased by approximately 0.6 °F since 1970, with winter warming exceeding 1.1 °F per decade. Extreme heat events are likely to increase throughout New York State, and short-duration warm season droughts will become more common.

Climatologists predict an increase in the number and intensity of severe weather events. More storms with higher winds will increase the chance that the power infrastructure will be impacted. Extreme temperatures are predicted to increase as well. During the hot summer months, potential for power overload will escalate as demand for power increases. Additionally, climatologists predict an increase in precipitation, which may lead to more winter weather, thus causing additional power failures.

5.4.12.2 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable within the identified hazard area. For the utility failure hazard, all of Erie County has been identified as the hazard area. Therefore, all assets in the county (population, structures, critical facilities, and lifelines), as described in the County Profile, Section 4, are vulnerable to a utility failure. This section discusses the potential impact of the utility failure hazard on the county.

The entire county is vulnerable to the utility failure hazard. Loss of power can exert serious impacts on the health and welfare of residents, continuity of businesses, and ability of public safety agencies to respond to emergencies. Individuals with medical needs are vulnerable to power failures because medical equipment, such as oxygen concentrators, requires electricity to operate. Elderly residents (persons over 65 years old) are also vulnerable to the effects of power failure, as power failure could expose older residents to extreme heat or extreme cold. According to the 2019 American Community Survey 5-year Population Estimates, 169,007 persons are over 65 years old in the county (American Community Survey 2019). Further, households that rely on electricity to power in-home heating and cooling systems will be exposed to significantly colder or hotter indoor temperatures during a utility failure in the winter and summer months, respectively. Households that use utility gas for home heating will be less vulnerable.

Additionally, during power failure events, water purification systems may not function. Further, populations relying on private wells will not have access to potable water. Many power outages are caused by storm events that can lead to flooding. Without electricity, residents would be unable to pump water from their basements, potentially causing structural and content damage to their homes. Section 5.4.6, Flood, includes a more detailed discussion of the county's vulnerability to the flood hazard.

Data were collected from Erie County and the Planning Partnership. Insufficient data were available to model long-term potential impacts of a utility failure on the county. Over time, additional data will be collected to allow better analysis of this hazard. Available information and a preliminary assessment are provided below.

Impacts on Life, Health, and Safety

For the purposes of this HMP, the entire population in Erie County is considered vulnerable to utility failure events. Section 4 of this HMP, County Profile, includes a summary of population statistics for the county. Utility failures pose potential health impacts including injury and death. Other issues pertaining to power outages include food safety from lack of refrigeration and carbon monoxide poisoning from misuse of generators.

Utility failure is particularly problematic for homes that are heated with electricity. Widespread power outages during the winter months can directly impact vulnerable populations, such as the elderly and medically frail. Individuals with medical needs are vulnerable to power failures because medical equipment, such as oxygen concentrators, requires electricity to operate. The elderly population (persons over 65 years old) is also vulnerable to the effects of power failure, as power failure could expose older residents to extreme heat or extreme cold. There are 169,007 persons over 65 years old in Erie County (American Community Survey 2019).

Furthermore, during power failure events, water purification systems may not function. Populations relying on private wells will not have access to potable water. Additionally, many power outage events are caused by storm events that can lead to flooding. Without electricity, residents would be unable to pump water from their basements, potentially causing structural and content damage to their homes.

Individuals powering their homes with generators are subjected to carbon monoxide poisoning if proper ventilation procedures are not followed. Improperly connected portable generators are capable of "back feeding" power lines, which may cause injury or death to utility works attempting to restore power and may damage house wiring and/or generators (Community Health Care Association of New York State 2020).

Impacts on General Building Stock

All building stock in the county is exposed to the utility interruption hazard. Section 4, County Profile, summarizes the building inventory in Erie County. Impacts sustained from utility interruption are likely to be secondary impacts. Should potable water distribution be reduced or not available, then structures could be at increased risk for structural fire since current fire suppression is dependent on accessing water from hydrants.

Impacts on Critical Facilities

All critical facilities in the county are exposed to the utility interruption hazard. It is essential that critical facilities remain operational during natural hazard events. Backup power is recommended for critical facilities and infrastructure. Loss of power can have serious impacts on the health and welfare of residents, continuity of business, and the ability of public safety agencies to respond to emergencies. Interruption of utility gas or water distribution could also reduce the effectiveness of critical facilities to operate at full capacity.

Impact on Economy

A prolonged power failure in Erie County may impact the county's economy. All roadway systems and supporting resources provide services locally, regionally, nationally, and internationally. Disruption in any of these services would mean that many workers, residents, and travelers would not be able to go where needed.

Power interruptions can cause economic impacts stemming from lost income, spoiled food and other goods, costs to the owners/operators of the utility facilities, and costs to government and community service groups. Interruption of utility gas or potable water distribution could also cause significant economic impacts such as additional costs for bringing in water tenders to maintain fire suppression capabilities; opening additional warming centers should electric and utility gas utility be interrupted to residential areas; and distribution of potable water for public consumption. Significant costs could be associated with reimbursing fire departments from other counties within New York to travel, staff, and maintain water tenders within Erie County during the duration of a water outage event.

Potential modeling of economic impacts from utility interruption would be developed by calculating interruption of service costs derived from a standard value per person per day multiplied out by the number of customers served. This would help to provide an estimate of the impact of the interrupted utility service but may not be representative of the complete economic impact of a prolonged utility interruption. For example, FEMA's benefit-cost analysis (BCA) methodology measures the loss of electrical service on a per-person-per-day-of-lost-service basis for the service area affected. The FEMA BCA Toolkit version 6.0 uses the following standard values to estimate cost of utility usage per person per day (FEMA 2020):

- Electric: $174.00
- Potable Water: $114.00

- Wastewater: $58.00

Impact on the Environment

At this time, there are no known impacts to the environment caused by utility failures.

Future Changes that May Impact Vulnerability

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

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

Projected Development

Any areas of growth could be potentially impacted by utility failures because the entire county is exposed and vulnerable. However, because of increased standards and codes, new development may be less vulnerable to utility failures compared to the aging building stock in the county. Section 4, County Profile, provides more information about the new development plans for Erie County.

Projected Changes in Population

According to the U.S. Census, the population for Erie County has decreased approximately less than 1 percent between 2010 and 2019 (U.S. Census Bureau 2021). Estimated population projections provided by the 2017 Cornell Program on Applied Demographics indicates that the county's total population will increase to approximately 945,891 residents by 2040 (Cornell University 2017). With the projected estimates, more people will reside in the county resulting in a higher reliance on electric power or more will be living/working out of properties that do not meet existing codes and are at risk of experiencing utility failure events. Section 4, County Profile, provides additional discussion on population trends.

Climate Change

Several implications for climate change are related to the power failure hazard. Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches, the more subject to changing dynamics it becomes.

Climatologists predict an increase in the number and intensity of severe weather events. More storms with higher winds will increase the chance that the power infrastructure will be impacted. Extreme temperatures are predicted to increase as well. During the hot summer months, the potential for power overload will increase as demand for power increases. Additionally, climatologists predict an increase in precipitation, which may lead to more winter weather causing additional power failures and utility interruptions.

Changes in Vulnerability Since the 2015 HMP

Utility failures are a new hazard of concern for Erie County. Since the 2015 analysis, population statistics have been updated using the 5-Year 2015-2019 American Community Survey Population Estimates (American Community Survey 2019). Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2015 HMP. This information provides more accurate exposure and potential loss estimates for Erie County.

5.4.13 Wildfire

This section provides a profile and vulnerability assessment of the wildfire hazard for the Erie County Hazard Mitigation Plan (HMP).

5.4.13.1 Hazard Profile

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

Hazard Description

A wildland fire can be defined as any non-structural fire that occurs in the wildland. Three distinct types of wildland fires have been defined and include naturally occurring wildfire, human-caused wildfire, and prescribed fire. They may be highly destructive and become difficult to control. Wildfires result in the disturbance of forest and brush and destruction of real estate and personal property, and have secondary impacts on other hazards, such as flooding, by removing vegetation and disturbing watersheds.

Wildfires are commonly termed forest fires, brush fires, grass fires, wildland-urban interface (WUI) fires, range fires, or ground fires. Wildfires do not include fires naturally or purposely ignited to manage vegetation for one or more benefits (NYS Division of Homeland Security and Emergency Services [DHSES] 2014). Although destructive fires do not occur annually, the state's fire history shows a cycle of outbreaks that have caused death, property loss, forest destruction, and air pollution (NYS DHSES 2019).

Wildfire in New York State is based on the same science and environmental factors as any wildfire in the world. Fuels, weather, and topography are the primary factors that determine the natural spread and destruction caused by every wildfire. New York State, including Erie County, has large tracts of diverse forest lands, many of which are the result of wildfires.

Wildfires are grouped within three classes: surface fires, ground fires, and crown fires. Surface fires, the most common, burn along the forest floor, moving slowly and killing or damaging trees. Ground fires are usually started during excessively dry periods, and burn on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along tops of trees.

The Federal Emergency Management Agency (FEMA) defines the following four categories of wildfires that occur throughout the United States:

- Wildland fires – fueled almost exclusively by natural vegetation. They typically occur in national forests and parks, where federal agencies are responsible for fire management and suppression.
- Interface or intermix fires – urban/wildland fires in which vegetation and the built-environment provide fuel.
- Firestorms – events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during extreme weather and generally burn until conditions change or the available fuel is exhausted.
- Prescribed fires and prescribed natural burns – fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes (FEMA 1997).

Wildfire Behavior and Fire Ecology

Potential for wildfire and its subsequent development (growth) and severity are controlled by the three factors of topography, fuel, and weather. Climate change is also considered a potential source of influence. These four factors are described below:

- Fuel
  - Lighter fuels (such as grasses, leaves, and needles) quickly expel moisture and burn rapidly, while heavier fuels (such as tree branches, logs, and trunks) take more time to warm and ignite.
  - Snags and hazard trees–especially those that are diseased, dying, or dead—are quickly engulfed and allow fires to spread quickly.
- Weather
  - Strong winds within the vicinity of the flames produce extreme fire conditions. Of particular concern are wind events that potentially persist for longer periods of time, or ones with significant wind speeds, which can sustain and quickly promote the spread of fire through movement of embers or exposure within tree crowns.
  - Spring and summer months, which can experience drought-like conditions extending beyond the normal season, also expand the average fire season. Likewise, the passage of a dry, cold front through the region can result in a sudden increase in wind speeds and a change in wind direction affecting fire spread.
  - Thunderstorm activity, which typically begins with wet storms, turns dry with little or no precipitation reaching the ground as the season progresses.
- Terrain
  - Regional and local topography influence the amount and moisture of fuel.
  - Barriers, such as highways and lakes, can affect the spread of fire.
  - Elevation and slope of landforms affect fire spread; flames move more easily uphill than downhill.
- Changes to Environment
  - Without an increase in summer precipitation (greater than any predicted by climate models), areas susceptible to future burning are very likely to increase.
  - Infestation from insects is also of concern as it may impact forest health. Potential insect populations may increase with warmer temperatures with the potential for infested stressed trees to increase the fuel load.
  - The composition of various tree species will change as species respond uniquely to a changing climate.
  - Wildfires cause both short-term and long-term losses. Short-term losses can include destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and the destruction of cultural and economic resources and community infrastructure.

Extent

The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. Several tools are available to estimate fire potential, extent, danger, and growth, including the following:

Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential, including national fire danger, weather maps, and satellite-derived "greenness" maps. It was developed by the Fire Behavior unit at the Fire Sciences Laboratory in Missoula, Montana, and is currently supported and maintained at the National Interagency Fire Center (NIFC) in Boise, Idaho (U.S. Forest Service [USFS] n.d.).

Each day during the fire season, the WFAS produces national maps of selected fire weather and fire danger components of the National Fire Danger Rating System (NFDRS) (USFS n.d.). Fire Danger Rating levels take into account current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (USFS n.d.). Table 5.4.13-1 shows the five fire danger ratings and color codes.

Table 5.4.13-1. Description of Fire Danger Ratings in New York State

Fire Danger Rating and Color Code	Description
Low (L) (Dark Green)	Fuels do not ignite readily from small firebrands; although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.
Moderate (M) (Light Green or Blue)	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
High (H) (Yellow)	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH) (Orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics, such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme (E) (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash (trunks, branches, and tree tops) or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Source: USFS n.d.

The ***Fire Potential Index (FPI)*** is derived by combining daily weather and vegetation condition information and can be used to identify the area's most susceptible to fire ignition. The combination of relative greenness and weather information identifies the moisture condition of the live and dead vegetation. The weather information also lists areas of low humidity, high temperature, and no precipitation to identify areas most susceptible to fire ignition. The FPI enables local and regional fire planners to quantitatively measure fire ignition risk (U.S. Geological Survey [USGS] 2005). FPI maps are provided on a daily basis by the USFS. The scale ranges from 0 (low) to 100 (high). The calculations used in the NFDRS are not part of the FPI, except for a 10-hour moisture content (Burgan et al. 2000).

Fuel Moisture (FM) is a tool that is used to understand the fire potential for locations across the United States. It is a measure of the amount of water in a fuel (vegetation) available to a fire, and is expressed as a percent of the dry weight of that specific fuel. When fuel moisture content is high, fires do not ignite readily, or at all, because heat energy has to be used to evaporate and drive water from the plant before it can burn. When the fuel moisture content is low, fires start easily and will spread. When the fuel moisture content is less than 30 percent, that fuel is essentially considered to be dead (known as dead fuels). Dead fuels respond solely to current environmental conditions and are critical in determining fire potential (Burgan et al. 2000).

The ***Keetch-Byram Drought Index (KBDI)*** is a drought index designed for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS n.d.). The index increases each day without rain and decreases when it rains. The scale ranges from 0 (no moisture deficit) to 800 (maximum drought possible). The range of the index is determined by assuming that 8 inches of moisture are in a saturated soil that is readily available to the vegetation. For different soil types, the depth of soil required to hold 8 inches of moisture varies. A prolonged drought influences fire intensity, largely because more fuel is available for combustion. The drying of organic material in the soil can lead to increased difficulty in fire suppression (USFS 2016).

The ***Haines Index***, also known as the Lower Atmosphere Stability Index, was developed for fire use. It is used to indicate the potential for wildfire growth by measuring the stability and dryness of the air over a fire. It is calculated by combining the stability and moisture content of the lower atmosphere into a number that correlates well with large fire growth. The stability term is determined by the temperature difference between two atmospheric layers; the moisture term is determined by the temperature and dew point difference. This index has been shown to be correlated with large fire growth on initiating and existing fires where surface winds do not dominate fire behavior. The Haines Index can range between 2 and 6. The drier and more unstable the lower atmosphere is, the higher the index:

- Very Low Potential (2) – moist, stable lower atmosphere
- Very Low Potential (3)
- Low Potential (4)
- Moderate Potential (5)
- High Potential (6) – dry, unstable lower atmosphere (USFS 2016)

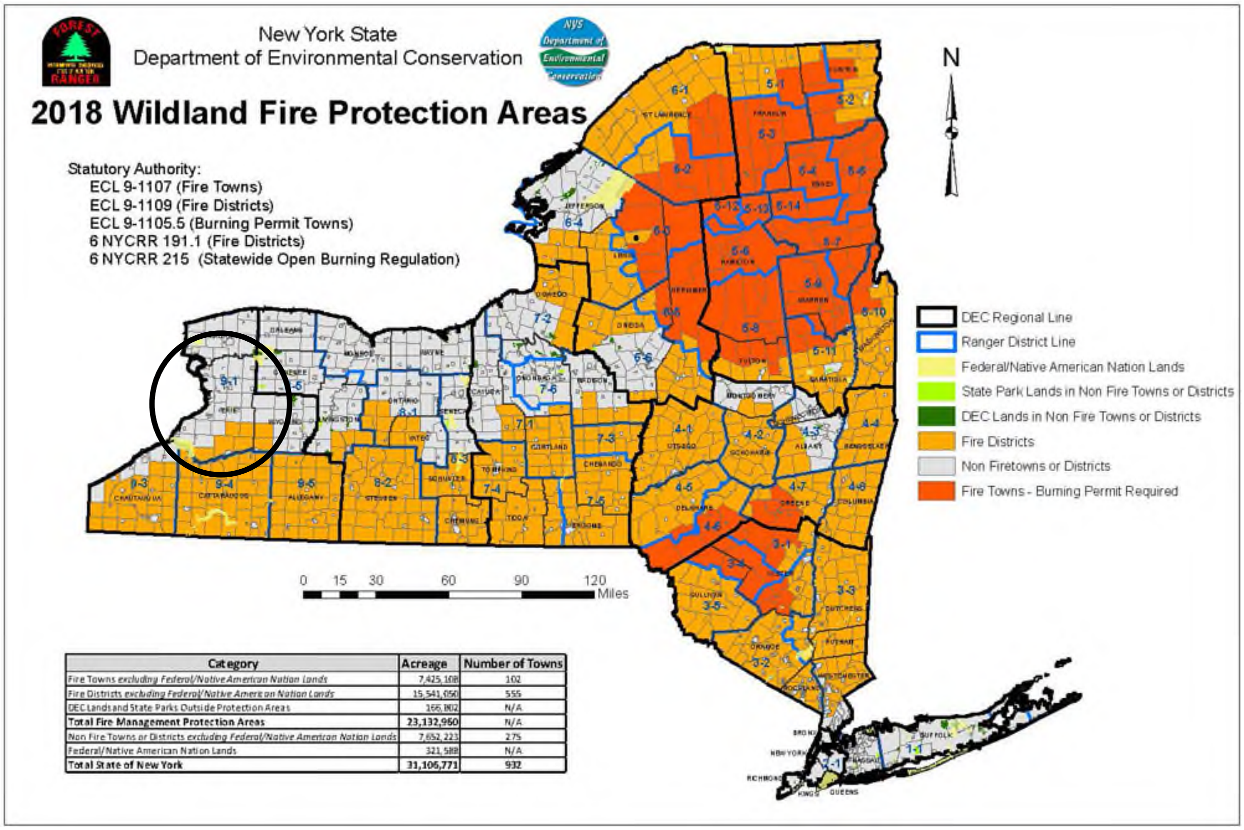
The ***Buildup Index (BUI)*** is a number that reflects combined cumulative effects of daily drying and precipitation in fuels with a 10-day time lag constant (North Carolina Forest Service 2007).

Location

According to the U.S. Fire Administration (USFA), the fire problems in the country vary from region to region. This often is a result of climate, poverty, education, demographics, and other causal factors (USFA 2013).

In New York State, the NYSDEC's Division of Forest Protection (Forest Ranger Division) is designated as the state's lead agency for wildfire mitigation. The Forest Ranger Division has a statutory requirement to provide a forest fire protection system for 657 of the 932 jurisdictions throughout New York State. It includes cities and villages and cover 23.5 million acres of land, including all state-owned land outside of the jurisdictions. Figure 5.4.13-1 displays the fire protection areas in New York State. This figure indicates that, as of 2018, a portion of Erie County is not part of the wildfire protection area highlighted in the black circle.

Figure 5.4.13-1. Forest Ranger Division Wildfire Protection Areas



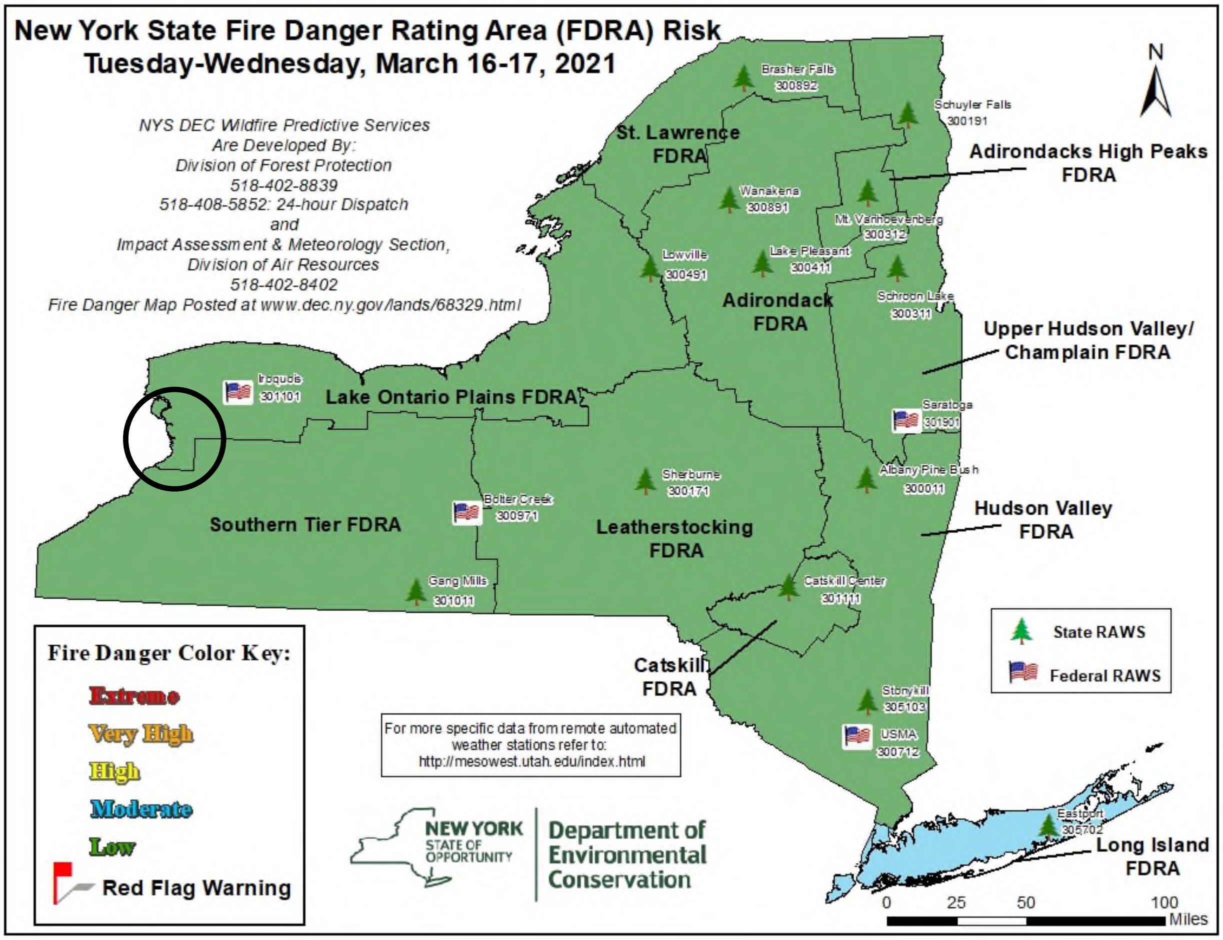
Source: NYSDEC 2020. The black oval indicates the location of Erie County.

New York State is divided into 10 fire danger rating areas (FDRAs). FDRAs are defined by areas of similar vegetation, climate, and topography in conjunction with agency regional boundaries, National Weather Service (NWS) fire weather hazard areas, political boundaries, fire occurrence history, and other influences. The Forest Ranger Division has fought fires and retained records for more than 125 years. Division records for the years of 1993 to 2017 indicate that rangers suppressed 5,423 wildfires that burned a total of 52,580 acres (NYSDEC 2018). Currently, more than 1,700 fire departments respond to an average of 4,500 wildfires each year. The Forest Ranger Division responds to approximately 3 percent of all wildfires; however, Rangers help contain 33 percent of all wildfire acres (NYSDEC 2018).

Wildfires occur in Erie County. Many areas in the County, particularly those that are heavily forested or contain large tracts of brush and shrubs, are prone to fires (NYSDEC 2018). The Forest Ranger Division/Wildland Fire Protection Area for Erie County is Region 9: Western New York and southern municipalities are specifically identified as fire districts (NYSDEC 2018). The boundaries of the FDRAs do not match the Forest Ranger Division boundaries.

A fire danger rating map is updated daily on the NYSDEC website (http://www.dec.ny.gov/lands/68329.html). The map is developed by information obtained from the Division of Forest Protection and Division of Air Resources (impact assessment and meteorology section). Figure 5.4.13-2 shows the FDRAs in New York State and the current fire danger risk for each area. As indicated by the legend, fire danger can be identified by varying colors and warning areas.

Figure 5.4.13-2. New York State Fire Danger Rating Areas



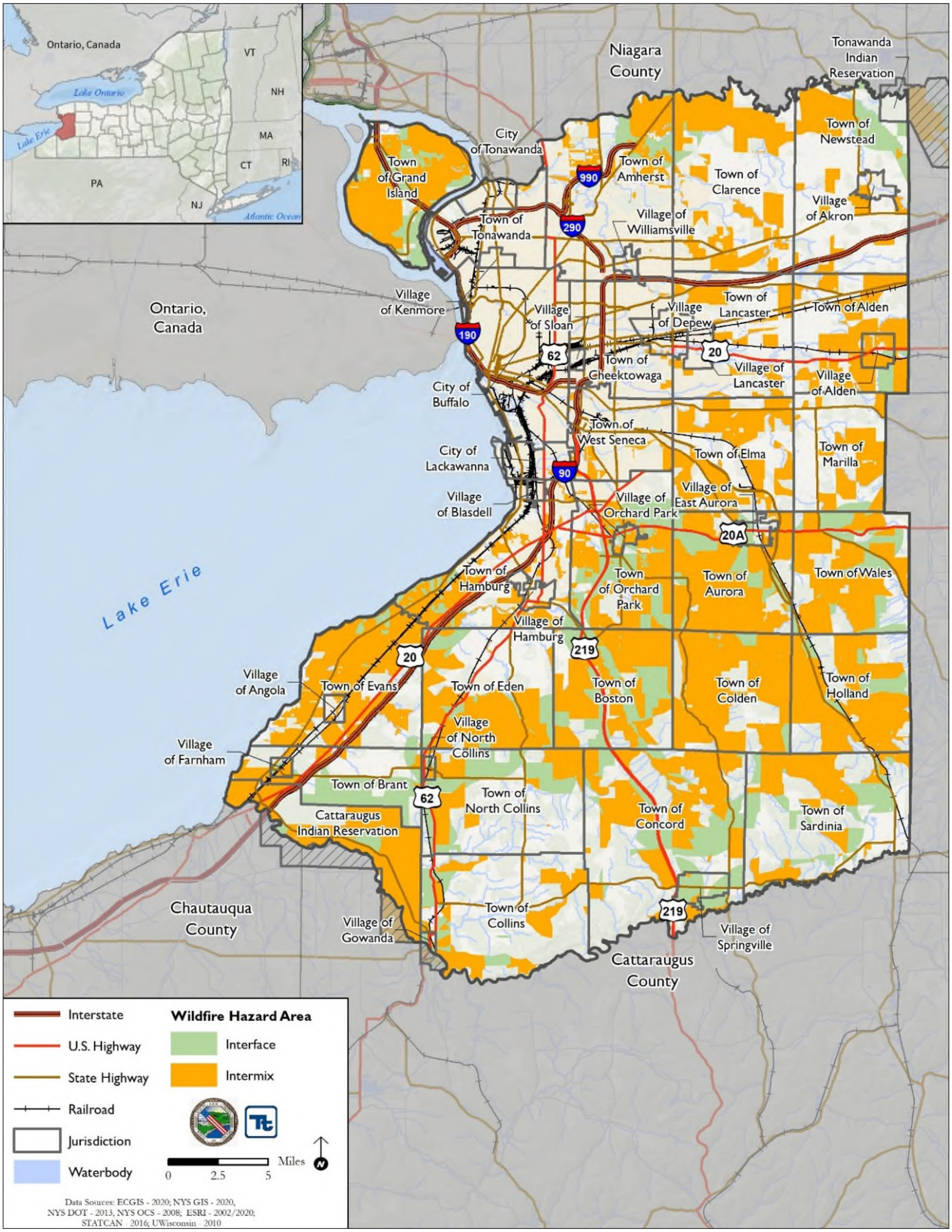
Source: NYSDEC 2021 Note: The black oval indicates the location of Erie County.

Wildland-Urban Interface in New York State/Erie County

Figure 5.4.13-3 shows the Wildland-Urban Interface divided into two categories: interface and intermix. The WUI Interface hazard area is land that stands between the undeveloped, natural land and developed, urban areas. The WUI Intermix hazard area is an area where human habitation is mixed with areas of flammable wildland vegetation. Intermix areas have more than one house per 40 acres and have more than 50-percent vegetation. Interface areas have more than one house per 40 acres, have less than 50-percent vegetation, and are within 1.5 miles of an area over 1,235 acres that is more than 75-percent vegetated (Stewart et al. 2007). The California Fire Alliance determined that 1.5 miles is the approximate maximum distance that firebrands can be carried from a wildland fire to the roof of a house. Therefore, even structures not within the forest are at risk from wildfire.

Approximately 33.2-percent of the County's land area is within the WUI Intermix hazard area, and 10.6 percent of the land area is within the WUI Interface hazard area.

Figure 5.4.13-3. Interface/Intermix WUI Hazard Areas in Erie County

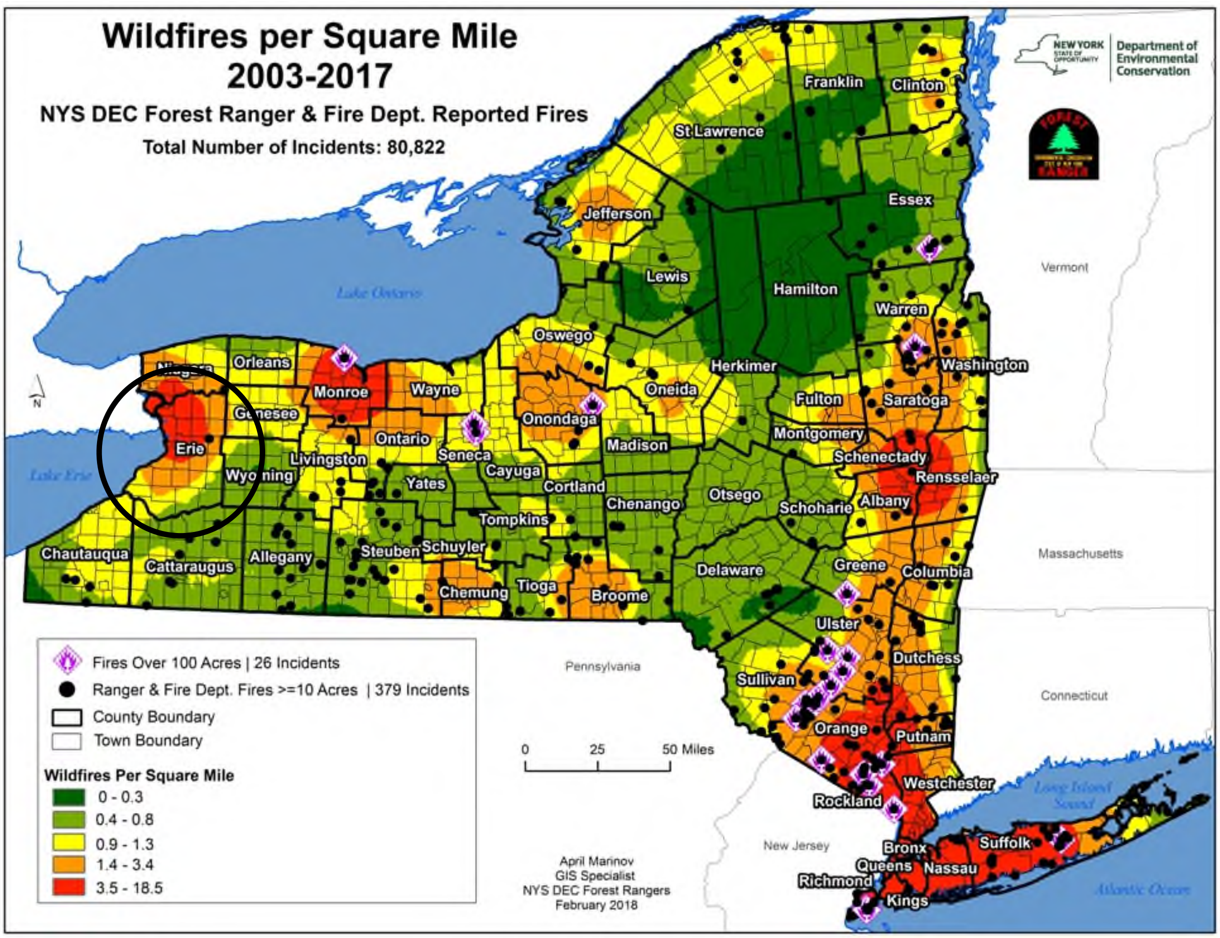


Previous Occurrences and Losses

Only limited historical information was found on previous occurrences and losses associated with wildfires throughout New York State and Erie County. Between 1954 and 2020, NYS was not included in any wildfire-related major disaster (DR) or emergency (EM) declarations (FEMA 2020).

Determinations of wildfire occurrences in New York State are based on two data sources: the New York State Forest Ranger Division and the New York State Office of Fire Prevention and Control (NYS OFP&C). The Forest Ranger Division wildfire occurrence data (1993 through 2017) indicates that 71 percent of wildfires in the state were human caused; the remaining 29 percent resulted from lightning. Regarding human-caused fires, debris burning accounted for 33 percent, incendiary fires accounted for 16 percent, campfires accounted for 16 percent, and smoking accounted for 6 percent (NYSDEC 2018). Figure 5.4.13-4 illustrates occurrences of wildfires in NYS between 2003 and 2017 (the most current data available). This figure reveals occurrences of 0.4 and 18.5 wildfires per square mile from 2003 to 2017 within Erie County municipalities.

Figure 5.4.13-4. Wildfire Occurrences in New York State, 2003-2017



Source: NYSDEC 2018. Note: The black circle indicates the location of Erie County.

Probability of Future Occurrences

The Forest Ranger Division wildfire occurrence data (2003 to 2018) indicates that NYS, including Erie County, is susceptible to wildfires. From March 15 through May 15, 47 percent of all fire department responses to wildfires occurred. Beginning in 2010, NYS enacted revised open burning regulations that ban brush burning statewide during this time period. Forest Ranger Division data indicate that this new statewide ban resulted in 74 percent fewer wildfires caused by debris burning in upstate New York from 2010 to 2012. Forest Ranger Division and fire department historical fire occurrence data recorded after the new burn ban regulations were enacted in 2010 will serve as a benchmark for analyses of wildfire occurrence (NYS DHSES 2014).

Nationally, wildfire risk is increasing, and wildfire experts point to the following four reasons:

- The way forests were handled in the past allowed fuel in the form of fallen leaves, branches, and plant growth, to accumulate. This fuel is currently lying around the forest with potential to "feed" a wildfire.
- Increasingly hot, dry weather has occurred and will continue to occur within the United States.
- Weather patterns across the country are changing.
- More homes are built within WUI areas, meaning that homes are built closer to wildland areas where wildfires can occur (NYS DHSES 2014).

Annual wildfires likely will occur throughout Erie County. However, advanced methods of wildfire management and control and better understanding of fire ecosystems should reduce the number of devastating fires in the future (NYS DHSES 2014).

Hazards of concern identified for Erie County were ranked in Section 5.3. Probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Partnership, the probability of occurrence of wildfire within villages, cities, and water authorities are unlikely and could occasionally occur in some towns.

Climate Change Impacts

A gradual change in temperatures will alter the growing environment of many tree species throughout the United States and New York, reducing the growth of some trees and increasing the growth of others. Tree growth and regeneration may be affected more by extreme weather events and climatic conditions than by gradual changes in temperature or precipitation. Warmer temperatures may lead to longer dry seasons and multi-year droughts, creating triggers for wildfires, insects, and invasive species. Increased temperature and change in precipitation will also affect fuel moisture during wildfire season and the length of time wildfires can burn in a given year (U.S. Department of Agriculture [USDA] 2012).

Climate change may also increase the frequency of lightning strikes. A warmer atmosphere holds more moisture, which is one of the key items for triggering a lightning strike. Lightning strikes cause approximately half of the wildfires in the United States. If the frequency of lightning strikes increases, the potential for wildfires from these strikes also increases (Lee 2014). Wildfire incidents are predicted to increase throughout the United States because of climate change, causing at least a doubling of areas burned within the next century (USDA 2012).

Summer temperatures have been increasing across New York State and are expected to continue to rise. New York is currently the eighth 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 to 2 degrees in most areas of 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. As a result of climate change, the frequency of extreme temperature events is expected to increase, and such events are associated with increased morbidity and mortality (NYS DHSES 2019).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25 °F per decade. Average annual temperatures are projected to increase across New York State by 2 °F to 3.4 °F by the 2020s, 4.1 °F to 6.8 °F by the 2050s, and 5.3 °F to 10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the State (NYSERDA 2014). The total number of hot days in New York State is expected to increase as this century progresses. The frequency and duration of heat waves, defined as three or more consecutive days with maximum temperatures at or above 90 ˚F, are also expected to increase (Table 5.4.13-2). In contrast, extreme cold events, defined both as the number of days per year with minimum temperature at or below 32 ˚F and those at or below 0 ˚F, are expected to decrease as average temperatures rise (NYSERDA 2011).

Each region within NYS, as defined by the Integrated Assessment for Effective Climate Change in New York State (ClimAID), contains attributes that climate change will affect. Erie County is part of ClimAID Region 1: The Great Lake Plains. In ClimAID Region 1, temperatures are estimated to increase between 3.7 to 7.3 ºF by the 2050s and 4.2 to 12 ºF by the 2080s (baseline of 47.7 ºF) (NYS Energy Research and Development Authority [NYSERDA] 2014). Extreme heat events and heat waves are also projected to increase, as listed in Table 5.4.13-2 below. Prolonged heat waves are likely to generate a greater number of wildfires. Stronger winds from larger storms may lead to more fallen branches for wildfires to consume. Increases in rain and snow events prime forests for fire by supporting growth of more fuel. Drought and warmer temperatures lead to drier forest fuels (NYS DHSES 2014).

Table 5.4.13-2. Extreme Event Projections for ClimAID Region 1

Event Type (2020s)	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
Days over 90 degrees Fahrenheit (°F) - (8 days)	12	14 to 17	19
Number of Heat Waves - (0.7 heat waves)	2	2 to 2	2
Duration of Heat Waves - (4 days)	4	4 to 4	4
Days below 32°F - (133 days)	99	103 to 111	116

Source: NYSERDA 2014

Fire potential depends on climate variability, local topography, and human intervention. Climate change can affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot, dry spells create highest fire risk. With temperatures increasing in New York State, wildfire danger may intensify with warming and drying of vegetation. When climate alters fuel loads and fuel moisture, it changes the susceptibility of forests to wildfires. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Annual temperatures have been rising throughout New York State since the start of the 20th century. The state's average temperatures have increased by approximately 0.6 °F since 1970, with winter warming exceeding 1.1 °F per decade. Extreme heat events are likely to increase throughout New York State and short-duration warm season droughts will become more common.

With the increase in temperatures, heat waves will become more frequent and intense, increasing heat-related illness and death and posing new challenges to the energy system, air quality, and agriculture. Summer droughts are projected to increase, affecting water supply, agriculture, ecosystems, and energy projects (NYSERDA 2011).

As stated above, according to the temperature projections for New York State and Erie County, this area can expect warmer and drier conditions, which may increase the frequency and intensity of wildfires. Higher temperatures are expected to increase the amount of moisture that evaporates from land and water. These changes have the potential to lead to more frequent and severe droughts, which, in turn, will increase the likelihood of wildfires (U.S. EPA 2009).

5.4.13.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable in the identified hazard area. A spatial analysis was conducted using the University of Wisconsin 2010 wildland-urban interface/intermix spatial layer. For the purposes of the assessment, an asset (population, structures, critical facilities, and lifelines) is considered exposed and potentially vulnerable to the wildfire hazard if it is located in the wildland-urban interface or wildland-urban intermix hazard areas.

Impact on Life, Health and Safety

Wildfires have the potential to impact human health and life of residents and responders, structures, infrastructure, and natural resources. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. Table 5.4.13-3 summarizes the estimated population exposed to the wildfire hazard by jurisdiction.

Based on the analysis, an estimated 154,141 residents, or approximately 16.8 percent of the County's population, are located in the wildland-urban interface/intermix hazard areas. Overall, the Town of Grand Island has the greatest number of individuals located in the wildfire hazard areas (i.e., 20,697 persons).

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Erie County contains approximately 161,498 people over the age of 65 and 126,041 people below the poverty level (American Community Survey 2019). Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a wildfire event, and they may have more difficulty evacuating. Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, and nitrogen oxides), and toxics (formaldehyde and benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Table 5.4.13-3. Estimated Population Located in the Wildland-Urban Interface/Intermix Hazard Area in Erie County

Jurisdiction	American Community Survey (2015-2019) Population	Estimated Population Located in the Wildland Urban Interface/Intermix (WUI) Hazard Area					
		Wildland Interface Area		Wildland Intermix Area		WUI (Interface and Intermix)	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Akron (V)	2,871	0	0.0%	233	8.1%	233	8.1%
Alden (T)	7,418	159	2.1%	3,107	41.9%	3,266	44.0%
Alden (V)	2,577	523	20.3%	1,015	39.4%	1,537	59.6%
Amherst (T)	120,276	5,511	4.6%	8,273	6.9%	13,784	11.5%
Angola (V)	2,373	0	0.0%	405	17.1%	405	17.1%
Aurora (T)	7,599	1,717	22.6%	5,166	68.0%	6,883	90.6%
Blasdell (V)	2,645	0	0.0%	0	0.0%	0	0.0%
Boston (T)	8,042	3,816	47.5%	3,753	46.7%	7,569	94.1%
Brant (T)	1,541	620	40.2%	416	27.0%	1,036	67.2%
Buffalo (C)	256,480	0	0.0%	73	<0.1%	73	<0.1%
Cheektowaga (T)	73,129	0	0.0%	693	0.9%	693	0.9%
Clarence (T)	32,440	283	0.9%	7,493	23.1%	7,776	24.0%
Colden (T)	3,328	216	6.5%	2,845	85.5%	3,061	92.0%
Collins (T)	5,418	1,163	21.5%	1,353	25.0%	2,516	46.4%
Concord (T)	4,186	1,113	26.6%	1,937	46.3%	3,050	72.9%
Depew (V)	15,102	0	0.0%	241	1.6%	241	1.6%
East Aurora (V)	6,184	2,868	46.4%	662	10.7%	3,530	57.1%
Eden (T)	7,631	724	9.5%	2,597	34.0%	3,322	43.5%
Elma (T)	11,732	69	0.6%	5,776	49.2%	5,844	49.8%
Evans (T)	13,782	2,034	14.8%	6,670	48.4%	8,704	63.2%
Farnham (V)	459	220	47.9%	163	35.5%	383	83.4%
Gowanda (V)	1,043	848	81.2%	177	17.0%	1,025	98.2%
Grand Island (T)	21,047	11,804	56.1%	8,893	42.3%	20,697	98.3%
Hamburg (T)	45,985	3,933	8.6%	10,319	22.4%	14,252	31.0%
Hamburg (V)	9,636	0	0.0%	534	5.5%	534	5.5%
Holland (T)	3,355	546	16.3%	2,423	72.2%	2,970	88.5%
Kenmore (V)	15,132	0	0.0%	0	0.0%	0	0.0%
Lackawanna (C)	17,831	0	0.0%	208	1.2%	208	1.2%
Lancaster (T)	27,625	0	0.0%	3,238	11.7%	3,238	11.7%
Lancaster (V)	10,144	0	0.0%	103	1.0%	103	1.0%
Marilla (T)	5,378	22	0.4%	1,209	22.5%	1,231	22.9%
Newstead (T)	5,804	539	9.3%	1,164	20.1%	1,703	29.3%
North Collins (T)	2,130	628	29.5%	672	31.6%	1,300	61.0%
North Collins (V)	1,370	1,207	88.1%	163	11.9%	1,370	100.0%

Jurisdiction	American Community Survey (2015-2019) Population	Estimated Population Located in the Wildland Urban Interface/Intermix (WUI) Hazard Area					
		Wildland Interface Area		Wildland Intermix Area		WUI (Interface and Intermix)	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Orchard Park (T)	26,361	9,008	34.2%	9,087	34.5%	18,094	68.6%
Orchard Park (V)	3,148	1,806	57.4%	1,337	42.5%	3,142	99.8%
Sardinia (T)	2,780	658	23.7%	1,000	36.0%	1,659	59.7%
Sloan (V)	3,562	0	0.0%	0	0.0%	0	0.0%
Springville (V)	4,298	2,958	68.8%	177	4.1%	3,135	72.9%
Tonawanda (C)	14,830	197	1.3%	0	0.0%	197	1.3%
Tonawanda (T)	57,027	0	0.0%	94	0.2%	94	0.2%
Wales (T)	3,020	981	32.5%	1,719	56.9%	2,700	89.4%
West Seneca (T)	45,344	0	0.0%	2,586	5.7%	2,586	5.7%
Williamsville (V)	5,233	0	0.0%	0	0.0%	0	0.0%
Erie County Total	**917,296**	**56,168**	**6.1%**	**97,973**	**10.7%**	**154,141**	**16.8%**

Source: American Community Survey – 2015-2019; University of Wisconsin - 2010
Notes: T = Town, V = Village, C = City, % = Percent; WUI = Wildland-Urban Interface/Intermix Hazard Area

Impact on General Building Stock

The most vulnerable structures to wildfire events are those within the WUI Interface/Intermix hazard area. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the fire hazard than buildings constructed of brick or concrete. To estimate the buildings exposed to the wildfire hazard, the wildland-urban interface/intermix hazard areas were overlaid upon the updated building inventory at the structure level. The replacement cost value of the structures with their center in the wildland-urban interface and intermix hazard areas were totaled (refer to Table 5.4.13-4 and Table 5.4.13-5). Overall, 70,429 buildings, with a replacement cost value of $36.7 billion, are located in the wildfire hazard in Erie County.

Table 5.4.13-4. Building Stock Replacement Cost Value and Building Count Located in the Wildland-Urban Interface/Intermix Hazard Area in Erie County

			Estimated Building Stock Located in the Wildfire Hazard Areas (WUI - Interface)				Estimated Building Stock Located in the Wildfire Hazard Areas (WUI - Intermix)			
Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	0	0.0%	$0	0.0%	99	7.8%	$62,661,306	7.2%
Alden (T)	3,400	$1,748,473,245	78	2.3%	$35,136,578	2.0%	1,370	40.3%	$559,194,754	32.0%
Alden (V)	1,102	$602,655,574	215	19.5%	$117,264,206	19.5%	428	38.8%	$259,004,326	43.0%
Amherst (T)	38,528	$27,372,255,690	1,702	4.4%	$848,825,368	3.1%	2,609	6.8%	$1,426,508,013	5.2%
Angola (V)	874	$525,704,230	0	0.0%	$0	0.0%	155	17.7%	$127,186,709	24.2%
Aurora (T)	4,280	$2,496,885,036	993	23.2%	$550,783,513	22.1%	2,817	65.8%	$1,512,890,557	60.6%
Blasdell (V)	1,026	$638,571,953	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Boston (T)	4,040	$1,702,475,276	1,936	47.9%	$825,789,177	48.5%	1,850	45.8%	$765,706,605	45.0%
Brant (T)	1,325	$657,594,060	534	40.3%	$280,822,035	42.7%	328	24.8%	$123,105,778	18.7%
Buffalo (C)	83,471	$58,603,851,634	0	0.0%	$0	0.0%	22	<0.1%	$6,550,279	<0.1%
Cheektowaga (T)	30,938	$17,530,893,277	0	0.0%	$0	0.0%	294	1.0%	$128,337,188	0.7%
Clarence (T)	13,660	$9,866,246,863	132	1.0%	$105,650,288	1.1%	3,167	23.2%	$2,091,318,969	21.2%
Colden (T)	2,110	$854,417,381	142	6.7%	$65,196,854	7.6%	1,778	84.3%	$699,996,520	81.9%
Collins (T)	2,521	$1,189,158,504	521	20.7%	$225,037,025	18.9%	609	24.2%	$242,185,281	20.4%
Concord (T)	3,245	$1,338,570,261	892	27.5%	$408,617,384	30.5%	1,412	43.5%	$520,178,482	38.9%
Depew (V)	6,532	$3,841,823,815	0	0.0%	$0	0.0%	98	1.5%	$29,596,329	0.8%
East Aurora (V)	2,441	$1,723,816,550	1,126	46.1%	$702,565,566	40.8%	239	9.8%	$144,097,549	8.4%
Eden (T)	4,290	$2,180,455,513	410	9.6%	$199,736,872	9.2%	1,383	32.2%	$619,095,236	28.4%
Elma (T)	6,093	$3,775,039,302	33	0.5%	$12,064,676	0.3%	2,964	48.6%	$1,674,276,455	44.4%
Evans (T)	7,952	$3,335,060,692	1,127	14.2%	$389,238,835	11.7%	3,822	48.1%	$1,891,053,709	56.7%
Farnham (V)	189	$87,990,422	89	47.1%	$37,702,302	42.8%	67	35.4%	$33,635,679	38.2%
Gowanda (V)	396	$249,516,940	319	80.6%	$205,534,209	82.4%	63	15.9%	$28,689,326	11.5%
Grand Island (T)	8,426	$4,674,517,058	4,726	56.1%	$2,401,986,736	51.4%	3,544	42.1%	$2,062,885,229	44.1%
Hamburg (T)	19,130	$11,911,210,828	1,574	8.2%	$687,898,162	5.8%	4,217	22.0%	$2,038,752,914	17.1%
Hamburg (V)	3,794	$2,005,172,252	0	0.0%	$0	0.0%	204	5.4%	$82,852,357	4.1%
Holland (T)	2,182	$1,151,194,342	386	17.7%	$237,398,995	20.6%	1,474	67.6%	$691,814,705	60.1%
Kenmore (V)	6,017	$2,305,529,001	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Lackawanna (C)	6,751	$4,030,622,400	0	0.0%	$0	0.0%	75	1.1%	$23,144,130	0.6%
Lancaster (T)	10,973	$6,845,493,469	0	0.0%	$0	0.0%	1,285	11.7%	$712,201,897	10.4%
Lancaster (V)	4,323	$2,217,331,122	0	0.0%	$0	0.0%	41	0.9%	$17,912,969	0.8%
Marilla (T)	2,956	$1,099,846,031	17	0.6%	$6,882,962	0.6%	647	21.9%	$245,663,392	22.3%
Newstead (T)	4,202	$2,181,758,974	322	7.7%	$128,207,461	5.9%	774	18.4%	$308,808,837	14.2%
North Collins (T)	1,898	$889,517,676	544	28.7%	$266,355,881	29.9%	525	27.7%	$222,673,805	25.0%
North Collins (V)	551	$383,968,909	478	86.8%	$307,172,899	80.0%	71	12.9%	$72,316,127	18.8%
Orchard Park (T)	10,748	$8,174,650,530	3,523	32.8%	$2,353,271,937	28.8%	3,622	33.7%	$2,394,810,199	29.3%
Orchard Park (V)	1,211	$867,347,745	726	60.0%	$576,497,352	66.5%	467	38.6%	$247,163,396	28.5%
Sardinia (T)	2,184	$1,068,523,829	506	23.2%	$225,921,911	21.1%	689	31.5%	$224,367,563	21.0%

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Located in the Wildfire Hazard Areas (WUI - Interface)				Estimated Building Stock Located in the Wildfire Hazard Areas (WUI - Intermix)			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Sloan (V)	1,674	$634,998,253	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Springville (V)	1,816	$1,354,905,864	1,279	70.4%	$903,610,051	66.7%	69	3.8%	$23,497,757	1.7%
Tonawanda (C)	6,452	$3,291,492,557	80	1.2%	$31,259,075	0.9%	0	0.0%	$0	0.0%
Tonawanda (T)	23,999	$14,694,684,404	0	0.0%	$0	0.0%	40	0.2%	$33,237,385	0.2%
Wales (T)	1,923	$833,853,270	649	33.7%	$311,489,082	37.4%	1,043	54.2%	$410,076,310	49.2%
West Seneca (T)	17,970	$9,583,482,689	0	0.0%	$0	0.0%	1,009	5.6%	$532,400,930	5.6%
Williamsville (V)	2,057	$1,126,868,443	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Erie County Total	**360,925**	**$222,515,035,436**	**25,059**	**6.9%**	**$13,447,917,391**	**6.0%**	**45,370**	**12.6%**	**$23,289,848,951**	**10.5%**

Source: Erie County GIS - 2020; University of Wisconsin - 2010
Notes: T = Town, V = Village, C = City, % = Percent, < = Less Than, WUI = Wildland-Urban Interface/Intermix, RCV = Replacement Cost Value

Table 5.4.13-5. Total Building Stock Replacement Cost Value and Building Count Located in the Wildland-Urban Interface/Intermix Hazard Area in Erie County

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Located in the Wildfire Hazard Area (WUI - Interface/Intermix)			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Akron (V)	1,275	$866,609,574	99	7.8%	$62,661,306	7.2%
Alden (T)	3,400	$1,748,473,245	1,448	42.6%	$594,331,332	34.0%
Alden (V)	1,102	$602,655,574	643	58.3%	$376,268,532	62.4%
Amherst (T)	38,528	$27,372,255,690	4,311	11.2%	$2,275,333,381	8.3%
Angola (V)	874	$525,704,230	155	17.7%	$127,186,709	24.2%
Aurora (T)	4,280	$2,496,885,036	3,810	89.0%	$2,063,674,070	82.6%
Blasdell (V)	1,026	$638,571,953	0	0.0%	$0	0.0%
Boston (T)	4,040	$1,702,475,276	3,786	93.7%	$1,591,495,781	93.5%
Brant (T)	1,325	$657,594,060	862	65.1%	$403,927,813	61.4%
Buffalo (C)	83,471	$58,603,851,634	22	<0.1%	$6,550,279	<0.1%
Cheektowaga (T)	30,938	$17,530,893,277	294	1.0%	$128,337,188	0.7%
Clarence (T)	13,660	$9,866,246,863	3,299	24.2%	$2,196,969,257	22.3%
Colden (T)	2,110	$854,417,381	1,920	91.0%	$765,193,374	89.6%
Collins (T)	2,521	$1,189,158,504	1,130	44.8%	$467,222,306	39.3%
Concord (T)	3,245	$1,338,570,261	2,304	71.0%	$928,795,866	69.4%
Depew (V)	6,532	$3,841,823,815	98	1.5%	$29,596,329	0.8%
East Aurora (V)	2,441	$1,723,816,550	1,365	55.9%	$846,663,116	49.1%
Eden (T)	4,290	$2,180,455,513	1,793	41.8%	$818,832,108	37.6%
Elma (T)	6,093	$3,775,039,302	2,997	49.2%	$1,686,341,131	44.7%
Evans (T)	7,952	$3,335,060,692	4,949	62.2%	$2,280,292,544	68.4%
Farnham (V)	189	$87,990,422	156	82.5%	$71,337,980	81.1%
Gowanda (V)	396	$249,516,940	382	96.5%	$234,223,535	93.9%
Grand Island (T)	8,426	$4,674,517,058	8,270	98.1%	$4,464,871,965	95.5%
Hamburg (T)	19,130	$11,911,210,828	5,791	30.3%	$2,726,651,076	22.9%

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Located in the Wildfire Hazard Area (WUI - Interface/Intermix)			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Hamburg (V)	3,794	$2,005,172,252	204	5.4%	$82,852,357	4.1%
Holland (T)	2,182	$1,151,194,342	1,860	85.2%	$929,213,700	80.7%
Kenmore (V)	6,017	$2,305,529,001	0	0.0%	$0	0.0%
Lackawanna (C)	6,751	$4,030,622,400	75	1.1%	$23,144,130	0.6%
Lancaster (T)	10,973	$6,845,493,469	1,285	11.7%	$712,201,897	10.4%
Lancaster (V)	4,323	$2,217,331,122	41	0.9%	$17,912,969	0.8%
Marilla (T)	2,956	$1,099,846,031	664	22.5%	$252,546,354	23.0%
Newstead (T)	4,202	$2,181,758,974	1,096	26.1%	$437,016,298	20.0%
North Collins (T)	1,898	$889,517,676	1,069	56.3%	$489,029,687	55.0%
North Collins (V)	551	$383,968,909	549	99.6%	$379,489,025	98.8%
Orchard Park (T)	10,748	$8,174,650,530	7,145	66.5%	$4,748,082,136	58.1%
Orchard Park (V)	1,211	$867,347,745	1,193	98.5%	$823,660,748	95.0%
Sardinia (T)	2,184	$1,068,523,829	1,195	54.7%	$450,289,474	42.1%
Sloan (V)	1,674	$634,998,253	0	0.0%	$0	0.0%
Springville (V)	1,816	$1,354,905,864	1,348	74.2%	$927,107,807	68.4%
Tonawanda (C)	6,452	$3,291,492,557	80	1.2%	$31,259,075	0.9%
Tonawanda (T)	23,999	$14,694,684,404	40	0.2%	$33,237,385	0.2%
Wales (T)	1,923	$833,853,270	1,692	88.0%	$721,565,392	86.5%
West Seneca (T)	17,970	$9,583,482,689	1,009	5.6%	$532,400,930	5.6%
Williamsville (V)	2,057	$1,126,868,443	0	0.0%	$0	0.0%
Erie County Total	**360,925**	**$222,515,035,436**	**70,429**	**19.5%**	**$36,737,766,342**	**16.5%**

Source: Erie County GIS - 2020; University of Wisconsin - 2010
Notes: T = Town, V = Village, C = City, % = Percent, < = Less Than, WUI = Wildland-Urban Interface/Intermix, RCV = Replacement Cost Value

Impact on Critical Facilities and Lifelines

It is recognized that a number of critical facilities and lifelines are located in the wildfire hazard area and are also vulnerable to the threat of wildfire. The majority of the critical facilities located in the wildland-urban interface/intermix hazard areas are government facilities, and potable water and wastewater facilities. Table 5.4.13-6 and Table 5.4.13-7 summarize the number of critical facilities and lifelines within the WUI Intermix and Interface hazard areas by jurisdiction. Overall, 378 critical facilities (360 of which are considered lifelines) are located in the wildland-urban interface hazard area and 719 critical facilities (627 of which are considered lifelines) are located in the wildland-urban intermix hazard area. The Town of Wales has the greatest number of critical facilities built in the wildland-urban interface (i.e., 32 critical facilities) and the Town of Aurora has the greatest number of critical facilities built in the wildland-urban intermix hazard areas (i.e., 68 critical facilities). Critical facilities are further broken out by type within the WUI Interface and Intermix hazard areas, as summarized in Table 5.4.13-8 and Table 5.4.13-9. Lifeline types located in the wildfire hazard areas are identified in Table 5.4.13-10.

Table 5.4.13-6. Critical Facilities and Lifelines in the Wildland-Urban Interface Hazard Area in Erie County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Interface Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	29	0	0.0%	0	0.0%
Alden (T)	76	76	3	3.9%	1	1.3%
Alden (V)	19	18	1	5.3%	1	5.6%
Amherst (T)	391	390	6	1.5%	6	1.5%
Angola (V)	20	19	0	0.0%	0	0.0%
Aurora (T)	95	95	16	16.8%	16	16.8%
Blasdell (V)	22	22	0	0.0%	0	0.0%
Boston (T)	81	80	28	34.6%	27	33.8%
Brant (T)	39	39	20	51.3%	20	51.3%
Buffalo (C)	751	750	0	0.0%	0	0.0%
Cheektowaga (T)	224	223	0	0.0%	0	0.0%
Clarence (T)	121	120	7	5.8%	7	5.8%
Colden (T)	67	67	9	13.4%	9	13.4%
Collins (T)	71	70	11	15.5%	11	15.7%
Concord (T)	84	84	31	36.9%	28	33.3%
Depew (V)	63	63	0	0.0%	0	0.0%
East Aurora (V)	42	41	17	40.5%	17	41.5%
Eden (T)	78	77	9	11.5%	9	11.7%
Elma (T)	83	82	0	0.0%	0	0.0%
Evans (T)	112	112	7	6.3%	6	5.4%
Farnham (V)	10	10	2	20.0%	2	20.0%
Gowanda (V)	7	7	6	85.7%	6	85.7%
Grand Island (T)	69	68	19	27.5%	18	26.5%
Hamburg (T)	189	189	13	6.9%	13	6.9%
Hamburg (V)	27	26	0	0.0%	0	0.0%
Holland (T)	90	90	16	17.8%	16	17.8%
Kenmore (V)	14	13	0	0.0%	0	0.0%
Lackawanna (C)	94	93	0	0.0%	0	0.0%
Lancaster (T)	109	109	0	0.0%	0	0.0%
Lancaster (V)	58	57	0	0.0%	0	0.0%
Marilla (T)	48	47	0	0.0%	0	0.0%
Newstead (T)	64	64	8	12.5%	8	12.5%
North Collins (T)	69	69	22	31.9%	22	31.9%
North Collins (V)	14	13	14	100.0%	13	100.0%
Orchard Park (T)	141	141	27	19.1%	25	17.7%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Interface Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Orchard Park (V)	21	20	13	61.9%	13	65.0%
Sardinia (T)	78	78	14	17.9%	11	14.1%
Sloan (V)	8	8	0	0.0%	0	0.0%
Springville (V)	35	34	26	74.3%	23	67.6%
Tonawanda (C)	61	60	1	1.6%	1	1.7%
Tonawanda (T)	266	266	0	0.0%	0	0.0%
Wales (T)	82	82	32	39.0%	31	37.8%
West Seneca (T)	145	144	0	0.0%	0	0.0%
Williamsville (V)	16	16	0	0.0%	0	0.0%
Erie County Total	**4,184**	**4,161**	**378**	**9.0%**	**360**	**8.7%**

Source: Erie County GIS 2020; University of Wisconsin, 2010
Notes: T = Town, V = Village, C = City, % = Percent

Table 5.4.13-7. Critical Facilities and Lifelines in the Wildland-Urban Intermix Hazard Area in Erie County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Intermix Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Akron (V)	30	26	1	3.3%	1	3.8%
Alden (T)	76	68	29	38.2%	25	36.8%
Alden (V)	19	17	9	47.4%	8	47.1%
Amherst (T)	391	387	15	3.8%	15	3.9%
Angola (V)	20	18	8	40.0%	8	44.4%
Aurora (T)	95	81	68	71.6%	56	69.1%
Blasdell (V)	22	22	0	0.0%	0	0.0%
Boston (T)	81	75	45	55.6%	40	53.3%
Brant (T)	39	39	8	20.5%	8	20.5%
Buffalo (C)	751	748	0	0.0%	0	0.0%
Cheektowaga (T)	224	221	2	0.9%	2	0.9%
Clarence (T)	121	115	32	26.4%	31	27.0%
Colden (T)	67	56	52	77.6%	44	78.6%
Collins (T)	71	55	12	16.9%	8	14.5%
Concord (T)	84	68	24	28.6%	19	27.9%
Depew (V)	63	63	0	0.0%	0	0.0%
East Aurora (V)	42	41	3	7.1%	3	7.3%
Eden (T)	78	72	25	32.1%	22	30.6%
Elma (T)	83	75	33	39.8%	31	41.3%
Evans (T)	112	109	52	46.4%	52	47.7%
Farnham (V)	10	10	2	20.0%	2	20.0%
Gowanda (V)	7	7	0	0.0%	0	0.0%
Grand Island (T)	69	66	27	39.1%	27	40.9%
Hamburg (T)	189	181	24	12.7%	20	11.0%
Hamburg (V)	27	23	3	11.1%	1	4.3%
Holland (T)	90	70	55	61.1%	44	62.9%
Kenmore (V)	14	13	0	0.0%	0	0.0%
Lackawanna (C)	94	93	2	2.1%	2	2.2%
Lancaster (T)	109	103	21	19.3%	18	17.5%
Lancaster (V)	58	53	0	0.0%	0	0.0%
Marilla (T)	48	37	14	29.2%	13	35.1%
Newstead (T)	64	61	12	18.8%	12	19.7%
North Collins (T)	69	56	19	27.5%	16	28.6%
North Collins (V)	14	13	0	0.0%	0	0.0%
Orchard Park (T)	141	129	43	30.5%	35	27.1%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Wildland-Urban Intermix Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Orchard Park (V)	21	18	3	14.3%	3	16.7%
Sardinia (T)	78	57	26	33.3%	21	36.8%
Sloan (V)	8	8	0	0.0%	0	0.0%
Springville (V)	35	32	1	2.9%	1	3.1%
Tonawanda (C)	61	60	0	0.0%	0	0.0%
Tonawanda (T)	266	265	0	0.0%	0	0.0%
Wales (T)	82	68	39	47.6%	29	42.6%
West Seneca (T)	145	140	10	6.9%	10	7.1%
Williamsville (V)	16	14	0	0.0%	0	0.0%
Erie County Total	**4,184**	**3,933**	**719**	**17.2%**	**627**	**15.9%**

Source: Erie County GIS 2020; University of Wisconsin, 2010
Notes: T = Town, V = Village, C = City, % = Percent
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*

Table 5.4.13-8. Critical Facilities by Type in the Wildland-Urban Interface Hazard Area in Erie County

Jurisdiction	Critical Facilities Located in the Wildland-Urban Interface Areas																										
	Airport	Airport Runway	Aquifer	Bridge	Communications Tower	Communications	Community Center	Dam	Electric Power Station	EMS Facility	Fire Station	Hazardous Materials	Highway Garage	Library	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Tank	Potable Water Well	Primary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
Akron (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alden (T)	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Alden (V)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amherst (T)	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Angola (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	0	0	4	1	0	0	0	0	0	0	0	1	0	0	0	1	2	1	2	2	0	0	0	0	2	0
Blasdell (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boston (T)	0	0	0	10	0	1	0	1	0	0	4	1	0	0	1	0	2	0	1	4	0	1	1	1	0	0	0
Brant (T)	0	0	1	4	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	10	0	1	0	0	0	0	0
Buffalo (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cheektowaga (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clarence (T)	0	0	0	4	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
Colden (T)	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	0	1	1	1	0	0	0
Collins (T)	0	0	0	6	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	1	0	0	0	0	0	0	0
Concord (T)	0	0	0	12	0	0	0	3	0	0	1	0	2	0	0	0	0	1	0	12	0	0	0	0	0	0	0
Depew (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Aurora (V)	0	0	0	2	0	1	0	1	0	0	0	2	1	0	0	0	0	0	0	0	5	0	0	0	1	4	0
Eden (T)	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	2	0
Elma (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evans (T)	0	0	0	3	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Farnham (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Gowanda (V)	0	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Grand Island (T)	0	0	0	3	0	1	0	0	0	0	1	6	1	1	0	0	0	1	0	1	1	0	1	0	2	0	0
Hamburg (T)	1	1	0	2	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2	0	0	0	0	5	0
Hamburg (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Holland (T)	0	0	0	3	0	1	1	0	0	0	1	2	0	0	0	0	0	3	0	1	0	0	2	1	0	1	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lackawanna (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lancaster (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lancaster (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Critical Facilities Located in the Wildland-Urban Interface Areas																										
	Airport	Airport Runway	Aquifer	Bridge	Communications Tower	Communications	Community Center	Dam	Electric Power Station	EMS Facility	Fire Station	Hazardous Materials	Highway Garage	Library	Oil Facility	Police Station	Post Office	Potable Water Facility	Potable Water Tank	Potable Water Well	Primary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station	Well
Marilla (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newstead (T)	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
North Collins (T)	0	0	0	1	0	0	0	1	0	0	1	1	0	0	2	0	1	0	0	15	0	0	0	0	0	0	0
North Collins (V)	0	0	0	1	0	1	0	0	0	1	1	2	0	1	0	1	1	0	0	0	2	0	1	2	0	0	0
Orchard Park (T)	0	0	0	12	0	1	0	2	0	0	0	2	1	0	0	0	0	1	0	3	3	0	1	0	0	1	0
Orchard Park (V)	0	0	0	1	0	0	1	0	0	0	2	0	0	0	0	1	1	0	0	0	3	1	1	2	0	0	0
Sardinia (T)	0	0	0	0	1	0	0	3	3	0	1	1	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0
Sloan (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Springville (V)	0	0	0	0	0	1	1	2	0	0	2	3	2	1	0	1	1	1	0	0	1	1	3	2	0	0	4
Tonawanda (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Tonawanda (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wales (T)	0	0	0	4	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	20	1	0	2	1	0	0	0
West Seneca (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**1**	**1**	**1**	**87**	**2**	**7**	**4**	**17**	**3**	**2**	**21**	**23**	**10**	**3**	**3**	**4**	**14**	**12**	**2**	**82**	**23**	**5**	**14**	**12**	**3**	**18**	**4**

Source: Erie County GIS - 2020; University of Wisconsin - 2010
Notes: T = Town, V = Village, C = City
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*
**Please note that only critical facilities exposed to the wildfire hazard area are represented in this table. Critical facility types that are found within each municipality but are not exposed to the wildfire hazard area may not be listed in the table.*

Table 5.4.13-9. Critical Facilities by Type in the Wildland-Urban Intermix Hazard Area in Erie County

Jurisdiction	Critical Facilities Located in the Wildland-Urban Intermix Areas																									
	Airport Runway	Aquifer	Bridge	Communication Tower	Communications	Community Center	Dam	Electric Power Station	Fire Station	Hazardous Materials	Highway Garage	Library	Natural Gas Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
Akron (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Alden (T)	0	0	8	0	0	0	4	0	1	0	1	0	0	0	0	0	0	0	13	0	0	0	2	0	0	0
Alden (V)	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3	0	1	1	0	0	0
Amherst (T)	0	0	9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	1	1	0	1	0	0	0
Angola (V)	0	0	3	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aurora (T)	0	0	14	0	0	0	12	0	1	1	1	0	0	0	1	3	0	0	27	3	0	0	0	0	0	5
Blasdell (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boston (T)	0	0	5	0	0	0	4	0	1	0	0	1	0	0	0	4	0	0	28	1	0	0	1	0	0	0
Brant (T)	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Buffalo (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cheektowaga (T)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Clarence (T)	2	0	8	0	1	0	1	0	1	2	0	0	1	0	1	1	0	0	6	3	0	0	3	0	1	1
Colden (T)	0	0	8	0	0	0	9	0	0	0	1	0	1	0	1	0	0	0	31	1	0	0	0	0	0	0
Collins (T)	0	0	1	1	0	0	5	0	1	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
Concord (T)	0	0	6	0	0	0	5	0	0	0	0	0	0	0	1	1	0	0	11	0	0	0	0	0	0	0
Depew (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Aurora (V)	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Eden (T)	0	0	7	0	0	0	3	0	0	1	0	0	0	0	0	3	0	0	9	0	0	0	2	0	0	0
Elma (T)	0	0	16	0	0	1	2	1	1	2	1	0	0	0	1	0	4	2	0	0	0	0	2	0	0	0
Evans (T)	0	0	13	1	1	0	0	1	4	2	1	0	0	1	2	10	0	0	4	2	0	2	2	0	1	5
Farnham (V)	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gowanda (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Island (T)	0	0	4	0	0	0	1	2	2	6	0	0	0	0	1	1	0	0	2	5	0	2	1	0	0	0
Hamburg (T)	0	0	7	0	0	0	4	0	1	0	1	0	0	0	1	2	0	0	1	1	0	0	0	0	0	6
Hamburg (V)	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Holland (T)	0	1	8	0	0	0	11	0	1	0	1	0	0	0	1	0	0	0	23	5	0	0	3	0	1	0
Kenmore (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lackawanna (C)	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lancaster (T)	0	0	5	0	0	0	3	1	1	3	2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	4

Jurisdiction	Airport Runway	Aquifer	Bridge	Communication Tower	Communications	Community Center	Dam	Electric Power Station	Fire Station	Hazardous Materials	Highway Garage	Library	Natural Gas Facility	Police Station	Post Office	Potable Water Facility	Potable Water Pumping Station	Potable Water Tank	Potable Water Well	Primary Education	Secondary Education	Senior Center	Shelter	Town Hall	Wastewater Facility	Wastewater Pump Station
	Critical Facilities Located in the Wildland-Urban Intermix Areas																									
Lancaster (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marilla (T)	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0
Newstead (T)	0	1	5	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0
North Collins (T)	0	0	6	0	0	0	3	0	1	0	0	0	0	0	0	1	0	0	5	2	0	0	1	0	0	0
North Collins (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchard Park (T)	0	0	14	0	0	1	8	2	1	3	0	0	1	0	0	0	0	5	1	4	0	0	0	0	0	3
Orchard Park (V)	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Sardinia (T)	0	0	4	1	1	0	5	0	0	1	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0
Sloan (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Springville (V)	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonawanda (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tonawanda (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wales (T)	0	0	7	0	0	0	10	0	1	0	0	0	0	0	1	0	0	0	20	0	0	0	0	0	0	0
West Seneca (T)	0	0	3	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Williamsville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erie County Total	**2**	**3**	**176**	**3**	**4**	**3**	**95**	**10**	**22**	**24**	**10**	**1**	**3**	**1**	**12**	**28**	**4**	**7**	**215**	**31**	**1**	**7**	**22**	**1**	**3**	**31**

Source: Erie County GIS - 2020; University of Wisconsin - 2010
Notes: T = Town, V = Village, C = City
* *Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update.*
**Please note that only critical facilities exposed to the wildfire hazard area are represented in this table. Critical facility types that are found within each municipality but are not exposed to the wildfire hazard area may not be listed in the table.*

Table 5.4.13-10. Lifelines Located in the Wildfire Hazard Areas

FEMA Lifeline Category	Total Number of Lifelines	Estimated Lifeline Located in the Wildfire Hazard Areas		
		Wildland-Urban Interface Area	Wildland-Urban Intermix Area	WUI (Interface and Intermix)
		Number of Lifelines	Number of Lifelines	Number of Lifelines
Communications	59	9	7	16
Energy	176	7	14	19
Food, Water, and Shelter	951	137	314	561
Hazardous Materials	398	23	24	47
Health and Medical	144	11	10	21
Safety and Security	1,047	84	80	162
Transportation	1,158	89	178	267
Erie County Total	**3,933**	**360**	**627**	**1,093**

Source: Erie County GIS - 2020; FEMA – 2020; University of Wisconsin – 2010
* Note: Cattaraugus Tribal Territory and Tonawanda Tribal Territory were not included in the above totals, as the two tribes did not participate in this HMP update

Impact on Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed businesses and decreases in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and can involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that provide employees with time off to volunteer to fight these fires.

Impact on the Environment

According to the USGS, post-fire runoff polluted with debris and contaminants can be extremely harmful to ecosystem and aquatic life (USGS 2018). Studies show that urban fires in particular are more harmful to the environment compared to forest fires (USGS 2018). The age and density of infrastructure within Erie County can exacerbate consequences of fires on the environment because of the increased amount of chemicals and contaminants that would be released from burning infrastructure. These chemicals, such as iron lead, and zinc, may leach into the storm water, contaminate nearby streams, and impair aquatic life.

Cascading Impacts on Other Hazards

Wildfires result in the uncontrolled destruction of forests, brush, field crops, grasslands, real estate, and personal property, and have secondary impacts on other hazards such as flooding, by removing vegetation and destroying watersheds. Additionally, wildfires can increase because of rising temperatures and increased droughts. More information about extreme temperature and flood hazards of concern is provided in Section 5.4.5 and Section 5.4.6, respectively.

Future Changes That May Impact Vulnerability

Understanding future changes that affect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and how they interact can also provide insight about ways to plan for the future.

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth located in the wildland-urban interface/intermix hazard areas could be at risk.

Figure 5.4.13-3 provides a countywide map of the wildland-urban interface/intermix hazard area and, additionally, the maps in each jurisdictional annex include new development project areas and their proximity to the wildland-urban interface/intermix hazard areas.

Projected Changes in Population

According to the U.S. Census Bureau, the population in Erie County has remained stable between 2010 and 2019 (917,173 persons in 2010 and 917,296 persons in 2019). Estimated population projections provided by the 2017 Cornell Program on Applied Demographics indicates that the County's population will decrease into 2040 to approximately 769,396 persons (Cornell Program on Applied Demographics 2017). The population that remains in the County is vulnerable to wildfires. Refer to Section 4 (County Profile) for additional discussion on population trends.

Climate Change

According to the USDA Forest Service, climate change will likely alter the atmospheric patterns that affect fire weather. Changes in fire patterns will, in turn, impact carbon cycling, forest structure, and species composition (EPA 2020). Climate change associated with warmer temperatures, changes in rainfall, and increased periods of drought may create an atmospheric and fuel environment that is more conductive to large, severe fires (USDA 2013). Under a changing climate, wildfires exceeding 50,000 acres have increased over the past 30 years (USDA 2013). Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include:

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species, and an increasing WUI.

As discussed earlier, average temperatures are anticipated to increase in New York; therefore, the suitability of habitats for specific types of trees will potentially change, altering the fire regime and resulting in more frequent fire events and changes in intensity. Prolonged and more frequent heat waves have the potential to increase the likelihood of a wildfire. The increased potential combined with stronger winds may make it harder to contain fires and thus will increase the County's vulnerability to this hazard.

Change of Vulnerability Since the 2015 HMP

For this hazard mitigation plan update, the 2010 Wildland-Urban Interface/Intermix data from the University of Wisconsin was referenced to determine areas within Erie County that are vulnerable to wildfires. Population statistics have been updated using the 5-Year 2015-2019 American Community Survey Population Estimates. The building stock inventory was updated using data from Erie County. Further, the building stock inventory replacement cost values were updated using RS Means 2020 values, providing an overall update to the assets assessed in this risk assessment. Additionally, the critical facility inventory list was updated by Erie County.

SECTION 6. MITIGATION STRATEGIES

This section presents mitigation strategies for Erie County to reduce potential exposure and losses identified as concerns in the Risk Assessment portion of this plan. The Steering Committee reviewed the Risk Assessment to identify and develop these mitigation actions, which are presented herein.

This section includes:

1. Background and Past Mitigation Accomplishments
2. General Planning Approach
3. Review and Update of Mitigation Goals and Objectives
4. Capability Assessment
5. Mitigation Strategy Development

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as revisions to land-use planning, training and education, and structural and nonstructural safety measures.

6.1 BACKGROUND AND PAST MITIGATION ACCOMPLISHMENTS

In accordance with the requirements of the Disaster Mitigation Act of 2000 (refer to Section 1 [Introduction] for more detail on DMA 2000), a discussion regarding past mitigation activities and an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this plan update. The county, through previous and ongoing hazard mitigation activities, has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural hazards. Examples of previous and ongoing actions and projects include the following:

- The county facilitated the development of the original Erie County Multi-Jurisdictional Hazard Mitigation Plan. The current planning process represents the regulatory five-year plan update process, which includes participation of 46 jurisdictions in the county, along with key county and regional stakeholders.
- All municipalities participating in this HMP update participate in the National Flood Insurance Program (NFIP), which requires the adoption of FEMA floodplain mapping and certain minimum standards for building within the floodplain.
- Reports, plans, and studies relating to or including information on natural hazards or natural hazard policies affecting Erie County have been reviewed and incorporated into this plan update as appropriate, as discussed in Section 3 (Planning Process) and References.

6.2 GENERAL MITIGATION PLANNING APPROACH

The overall approach used to update the county and local hazard mitigation strategies is based on FEMA and New York State (NYS) regulations and guidance regarding local mitigation plan development, including:

- DMA 2000 regulations, specifically 44 CFR 201.6 (local mitigation planning).
- FEMA *Local Mitigation Planning Handbook*, March 2013.
- FEMA *Local Mitigation Plan Review Guide*, October 1, 2011.
- FEMA *Integrating Hazard Mitigation into Local Planning*, March 1, 2013.
- FEMA *Plan Integration: Linking Local Planning Efforts*, July 2015.
- FEMA *Mitigation Planning How-To Guide #3, Identifying Mitigation Actions and Implementing Strategies* (FEMA 386-3), April 2003.
- FEMA *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013.

- NYS DHSES *New York State Hazard Mitigation Planning Standards*, 2017.
- NYS DHSES *New York State Hazard Mitigation Planning Standards Guide*, 2017.

The mitigation strategy update approach includes the following steps that are further detailed in later subsections of this section:

- Section 6.3 - Review and update mitigation goals and objectives.
- Section 6.4 - Identify mitigation capabilities and evaluate their capacity and effectiveness to mitigate and manage hazard risk.
- Section 6.5 - Prepare an implementation strategy, including:
    - Identification of progress on previous county and local mitigation strategies;
    - Development of updated county and local mitigation strategies; and
    - Prioritization projects and initiatives in the updated mitigation strategy.

6.3 REVIEW AND UPDATE OF MITIGATION GOALS AND OBJECTIVES

This section documents the efforts to develop hazard mitigation goals and objectives established to reduce or avoid long-term vulnerabilities to the identified hazards.

6.3.1 Goals and Objectives

FEMA defines ***Goals*** as general guidelines that explain what should be achieved. Goals are usually broad, long-term, policy statements, and represent a global vision.

FEMA defines ***Objectives*** as strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.

FEMA defines ***Mitigation Actions*** as specific actions that help to achieve the mitigation goals and objectives.

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." The mitigation goals were developed based on the risk assessment results, discussions, research, and input from the committee, existing authorities, policies, programs, resources, stakeholders, and the public. The Steering Committee reviewed the 2015 goals and objectives and made revisions for the 2022 update based on the risk assessment results, discussions, research, and input from among the committee, existing authorities, policies, programs, resources, stakeholders, and the public. For the purposes of this plan, goals and objectives are defined as follows:

Goals are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the plan is trying to achieve. The success of the plan, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).

Objectives are short-term aims that form a strategy or course of action to meet a goal. Unlike goals, objectives are stand-alone measurements of the effectiveness of a mitigation action. The objectives also are used to help establish priorities.

During the 2022 plan update process, the Steering Committee reviewed the goals and objectives established in the 2015 HMP. These goals and objectives were reviewed in consideration of the hazard events and losses since the 2015 plan, the updated hazard profiles and vulnerability assessment, the goals and objectives established in the New York State 2019 HMP, Erie County, and local risk management plans as well as direct input on how the county and municipalities need to move forward to best manage their hazard risk. Amendments include additions/edits to goals and/or objectives to express the Planning Partnership's interests in integrating this plan with other planning mechanisms/programs and to support mitigation through the protection and preservation of natural systems, including particular reference to certain goals and objectives in the NYS 2019 HMP update, as identified in the table below.

As a result of this review process, the goals and objectives for the 2022 update were updated to those presented in Table 6-1.

Table 6-1. Erie County Hazard Mitigation Plan Goals and Objectives

Goals	Objectives
Goal 1: Protect life, property, and critical infrastructure from hazard impacts.	Objective 1.1: Retrofit critical facilities and community assets to protect against hazard impacts.
	Objective 1.2: Work with residents and business owners to make their structures more hazard resistant.
	Objective 1.3: Enhance stormwater management infrastructure.
	Objective 1.4: Ensure that critical facilities can continue to function during and after hazard impacts.
	Objective 1.5: Acquire, retrofit, or relocate structures from hazard-prone areas.
	Objective 1.6: Encourage residents and business owners to insure their property against hazard impacts, including through flood insurance through the National Flood Insurance Program (NFIP).
Goal 2: Reduce the risk of hazards on life, property, and the environment.	Objective 2.1: Develop and/or update local regulations based on current information and best practices to help prevent hazard impacts.
	Objective 2.2: Maintain natural waterways and drainage systems to reduce the impacts of hazards.
Goal 3: Educate the public, officials, and other stakeholders about the hazards they face and what can be done to mitigate hazard impacts.	Objective 3.1: Ensure that local officials attend current training on regulatory issues, best practices, and resources available to address hazards.
	Objective 3.2: Educate individuals throughout the County on the hazards they face and what property protection measures they can take to lessen the impact of hazards.

6.4 CAPABILITY ASSESSMENT

According to FEMA's *Mitigation Planning How-To Guide #3*, a capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out. This assessment is an integral part of the planning process. The assessment process enables identification, review, and analysis of current local and state programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation.

During the original planning process, the county and participating jurisdictions identified and assessed their capabilities in the areas of existing programs, policies, and technical documents. By completing this assessment, each jurisdiction learned how or whether they would be able to implement certain mitigation actions by determining the following:

- Limitations that may exist on undertaking actions;
- The range of local and/or state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing their mitigation actions;
- Actions deemed infeasible as they are currently outside the scope of capabilities;
- Types of mitigation actions that may be technically, legally (regulatory), administratively, politically, or fiscally challenging or infeasible;
- Opportunities to enhance local capabilities to support long-term mitigation and risk reduction.

During the plan update process, all participating jurisdictions were tasked with developing or updating their capability assessment, paying particular attention to evaluating the effectiveness of these capabilities in supporting hazard mitigation and identifying opportunities to enhance local capabilities.

County and municipal capabilities in the Planning and Regulatory, Administrative and Technical, and Fiscal arenas may be found in the Capability Assessment section of each jurisdictional annex in Section 9 - Annexes. Within each annex, participating jurisdictions identified how they have integrated hazard risk management into their existing planning, regulatory, and operational/administrative framework ("integration capabilities") and how they intend to promote this integration ("integration actions"). A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7 – Plan Maintenance.

The Erie County Department of Homeland Security and Emergency Services staff provided leadership for the Erie County HMP Update planning effort. In addition, the county staff on the Steering Committee provided continuous support for the implementation of mitigation projects and mitigation educational outreach and serves as a resource to the county and municipalities.

A summary of the various federal, state, county, and local planning and regulatory, administrative and technical, and fiscal programs available to promote and support mitigation and risk reduction in Erie County are presented below.

6.4.1 Planning and Regulatory Capabilities - County and Local

Municipal Land Use Planning and Regulatory Authority

The county and municipalities have various land use planning mechanisms that can be leveraged to mitigate flooding and support natural hazard risk reduction. Specific county and local planning and regulatory capabilities are identified in their jurisdictional annexes in Section 9 – Annexes. These include but are not limited to: comprehensive plans, flood damage prevention ordinances, local codes and regulations, stormwater regulations, and municipal level plans. A list of plans review is provided in Section 3 (Planning Process) and summarized in Appendix I (Plan Review Matrix).

Section 239 of New York State General Municipal Law (GML) requires the referral of certain local planning actions to the Erie County Planning Board for the examination of possible intermunicipal impacts. The Erie County Planning Board operates under New York State General Municipal Law §239 l and m to advise local boards on the potential intermunicipal or countywide impact of local land use decisions. The Planning Board uses the Erie County Comprehensive Plan to direct recommendations on municipal land use referrals and to review proposed county capital improvement projects.

Staff at Erie County's Department of Environment and Planning manage numerous planning programs that improve the quality of life in Erie County. These programs plan for or implement development projects that are consistent with the Framework for Regional Growth, the County's adopted comprehensive plan. These programs include;

- Office of Agriculture
- Arts & Culture
- Capital Improvements Program
- Environmental Review
- Erie County Parks Master Plan
- Erie-Niagara Regional Framework
- Fisheries Advisory Board

- Local Government Training
- Local Planning Assistance
- Land Development & Economic Development Planning Studies
  - Agribusiness Park Feasibility Study
  - Buffalo Niagara Convention Center
  - Business Park Report
- Brownfield & Urban Redevelopment
- Municipal Referrals
  - ZR1 form (referral form)
  - Online Submission - BETA phase
- Waterfront Planning

Emergency and Evacuation Plans

The Erie County Department of Homeland Security and Emergency Services is designated to coordinate all emergency management activities in the county, including planning, response, and management. The department works collaboratively with many other agencies and organizations, which enables the county to better protect life and property during disasters and emergencies. This Department maintains the Erie County Comprehensive Emergency Management Plan (CEMP), which is a comprehensive approach to emergency management. The CEMP is an all-hazards plan that outlines how the county will efficiently and effectively manage emergencies and disaster situations. The CEMP includes an evacuation annex that provides guidance for vehicle movements and evacuations throughout the entire county.

Local Waterfront Revitalization Program

The Waterfront Revitalization of Coastal Areas and Inland Waterways Act offers local governments the opportunity to participate in the State's Coastal Management Program (CMP) on a voluntary basis by preparing and adopting a Local Waterfront Revitalization Program (LWRP), providing more detailed implementation of the State's CMP through use of such existing broad powers as zoning and site plan review (New York State Division of Planning 2018).

When an LWRP is approved by the New York State Secretary of State, State agency actions are required to be consistent with the approved LWRP to the maximum extent practicable. When the federal government concurs with the incorporation of an LWRP into the CMP, federal agency actions must be consistent with the approved addition to the CMP. Title 19 of NYCRR Part 600, 601, 602, and 603 provide the rules and regulations that implement each of the provisions of the Waterfront Revitalization of Coastal Areas and Inland Waterways Act, including but not limited to the required content of an LWRP, the processes of review and approval of an LWRP, and LWRP amendments (New York State Division of Planning 2018).

A LWRP consists of a planning document prepared by a community and the program established to implement the plan. An LWRP may be comprehensive and address all issues that affect a community's entire waterfront, or it may address the most critical issues facing a significant portion of its waterfront. An approved LWRP reflects community consensus and provides a clear direction for appropriate future development. It establishes a long-term partnership among local government, community-based organizations, and the State. Also, funding to advance preparation, refinement, or implementation of Local Waterfront Revitalization Programs is available under Title 11 of the New York State Environmental Protection Fund Local Waterfront Revitalization Program (EPF LWRP), among other sources (New York State Division of Planning 2018).

Any village, town, or city located along the State's coast or designated inland waterway can prepare a new or amend an existing Local Waterfront Revitalization Program. Municipalities are encouraged to address local revitalization issues in a broader context, aligned with regional economic development strategies and regional resource protection and management programs (New York State Division of Planning 2018).

Several communities have adopted Local Waterfront Revitalization Plans, including the Town of Brant, Town of Grand Island, Town of Evans, Town of Hamburg, Town and City of Tonawanda, the City of Buffalo and the City of Lackawanna.

Comprehensive Master Plans

Comprehensive planning is a term used in the United States by land use planners to describe a process that determines community goals and aspirations in terms of community development. The outcome of comprehensive planning is the “Comprehensive Plan” or “Master Plan,” which dictates public policy in terms of transportation, utilities, land use, recreation, and housing. Towns are authorized to develop and adopt a comprehensive plan by New York State Town Law Section 272-a.; villages can do the same per Section 7-722 of the Village Law. State statutes require that all land use laws in a municipality be consistent with a comprehensive plan.

6.4.2 Planning and Regulatory Capabilities – State and Federal

National Flood Insurance Program (NFIP)

The U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968 (FEMA’s 2002 National Flood Insurance Program (NFIP): Program Description). The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Please refer to the Flood Hazard Profile in Section 5.4.6 (Flood) for information on legislation related to reforms to the NFIP.

There are three components to the NFIP: flood insurance, floodplain management and flood hazard mapping. Communities participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage in the U.S. is reduced by nearly $1 billion each year through communities implementing sound floodplain management requirements and property owners purchasing flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 80% less damage annually than those not built in compliance (FEMA, 2008).

All municipalities in Erie County actively participate in the NFIP. As of 2020, there were 1,923 NFIP policies in Erie County. There have been 1,597 claims made, totaling over $10 million for damages to structures and contents. There are 400 NFIP Repetitive Loss (RL) properties in the county. Information on specific locations of Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties was not made available from FEMA for this plan update, so the county is unable to provide a breakdown of the RL properties by occupancy. Further details on the county’s flood vulnerability may be found in the flood hazard profile in Section 5.4.6 - Flood.

Municipal compliance with the NFIP is described in each of the jurisdictional annex in Section 9 (Jurisdictional Annexes). The county’s municipalities have been compliant with the NFIP. To enhance their flood damage prevention programs and enhance compliance with the NFIP in the future, several municipalities propose actions in their mitigation strategies to ensure that their floodplain administrators complete training on floodplain management and the NFIP. In addition, Erie County’s mitigation strategy (see Section 9.1) includes an action to encourage and empower municipalities to participate in FEMA's Community Rating System. Additional information on the NFIP program and its implementation throughout the county may be found in the flood hazard profile (Section 5.4.6 - Flood).

The state and municipalities within it may adopt higher regulatory standards when implementing the provisions of the NFIP. Specifically identified are the following:

Freeboard: By law, NYS requires Base Flood Elevation plus 2 feet (BFE+2) for all construction. When there is a base flood elevation available, the lowest floor, including any basement, must be at or above the base flood elevation (plus two feet beginning in 2007). Elevation may be by means of properly compacted fill, a solid slab foundation, or a "crawl space" foundation, which contains permanent openings to let flood waters in and out. Non-residential structures may be flood-proofed in lieu of elevation. Where a local floodplain administrator has information to estimate a base flood elevation, such as historic flood records or a hydraulic study, that elevation must be used. If the development consists of more than 5 acres or more than 50 lots, the permit applicant must develop a base flood elevation and build accordingly (NYDEC 2018). Communities may go beyond this requirement, providing for additional freeboard. In most New York communities, new structures must have the lowest floor 3 feet or more above the highest adjacent grade.

Cumulative Substantial Improvements/Damages: The NFIP allows improvements valued at up to 50% of the building's pre-improvement value to be permitted without meeting the flood protection requirements. Over the years, a community may issue a succession of permits for different repairs or improvement to the same structures. This can greatly increase the overall flood damage potential for structures within a community. The community may wish to deem "substantial improvement" cumulatively so that once a threshold of improvement within a certain length of time is reached, the structure is considered to be substantially improved and must meet flood protection requirements.

NFIP Community Rating System (CRS)

As an additional component of the NFIP, the CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance (FEMA, 2012).

As of August 5, 2021, there are two communities within Erie County that participate in the CRS program, the Town of Amherst and the City of Lackawanna.

U.S. Army Corps of Engineers

Under Section 404(e) of the Clean Water Act, the U.S. Army Corps of Engineers (USACE) can issue general permits to authorize activities that have only minimal individual and cumulative adverse environmental effects. A nationwide permit (NWP) is a general permit that authorizes activities across the country unless a district or division commander revokes the nationwide permit in a state or other geographic region. There are 54 nationwide permits, and they authorize a wide variety of activities, including linear transportation projects, bank stabilization activities, residential development, commercial and industrial developments, aids to navigation and certain maintenance activities (USACE 2017). Details on each NWP can be found here: https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll7/id/6711.

There are three types of USACE permits: standard, nationwide (described above), and regional. Standard permits are individual permits that involve full public interest review of an individual permit application and includes the issuance of a public notice for any project that does not meet the terms and conditions of an NWP or a Letter of Permission (LOP). Regional general permits are for small, specialized projects. In New York State, there are six regional general permit categories (see https://www.lrb.usace.army.mil/Missions/Regulatory/New-York-Permit-Information/) (USACE Buffalo District 2019).

New York State Floodplain Management

There are two departments that have statutory authorities and programs that affect floodplain management at the local jurisdiction level in New York State: the NYSDEC and the Department of State's Division of Code Enforcement and Administration (DCEA).

The NYSDEC is charged with conserving, improving, and protecting the state's natural resources and environment, and preventing, abating, and controlling water, land, and air pollution. Programs that have bearing on floodplain management are managed by the Bureau of Flood Protection and Dam Safety, which cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion, and dam failures. These objectives are accomplished through floodplain management and both structural and nonstructural means.

The Dam Safety Section is responsible for "reviewing repairs and modifications to dams and assuring [sic] that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning." The Flood Control Projects Section is responsible for reducing flood risk to life and property through construction, operation, and maintenance of flood control facilities.

The Floodplain Management Section is responsible for reducing flood risk to life and property through management of activities, such as development in flood hazard areas, and for reviewing and developing revised flood maps. The Section serves as the NFIP State Coordinating Agency and, in this capacity, is the liaison between FEMA and New York communities that elect to participate in the NFIP. The Section provides a wide range of technical assistance.

Stormwater Management Planning

When proper controls are not in place, research studies show a clear link between urbanization and increased flooding and pollutant export. The goal of stormwater management is to ensure that the quantity and quality of stormwater runoff from a site that is undergoing construction or development should not be substantially altered from its pre-development conditions (NYSDEC 2015).

According to the federal law commonly known as Stormwater Phase II, permits are required for stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas and those additionally designated by the New York State Department of Environmental Conservation (NYSDEC). Owners or operators of such MS4s must be authorized in accordance with the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems. The permit requires development of a Stormwater Management Program (SWMP).

6.4.3 Administrative and Technical Capabilities - County and Local

This subsection provides a summary of capabilities to support hazard mitigation for local jurisdictions, some of whom sat on the Steering Committee and others who provide a resource for support and information to communities. Specific local capabilities (e.g., police, fire, EMS, highway and public works departments, etc.) are provided in Section 9 (Jurisdictional Annexes).

Erie County Department of Homeland Security and Emergency Services

The Erie County Department of Homeland Security and Emergency Services is responsible for all emergency planning, response, and management within the county. The county's Emergency Manager is the Deputy Commissioner of Preparedness and Homeland Security The Department creates and maintains county emergency plans, including the CEMP, and reviews and files municipal emergency plans; additionally, the office leads the county emergency operations and assists all towns, cities, and villages with emergency planning and coordination. The county offers Fire Service Training, Emergency Medical Service Training, and American Heart Association CPR/ AED/ First Aid Training.

The Department of Homeland Security & Emergency Services works closely with the entire emergency services and public safety community in Erie County, serving the public and first responders alike. The Department maintains a countywide radio system consisting of over 3,000 mobile and portable radios, 14 base stations and several radio towers. Fire Safety, Emergency Medical Services, and Homeland Security/Emergency Management/Disaster Preparedness are divisions of the Department of Homeland Security & Emergency Services.

Staff within the Department are trained in the principles of National Incident Management Systems (NIMS) and Incident Command System (ICS), allowing them to serve as the primary support for the Erie County Emergency Operations Center (EOC). Staff also works with NYS DHSES, FEMA, and county agencies such as fire departments and Emergency Medical Services providers.

The Department led and helped to organize the update of this Hazard Mitigation Plan and was also an active participant in the Steering Committee.

Erie County Department of Environment and Planning

Staff at Erie County's Department of Environment and Planning manage numerous planning programs that improve the quality of life in Erie County. These programs plan for or implement development projects that are consistent with the Framework for Regional Growth, the County's adopted comprehensive plan. The Department was an active participant in the Steering Committee and provided important hazard specific input during meetings and via municipal worksheets.

The Department These programs include:

- Office of Agriculture
- Arts & Culture
- Capital Improvements Program
- Environmental Review
- Erie County Parks Master Plan
- Erie-Niagara Regional Framework
- Fisheries Advisory Board
- Local Government Training
- Local Planning Assistance
- Land Development & Economic Development Planning Studies
- Brownfield & Urban Redevelopment
- Municipal Referrals
- Other Reports
- Waterfront Planning

For more information about the County's Planning activities please visit Planning and Development | Environment & Planning (erie.gov)

Erie County Department of Health

The Department of Health protects the welfare of the present and future generations of Erie County residents through the conservation of soil, water, air, plant and animal resources by delivery of sound, science-based, locally-directed, technical and educational assistance.

Erie County Soil and Water Conservation District

It is the mission of the Erie County Soil and Water District to protect and promote the health, safety and general welfare of the present and future generations of Erie County residents through the conservation of soil, water, air, plant and animal resources by delivery of sound, science-based, locally-directed, technical and educational assistance. Mark Gaston was an active member of the Steering Committee and provided important information about SWCD's mitigation efforts.

The Erie County Soil and Water Conservation District (ECSWCD) is a subdivision of the local government established under New York State law. The ECSWCD's purpose is to carry out a program for the conservation, use, and development of soil, water, and related resources. The ECSWCD coordinates and implements resource management programs at a local level and facilitates cooperation between local, state, and federal agencies. The ECSWCD works with landowners, land managers, local government agencies, and other local interests to address issues related to soil and water, including:

- Agricultural Environmental Management (AEM)
- Streambank Stabilization
- Education
- Fish Stocking - The District offers an annual sale and distribution of largemouth bass, fathead minnows and trout for the stocking of rural ponds.
- Pond Design - The District offers a pond planning service, for a fee, for Erie County residents that would like to construct a pond for wildlife, recreational and fire protection uses.
- Conservation Products - The District has a variety of conservation-related products for sale, to help promote wildlife habitat enhancement and learning, including:
  - Blue Bird Nest Boxes
  - Bat Houses
  - Wood Duck Houses
  - Field ID Guides
- Stormwater Management
- Technical Assistance and Services
- Agricultural Conservation Assistance
- Conservation Assistance to Municipalities
- Agricultural Assessment Program
- Watershed Planning

Erie County Health Department – Division of Environmental Health

The Erie County Health Department works to protect and improve the health of county residents. Representatives of ECDOH actively participated as a member of the Steering Committee. There are many services provided by the department including:

- Animal & Pet Health
- Vermin Control
- Health Services/Dental

- Community Health Fairs
- Community Wellness
- COVID-19 Coronavirus
- Disease Intervention Services
- Early Intervention
- Emergency Medical Services (EMS)
- Environmental Health
- Epidemiology & Disease Control
- Food Safety & Security
- Healthy Neighborhoods Program (HNP)
- Heart Health
- Lead Poisoning Prevention
- Lyme Disease & Ticks
- Maternal and Child Health
- Medical Examiner's Office
- Mental Health
- Rabies, Disease & Vector Control Program
- Rabies Information
- Substance Use
- WNY Stress Reduction Program

Erie County Legislature

The Legislature serves as the governing body of the county. The purpose of the Legislature is to exercise the powers and discharge any duties of local government and the administration of public affairs that can be imposed or conferred upon it by law. It is composed of eight legislative districts and operates under a committee system. The committees include:

- Community Enrichment
- Government Affairs
- Economic Development
- Health and Human Services
- Energy and Environment
- Minority and Women Business
- Finance Management
- Public Safety
- Small Business

Erie County Department of Public Works

The mission of the Department of Public Works is to provide safe, functional roadways and bridges for the traveling public and accurate testing of scales and measuring devices. The department also provides leadership and management in the design, construction, maintenance and management of county-owned facilities. The department is divided into four divisions: Buildings and Grounds, Highways, Weights and Measures, and Fleet. Public Works staff from the Sewer Division and the Highway Division were active participants of the Steering Committee and provided very valuable information that was incorporated into the Hazard Mitigation Update. A list of currently active projects is available here; https://www2.erie.gov/dpw/index.php?q=project-list&order=title&sort=asc

Highway Division

The Division of Highways is responsible for the engineering and inspection of over a thousand miles of roadways, making ours the largest transportation design team in Western New York. The Division of Highways is also responsible for snow and ice control of county roads.

6.4.4 Administrative and Technical Capabilities - State and Federal

New York State Division of Homeland Security and Emergency Services (NYS DHSES)

For more than 50 years, NYS DHSES (formerly New York State Office of Emergency Management) and its predecessor agencies have been responsible for coordinating the activities of all State agencies to protect New York's communities, the State's economic well-being, and the environment from natural and man-made disasters and emergencies. NYS DHSES routinely assists local governments, voluntary organizations, and private industry through a variety of emergency management programs, including hazard identification, loss prevention, planning, training, operational response to emergencies, technical support, and disaster recovery assistance.

NYS DHSES administers the FEMA mitigation grant programs in the state and supports local mitigation planning in addition to developing and routinely updating the State Hazard Mitigation Plan. NYS DHSES prepared the current State Hazard Mitigation Plan working with input from other State agencies, authorities, and organizations. It was approved by FEMA in 2018, and it keeps New York eligible for recovery assistance in Public Assistance (Categories A through G) and Hazard Mitigation assistance in each of the Unified Hazard Mitigation Assistance Program's five grant programs. The 2019 New York State HMP was used as guidance in completing the Erie County HMP Update. The State HMP can be found here: https://mitigateny.availabs.org/.

For the purpose of this HMP, representatives from NY DHSES completed stakeholder surveys, provided technical assistance and data, and attended planning partnership meetings. NYS DHSES also presented about state requirements for hazard mitigation plans at the June 2021 Mitigation Action Workshop.

New York State Department of Environmental Conservation (NYSDEC) – Region 9 – Central New York

NYSDEC – Region 9 is located in western New York and includes Allegany, Erie, Chautauqua, Erie, Niagara, and Wyoming counties. The main Department of Environmental Conservation (DEC) office is located in Buffalo with a sub-office in Allegany. DEC staff have two main areas of responsibility: natural resource management and environmental quality protection. As part of natural resource management, staff oversee state fish and wildlife resources as well as state forests (NYSDEC Region 9 2019).

New York State Department of Environmental Conservation (NYSDEC) – Division of Water - Bureau of Flood Protection and Dam Safety

Within the NYSDEC – Division of Water, the Bureau of Flood Protection and Dam Safety (https://www.dec.ny.gov/lands/4991.html) cooperates with federal, state, regional, and local partners to protect lives and property from floods, coastal erosion and dam failures through floodplain management and both structural and nonstructural means; and provides support for information technology needs in the division. The bureau consists of the following sections:

- Coastal Management: Works to reduce coastal erosion and storm damage to protect lives, natural resources, and properties through structural and nonstructural means.

- Dam Safety: Is responsible for reviewing repairs and modifications to dams and assuring that dam owners operate and maintain dams in a safe condition through inspections, technical reviews, enforcement, and emergency planning.

- Flood Control Projects: Is responsible for reducing flood risk to life and property through construction, operation, and maintenance of flood control facilities.

- Floodplain Management: Is responsible for reducing flood risk to life and property through proper management of activities including, development in flood hazard areas and review and development of revised flood maps (NYSDEC Bureau of Flood Protection and Dam Safety 2019).

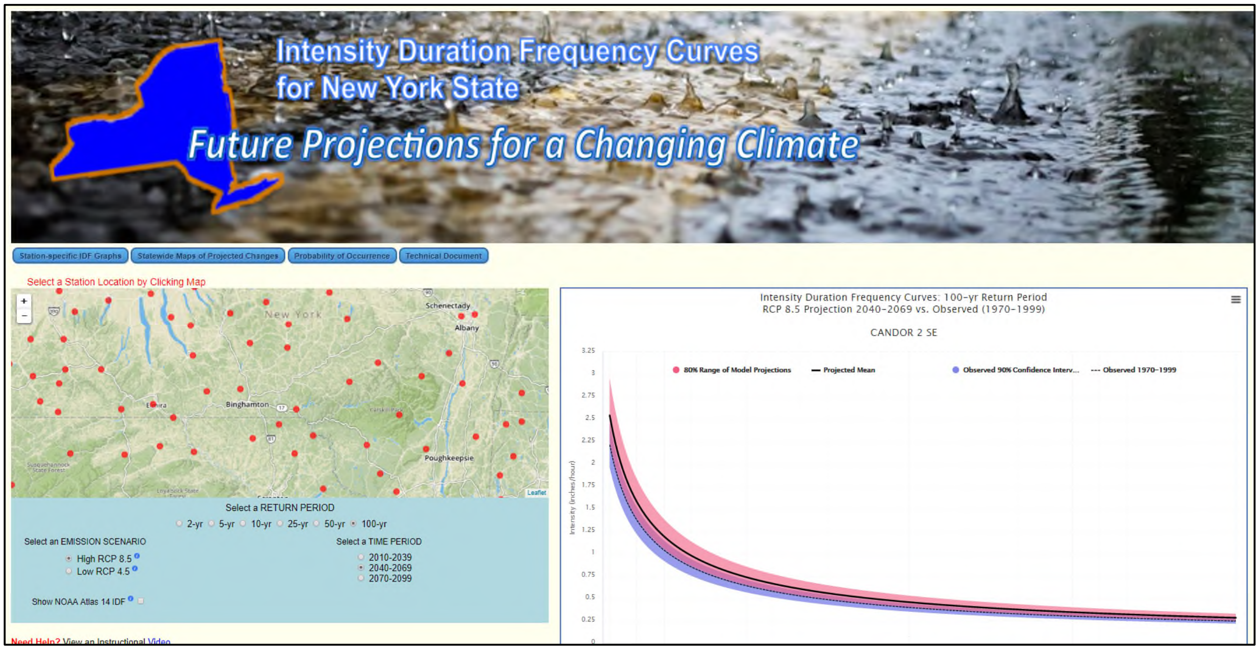
The NYSDEC's Mission is "To conserve, improve and protect New York's natural resources and environment and to prevent, abate and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being."

DEC's goal is to achieve this mission through the simultaneous pursuit of environmental quality, public health, economic prosperity and social well-being, including environmental justice and the empowerment of individuals to participate in environmental decisions that affect their lives.

Northeast Regional Climate Center

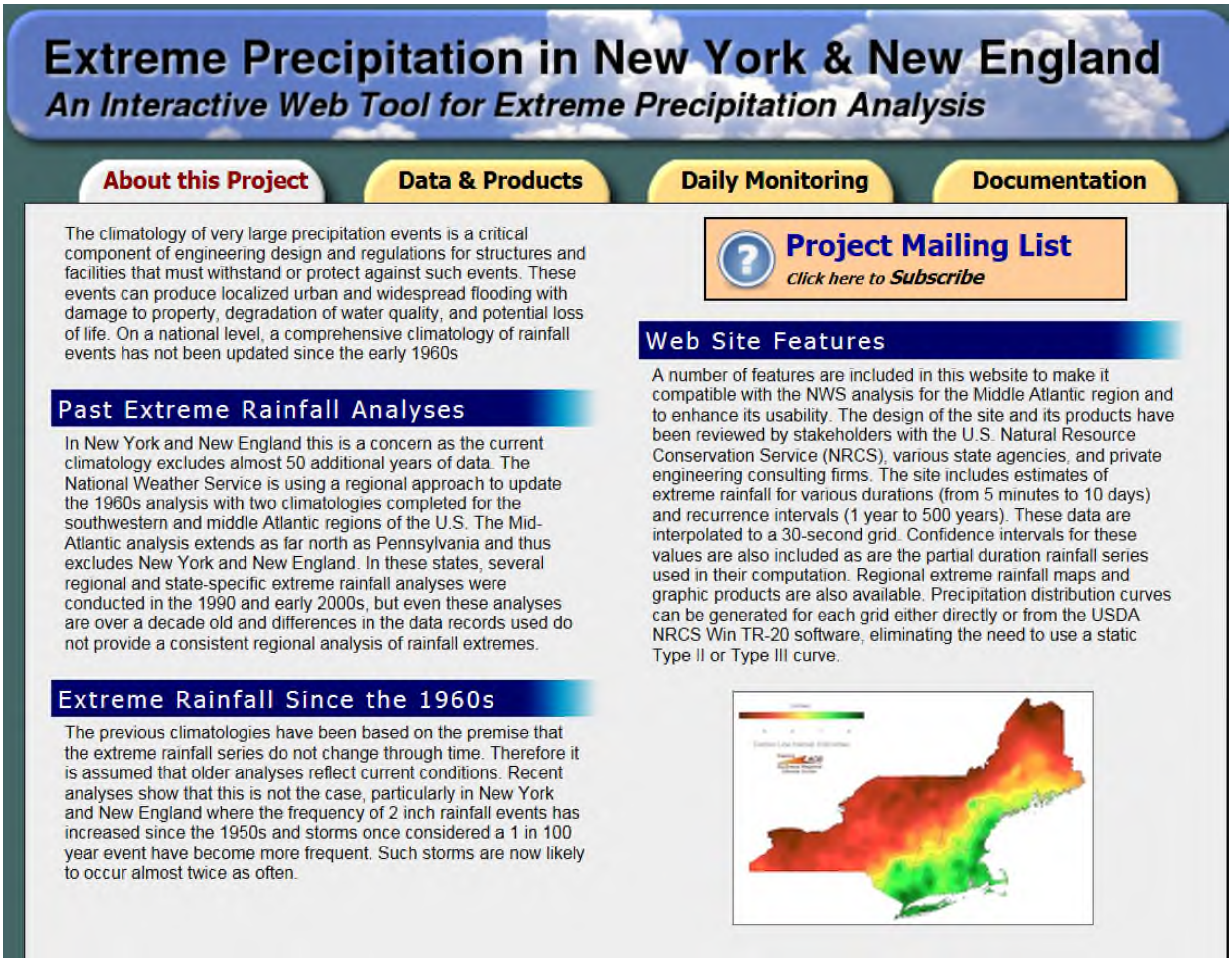
The Northeast Regional Climate Center (NRCC) partnered with the New York State Energy Research and Development Authority (NYSERDA) to compare various methods of downscaling global climate model (GCM) output and create extreme precipitation projections for New York State. These projections will ultimately be incorporated into climate change adaptation planning. In 2009 alone, 175 total flooding events in New York State led to $32.82 million in property damage. The state is also still recovering from the $42 billion toll of Superstorm Sandy. Climate change is resulting in an increase in the frequency of heavy rainfall events. To help New York State communities plan for effects of climate change, new graphics are now available showing the increased likelihood of heavy precipitation events. These graphs, called Intensity Duration Frequency (IDF) curves, show anticipated increases of storm events from 2- to 100-year intervals and are projected into the future as far as 2099. These products are designed for use by municipal officials, researchers, planners, highway departments, and other decision-makers who need to take storm events into account. These IDF curves display how precipitation events are being affected by New York State's rapidly changing climate (NRCC 2015). Figure 6-1 displays the screenshot of the website.

Figure 6-1. Screenshot of the IDF Curves for New York State



NRCC also maintains the Extreme Precipitation in New York & New England website, an interactive tool for extreme precipitation analysis. The site includes estimates of extreme rainfall for various durations (5 minutes to 10 days) and recurrence intervals (1 year to 500 years). These data are interpolated to a 30-second grid. Confidence intervals for these values are included as are the partial duration rainfall series used in their computation. Regional extreme rainfall maps and graphic products are available. Precipitation distribution curves can be generated for each grid either directly or from the USDA NRCS Win TR-20 software, eliminating the need to use a static Type II or Type III curve (NRCC 2018). This tool can be used by municipalities to assist them in the design and feasibility assessment of future projects and allow them to see the future intensity and frequency of rain events. Figure 6-2 shows a screenshot of the website.

Figure 6-2. Screenshot of the Extreme Precipitation in New York & New England website



Department of State's Division of Code Enforcement and Administration (DCEA)

Technical Bulletins for the 2010 Codes of New York State

The DCEA publishes technical bulletins for its building codes. TB-1004 came into effect in October 2017 and addressed Flood Venting in Foundations and Enclosures in Flood Areas. The bulletin clarifies definitions and requirements with regard to Residential and Building Construction (19NYCRR 1220 and 1221). Bulletins also address requirements for critical facilities such as fire stations, requirements for fire extinguishers, and other hazards.

Forms and Publications

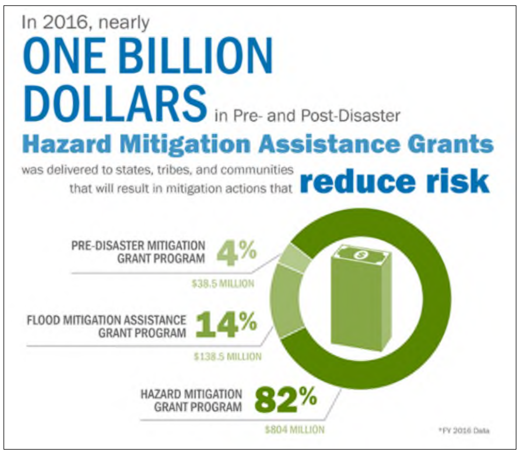
The DCEA posts several model reporting forms and related publications on its web page. The Building Permit Application requests the applicant to indicate whether the site is or is not in a floodplain and advises checking with town clerks or NYSDEC. The General Residential Code Plan Review form includes a reminder to "add 2' freeboard." Sample Flood Hazard Area Review Forms, including plan review checklists and inspection checklists for Zone A and Zone V, are based on the forms in Reducing Flood Losses through the International Code Series published by International Code Council and FEMA (2008).

6.4.5 Fiscal Capabilities – County and Local

Municipal Fiscal Capabilities

Erie County and individual municipalities are (legally, not necessarily practically) able to fund mitigation projects though existing local budgets, local appropriations (including referendums and bonding), and a variety of federal and state loan and grant programs. Many municipalities noted throughout the planning process that they are faced with increasing fiscal constraints, including decreasing revenues, budget constraints, and tax caps. In an effort to overcome these fiscal challenges, municipalities have continued to leverage the sharing of resources and combining available funding with grants and other sources and note that plans and intermunicipal cooperation are beneficial in obtaining grants.

6.4.6 Fiscal Capabilities – State and Federal



Source: FEMA, 2018

The *NYS Capabilities* section of the 2019 New York State Hazard Mitigation Plan features a section on mitigation-related funding administered by state agencies that eligible jurisdictions can use to find mitigation actions. A list of funding opportunities can be accessed here: https://mitigateny.availabs.org/strategies/funding

As noted on the FEMA hazard mitigation assistance website (https://www.fema.gov/hazard-mitigation-assistance), FEMA administers five programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damages. The programs are the Hazard Mitigation Grant Program (HMGP), and the HMGP Post Fire Grant, the Flood Mitigation Assistance (FMA) Program, the Pre-Disaster Mitigation (PDM) Program, and the new Building Resilient Infrastructure & Communities (BRIC) Program.

HMGP assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration. PDM provides funds for hazard mitigation planning and projects on an annual basis. FMA provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis. BRIC supports jurisdictions in hazard mitigation projects, reducing the risks they face from disasters and natural hazards. The BRIC program will replace the existing Pre-Disaster Mitigation (PDM) program. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency (FEMA 2020).

HMGP funding is generally 15% of the total amount of Federal assistance provided to a State, Territory, or federally-recognized tribe following a major disaster declaration. PDM and FMA funding depends on the amount congress appropriates each year for those programs. BRIC is funded by a 6% ($500 million) set-aside from federal post-disaster grant funding.

Individual homeowners and business owners may not apply directly to FEMA. Eligible local governments may apply on their behalf (FEMA 2020).

Table 6-2 provides an overview of program funding eligibility and cost share.

Table 6-2. FEMA HMA Grant Cost Share Requirements

Programs	Cost Share (Percent of Federal / Non-Federal Share)
HMGP	75 / 25
FMA – insured properties and planning grants	75 / 25
FMA – repetitive loss property(2)	90 / 10
FMA – severe repetitive loss property(2)	100 / 0
BRIC	75 / 25
BRIC – subrecipient is small and impoverished community	90 / 10

Source: FEMA HMA Guidance 2015; Regulations.gov; FEMA 2020

(1) Subapplicants should consult their State Hazard Mitigation Officer (SHMO) for the amount of percentage of HMGP subrecipient management cost funding their State has determined to be passed through subrecipients.

(2) To be eligible for an increased federal cost share, a FEMA-approved state or tribal (standard or enhanced) mitigation plan that addressed repetitive loss properties must be in effect at the time of award, and the property is being submitted for consideration must be a repetitive loss property.

Federal Hazard Mitigation Funding Opportunities

Federal mitigation grant funding is available to all communities with a current hazard mitigation plan (this plan); however, most of these grants require a "local share" in the range of 10-25% of the total grant amount. Details about this program and a further description of these opportunities can be found at: https://www.fema.gov/hazard-mitigation-assistance. The FEMA mitigation grant programs are described below.

Hazard Mitigation Grant Program (HMGP)

The HMGP is a post-disaster mitigation program. It is made available to states by FEMA after each Federal disaster declaration. The HMGP can provide up to 75% funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard-prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved Hazard Mitigation Plan (this plan).

Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to NYS DHSES and placed in rank order for available funding and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available. For additional information regarding HMGP, please refer to: https://www.fema.gov/hazard-mitigation-grant-program

Flood Mitigation Assistance (FMA) Program

The FMA program combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. The FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is at least 75%. At most, 25% of the total eligible costs must be provided by a non-federal source. Of this 25%, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state. The NYS DHSES serves as the grantee and program administrator for the FMA program.

For additional information regarding the FMA program, please refer to: https://www.fema.gov/flood-mitigation-assistance-grant-program

Building Resilient Infrastructure and Communities (BRIC) Program

Building Resilient Infrastructure and Communities (BRIC) will support states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program.

The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

For additional information regarding the BRIC program, please refer to:
https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities

Rehabilitation of High Hazard Potential Dams (HHPD) Program

The Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness.

The HHPD Grant Program will provide assistance for technical, planning, design and construction activities toward:

- Repair
- Removal
- Structural/nonstructural rehabilitation of eligible high hazard potential dams

For additional information regarding the HHPD program, please refer to: https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants/resources.

Extraordinary Circumstances

For BRIC and FMA project subawards, the (FEMA) Region may apply extraordinary circumstances when justification is provided and with concurrence from FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) prior to granting an exception. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community.

For HMGP, BRIC, and FMA, extraordinary circumstances exist when a determination is made by the Applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the State (Standard or Enhanced) Mitigation Plan and that the jurisdiction meets at least one of the criteria below. If the jurisdiction does not meet at least one of these criteria, the Region must coordinate with FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) for HMGP; however, for BRIC and FMA the Region must coordinate and seek concurrence prior to granting an exception:

- The jurisdiction meets the small, impoverished community criteria (see Part VIII, B.2).
- The jurisdiction has been determined to have had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline.
- The jurisdiction has been determined to have been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development.
- The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award.
- The jurisdiction does not have a mitigation plan for reasons beyond the control of the State, federally-recognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or Tribal Mitigation Plan.

For HMGP, BRIC, and FMA, the Applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement and identifies the specific actions or circumstances that eliminated the deficiency.

When an HMGP project funding is awarded under extraordinary circumstances, the Recipient shall acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The Recipient must provide a work plan for completing the local or Tribal Mitigation Plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement shall be incorporated into the award (both the planning and project subaward agreements if a planning subaward is also awarded).

Federal and State Disaster and Recovery Assistance Programs

Following a disaster, various types of assistance may be made available by local, state, and federal governments. The types and levels of disaster assistance depend on the severity of the damage and the declarations that result from the disaster event. Among the general types of assistance that may be provided should the President of the United States declare the event a major disaster includes the following:

Individual Assistance (IA)

IA provides help for homeowners, renters, businesses, and some nonprofit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration. For homeowners and renters, those who suffered uninsured or underinsured losses may be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. Individuals may borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property, and an additional 20% for mitigation. For businesses, loans may be made to repair or replace disaster damages to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Nonprofit organizations such as charities, churches, private universities, etc. are also eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster. These loans are restricted, by law, to small businesses only. For additional information regarding IA, please refer to: https://www.fema.gov/individual-disaster-assistance

Public Assistance (PA)

PA provides cost reimbursement aid to local governments (state, county, local, municipal authorities and school districts) and certain nonprofit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA with both local and state matching contributions required. For additional information regarding PA, please refer to: https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit

Small Business Administration (SBA) Loans

SBA provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

Homeowners may apply for up to $200,000 to replace or repair their primary residence. Renters and homeowners may borrow up to $40,000 to replace or repair personal property (such as clothing, furniture, cars, and appliances) damaged or destroyed in a disaster. Physical disaster loans of up to $2 million are available to qualified businesses or most private nonprofit organizations. For additional information regarding SBA loans, please refer to: https://www.sba.gov/managing-business/running-business/emergency-preparedness/disaster-assistance

Social Services Block Grant Program (SSBG)

To address the needs of critical health and human service providers and the populations they serve, the State of New York will receive a total of $235.4 million in federal Superstorm Sandy SSBG funding. The state will distribute $200,034,600 through a public and transparent solicitation for proposals and allocate $35.4 million in State Priority Projects, using the SSBG funding. Sandy SSBG resources are dedicated to covering necessary expenses resulting from Superstorm Sandy, including social, health, and mental health services for individuals, and for repair, renovation, and rebuilding of health care facilities, mental hygiene facilities, child care facilities, and other social services facilities. Additional information regarding the SSBG program is available on the website: https://www.acf.hhs.gov/ocs/programs/ssbg.

Department of Homeland Security Grant Program (HSGP)

The Homeland Security Grant Program (HSGP) plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. The program supports efforts to build and sustain core capabilities across the Prevention, Protection, Mitigation, Response, and Recovery mission areas. This includes two priorities: building and sustaining law enforcement terrorism prevention capabilities and maturation and enhancement of state and major urban area fusion centers. HSGP is composed of three interconnected grant programs including the State Homeland Security Program (SHSP), Urban Areas Security Initiative (UASI), and the Operation Stonegarden (OPSG). Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration. For additional information regarding HSGP, please refer to: https://www.fema.gov/grants/preparedness/homeland-security

Community Development Block Grants (CDBG)

CDBG are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, as suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, planning, and administration. Public improvements may include flood and drainage improvements. In limited instances, and during the times of “urgent need” (e.g., post-disaster) as defined by the CDBG National Objectives, CDBG funding may be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. For additional information regarding CDBG, please refer to: https://www.hudexchange.info/programs/cdbg-entitlement/

U.S. Economic Development Administration

The U.S. Economic Development Administration (USEDA) is an agency of the U.S. Department of Commerce that supports regional economic development in communities around the country. It provides funding to support comprehensive planning and makes strategic investments that foster employment creation and attract private investment in economically distressed areas of the United States. Through its Public Works Program, USEDA invests in key public infrastructure, such as in traditional public works projects, including water and sewer systems improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities, telecommunications and development facilities. Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund (RLF) Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business, in areas that have experienced or are under threat of serious structural damage to the underlying economic base. Please refer to the USEDA website (https://www.eda.gov/) for additional information.

Federal Highway Administration - Emergency Relief (FHWA-ER)

The FHWA- ER is a grant program that may be used for repair or reconstruction of Federal-aid highways and roads on Federal lands which have suffered serious damage as a result of a disaster. NYS is serving as the liaison between local municipalities and FHWA. $30 million in funding was released in October–November of 2012 for emergency repair work conducted in the first 180 days following Hurricane Sandy. Another $220 million in additional funding became available February 2013. For information regarding the FHWA-ER Program, please refer to: https://www.fhwa.dot.gov/programadmin/erelief.cfm

Federal Transit Administration - Emergency Relief (FTA-ER)

The FTA-ER is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the Federal Transit Authority at the U.S. Department of Transportation and directly allocated to metropolitan transit authorities (MTA) and port authorities, this transportation-specific fund was created as an alternative to FEMA PA. Currently, a total of $5.2 billion has been allocated to NYS-related entities. For information regarding the FTA-ER Program, please refer to: https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program

State Hazard Mitigation Funding Opportunities

Empire State Development

Empire State Development offers a wide range of financing, grants and incentives to promote business and employment growth, and real estate development throughout the State. Several programs address infrastructure construction associated with project development, acquisition, and demolition associated with project development and brownfield remediation and redevelopment. For additional information regarding Empire State Development, please refer to: https://esd.ny.gov/

Local Waterfront Revitalization Program

The Waterfront Revitalization of Coastal Areas and Inland Waterways Act offers local governments the opportunity to participate in the State's Coastal Management Program (CMP) (pdf) on a voluntary basis by preparing and adopting a LWRP, providing more detailed implementation of the State's CMP through use of such existing broad powers as zoning and site plan review. When an LWRP is approved by the New York State Secretary of State, State agency actions are required to be consistent with the approved LWRP to the maximum extent practicable. When the federal government concurs with the incorporation of an LWRP into the CMP, federal agency actions must be consistent with the approved addition to the CMP.

An approved LWRP reflects community consensus and provides a clear direction for appropriate future development. It establishes a long-term partnership among local government, community-based organizations, and the State. Also, funding to advance preparation, refinement, or implementation of Local Waterfront Revitalization Programs is available under Title 11 of the New York State EPF LWRP, among other sources.

In addition, State permitting, funding, and direct actions must be consistent, to the maximum extent practicable, with an approved LWRP. Within the federally defined coastal area, federal agency activities are also required to be consistent with an approved LWRP. This "consistency" provision is a strong tool that helps ensure all government levels work in unison to build a stronger economy and a healthier environment.

New York State Department of Transportation (NYSDOT)

Scour Critical/Flood Prone Bridge Program

The Scour Critical/Flood Prone Bridge Program is an initiative developed to harden New York State's at-risk bridges to withstand extreme weather events. In the past three years, the State has suffered nine presidentially declared disasters due to extreme weather, many involving severe flooding (NYSDOT 2015).

For this initiative, 105 scour critical/flood prone bridges (https://www.dot.ny.gov/main/business-center/cbow/repository/CBOW_list_2015.pdf) throughout New York State were identified as most at-risk from repeated flooding and are located in the Capital District, Long Island, Mid-Hudson, Mohawk Valley, North Country, Finger Lakes, Central/Western and Southern Tier regions. The locations encompass 78 communities within 30 counties across the State (NYSDOT 2015).

All of the bridges included in this program were built to the codes and standards of their time and remain safe and open for everyday traffic. However, due to a variety of natural severe weather events and the increasing frequency of major storms and floods, they are vulnerable to scour, and flooding caused by the intensity and velocity of water from extreme natural events. Bridge scour erodes and carries away foundation materials such as sand and rocks from around and beneath bridge abutments, piers, foundations and embankments (NYSDOT 2015).

This program encompasses a variety of bridge improvement work, including upgrading concrete bridge abutments and/or piers by adding steel or concrete pile foundations, increasing the size of waterway openings to meet 100-year flood projections and reducing or eliminating the number of bridge piers in the water to prevent debris and ice jams that can flood surrounding areas. Completion of the program will ensure continual access to critical facilities and essential personnel during emergency events. Adverse impacts to travel throughout the State will be greatly reduced during severe weather events as well (NYSDOT 2015).

Through HMGP, this program aims to increase the State's resiliency and mitigate the risks of loss and damage associated with future disasters. The total cost of the program, including all 105 bridges across the state, is $518 million. It will be paid for with a mix of funding from FEMA and the U.S. Department of Housing and Urban Development. No state funding will be required (NYSDOT 2015).

Emergency Watershed Protection Program

The purpose of the Emergency Watershed Protection Program (EWP) was established by Congress to respond to emergencies created by natural disasters. The EWP Program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences. The U.S. Department of Agriculture's Natural Resources Conservation Service

(NRCS) administers the EWP Program; EWP-Recovery, and EWP–Floodplain Easement (FPE). For additional information regarding the EWP, please refer to:
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/

EWP - Recovery

The EWP Program is a recovery effort program aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance but must be represented by a project sponsor that must be a legal subdivision of the State, such as a city, county, township or conservation district, and Native American Tribes or Tribal governments. NRCS may pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

EWP work is not limited to any one set of measures. It is designed for installation of recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a Damage Survey Report (DSR) which provides a case-by-case investigation of the work necessary to repair or protect a site.

Watershed impairments that the EWP Program addresses are debris-clogged stream channels, undermined and unstable streambanks, jeopardized water control structures and public infrastructures, wind-borne debris removal, and damaged upland sites stripped of protective vegetation by fire or drought.

EWP - Floodplain Easement (FPE)

Privately-owned lands or lands owned by local and state governments may be eligible for participation in EWP-FPE. To be eligible, lands must meet one of the following criteria:

- Lands that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous 10 years
- Other lands within the floodplain are eligible, provided the lands would contribute to the restoration of the flood storage and flow, provide for control of erosion, or that would improve the practical management of the floodplain easement
- Lands that would be inundated or adversely impacted as a result of a dam breach

EWP-FPE easements are restored to the extent practicable to the natural environment and may include both structural and nonstructural practices to restore the flood storage and flow, erosion control, and improve the practical management of the easement.

Structures, including buildings, within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

New York State Department of Environmental Conservation Climate Smart Communities (CSC) Program

The CSC program is jointly sponsored by the following six New York State agencies: DEC; Energy Research and Development Authority; Public Service Commission; Department of State; NYSDOT; and the Department of Health. The program encourages municipalities to minimize the risks of climate change and reduce long-term costs through actions which reduce greenhouse gas emissions and adapt to a changing climate. The program offers free technical support on energy and climate and guidance tailored to New York State communities. As of April 2020, more than 303 communities, representing 8.7 million New Yorkers in every region of the state, have committed to acting on climate through New York State's Climate Smart Communities program.

Benefits of participating in the program include saving taxpayer dollars, improving operations and infrastructure, increasing energy independence and security, demonstrating leadership, and positioning for economic growth. Registered Climate Smart Communities receive notification of state and federal assistance that they can leverage to help adopt low-carbon technologies and of programs and support for efficiency improvements and energy conservation. Further, those communities receive an advantage in accessing some state assistance programs, can call on the help of other local governments that already have adopted climate smart practices and policies, and receive statewide recognition for their climate-smart accomplishments. Key elements of the Climate Smart Communities program are described below.

For additional information regarding the CSC program, please refer to: https://climatesmart.ny.gov/

Climate Smart Communities Pledge

Any city, town, village, or county in New York can join the program by adopting the Climate Smart Communities Pledge. To become a registered Climate Smart Community, the municipality's governing body must adopt a resolution that includes all 10 elements of the Pledge and inform DEC of the passage of the resolution. The required 10 elements of the Pledge are as follows:

- Pledge to be a Climate Smart Community.
- Set goals, inventory emissions, plan for climate action.
- Decrease community energy use.
- Increase community use of renewable energy.
- Realize benefits of recycling and other climate smart solid waste management practices.
- Reduce greenhouse gas emissions through use of climate smart land use tools.
- Enhance community resilience and prepare for the effects of climate change.
- Support development of a green innovation economy.
- Inform and inspire the public.
- Commit to an evolving process of climate action.

At the time of this plan update, 8 communities in Erie County have registered to take the Climate Smart Communities Pledge.

Climate Smart Communities Certification (CSC) Program

The Climate Smart Communities Certification (CSC) program enables high-performing registered communities to achieve recognition for their leadership. Designed around the existing ten pledge elements, the certification program recognizes communities achieving any on over 130 total possible actions through a rating system leading to four levels of award: Certified, Bronze, Silver, and Gold. Recertification of completed actions is required every five years. Details of the program and the specific documentation required for each action are described in the CSC Certification Manual at https://climatesmart.ny.gov/actions-certification/actions/

At the time of this plan update, two communities have achieved certification: City of Buffalo and Erie County.

Climate Smart Communities Grant Program

In 2019 DEC announced an expansion of the Environmental Protection Fund to support communities ready to reduce greenhouse gas emissions and prepare for the effects of climate change. Climate Smart Community Implementation grants support mitigation and adaptation projects and range from $100,000 to $2 million. Competitive grants have typically ranged from $25,000 to $100,000 will also provide support for local governments to become certified Climate Smart Communities. All counties, cities, towns, and villages of the

State of New York are eligible to receive funding. The CSC Grant Program will provide 50/50 matching grants for eligible projects in the following categories.

Funding is available for implementation projects that advance a variety of climate adaptation and mitigation actions, including the following:

- Construction of natural resiliency measures
- Relocation or retrofit of climate-vulnerable facilities
- Conservation or restoration of riparian areas and tidal marsh migration area
- Reduction of flood risk
- Clean transportation
- Reduction or recycling of food waste

Funding is also available for **certification projects** that advance several specific actions aligned with Climate Smart Communities Certification requirements:

- Right-sizing of government fleets
- Developing natural resource inventories
- Conducting vulnerability assessments
- Developing climate adaptation strategies
- Updating hazard mitigation plans to address changing conditions and reduce climate vulnerability

In scoring grant applications, increasing points are awarded to communities who have already taken the CSC pledge and to those that have achieved certification status. All grant recipients must take the Climate Smart Communities Pledge within the term of their grant contract. For climate mitigation projects, grant recipients must provide a report of estimates of emissions reduction. Certification actions must adhere to the requirements and standards described in the Climate Smart Communities Certification Manual that is available on the website: http://www.dec.ny.gov/energy/96511.html. For implementation projects involving property (construction, improvements, restoration, rehabilitation), grant recipients that do not have ownership of the property must obtain a climate change mitigation easement.

The Climate Smart Communities Toolkit was developed to educate New York communities on recommended practices that will help to reduce greenhouse gas emissions and adapt to the effects of climate change, specifically in the areas of land-use, transportation policy, green buildings, infrastructure investment, green infrastructure, housing policy, adaptation, and resilience. The Climate Smart Communities Guide to Local Action contains overviews of possible community actions, how-to's and case studies to help communities implement the CSC pledge. The Climate Smart Communities Land Use Toolkit allows New York communities to find recommended practices that will help to reduce greenhouse gas emissions in the areas of land use, transportation policy, green building, infrastructure investment, green infrastructure, and housing policy.

New York State Department of Environmental Conservation (NYSDEC)

Water Quality Improvement Project (WQIP) Program

The WQIP program is a competitive reimbursement grant program that funds projects that directly address documented water quality impairments. The competitive, statewide grant program is open to local governments and not-for-profit corporations. Grant recipients may receive up to 75 percent of the project costs for high priority wastewater treatment improvement, non-agricultural nonpoint source abatement and control, land acquisition for source water protection, aquatic habitat restoration, and municipal separate storm sewer system projects; up to 50% for salt storage projects; and up to 40% for general wastewater infrastructure improvement projects. Eligible activities include:

- Wastewater treatment improvement
- Non-agricultural nonpoint source abatement and control
- Land acquisition for source water protection
- Salt storage
- Aquatic habitat restoration
- Municipal separate storm sewer systems (MS4)

Details regarding this program are available here: https://www.dec.ny.gov/pubs/4774.html.

New York State DEC/Environmental Facilities Corporation (EFC) Wastewater Infrastructure Engineering Planning Grant (EPG)

The New York State DEC, in conjunction with the New York State EFC, will offer grants to municipalities to help pay for the initial planning of eligible Clean Water State Revolving Fund (CWSRF) water quality projects.

The Wastewater Infrastructure Engineering Planning Grant will assist municipalities with the engineering and planning costs of CWSRF-eligible water quality projects. Municipalities with a Median Household Income (MHI) of $65,000 or less in Regional Economic Development Council (REDC) regions of Capital District, Southern Tier, North Country, Mohawk Valley, Central NY, Finger Lakes, or Western NY OR with a Median Household Income of $85,000 or less in REDC regions of Long Island, New York City or Mid-Hudson are eligible to apply. Grants with a 20 percent required local match will be provided to finance activities, including engineering and/or consultant fees for engineering and planning services for the production of an engineering report.

The goal of the EPG program is to advance water quality projects to construction, so successful applicants can use the engineering report funded by the grant to seek financing through the CWSRF program, WQIP program, or other funding entities to further pursue the identified solution. Funding priorities go to projects that are:

- Required by an executed Order on Consent; or
- Required by a draft or final SPDES permit; or
- Upgrading or replacing an existing wastewater system; or
- Constructing a wastewater treatment and/or collection system for an area with failing onsite septic systems; or
- Identified in a Total Maximum Daily Load (TMDL) Implementation Plan.

Details regarding this program can be found here: https://www.dec.ny.gov/pubs/81196.html.

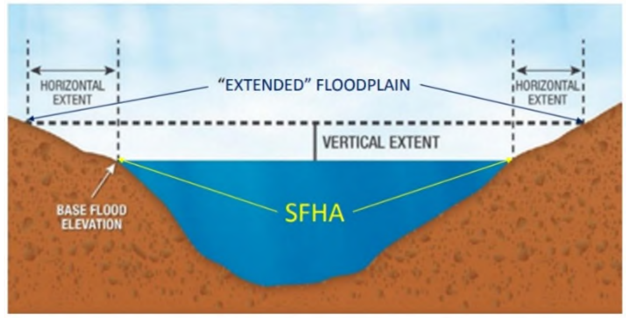
New York State Department of Transportations

BRIDGE NY

The BRIDGE NY program, administered by the NYSDOT, is open to all municipal owners of bridges and culverts. Projects will be awarded through a competitive process and will support all phases of project development. Projects selected for funding under the BRIDGE NY Initiative will be evaluated based on the resiliency of the structure, including such factors as hydraulic vulnerability and structural resiliency; the significance and importance of the bridge including traffic volumes, detour considerations, number and types of businesses served and impacts on commerce; and the current bridge and culvert structural conditions. Information regarding the program can be found here: https://www.dot.ny.gov/BRIDGENY

Community Risk and Resiliency Act (CRRA)

On September 22, 2015, Governor Andrew Cuomo signed bill A06558/S06617-B, the CRRA. The purpose of the bill is to ensure that certain state monies, facility-siting regulations, and permits include consideration of the effects of climate risk and extreme weather events. The bill's provisions will apply to all applications and permits no later than January 1, 2017. CRRA includes five major provisions:



- Official Sea-Level Rise Projections - CRRA requires the DEC to adopt science-based sea-level rise projections into regulation.
- Consideration of Sea-Level Rise, Storm Surge and Flooding - CRRA requires applicants for permits or funding in a number of specified programs to demonstrate that future physical climate risk due to sea-level rise, storm surge, and flooding have been considered, and that DEC consider incorporating these factors into certain facility-siting regulations.
- Smart-Growth Public Infrastructure Policy Act Criteria - CRRA adds mitigation of risk due to sea-level rise, storm surge, and flooding to the list of smart-growth criteria to be considered by state public infrastructure agencies.
- Guidance on Natural Resiliency Measures - CRRA requires DEC, in consultation with the Department of State (DOS), to develop guidance on the use of natural resources and natural processes to enhance community resiliency.
- Model Local Laws Concerning Climate Risk - CRRA requires DOS, in cooperation with DEC, to develop model local laws that include consideration of future risk due to sea-level rise, storm surge and/or flooding. These model local laws must be based on available data predicting the likelihood of extreme weather events, including hazard risk analysis (NYSDEC 2018).

CRRA requires NYSDEC, in consultation with DOS, to prepare guidance on implementation of the statute. To meet its obligation to develop guidance for the implementation of CRRA, DEC is proposing a new document, State Flood Risk Management Guidance (SFRMG). The SFRMG is intended to inform state agencies as they develop program-specific guidance to require that applicants demonstrate consideration of sea-level rise, storm surge, and flooding, as permitted by program-authorizing statutes and operating regulations. The SFRMG incorporates possible future conditions, including the greater risks of coastal flooding presented by sea-level rise and enhanced storm surge and inland flooding expected to result from increasingly frequent extreme precipitation events (NYSDEC 2018).

For additional details on the CRRA, please refer to: https://www.dec.ny.gov/energy/102559.html

6.4.7 Potential Mitigation Funding Sources

While it is important to recognize the mitigation strategies for each jurisdiction to help achieve the mitigation goals and objectives of the (HMP, it is also important to provide sources for funding to implement these strategies. The table below provides a list of programs, descriptions, and links for those seeking funding sources. This table is not intended to be a comprehensive list, but rather a starting point to help identify potential sources of funding for the identified mitigation strategies.

Table 6-3. Mitigation Funding Sources

Program	Description	Lead Agency	Website
Federal			
Hazard Mitigation Assistance (HMA)	Grants to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages – includes FMA, HMGP, BRIC.	FEMA	https://www.fema.gov/hazard-mitigation-assistance
Flood Mitigation Assistance (FMA)	Program grants to States and communities for pre-disaster mitigation planning and projects to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program.	FEMA	https://www.fema.gov/flood-mitigation-assistance-grant-program
Hazard Mitigation Grant Program (HMGP)	Grants to States and communities for planning and projects providing long-term hazard mitigation measures following a major disaster declaration.	FEMA	https://www.fema.gov/hazard-mitigation-grant-program
Building Resilient Infrastructure and Communities (BRIC)	Grants to States local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the Pre-Disaster Mitigation (PDM) program.	FEMA	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
Public Assistance: Hazard Mitigation Funding Under Section 406	Hazard mitigation discretionary funding available under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act following a Presidentially declared disaster.	FEMA	https://www.fema.gov/news-release/2017/05/03/4309/fema-hazard-mitigation-grants-404-and-406
Assistance to Firefighters Grant Program	The primary goal of the Assistance to Firefighters Grants (AFG) is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated Emergency Medical Services organizations, and State Fire Training Academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.	FEMA	https://www.fema.gov/welcome-assistance-firefighters-grant-program
Disaster Housing Program	Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage and rental assistance.	HUD	https://www.hud.gov/program_offices/public_indian_housing/publications/dhap
HOME Investment Partnerships Program	Grants to local and state government and consortia for permanent and transitional housing, (including financial support for property acquisition and rehabilitation for low income persons).	HUD	https://www.hud.gov/program_offices/comm_planning/affordablehousing/programs/home/
HUD Disaster Recovery Assistance	Grants to fund gaps in available recovery assistance after disasters (including mitigation).	HUD	https://www.hud.gov/info/disasterresources
Section 108 Loan Guarantee	Enables states and local governments participating in the Community Development Block Grant (CDBG) program to obtain federally guaranteed loans for disaster-distressed areas.	HUD	https://www.hudexchange.info/programs/section-108/

Program	Description	Lead Agency	Website
Smart-Growth Implementation Assistance (SGIA) program	The SGIA program focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under 4 categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design or medical and social service facilities siting.	EPA	https://www.epa.gov/smartgrowth
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	U.S. Fish and Wildlife Service	https://www.fws.gov/partners/
FHWA Emergency Relief Program	Fund for the repair or reconstruction of Federal-aid highways that have suffered serious damage as a result of (1) natural disasters or (2) catastrophic failures from an external cause.	U.S. Department of Transportation (DOT)	https://www.fhwa.dot.gov/programadmin/erelief.cfm
Better Utilizing Investments to Leverage Development (BUILD)	Investing in critical road, rail, transit and port projects across the nation	U.S. DOT	https://www.transportation.gov/BUILDgrants/about
Community Facilities Direct Loan & Grant Program	This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings.	USDA	https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program
Emergency Loan Program	USDA's Farm Service Agency (FSA) provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters or quarantine.	USDA	https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/index
Emergency Watershed Protection (EWP) Program	Provide assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/
Financial Assistance	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/
Regional Conservation Partnership Program (RCPP)	The RCPP promotes coordination of NRCS conservation activities with partners that offer value-added contributions to expand our collective ability to address on-farm, watershed, and regional natural resource concerns. Through RCPP, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address.	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/rcpp/
Emergency Management Performance Grants (EMPG) Program	Assist local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities.	U.S. DHS	https://www.fema.gov/emergency-management-performance-grant-program

Program	Description	Lead Agency	Website
Land & Water Conservation Fund	Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies).	National Park Service	https://www.nps.gov/subjects/lwcf/index.htm
Coastal Watersheds Grant Program	Restore America's Estuaries, in close coordination with and financial support from EPA, administers the National Estuary Program (NEP) Coastal Watersheds Grant Program. This grant program funds projects within the geographic areas shown here and supports the following Congressionally-set priorities: •Loss of key habitats resulting in significant impacts on fisheries and water quality such as seagrass, mangroves, tidal and freshwater wetlands, forested wetlands, kelp beds, shellfish beds, and coral reefs; •Recurring harmful algae blooms; •Unusual or unexplained marine mammal mortalities; •Proliferation or invasion of species that limit recreational uses, threaten wastewater systems, or cause other ecosystem damage; •Flooding and coastal erosion that may be related to sea-level rise, changing precipitation, or salt marsh, seagrass, or wetland degradation or loss; •Impacts of nutrients and warmer water temperatures on aquatic life and coastal ecosystems, including low dissolved oxygen conditions in estuarine waters; and •Contaminants of emerging concern found in coastal and estuarine waters such as pharmaceuticals, personal care products, and microplastics.	National Estuary Program	https://estuaries.org/initiatives/watershedgrants/
Rehabilitation of High Hazard Potential Dams Grant Program	The main objective of the HHPD grant program is to provide technical, planning, design, and construction assistance in the form of grants to non-federal sponsors for rehabilitation of eligible high hazard potential dams.	FEMA	https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants/resources
State			
Local Government Records Management Improvement Fund (LGRMIF) Disaster Recovery Grants	Grants for disaster recovery projects related to damage caused by a sudden, unexpected event involving fire, water, man-made or natural phenomena where a timely response is necessary to prevent the irretrievable loss of vital or archival records, or to ensure reasonable, timely access to vital records.	New York State Archives / New York State Education Department	http://www.archives.nysed.gov/grants/grants_lgrmif.shtml
The New York State Emergency Services Revolving Loan	Repair of firefighting apparatus, ambulances, or rescue vehicles; Renovation, rehabilitation, or repair of facilities that house firefighting equipment, ambulances, rescue vehicles, and related equipment.	NYS DHSES	http://www.dhses.ny.gov/ofpc/services/loan/
Environmental Protection Fund (EPF)	Matching grants for the acquisition, planning, development, and improvement of parks, historic properties.	New York State Parks, Recreation & Historic Preservation (NYSOPRHP)	https://www.dec.ny.gov/about/92815.html

Program	Description	Lead Agency	Website
Recreational Trails (RTP)	Program Matching grants for the acquisition, development, rehabilitation and maintenance of trails and trail-related projects.	NYSOPRHP	https://parks.ny.gov/grants/recreational-trails/default.aspx
Environmental Protection & Improvement Grants	Competitive grants for environmental protection and improvement; available for municipalities, community organizations, not-for-profit organizations and others.	New York State Department of Environmental Conservation	https://www.dec.ny.gov/about/92815.html
Volunteer Fire Assistance Grants	The grant is a 50/50 matching funds program. Its purpose is to make funds available to rural fire companies for the purchase of wildland firefighting equipment such as portable backpack pumps, Nomex protective clothing, hand tools, hard hats, hose, portable radios and dry hydrants.	NYSDEC	https://www.dec.ny.gov/regulations/2364.html
Clean Water Act Section 604(b) Water Quality Planning Grants	Provide funding to implement regional comprehensive water quality management planning activities as described in Section 604(b) of the federal Clean Water Act. 604(b) funds are to be used for water quality management planning activities, including tasks to determine the nature, extent and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.	NYSDEC	https://www.dec.ny.gov/lands/53122.html
Water Quality Improvement Project (WQIP) Program	The WQIP program is a competitive, reimbursement grant program that funds projects that directly address documented water quality impairments. Applications are typically available each spring through the Consolidated Funding Application.	NYSDEC	https://www.dec.ny.gov/pubs/4774.html
New York State DEC/EFC Wastewater Infrastructure Engineering Planning Grant (EPG)	The New York State Department of Environmental Conservation (DEC), in conjunction with the New York State Environmental Facilities Corporation (EFC), will offer grants to municipalities to help pay for the initial planning of eligible Clean Water State Revolving Fund (CWSRF) water quality projects. The ultimate goal of the EPG program is to advance water quality projects to construction, so successful applicants can use the engineering report funded by the grant to seek financing through the CWSRF program, Water Quality Improvement Project program, or other funding entities to further pursue the identified solution.	NYSDEC	https://www.dec.ny.gov/pubs/81196.html
Climate Smart Communities Grant Program	The CSC Grant program was established in 2016 to provide 50/50 matching grants to cities, towns, villages, and counties (or boroughs of New York City) of the State of New York for eligible climate adaptation and mitigation projects.	NYSDEC	https://www.dec.ny.gov/energy/109181.html
BRIDGE NY	The state is making funding available for local governments to rehabilitate and replace bridges and culverts statewide.	NYS DOT	https://www.dot.ny.gov/BRIDGENY

6.5 MITIGATION STRATEGY DEVELOPMENT AND UPDATE

6.5.1 Update of Municipal Mitigation Strategies

To evaluate progress on local mitigation actions, each jurisdiction was provided with a Mitigation Action Plan Review Worksheet, pre-populated with those actions identified for their jurisdiction in the prior (2015) plan. For each action, municipalities were asked to indicate the status of each action ("No Progress/Unknown," "In Progress/Not Yet Complete," "Continuous," "Completed," "Discontinued") and provide review comments on each. Municipalities were requested to quantify the extent of progress and provide reasons for the level of progress or why actions were discontinued. Each jurisdictional annex provides a table identifying their prior mitigation strategy, the status of those actions and initiatives, and their disposition within their updated strategy.

Local mitigation actions identified as "Complete" and actions identified as "Discontinued" have been removed from the updated strategies. Those local actions that municipalities identified as "No Progress/Unknown" or "In Progress/Not Yet Complete," as well as certain actions/initiatives identified as "Continuous," have been carried forward in their local updated mitigation strategies. Actions considered ongoing capabilities were marked as "Discontinued" and included in the plan as ongoing capabilities. Municipalities were asked to provide further details on these projects to help better define the projects, identify benefits and costs, and improve implementation.

At the Kick-Off and during subsequent local level planning meetings, all participating municipalities were further surveyed to identify mitigation activities completed, ongoing, and potential/proposed. As new additional potential mitigation actions, projects or initiatives became evident during the plan update process, including as part of the risk assessment update and as identified through the public and stakeholder outreach process (see Section 3 – Planning Process), communities were made aware of these either through direct communication (local meetings, email, phone) or via their draft municipal annexes.

To help support the selection of an appropriate, risk-based mitigation strategy, each annex provided a summary of hazard vulnerabilities identified during the plan update process, either directly by municipal representatives or through review of available county and local plans and reports, and through the hazard profiling and vulnerability assessment process.

Beginning in November 2020, members of the Steering Committee and contract consultants worked directly with each jurisdiction (phone, email, local support meetings) to assist with the development and update of their annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

Concerted efforts were made to ensure that municipalities develop updated mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013), specifically:

- Local Plans and Regulations – These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
- Structure and Infrastructure Project – These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct man-made structures to reduce the impact of hazards.

- Natural Systems Protection – These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.

- Education and Awareness Programs – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the National Flood Insurance Program and Community Rating System, StormReady (NOAA), and Firewise (NFPA) Communities.

A series of mitigation strategy workshops were conducted the week of June 9, 2021, for all participating jurisdictions to support the development of focused problem statements based on the impacts of natural hazards in the county and their communities. These problem statements are intended to provide a detailed description of the problem area, including its impacts to the municipality/jurisdiction; past damages; loss of service; etc. An effort was made to include the street address of the property/project location, adjacent streets, water bodies, and well-known structures as well as a brief description of existing conditions (topography, terrain, hydrology) of the site. These problem statements form a bridge between the hazard risk assessment, which quantifies impacts to each community with the development of actionable mitigation strategies. In total, two workshops were held for Erie County's municipalities.

A strong effort has been made to better focus local mitigation strategies to clearly defined, readily implementable projects and initiatives that meet the definition or characteristics of mitigation. Broadly defined mitigation objectives have been eliminated from the updated strategy unless accompanied by discrete actions, projects or initiatives.

Certain continuous or ongoing strategies that represent programs that are, or since prior and existing plans have become, fully integrated into the normal operational and administrative framework of the community have been identified within the Capabilities section of each annex and removed from the updated mitigation strategy.

At least two mitigation projects per jurisdiction have been documented with an Action Worksheet, as per the New York State Hazard Mitigation Planning Standards Guide.

As discussed within the hazard profiles in Section 5.4 (Risk Assessment), the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards, including flood, severe storm, severe winter storm, and wildfire. By way of addressing these climate change-sensitive hazards within their local mitigation strategies and integration actions, communities are working to evaluate and recognize these long-term implications and potential impacts, and to incorporate in planning and capital improvement updates.

Municipalities included mitigation actions to address vulnerable critical facilities. These actions have been proposed in consideration of protection against 500-year events or worst-case scenarios. It is recognized, however, that in the case of projects being funded through Federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, municipal discretion must be recognized. Further, it must be recognized that the county and municipalities have limited authority over privately-owned critical facility owners with regard to mitigation at any level of protection.

6.5.2 Update of County Mitigation Strategy

The update of the County-level mitigation strategies included a review of progress on the actions/initiatives identified in the 2015 HMP using a process similar to that used to review municipal mitigation strategy progress. The County, through their various department representatives, was provided with a Mitigation Action Plan Review Worksheet identifying all county-level actions and initiatives from the 2015 plan. The County reviewed each action and provided progress. For each action, relevant county representatives were asked to indicate the status of each action (*No Progress/Unknown*, *In Progress/Not Yet Complete*, *Ongoing*, *Completed*, or *Discontinued*), and provide review comments on each.

Projects/initiatives identified as "*Complete*", as well as those actions identified as *Discontinued*, have been removed from this plan update. Those actions the County has identified as *No Progress/Unknown*, *In Progress/Not Yet Complete*, or *Ongoing* have been carried forward in the County's updated mitigation strategy. Actions considered ongoing capabilities were marked as *Discontinued* and included in the plan as ongoing capabilities.

Throughout the course of the plan update process, additional regional and county-level mitigation actions were identified by the following processes:

- Review of the results and findings of the updated risk assessment.
- Review of available regional and county plans reports and studies.;
- Direct input from county departments and other county and regional agencies, including:
    - Erie County Department of Environment and Planning
    - Erie County Department of Homeland Security and Emergency Services
    - Erie County Department of Health
    - Erie County Soil and Water Conservation District
    - Erie County Department of Public Works
    - Erie County Water Authority
- Input received through the public and stakeholder outreach process.

As discussed within the hazard profiles in Section 5.4 (Risk Assessment), the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including drought, flood, severe storm, and severe winter storm. The County has included mitigation actions and initiatives, including continuing and long-term planning and emergency management support, to address these long-term implications and potential impacts.

Various county departments and agencies included mitigation actions to address vulnerable critical facilities. These actions were proposed in consideration of protection against 0.2% annual chance (500-year) events, or worst-case scenarios.

It is recognized, however, that in the case of projects being funded through federal mitigation programs, the level of protection can be influenced by cost-effectiveness, as determined through a formal benefit-cost analysis. In the case of "self-funded" projects, local government authority can affect the ability to implement. Further, the County has limited authority over privately-owned critical facility owners regarding mitigation at any level of protection.

6.5.3 Mitigation Best Practices

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use in Erie County, in compliance with 44 CFR Section 201.6(c)(3)(ii). One catalog was developed for each hazard of concern evaluated in this plan. The catalogs present alternatives that are categorized in two ways:

- By whom would have responsibility for implementation:
    - Individuals – personal scale
    - Businesses – corporate scale

    - Government – government scale
- By what the alternatives would do:
    - Manipulate the hazard
    - Reduce exposure to the hazard
    - Reduce vulnerability to the hazard
    - Build local capacity to respond to or be prepared for the hazard

The alternatives presented include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change. Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the catalogs. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are within the capabilities of the planning partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalogs was to provide a list of what could be considered to reduce risk from natural hazards within the planning area. Actions in the catalog that are not included for the partnership's action plan were not selected for one or more of the following reasons:

- The action is not feasible
- The action is already being implemented
- There is an apparently more cost-effective alternative
- The action does not have public or political support.

6.5.4 Mitigation Strategy Evaluation and Prioritization

Section 201.c.3.iii of 44 CFR requires how the identified mitigation strategies will be prioritized, implemented, and administered by the local jurisdictions. For this plan update, each mitigation strategy was prioritized using a modified STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) mitigation action evaluation methodology based on a set of evaluation criteria suited to the purposes of hazard mitigation strategy evaluation. This method provides a systematic approach that considers the opportunities and constraints of implementing a particular mitigation action.

The Steering Committee applied an action evaluation and prioritization methodology, which includes an expanded set of 14 criteria to include the consideration of cost-effectiveness, availability of funding, anticipated timeline, and if the action addresses multiple hazards. The 14 evaluation/prioritization criteria used in the 2022 update process are:

1. Life Safety – How effective will the action be at protecting lives and preventing injuries?
2. Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?
3. Cost-Effectiveness – Are the costs to implement the project or initiative commensurate with the benefits achieved?
4. Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
5. Political – Is there overall public support for the mitigation action? Is there the political will to support it?
6. Legal – Does the municipality have the authority to implement the action?
7. Fiscal – Can the project be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?

8. Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?
9. Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
10. Administrative – Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
11. Multi-hazard – Does the action reduce the risk to multiple hazards?
12. Timeline – Can the action be completed in less than 5 years (within our planning horizon)?
13. Local Champion – Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?
14. Other Local Objectives – Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

Participating jurisdictions were asked to use these criteria to assist them in evaluating and prioritizing mitigation actions identified in the 2022 update. Specifically, for each mitigation action, the jurisdictions were asked to assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria, defined as follows:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Further, jurisdictions were asked to provide a brief summary of the rationale behind the numeric rankings assigned, as applicable. The numerical results were totaled and then used by each jurisdiction to help prioritize the action or strategy as *low*, *medium*, or *high*. Actions that had a numerical value between 1 and 5 were categorized as *low*; actions with numerical values between 6 and 9 were categorized as *medium*; and actions with numerical values between 10 and 14 were categorized as *high*. While this provided a consistent, systematic methodology to support the evaluation and prioritization of mitigation actions, jurisdictions may have additional considerations that could influence their overall prioritization of mitigation actions.

It is noted that jurisdictions may be carrying forward mitigation actions and initiatives from prior mitigation strategies that were prioritized using a different, but not inherently contrary, approach. Mitigation actions in the prior (2015) Erie County HMP were "qualitatively evaluated against the mitigation goals and objectives and other evaluation criteria. They were then prioritized into three categories: high, medium, and low." At their discretion, jurisdictions carrying forward prior initiatives were encouraged to re-evaluate their priority, particularly if conditions that would affect the prioritization criteria had changed.

For the plan update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include projects and initiatives that are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. In addition, each municipality was asked to develop problem statements. With active support from NYS DHSES planning staff, municipalities were able to develop action-oriented and achievable mitigation strategies.

As such, many of the initiatives in the updated mitigation strategy were ranked as *high* or *medium* priority, as reflective of the community's clear intent to implement them, available resources not-withstanding. In general, initiatives that would have had *low* priority rankings were appropriately screened out during the local action evaluation process.

6.5.5 Benefit/Cost Review

Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. Stated otherwise, cost-effectiveness is one of the criteria that must be applied during the evaluation and prioritization of all actions comprising the overall mitigation strategy.

The benefit/cost review applied for the evaluation and prioritization of projects and initiatives in this plan update process was qualitative; that is, it does not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Assistance (HMA) grant programs. For all actions identified in the local strategies, jurisdictions have identified both the costs and benefits associated with project, action, or initiative.

Costs presented include the total project estimation. This can include administrative, construction (engineering, design, and permitting), and maintenance costs.

Benefits are the savings from losses avoided attributed to project implementation. These can include life safety, structure and infrastructure damages, loss of service or function, and economic and environmental damage and losses.

When possible, jurisdictions were asked to identify the actual or estimated dollar costs and associated benefits. Often numerical costs and/or benefits were not identified and may be impossible to quantify. In this case, jurisdictions were asked to evaluate project cost-effectiveness using *high*, *medium*, and *low* ratings. Where estimates of costs and benefits were available, the ratings were defined as the following:

Low < = $10,000 Medium = $10,000 to $100,000 High > = $100,000

Where quantitative estimates of costs and/or benefits were not available, qualitative ratings using the following definitions were used:

Table 6-4 Qualitative Cost and Benefit Ratings

Costs	
High	Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
Benefits	
High	Project will have an immediate impact on the reduction of risk exposure to life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
Low	Long-term benefits of the project are difficult to quantify in the short-term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-effective.

For some of the Erie County initiatives identified, the Planning Partnership may seek financial assistance under FEMA's HMA programs. These programs require detailed benefit/cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA BCA model process. The Planning Partnership is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the

Planning Partnership reserves the right to define benefits according to parameters that meet its needs and the goals and objectives of this plan.

SECTION 7. PLAN MAINTENANCE PROCEDURES

This section details the formal process that will ensure that the Hazard Mitigation Plan (HMP) remains an active and relevant document and that the Planning Partnership maintains its eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every 5 years. In addition, this section describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

The plan maintenance matrix shown in Table 7-1 provides a synopsis of responsibilities for plan monitoring, integration, evaluation, and update, which are discussed in further detail in the sections below.

Table 7-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Outreach to planning partners to recommend update of mitigation strategies and progress toward implementation of project and identification of new projects and to provide updated information on funding opportunities.	Each June or after the occurrence of a presidentially declared disaster	Jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	Jurisdictional implementation lead identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)
Integration	In order for integration of mitigation principles action to become an organic part of the ongoing county and municipal activities, the county will incorporate the distribution of the safe growth worksheet (see 7.1.2 below) for annual review and update by all participating jurisdictions.	June each year with interim email reminders to address integration in county and municipal activities	HMP Coordinator and jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	HMP Coordinator
Evaluation	Review the status of previous actions, as submitted by the monitoring task lead, and assess the effectiveness of the plan; compile and finalize update of mitigation strategy.	Updated progress report completed by September 30 of each year	Jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	Alternate jurisdictional points of contact
Update	Reconvene the planning partners, at a minimum, every 5 years to guide a comprehensive update to review and revise the plan.	Every 5 years or upon major update to Comprehensive Plan or after the occurrence of a major disaster	Erie County HMP Coordinator	Jurisdictional points of contacts identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)

7.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

The procedures for monitoring, evaluating, and updating the plan are provided below.

The HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period. The HMP Coordinator will convene the Planning Partnership and be the prime point of contact for questions regarding the plan and its implementation and will also coordinate the incorporation of additional information into the plan.

The HMP Coordinator will manage the monitoring, evaluation, and updating responsibilities identified in this section. As of the date of this plan, primary and secondary mitigation planning representatives (points of contact) are identified in each jurisdictional annex in Section 9 (Jurisdictional Annexes).

It will be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation.

Currently, the Erie County HMP Coordinator is designated as:

Gregory Butcher, Deputy Commissioner
Erie County Department of Homeland Security and Emergency Services
45 Elm Street
Buffalo, NY 14203
716-858-6578
Email: gregory.butcher@erie.gov

7.1.1 Monitoring

The Planning Partnership will be responsible for monitoring progress on and evaluating the effectiveness of the plan and documenting annual progress. Each year, beginning one year after plan development, Erie County and local Planning Partnership representatives will collect and process information from the departments, agencies, and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes (Section 9) of this plan, by contacting persons responsible for initiating and/or overseeing the mitigation projects.

In the first year of the performance period, this will be accomplished by utilizing an online performance progress reporting system (the BATool^{SM}), which will enable municipal and county representatives to directly access mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, and add or delete projects to maintain mitigation project implementation. It is anticipated that all participating partners will be prompted by the tool to update progress on a quarterly basis, providing an incentive for participants to refresh their mitigation strategies and to continue implementation of projects. It is expected that this reporting system will support the submittal of an increased number of project grant fund applications due to the functionality of the system, which facilitates the sorting and prioritization of projects.

In addition to progress on the implementation of mitigation actions, including efforts to obtain outside funding and obstacles or impediments to implementation of actions, the information that Planning Partnership representatives shall be expected to document, as needed and appropriate, includes:

- Any grant applications filed on behalf of any of the participating jurisdictions
- Hazard events and losses occurring in their jurisdiction
- Additional mitigation actions believed to be appropriate and feasible
- Public and stakeholder input.

Plan monitoring for years 2 through 4 of the plan performance period will be similarly addressed via the BATool[SM] or manually.

7.1.2 Integration of the HMP into Municipal Planning Mechanisms

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns that reduce risk from known hazards or to redevelopment that reduces risk from known hazards. The Erie County Planning Partnership was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. Section 9 (Jurisdictional Annexes) describes how this is done for each participating municipality. During this process, many municipalities recognized the importance and benefits of incorporating hazard mitigation into future municipal planning and regulatory processes.

The Planning Partnership representatives will incorporate mitigation planning as an integral component of daily government operations. Planning Partnership representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Section 2 – Plan Adoption) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Partnership anticipates that:

1. Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts.
2. The HMP, Comprehensive Plans, Emergency Management Plans, and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.

During the HMP annual review process, each participating municipality will be asked to document how they are utilizing and incorporating the Erie County HMP into their day-to-day operations and planning and regulatory processes. Each municipality will also identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report. The following checklist was adapted from FEMA's Local Mitigation Handbook (2013), Appendix A, Worksheet 4.2. This checklist will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, ordinances, and policies. By completing the checklist, it will help municipalities identify areas that currently integrate hazard mitigation and where to make improvements and reduce vulnerability to future development.

Table 7-2. Safe Growth Check List

Planning Mechanisms	Do You Do This? Yes	Do You Do This? No	Notes: How is it being done or how will this be utilized in the future?
Operating, Municipal, and Capital Improvement Program Budgets			
• When constructing upcoming budgets, hazard mitigation actions will be funded as budget allows. Construction projects will be evaluated to see if they meet the hazard mitigation goals.			
• Annually, during adoption process, the municipality will review mitigation actions when allocating funding.			
• Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			

Planning Mechanisms	Do You Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
• Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?			
• Do budgets provide funding for hazard mitigation projects identified in the HMP?			
Human Resource Manual			
• Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk?			
Building and Zoning Ordinances			
• Prior to zoning changes or development permitting, the municipality will review the HMP and other hazard analyses to ensure consistent and compatible land use.			
• Does the zoning ordinance discourage development or redevelopment within natural areas, including wetlands, floodways, and floodplains?			
• Does the ordinance contain natural overlay zones that set conditions			
• Does the ordinance require developers to take additional actions to mitigate natural hazard risk?			
• Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
• Does the ordinance prohibit development within or filling of wetlands, floodways, and floodplains?			
Subdivision Regulations			
• Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
• Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?			
• Do the regulations allow density transfers where hazard areas exist?			
Comprehensive Plan			
• Are the goals and policies of the plan related to those of the HMP?			
• Does the future land use map clearly identify natural hazard areas?			
• Do the land use policies discourage development or redevelopment with natural hazard areas?			
• Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Land Use			
• Does the future land use map clearly identify natural hazard areas?			
• Do the land use policies discourage development or redevelopment with natural hazard areas?			
• Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			

Planning Mechanisms	Do You Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
Transportation Plan			
• Does the transportation plan limit access to hazard areas?			
• Is transportation policy used to guide growth to safe locations?			
• Are transportation systems designed to function under disaster conditions (e.g., evacuation)?			
Environmental Management			
• Are environmental systems that protect development from hazards identified and mapped?			
• Do environmental policies maintain and restore protective ecosystems?			
• Do environmental policies provide incentives to development located outside protective ecosystems?			
Grant Applications			
• Data and maps will be used as supporting documentation in grant applications.			
Municipal Ordinances			
• When updating municipal ordinances, hazard mitigation will be a priority			
Economic Development			
• Local economic development group will take into account information regarding identified hazard areas when assisting new businesses in finding a location.			
Public Education and Outreach			
• Does the municipality have any public outreach mechanisms/ programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events?			

7.1.3 Evaluating

Evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the HMP goals are being achieved, and whether changes are needed. The HMP Coordinator will consult with the Planning Partnership members to evaluate the effectiveness of the plan implementation and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Partnership to be held either in person or via teleconference approximately 1 year from the date of local adoption of this update and successively thereafter. At least 2 weeks before the annual plan review meeting, the Erie County HMP Coordinator will advise Planning Partnership members of the meeting date, agenda, and expectations of the members.

The Erie County HMP Coordinator will be responsible for calling participants and coordinating the annual plan review meeting and soliciting input regarding progress toward meeting plan goals and objectives. These evaluations will assess whether:

- Goals and objectives address current and expected conditions
- The nature or magnitude of the risks has changed
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available

- Actions were cost effective
- Schedules and budgets are feasible
- Implementation problems are present, such as technical, political, legal, or coordination issues with other agencies
- Outcomes have occurred as expected
- Changes in county, city, town, or village resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies/departments/staff are included, involving other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Partnership will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Underspending/overspending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

Finally, the Planning Partnership will evaluate how other programs and policies have conflicted or augmented planned or implemented measures and will identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions ("Implementation of Mitigation Plan through Existing Programs" subsection later in this section discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public education and outreach
- Transportation

The Planning Partnership should refer to the evaluation forms, Worksheets #2 and #4 in the FEMA 386-4 guidance document, to assist in the evaluation process (see Appendix G – Plan Review Tools). Further, the Planning Partnership should refer to any process and plan review deliverables developed by the county or participating jurisdictions as a part of the plan review processes established for prior or existing local HMPs within the county.

The Erie County HMP Coordinator will be responsible for preparing an Annual HMP Progress Report for each year of the performance period, based on the information provided by the Planning Partnership and municipal points of contact, and other information as appropriate and relevant. These annual reports will provide data for the 5-year update of this HMP and will assist in pinpointing any implementation challenges. By monitoring the implementation of the HMP, the Planning Partnership will be able to assess which projects are completed, which are no longer feasible, and which projects should require additional funding.

Following any major disasters, the HMP will be evaluated and revised to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damage or if data listed in the Section 5.4 (Hazard Profiles) of this plan has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

7.1.4 Updating

44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval to remain eligible for benefits awarded under DMA 2000. It is the intent of the Erie County HMP Planning Partnership to update this plan on a 5-year cycle from the date of initial plan adoption.

To facilitate the update process, the Erie County HMP Coordinator, with support of the Planning Partnership, will use the second annual Planning Partnership meeting to develop and commence the implementation of a detailed plan update program. Prior to the 5-year update, the Erie County HMP Coordinator will invite representatives from the New York State Division of Homeland Security and Emergency Services (NYS DHSES) to provide guidance on plan update procedures. At a minimum, this will establish who will be responsible for managing and completing the plan update effort, items that need to be included in the updated plan, and a detailed timeline with milestones to ensure that the update is completed according to regulatory requirements.

At this meeting, the project team will determine what resources will be needed to complete the update and seek to secure these resources.

Following each 5-year update of the HMP, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all planning partners.

7.1.5 Grant Monitoring and Coordination

Erie County intends to be a resource to the Planning Partnership in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the partnership during openings for grant applications. As part of grant monitoring and coordination, Erie County intends to provide the following:

- Notification to planning partners about impending grant opportunities
- A current list of eligible, jurisdiction-specific projects for funding pursuit consideration
- Notification about mitigation priorities for the fiscal year to assist the planning partners in the selection of appropriate projects.

7.2 IMPLEMENTATION OF MITIGATION PLAN THROUGH EXISTING PROGRAMS

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

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

It is the intention of Planning Partnership representatives to incorporate mitigation planning as an integral component of daily government operations. Planning Partnership representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Section 2 – Plan Adoption) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Partnership anticipates that:

1) Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
2) The HMP, Comprehensive Plans, Emergency Management Plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.

Other planning processes and programs to be coordinated with the recommendations of the HMP include the following:

- Emergency response plans
- Training and exercise of emergency response plans
- Debris management plans
- Recovery plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community wildfire protection plans
- Comprehensive flood hazard management plans
- Resiliency plans
- Community Development Block Grant-Disaster Recovery action plans
- Public information/improved public participation
- Educational programs
- Continued interagency coordination

During the annual plan evaluation process, the HMP Coordinator and Planning Partnership will strive to identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Reporting.

7.3 CONTINUED PUBLIC INVOLVEMENT

Erie County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted on line at the following link: https://www2.erie.gov/disaster/index.php?q=multi-hazard-mitigation-plan In addition, public outreach and dissemination of the HMP will include:

- Links to the plan on municipal websites of each jurisdiction with capability
- Continued utilization of existing social media outlets (Facebook, Twitter) to inform the public of natural hazard events, such as floods and severe storms; the public can be educated via the jurisdictional websites on how these applications can be used in an emergency situation
- Promotion of articles or workshops on hazards to educate the public and keep them aware of the dangers of hazards

The Erie County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan via the hazard mitigation website at any time. The Erie County HMP Coordinator will ensure that:

- Public and stakeholder comments and input on the plan, and hazard mitigation in general, are collected, recorded, and addressed as appropriate.
- The Erie County HMP website is maintained and updated as appropriate.
- Copies of the latest approved plan are available for review at appropriate county facilities, along with instructions to facilitate public input and comment on the plan.
- Public notices, including media releases, are made (as appropriate) to inform the public of the availability of the plan, particularly during plan update cycles.

REFERENCES

Belvederesi et al. 2018. Statistical analysis of environmental consequences of hazardous liquid pipeline accidents. Online address: https://linkinghub.elsevier.com/retrieve/pii/S2405844018356020

Britannica. 2020. Erie County, New York. Accessed 2020. https://www.britannica.com/place/Erie-county-New-York.

Britannica. 2011. "Hail." < https://www.britannica.com/science/hail-meteorology >

Centers for Disease Control and Prevention (CDC). Social Vulnerability Index. Accessed 2021. https://svi.cdc.gov/map.html

Centers for Disease Control. 2020. "You Can Control Mold." Accessed 2021. Online address: https://www.cdc.gov/mold/control_mold.htm.

City of Buffalo. 2006. The Queen City Comprehensive Plan.

City of Lackawanna. 2020. Accessed 2020. http://lackawannany.gov/

Community Health Care Association of New York State (CHC NYS). 2020. "Hurricane Sandy Recovery: Generator Safety." On-Line Address: http://chcanys.org/index.php_src=gendocs&ref=GeneratorSafety&category=EmergencyPages.html

Cornell University Program on Applied Demographics. 2018. "Erie County Profile 2017". Online access https://pad.human.cornell.edu/profiles/Cattaraugus.pdf

Dinicola, K. 2009. U.S. Geological Survey (USGS). The "100-Year Flood." 2009. On-Line Address: http://pubs.usgs.gov/fs/FS-229-96/.

Disaster Preparedness Portal. 2017. "Saffir-Simpson Hurricane Wind Scale." Online address: http://disasterpreparednesscourse.com/disaster-hazards/cyclones-tropical/saffir-simpson-hurricane-wind-scale/

Environmental Literacy Council. "Deicing" Accessed 2021. https://enviroliteracy.org/environment-society/transportation/deicing/

Erie County Water Authority. 2020. "Mission". Accessed 2020. https://my.ecwa.org/MissionPage.

Erie County Water Authority. 2020. "Performance Metrics". Accessed 2020. https://my.ecwa.org/pdf/About/Mission/Authority_Performance_Measures_and_Reports/Mission%20Statement.pdf.

Federal Emergency Management Agency (FEMA). 2021. Disaster Declarations for States and Counties. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties.

Federal Emergency Management Agency (FEMA). 2021. FEMA Benefit Cost Analysis (BCA) Toolkit 6.0 Release Notes. On-Line Address: https://www.fema.gov/sites/default/files/2020-08/fema_bca_toolkit_release-notes-july-2020.pdf

Federal Emergency Management Agency (FEMA). 2018a. "Why Dams Fail." On-Line Address: https://www.fema.gov/why-dams-fail

Federal Emergency Management Agency (FEMA). 2007. Floodplain Management Principles and Current Practices. Accessed 2021. On-Line Address: https://training.fema.gov/hiedu/aemrc/courses/coursetreat/fm.aspx

Federal Emergency Management Agency (FEMA). 2003. "FEMA Flood Insurance Study Tutorial." Accessed 2021. On-Line Address: https://www.fema.gov/media-library-data/20130726-1550-20490-1795/ot_fis.pdf

Federal Emergency Management Agency (FEMA). 1997. FEMA's Multi-Hazard Identification and Risk Assessment (MHIRA). Accessed 2021. < http://www.fema.gov/media-library/assets/documents/7251?id=2214>

Federal Emergency Management Agency (FEMA). N.d. "Coastal Construction Manual." On-Line Address: https://www.fema.gov/media-library-data/20130726-1510-20490-9375/fema55_volii_ch10rev.pdf

Green, S. 2019. Effects of a Mudslide. Online Address: https://sciencing.com/effects-mudslide-8660158.htmlchast

Illinois Association for Floodplain and Stormwater Management. 2006. Section 1 Natural Aspects of Flooding: Part 1 Flooding and Floodplain Management. Mar. On-Line Address: http://www.illinoisfloods.org/documents/home_study_course/1%20Natural%20Aspects%20of%20Fl ooding.pdf.

Kreeger et al. 2010. Three Case Studies in Vulnerability Assessment and Adaptation Planning. Online Address: https://www.nrc.gov/docs/ML1434/ML14345A598.pdf

National Aeronautics and Space Administration. 2013. Severe thunderstorms and climate change. Online Address: https://climate.nasa.gov/news/897/severe-thunderstorms-and-climate-change/

National Oceanographic and Atmospheric Administration (NOAA) Storm Prediction Center (SPC). 2017. "SPC Products." https://www.spc.noaa.gov/misc/about.html

National Oceanographic and Atmospheric Administration (NOAA). 2013. "Ice Jams." March 13. On-Line Address: http://www.floodsafety.noaa.gov/ice_jam.shtml

National Oceanographic and Atmospheric Administration (NOAA). National Weather Service (NWS). 2011 "Flood Safety". Last Modified 5 July 2011.Online address: http://www.floodsafety.noaa.gov/floodsafe.shtml

National Oceanographic and Atmospheric Administration (NOAA). 2011. "Tornadoes 101." Online address: https://www.noaa.gov/stories/tornadoes-101

National Oceanographic and Atmospheric Administration (NOAA) "Climate change impacts us coasts threaten public health safety and economy" https://www.noaa.gov/noaa-usgs-climate-change-impacts-us-coasts-threaten-public-health-safety-and-economy

National Oceanographic and Atmospheric Administration (NOAA). National Weather Service (NWS). Accessed 2021. Historical Hurricane Tracker. Online address: NOAA Historical Hurricane Tracks

National Oceanographic and Atmospheric Administration (NOAA). 2019. Climate Change Impacts. Online Address: https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts

National Severe Storms Laboratory (NSSL). 2015. "Severe Weather 101 – Winter Weather Basics." Accessed 2021. On-Line Address: https://www.nssl.noaa.gov/education/svrwx101/winter/types/

National Severe Storms Laboratory (NSSL). 2013. "Severe Thunderstorm Climatology." National Oceanic & Atmospheric Administration. March 29. On-Line Address: http://www.nssl.noaa.gov/projects/hazard/index.html

National Snow and Ice Data Center (NSIDC). 2013. "Introduction to Snow." On-Line Address: http://nsidc.org/cryosphere/snow/index.html

National Weather Service (NWS). 2018. "Explanation of EF Scale Ratings." Online address: https://www.weather.gov/hun/efscale_explanation

National Weather Service (NWS). 2018. "Winter Weather." On-Line Address: https://www.weather.gov/aly/preparednessWinter

National Weather Service (NWS). 2016. "Winter Weather Safety." Accessed 2021. On-Line Address: http://www.nws.noaa.gov/om/winter/windchill.shtml

National Weather Service (NWS). 2015. "Natural hazard Statistics." National Oceanic & Atmospheric Administration. June 10. Accessed 2021. On-Line Address: http://www.nws.noaa.gov/om/hazstats.shtml

National Weather Service (NWS). 2013. "Winter Weather Forecasting." January. Accessed 2021. On-Line Address: http://www.weather.gov/media/abr/Skyscanner/2013/20130101.pdf

National Weather Service (NWS). 2010c. "Hail Awareness." On-Line Address: http://www.weather.gov/cae/hail.html

National Weather Service (NWS). 2009. "National Weather Service Glossary." June 25. On-Line Address: http://w1.weather.gov/glossary/

National Weather Service (NWS). 2009. "Thunderstorm." On-Line Address: http://w1.weather.gov/glossary/index.php?word=thunderstorm

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA). No date. "Watch/Warning/Advisory Definitions". Accessed August 2021. Online address: https://www.weather.gov/lwx/WarningsDefined

New York City Hazard Mitigation Plan. Accessed 2021. https://"www1.nyc.gov/site/em/ready/hazard-mitigation.page

New York State Department of Environmental Conservation (NYSDEC). 2020. "Bulk Storage Database Search." Online address: https://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=4

New York State Department of Environmental Conservation (NYSDEC). 2020. "Inventory of Dams." Online Address: http://gis.ny.gov/gisdata/metadata/nysdec.dams.xml

New York State Department of Environmental Conservation (NYSDEC). 2020. "Niagara River/Lake Erie Watershed". https://www.dec.ny.gov/lands/48024.html#Watershed.

New York State Department of Environmental Conservation (NYSDEC). 2018. "Map of Wildfires as Reported by NYS Forest Rangers and Fire Departments." Online address: http://www.dec.ny.gov/lands/68333.html

New York State Department of Environmental Conservation (NYSDEC). 2015. "New York State Stormwater Management Design Manual." Online address: https://www.dec.ny.gov/chemical/29072.html

New York State Department of Environmental Conservation (NYSDEC). 2009. "Guidance for Dam Hazard Classification". Online address: http://www.dec.ny.gov/docs/water_pdf/togs315.pdf.

New York State Department of Transportation (NYS DOT). 2020. County Roads Listing – Erie County. Accessed 2020. https://www.dot.ny.gov/divisions/engineering/technical-services/hds-respository/NYSDOT_2020_LHI_County_Roads_Erie_County.pdf.

New York State Department of Transportation (NYS DOT). 2019. Railroads in New York – 2019. Accessed 2020. https://www.dot.ny.gov/divisions/operating/opdm/passenger-rail/passenger-rail-repository/2019%20NYS%20Rail%20Map.pdf.

New York State Disaster Preparedness Commission (NYSDPC). New York State Emergency Management Office (NYSEMO). Draft New York State Comprehensive Emergency Management Plan (Volume 1). New York State Standard Multi-Hazard Mitigation Plan. Accessed 2021. Online address: http://www.semo.state.ny.us/programs/planning/hazmitplan.cfm

New York State Division of Homeland Security and Emergency Services (NYS DHSES). 2019 New York State Standard Multi-Hazard Mitigation Plan. 2019. Accessed 2021. Online address: https://mitigateny.availabs.org/

New York State Division of Homeland Security and Emergency Services (NYS DHSES). 2014 New York State Standard Multi-Hazard Mitigation Plan. 2014. Accessed 2021. Online address: http://www.dhses.ny.gov/oem/mitigation/plan.cfm

New York State Energy Research and Development Authority (NYSERDA). Responding to Climate Change in New York. 2014. Accessed 2021. Online address: http://www.nyserda.ny.gov/climaid

New York State Energy Research and Development Authority (NYSERDA). 2011. Responding to Climate Change in New York State – Synthesis Report. Accessed 2021. On-Line Address: https://www.nyserda.ny.gov/climaid

Radbruch-Hall, Dorothy H., et. al. "Landslide Overview Map of the Conterminous United States." United States Government Printing Office, Washington: 1982.

Stewart et. al. 2007. "Defining the Wildland-Urban Interface" Online address: http://silvis.forest.wisc.edu/wp-content/uploads/2018/10/Stewart-et-al-JOF-2007.pdf

Tantala, M. et al.. 2003.“The New York City Consortium for Earthquake Loss Mitigation (NYCEM) Earthquake Risks and Mitigation in New York, New Jersey, and Connecticut Region.” Accessed 2021<http://nycem.org/techdocs/FinalReport/03-SP02p.pdf>.

Town of Alden. 2010. Town of Alden Comprehensive Plan.

Town of Boston. 2002. Town of Boston Comprehensive Plan.

Town of Brant. 2003. Town of Brant Comprehensive Plan.

Town of Clarence. 2007. Town of Clarence Master Plan.

Town of Concord and Village of Springville. 1999. Town of Concord and Village of Springville Comprehensive Plan.

Town of Eden 2015. Town of Eden Comprehensive Plan.

Town of Elma. 2020. Accessed 2020. http://www.elmanewyork.com/

Town of Evans & Village of Angola. 2019. Town of Evans & Village of Angola Comprehensive Plan.

Town of Hamburg. 2020. Accessed 2020. https://www.townofhamburgny.com/

Town of Lancaster. 2020. Accessed 2020. https://www.lancasterny.gov/

Town of Lancaster, Village of Lancaster, and Village of Depew. 2000. Town of Lancaster, Village of Lancaster, and Village of Depew Comprehensive Plan.

Town of Newstead and Village of Akron. 2001. Town of Newstead and Village of Akron Comprehensive Plan.

Town of North Collins. 2020. Accessed 2020. http://www.northcollinsny.org/

Town of Orchard Park. 2007. Town of Orchard Park Comprehensive Plan.

Town of Tonawanda. 2020. Accessed 2020. https://www.tonawanda.ny.us/

U.S. Army Corps of Engineers (USACE). 2020. “Dam Safety Program. Program Activities”. On-Line Address: https://www.usace.army.mil/Missions/Civil-Works/Dam-Safety-Program/Program-Activities/

U.S. Army Corps of Engineers (USACE). 2020. “National Levee Database.” Online address: https://levees.sec.usace.army.mil/#/

United States Bureau of Reclamation (USBR). 2012. “Flood Overtopping Failure of Dams and Levees”. Online address: https://www.usbr.gov/ssle/damsafety/risk/BestPractices/Chapters/IV-2-20121126.pdf

U.S. Census Bureau. 2020. “Poverty Thresholds.” Accessed 2021. Online address: https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html

U.S. Department of Transportation (USDOT). Pipeline and Hazardous Materials Administration (PHSMA). 2020. “National Pipeline Mapping System Public Viewer.” Online address: https://pvnpms.phmsa.dot.gov/PublicViewer/

U.S. Environmental Protection Agency 2020. Hazardous Waste. On-Line Address: https://www.epa.gov/hw/learn-basics-hazardous-waste

U.S. Environmental Protection Agency. 2020. “Envirofacts”. Accessed 2021. https://enviro.epa.gov/.

U.S. Environmental Protection Agency (USEPA). 2001. “Chemical Accidents from Electrical Power Outages.” September. On-Line Address: http://www.sbcfire.org/hazmat/Forms/BP_CalARP%20Forms/CalARPguidance/EPA_Safety%20Alerts/epa%20alert%20power%20outages.pdf

U.S. Forest Service (USFS). 2020. “Wildland Fire Management”. Online address: https://www.fs.usda.gov/managing-land/fire

U.S. Forest Service (USFS). 2013. Wildfire, Wildlands, and People: Understanding and Preparing for Wildfire in the Wildland-Urban Interface. Online Address: https://www.fs.fed.us/openspace/fote/reports/GTR-299.pdf

U.S. Forest Service (USFS). 2003. “Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects”. Online address: https://www.fs.fed.us/projects/hfi/docs/forest_structure_wildfire.pdf

U.S. Forest Service (USFS). Wildland Fire Assessment System (WFAS). Adjective Class Rating. Date Unknown. Accessed 2021. Online address: http://www.wfas.net/index.php/fire-danger-rating-fire-potential--danger-32/class-rating-fire-potential--danger-51

U.S. Geological Survey (USGS). 2020. At what magnitude does damage begin to occur in an earthquake? Online Address: https://www.usgs.gov/faqs/what-magnitude-does-damage-begin-occur-earthquake?qt-news_science_products=0#qt-news_science_products

U.S. Geological Survey (USGS). 2020. “Drought, Fire and Extreme Weather”. On-Line Address: https://www.usgs.gov/ecosystems/climate-adaptation-science-centers/science/drought-fire-and-extreme-weather

U.S. Geological Survey (USGS). 2020. Ground Failure. Online Address: https://earthquake.usgs.gov/data/ground-failure/

U.S. Geological Survey (USGS). 2018. Water Quality after a Wildfire. Online Address: https://ca.water.usgs.gov/wildfires/wildfires-water-quality.html

U.S. Geological Survey (USGS). “Landslide Preparedness.” December 18, 2013. Accessed 2021. Online address: http://landslides.usgs.gov/learn/prepare.php

U.S. Geological Survey (USGS). Hurricane Hazards – A National Threat. Fact Sheet 2005-3121. Oct. 2005. Accessed 2021. Online address: http://walrus.wr.usgs.gov/infobank/programs/html/factsheets/pdfs/2005_3121.pdf

U.S. Geological Survey (USGS). Geospatial Multi-Agency Coordination (GeoMAC). Accessed 2021 https://www.usgs.gov/special-topic/water-science-school/science/snowmelt-runoff-and-water-cycle?qt-science_center_objects=0#qt-science_center_objects

U.S. Geological Survey (USGS).. n.d. Sediment and Suspended Sediment. Online Address: https://www.usgs.gov/special-topic/water-science-school/science/sediment-and-suspended-sediment?qt-science_center_objects=0#qt-science_center_objects

U.S. Geological Survey (USGS). n.d.. What are the Effects of Earthquakes? Online Address: https://www.usgs.gov/natural-hazards/earthquake-hazards/science/what-are-effects-earthquakes?qt-science_center_objects=0#qt-science_center_objects

U.S. Geological Survey (USGS). “What is a Landslide and what causes one?” Accessed 2021. https://www.usgs.gov/faqs/what-a-landslide-and-what-causes-one?qt-news_science_products=0#qt-news_science_products

U.S. Nuclear Regulatory Commission (NRC). 2020. “New York”. Accessed 2021. https://www.nrc.gov/info-finder/region-state/newyork.html.

Weather Channel. Weather Glossary. 2012. Accessed 2021. Online address: http://www.weather.com/glossary/h.html

Village of Alden. 2000. Village of Alden Comprehensive Plan.

Village of Angola. 2020. Accessed 2020. https://www.villageofangola.org/index.html

Village of Blasdell. 2020. Accessed 2020. https://www.blasdell.org/

Village of Hamburg. 2012. Village of Hamburg Comprehensive Plan.

Village of Kenmore. 2020. Accessed 2020. https://www.villageofkenmore.org/

Village of Sloan. 2020. Accessed 2020. https://villageofsloan.org/

Village of Springville. 2020. Accessed 2020. https://www.villageofspringvilleny.com/

Village of Springville. 2014. Village of Springville Comprehensive Plan.

Village of Williamsville. 2020. Accessed 2020. http://walkablewilliamsville.com/

Visit Buffalo Niagara. 2017. About Us. Online Address: https://www.visitbuffaloniagara.com/about/

%	Percent
ACS	American Community Survey
ADA	Americans with Disabilities Act
AFG	Assistance to Firefighters Grants
BCA	Benefit Cost Analysis
BCEGS	Building Code Effectiveness Grading Schedule
BFE	Base Flood Elevation
BOCES	Board of Cooperative Educational Services
BRIC	Building Resilient Infrastructure and Communities Program
BUI	Buildup Index
CAV	Community Assistance Visit
CBS	Chemical Bulk Storage
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant Disaster Recovery
CDC	Centers for Disease Control and Prevention
CEMP	Comprehensive Emergency Management Plan
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
CRRA	Community Risk and Resiliency Act
CRREL	Cold Regions Research and Engineering Laboratory
CRS	Community Rating System
CSC	Climate Smart Communities (NYSDEC)
CTC	Community Transportation Coalition
CWSRF	Clean Water State Revolving Fund
DCEA	Division of Code Enforcement and Administration
DFIRM	Digital Flood Insurance Rate Map
DMA 2000	Disaster Mitigation Act of 2000
DOT	Department of Transportation
DPW	Department of Public Works
DR	Major Disaster Declaration (FEMA)
DSR	Damage Survey Report
EAP	Education and Awareness Program
EAP	Emergency Action Plan
EC PHEP	Erie County Office of Public Health Emergency Preparedness

EC DHSES	Erie County Department of Homeland Security and Emergency Services
EC DEP	Erie County Department of Environment and Planning
EC DOH	Erie County Department of Health
EF	Enhanced Fujita Scale
EFC	New York State Environmental Facilities Corporation
EHP	Environmental Planning and Historic Preservation
EM	Emergency Declaration (FEMA)
EM	Emergency Management
EMS	Emergency Medical Services
EOC	Emergency Operation Center
EOP	Emergency Operation Plan
EPA	Environmental Protection Agency
EPF LWRP	Environmental Protection Fund Local Waterfront Revitalization Program
ES	Emergency Services
ESRI	Environmental Systems Research Institute
EWP	Emergency Watershed Protection Program
FD	Fire Department
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIA	Flood Insurance Administration
FIS	Flood Insurance Study
FM	Fuel Moisture
FMA	Flood Mitigation Assistance
FPA	Floodplain Administrator
FPI	Fire Potential Index
FSA	Farm Service Agency
FTA	Federal Transit Administration
GHG	Greenhouse Gas
GIS	Geographic Information System
GML	General Municipal Law
HAZMAT	Hazardous Materials
HAZUS	Hazards U.S.
HAZUS-MH	Hazards U.S. Multi-Hazard
HMP	Hazard Mitigation Plan
HSGP	Homeland Security Grant Program

HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IA	Individual Assistance
ID	Identification
ISO	Insurance Services Office
IT	Information Technology
KBDI	Keetch-Byram Drought Index
LEWPA	Lake Erie Watershed Protection Alliance
LGRMIF	Local Government Records Management Improvement Fund
LLC	Limited Liability Company
LPR	Local Plans and Regulations
LWRP	Local Waterfront Revitalization Program
MOSF	Major Oil Storage Facilities
MRP	Mean Return Period
NAC-AAA	National Avalanche Center – American Avalanche Association
NCEI	National Centers for Environmental Information
NEHRP	National Earthquake Hazard Reductions Program
NEP	National Estuary Program
NFDRS	National Fire Danger Rating System
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NGVD	National Geodetic Vertical Datum
NHC	National Hurricane Center
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NPDP	National Performance of Dams Program
NPL	National Priorities List
NRCC	Northeast Regional Climate Center
NR	Natural Resource Protection
NSIDC	National Snow and Ice Data Center
NSP	Natural Systems Protection
NSSL	National Severe Storms Library
NWP	Nationwide Permit
NWS	National Weather Service
NY	New York
NYC OEM	New York City Office of Emergency Management

NYCRR	New York Codes, Rule, and Regulations
NYOIT	New York Office of Information Technology Services
NYS	New York State
NYS DEC	New York State Department of Environmental Conservation
NYS DHSES	New York State Division of Homeland Security and Emergency Services
NYS HMP	New York State Hazard Mitigation Plan
NYS GIS	New York State Geographic Information System
NYS OEM	New York State Office of Emergency Management
NYS OFP&C	New York State Office of Fire Prevention and Control
NYS OPRHP	New York State Parks, Recreation & Historic Preservation
NYSERDA	New York State Energy Research and Development Authority
NYSGS	New York State Geologic Survey
PA	Public Assistance
PBS	Petroleum Bulk Storage
PD	Police Department
PDM	Pre-Disaster Mitigation Program
PGA	Peak Ground Acceleration
EC PHEP	Erie County Office of Public Health Emergency Preparedness
PI	Public Information
POC	Point of Contact
Pop.	Population
PP	Property Protection
PR	Preventative Measures
RCV	Replacement Cost Value
RL	Repetitive Loss
RLF	Revolving Loan Fund
RSI	Regional Snowfall Index
RTE	Route
RTP	Recreational Trails
SBA	Small Business Administration
SGIA	Smart Growth Implementation Assistance program
SFHA	Special Flood Hazard Area
SIP	Structure and Infrastructure Project
SP	Structural Flood Control Projects
SPC	Storm Prediction Center
SPDES	State Pollutant Discharge Elimination System

SSBG	Social Services Block Grant Program
SVI	Social Vulnerability Index
Sq. Mi.	Square mile
SRL	Severe Repetitive Loss
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, Environmental
SUNY Buffalo	State University of New York at Buffalo
SWCD	Soil and Water Conservation District
SWMP	Stormwater Management Plan/Program
SWOO	Strengths, Weaknesses, Obstacles and Opportunities
SWPPP	Stormwater Pollution Prevention Plan
TBD	To Be Determined
THIRA	Threat & Hazard Identification & Risk Assessment
TIGER	Topologically Integrated Geographic Encoding & Reference
TMDL	Total Maximum Daily Load
TS	Tropical Storm
UASI	Urban Areas Security Initiative
US	United States
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USD	U.S. Dollar
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEDA	U.S. Economic Development Administration
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
WFAS	Wildland Fire Assessment System
WQIP	Water Quality Improvement Project
WUI	Wildland Urban Interface

GLOSSARY

This resource defines terms that are used in or support the hazard mitigation plan. These definitions were based on terms defined in documents included in the references section, with modifications as appropriate to address the Erie County specific definitions and requirements.

1% flood (100-year flood) – A flood that has a 1-percent chance of being equaled or exceeded in any given year. This flood event is also referred to as the base flood. The term "100-year flood" can be misleading; it is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Therefore, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management to determine the need for flood insurance.

0.2 % flood (500-year flood) – A flood that has a 0.2-percent chance of being equaled or exceeded in any one year.

Aggregate Data – Data gathered together across an area or region (for example, census tract or census block data).

Annualized Loss – The estimated long-term value of losses from potential future hazard occurrences of a particular type in any given single year in a specified geographic area. In other words, the average annual loss that is likely to be incurred each year based on frequency of occurrence and loss estimates. Note that the loss in any given year can be substantially higher or lower than the estimated annualized loss.

Annualized Loss Ratio – Represents the annualized loss estimate as a fraction of the replacement value of the local building inventory. This ratio is calculated using the following formula: Annualized Loss Ratio = Annualized Losses / Exposure at Risk. The annualized loss ratio gauges the relationship between average annualized loss and building value at risk. This ratio can be used as a measure of relative risk between hazards as well as across different geographic units

Asset – Any man-made or natural feature that has value, including but not limited to people, buildings, infrastructure (such as bridges, roads, and sewer and water systems), and lifelines (such as electricity and communication resources or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks).

At-Risk – Exposure values that include the entire building inventory value in census blocks that lie within or border the inundation areas or any area potentially exposed to a hazard based on location.

Base Flood – Flood that has a 1 percent probability of being equaled or exceeded in any given year. It is also known as the 100-year flood.

Base Flood Elevation (BFE) – Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The BFE is used as the standard for the National Flood Insurance Program.

Benefit – Net project outcomes, usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of conducting a benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including a reduction in expected property losses (building, content, and function) and protection of human life.

Benefit-cost analysis (BCA) – Benefit-cost analysis is a systematic, quantitative method of comparing the projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Blizzard – Characterized by low temperatures, wind gusts of 35 mph or more and falling and/or blowing snow that reduces visibility to 0.25 miles or less for an extended period of time (three or more hours).

Building – A structure that is walled and roofed, principally aboveground and permanently fixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Building Codes – Regulations that set forth standards and requirements for construction, maintenance, operation, occupancy, use, or appearance of buildings, premises, and dwelling units. Building codes can include standards for structures to withstand natural disasters.

Capability Assessment – An assessment that provides a description and analysis of a community or state's current capacity to address the threats associated with hazards. The capability assessment attempts to identify and evaluate existing policies, regulations, programs, and practices that positively or negatively affect the community or state's vulnerability to hazards or specific threats.

Climate – The meteorological elements, including temperature, precipitation, and wind, that characterizes the general conditions of the atmosphere over a period of time (typically 30-years) for a particular region.

Community Rating System (CRS) – CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specific activities, the insurance premiums of these policyholders in communities are reduced.

Comprehensive Plan – A document, also known as a "general plan", covering the entire geographic area of a community and expressing community goals and objectives. The plan lays out the vision, policies, and strategies for the future of the community, including all of the physical elements that will determine the community's future development. This plan can discuss the community's desired physical development, desired rate and quantity of growth, community character, transportation services, location of growth, and siting of public facilities and transportation. In most states, the comprehensive plan has no authority in and of itself, but serves as a guide for community decision-making.

Critical Facility – Facilities that are critical to the health and welfare of the population and that are especially important following a hazard. Critical facilities include essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities. As defined for the Erie County risk assessment, this category includes police stations, fire and/or EMS stations, major medical care facilities, and emergency communications.

Crop Moisture Index (CMI) – The CMI was developed by Wayne Palmer in 1968, can be used to measure the status of dryness or wetness affecting warm season crops and field activities. It gives the short-term or current status of purely agricultural drought or moisture surplus and can change rapidly from week to week.

Debris – The scattered remains of assets broken or destroyed during the occurrence of a hazard. Debris caused by a wind or water hazard event can cause additional damage to other assets.

Digital Elevation Model (DEM) – U.S. Geological Survey (USGS) Digital Elevation Model (DEM) data files that are digital representations of cartographic information in a raster form. DEMs include a sampled array of elevations for a number of ground positions at regularly spaced intervals. These digital cartographic/geographic data files are produced by USGS as part of the National Mapping Program.

Digital Flood Insurance Rate Maps (DFIRMs) – These maps are used to calculate the cost insurance premiums, establish flood risk zones and base flood elevations to mitigate against potential future flood damages to properties.

Displacement Time – After a hazard occurs, the average time (in days) that a building's occupants must operate from a temporary location while repairs are made to the original building due to damages resulting from the hazard.

Disaster Mitigation Act of 2000 (DMA 2000) – Law that requires and rewards local and state pre-disaster planning, promotes sustainability as a strategy for disaster resistance, and is intended to integrate state and local planning with the aim of strengthening state-wide mitigation planning.

Drought - A deficiency of moisture that results in adverse impacts on people, animals, or vegetation over a sizeable area.

Drought Impact Reporter (DIR) – The DIR is an interactive tool developed by the NDMC to collect, quantify, and map reported drought impacts for the U.S.

Duration – The length of time a hazard occurs.

Earthquake – A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Essential Facility – A facility that is important to ensure a full recovery of a community or state following the occurrence of a hazard. These facilities can include: government facilities, major employers, banks, schools, and certain commercial establishments (such as grocery stores, hardware stores, and gas stations). For the Erie County risk assessment, this category was defined to include schools, colleges, shelters, adult living and adult care facilities, medical facilities and health clinics, hospitals.

Exposure – The number and dollar value of assets that are considered to be at risk during the occurrence of a specific hazard.

Extent – The size of an area affected by a hazard or the occurrence of a hazard.

Extra Tropical Cyclone – A group of cyclones defined as synoptic scale, low pressure, weather systems that occur in the middle latitudes of the Earth. These storms have neither tropical nor polar characteristics and are connected with fronts and horizontal gradients in temperature and dew point otherwise known as "baroclinic zones". These cyclones produce impacts ranging form cloudiness and mild showers to heavy gales and thunderstorms.

Federal Emergency Management Agency (FEMA) – Independent agency (now part of the Department of Homeland Security) created in 1978 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.

Flash Flood – A flood occurring with little or no warning where water levels rise at an extremely fast rate.

Flood – A general and temporary condition of partial or complete inundation of normally dry land areas resulting from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Depth – Height of the flood water surface above the ground surface.

Flood Elevation – Height of the water surface above an established datum (for example, the National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or mean sea level).

Flood Hazard Area – Area shown to be inundated by a flood of a given magnitude on a map.

Flood Insurance Rate Map (FIRM) – Map of a community, prepared by the FEMA that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) – A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

Flood Mitigation Assistance (FMA) Program – A program created as a part of the National Flood Insurance Report Act of 1994. FMA provides funding to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other NFIP insurance structures, with a focus on repetitive loss properties.

Floodplain – Any land area, including a watercourse, susceptible to partial or complete inundation by water from any source.

Flood Polygon – A geographic information system vector file outlining the area exposed to the flood hazard. HAZUS-MH generates this polygon at the end of the flood computations in order to analyze the inventory at risk.

Freezing Rain – Rain that falls as a liquid but freezes into glaze upon contact with the ground.

Frequency – A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1 percent chance of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Fujita Scale of Tornado Intensity – Rates tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 (wind speed less than 73 mph) indicates minimal damage such as broken tree limbs or signs, while an F5 (wind speeds of 261 to 318 mph) indicated severe damage sustained.

Geology – The scientific study of the earth, including its composition, structure, physical properties, and history.

Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term in nature, and represent global visions.

Geographic Information Systems (GIS) – A computer software application that relates data regarding physical and other features on the earth to a database to be used for mapping and analysis.

GIS Shape Files – A type of GIS vector file developed by ESRI for their ArcView software. This type of file contains a table and a graphic. The records in the table are linked to corresponding objects in the graphic.

Hailstorm – Storm associated with spherical balls of ice. Hail is a product of thunderstorms or intense showers. It is generally white and translucent, consisting of liquid or snow particles encased with layers of ice. Hail is formed within the higher reaches of a well-developed thunderstorm. When hailstones become too heavy to be caught in an updraft back into the clouds of the thunderstorm (hailstones can be caught in numerous updrafts adding a coating of ice to the original frozen droplet of rain each time), they fall as hail and a hailstorm ensues.

Hazard – A source of potential danger or an adverse condition that can cause harm to people or cause property damage. For this risk assessment, priority hazards were identified and selected for the pilot project effort. A natural hazard is a hazard that occurs naturally (such as flood, wind, and earthquake). A man-made hazard is one that is caused by humans (for example, a terrorist act or a hazardous material spill). Hazards are of concern if they have the potential to harm people or property.

Hazards of Interest – A comprehensive listing of hazards that may affect an area.

Hazards of Concern – Those hazards that have been analytically determined to pose significant risk in an area, and thus the focus of the particular mitigation plan for that area (a subset of the Hazards of Interest).

Hazard Identification – The process of identifying hazards that threaten an area.

Hazardous Material Facilities – Facilities housing industrial and hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials, and toxins.

Hazard Mitigation – Sustained actions taken to reduce or eliminate the long-term risk and effects that can result from the occurrence of a specific hazard. For example, building a retaining wall can protect an area from flooding.

Hazard Mitigation Grant Program (HMGP) – Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazard Mitigation Plan – A collaborative document in which hazards affecting the community are identified, vulnerability to hazards assessed, and consensus reached on how to minimize or eliminate the effects of these hazards.

Hazard Profile – A description of the physical characteristics of a hazard, including a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazards U.S. (HAZUS) – A GIS-based nationally standardized earthquake loss estimation tool developed by FEMA. HAZUS was replaced by HAZUS-MH (see below) in 2003.

Hazards U.S. – Multi-Hazard (HAZUS-MH) – A GIS-based nationally standardized earthquake, flood, and wind loss estimation tool developed by FEMA. The purpose of this pilot project is to demonstrate and implement the use of HAZUS-MH to support risk assessments

HAZUS-MH Risk Assessment Methodology – This analysis uses the HAZUS-MH modules (earthquake, wind--hurricane and flood) to analyze potential damages and losses. For this pilot project risk assessment, the flood and hurricane hazards were evaluated using this methodology.

HAZUS-MH-Driven Risk Assessment Methodology – This analysis involves using inventory data in HAZUS-MH combined with knowledge such as (1) information about potentially exposed areas, (2) expected impacts, and (3) data regarding likelihood of occurrence for hazards. For this risk assessment, a HAZUS-Driven Risk Assessment Methodology could not be used to estimate losses associated with any hazards because of a lack of adequate data. However, the methodology was used, based on more limited data to estimate exposure for the dam failure, urban fire, fuel pipeline breach, and HazMat release hazards.

Heavy Snow – Snowfall accumulating to 4” or more in depth in 12 hours or less; or snowfall accumulating to 6” or more in depth in 24 hours or less.

High Potential Loss Facilities – Facilities that would have a high loss associated with them, such as nuclear power plants, dams, and military installations.

Hurricane – An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74 miles-per-hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the North Atlantic Ocean, northeast Pacific Ocean, or the South Pacific Ocean (east of 160°E longitude). Hurricane circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Hydraulics – That branch of science, or of engineering, which addresses fluids (especially, water) in motion, its action in rivers and canals, the works and machinery for conducting or raising it, its use as a prime mover, and other fluid-related areas.

Hydrology – The science of dealing with the waters of the earth (for example, a flood discharge estimate is developed through conduct of a hydrologic study).

Infrastructure – The public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, transportation system (such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry docks, piers and regional dams).

Ice Jam – An accumulation of ice in a river that acts as a natural dam and can flood low-lying areas upstream. They occur when warm temperatures and heavy rains cause rapid snow melt.

Ice Storm – Term used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication.

Intensity – A measure of the effects of a hazard occurring at a particular place.

Inventory – The assets identified in a study region. It includes assets that can be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Level 1 Analysis – A HAZUS-MH analysis that yields a rough estimate or preliminary analysis based on the nationwide default database included in HAZUS-MH. A Level 1 analysis is a great way to begin the risk assessment process and prioritize high-risk communities without collecting or using local data.

Level 2 Analysis – A HAZUS-MH analysis that requires the input of additional or refined data and hazard maps that will produce more accurate risk and loss estimates. Assistance from local emergency management personnel, city planners, GIS professionals, and others may be necessary for this level of analysis.

Level 3 Analysis – A HAZUS-MH analysis that yields the most accurate estimate of loss and typically requires the involvement of technical experts such as structural and geotechnical engineers who can modify loss parameters based on the specific conditions of a community. This level analysis will allow users to supply their own techniques to study special conditions such as dam breaks and tsunamis. Engineering and other expertise is needed at this level.

Lifelines – Critical facilities that include utility systems (potable water, wastewater, oil, natural gas, electric power facilities and communication systems) and transportation systems (airways, bridges, roads, tunnels and waterways).

Lightning – A visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds or between a rain cloud and the ground.

Loss Estimation – The process of assigning hazard-related damage and loss estimates to inventory, infrastructure, lifelines, and population data. HAZUS-MH can estimate the economic and social loss for specific hazard occurrences. Loss estimation is essential to decision making at all levels of government and provides a basis for developing mitigation plans and policies. It also supports planning for emergency preparedness, response, and recovery.

Lowest Floor – Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure. For the HAZUS-MH flood model, this information can be used to assist in assessing the damage to buildings.

Magnitude – A measure of the strength of a hazard occurrence. The magnitude (also referred to as severity) of a given hazard occurrence is usually determined using technical measures specific to the hazard. For example, ranges of wind speeds are used to categorize tornados.

Major Disaster Declarations – Post-disaster status requested by a state's governor when local and state resources are not sufficient to meet disaster needs. It is based on the damage assessment, and an agreement to commit state funds and resources to the long-term recovery. The event must be clearly more than the state or local government can handle alone.

Mean Return Period (MRP) – The average period of time, in years, between occurrences of a particular hazard (equal to the inverse of the annual frequency of exceedance).

Mitigation Actions – Specific actions that help you achieve your goals and objectives.

Mitigation Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term, and represent global visions.

Mitigation Objectives – Strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Mitigation Plan – A plan that documents the process used for a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in a state or community. The plan includes a description of actions to minimize future vulnerability to hazards. This plan should be developed with local experts and significant community involvement.

National Drought Mitigation Center (NDMC) – The NDMC helps develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management. Most of the NDMC's services are directed to state, federal, regional, and tribal governments that are involved in drought and water supply planning. The NDMC produces a daily drought monitor map that identifies drought areas and ranks droughts by intensity. U.S. Drought Monitor summary maps are available from May 1999 through the present and identify general drought areas and classification droughts by intensity ranging from D1 (moderate drought) to D4 (exceptional drought). Category D0, drought watch areas, are either drying out and possibly heading for drought, or are recovering from drought but not yet back to normal, suffering long-term impacts such as low reservoir levels.

National Flood Insurance Program (NFIP) – Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 Code of Federal Regulations (CFR) §60.3.

New York State Division of Homeland Security & Emergency Services (NYS DHSES) – NYS DHSES and its predecessor agencies have been responsible for coordinating the activities of all State agencies to protect New York's communities, the State's economic well-being, and the environment from natural and man-made disasters and emergencies. NYS DHSES routinely assists local governments, voluntary organizations, and private industry through a variety of emergency management programs including hazard identification, loss prevention, planning, training, operational response to emergencies, technical support, and disaster recovery assistance.

Nor'Easter – Named for the strong northeasterly winds blowing in ahead of the storm, are also referred to as a type of extra-tropical cyclones (mid-latitude storms, or Great Lake storms). A Nor'Easter is a macro-scale extra-tropical storm whose winds come from the northeast, especially in the coastal areas of the Northeastern U.S. and Atlantic Canada.

North America Drought Monitor (NA-DM) – The NA-DM is a cooperative effort between drought experts in Canada, Mexico and the U.S. to monitor drought across the continent on an ongoing basis. The Drought Monitor concept was developed as a process that synthesizes multiple indices, outlooks and local impacts, into an assessment that best represents current drought conditions. The final outcome of each Drought Monitor is a consensus of federal, state and academic scientists. Maps of U.S. droughts are available from this source from 2003 to the present.

Objectives – Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Occupancy Classes – Categories of buildings used by HAZUS-MH (for example, commercial, residential, industrial, government, and "other").

Ordinance – A term for a law or regulation adopted by local government.

Palmer Drought Severity Index (PDSI) – The PDSI was developed in 1965, and indicates the prolonged and abnormal moisture deficiency or excess. The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. It can be used to help delineate disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential intensity of forest fires.

Planning – The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Post-disaster mitigation – Mitigation actions taken after a disaster has occurred, usually during recovery and reconstruction.

Presidential Disaster Declaration – A post-disaster status that puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities in the areas of human services, public assistance (infrastructure support), and hazard mitigation. If declared, funding comes from the President's Disaster Relief Fund and disaster aid programs of other participating federal agencies.

Preparedness – Actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Priority Hazards – Hazards considered most likely to impact a community based on frequency, severity, or other factors such as public perception. These are identified using available data and local knowledge.

Provided Data – The databases included in the HAZUS-MH software that allow users to run a preliminary analysis without collecting or using local data.

Probability – A statistical measure of the likelihood that a hazard event will occur.

Public Education and Outreach Programs – Any campaign to make the public more aware of hazard mitigation and mitigation programs, including hazard information centers, mailings, public meetings, etc.

Recovery – The actions taken by an individual or community after a catastrophic event to restore order and lifelines in the community.

Regulation – Most states have granted local jurisdictions broad regulatory powers to enable the enactment and enforcement of ordinances that deal with public health, safety, and welfare. These include building codes, building inspections, zoning, floodplain and subdivision ordinances, and growth management initiatives.

Recurrence Interval – The average time between the occurrences of hazardous events of similar size in a given location. This interval is based on the probability that the given event will be equaled or exceeded in any given year.

Repetitive Loss Property – A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1,000 each have been paid within any 10-year period since 1978.

Replacement Value – The cost of rebuilding a structure. This cost is usually expressed in terms of cost per square foot and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

Resolutions – Expressions of a governing body's opinion, will, or intention that can be executive or administrative in nature. Most planning documents must undergo a council resolution, which must be supported in an official vote by a majority of representatives to be adopted. Other methods of making a statement or announcement about a particular issue or topic include proclamations or declarations.

Resources – Resources include the people, materials, technologies, money, etc., required to implement strategies or processes. The costs of these resources are often included in a budget.

Risk – The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment – A methodology used to assess potential exposure and estimated losses associated with priority hazards. The risk assessment process includes four steps: (1) identifying hazards, (2) profiling hazards, (3) conducting an inventory of assets, and (4) estimating losses.

Risk Factors – Characteristics of a hazard that contribute to the severity of potential losses.

Riverine – Of or produced by a river (for example, a riverine flood is one that is caused by a river overflowing its banks).

Saffir-Simpson Scale – This scale categorizes or rates hurricanes from 1 (Minimal) to 5 (Catastrophic) based on their intensity. It is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the shape of the coastline, in the landfill region.

Scale – A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Scour – Removal of soil or fill material by the flow of floodwaters. This term is frequently used to describe storm-induced, localized, conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

Severe Repetitive Loss Property – A structure that is currently insured for which four or more National Flood Insurance Program losses (including building and contents) of at least $5,000 each, and with the cumulative amount of claim payments exceeding $20,000; or for which two separate claim payments (building only) have been made with the cumulative amount of claim payments exceeding the market value of the structure.

Special Flood Hazard Area (SFHA) – An area within a floodplain having a 1-percent or greater chance of flood occurrence in any given year (that is, the 100-year or base flood zone); represented on FIRMs as darkly shaded areas with zone designations that include the letter "A" or "V."

Stafford Act – The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law (PL) 100-107 was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most Federal disaster response activities, especially as they pertain to FEMA and its programs.

Stakeholder – Stakeholders are individuals or groups, including businesses, private organizations, and citizens, that will be affected in any way by an action or policy.

Standardized Precipitation Index (SPI) – The SPI is a probability index that considers only precipitation. It is based on the probability of recording a given amount of precipitation, and the probabilities are standardized so that an index of zero indicates the median precipitation amount (half of the historical precipitation amounts are below the median, and half are above the median). The index is negative for drought, and positive for wet conditions.

State Hazard Mitigation Officer (SHMO) – The representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Structure – Something constructed (for example, a residential or commercial building).

Study Area – The geographic unit for which data are collected and analyzed. A study area can be any combination of states, counties, cities, census tracts, or census blocks. The study area definition depends on the purpose of the loss study and in many cases will follow political boundaries or jurisdictions such as city limits.

Substantial Damage – Damage of any origin sustained by a structure in a SFHA, for which the cost of restoring the structure to its pre-hazard event condition would equal or exceed 50 percent of its pre-hazard event market value.

Thunderstorm – A local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder. It forms from a combination of moisture, rapidly rising warm air and a force capable of lifting air, such as a warm and cold front, a sea breeze, or a mountain.

Topographic – Map that shows natural features and indicate the physical shape of the land using contour lines based on land elevation. These maps also can include man-made features.

Tornado – A violently rotating column of air extending from a thunderstorm to the ground.

Transportation Systems – One of the lifeline system categories. This category includes: airways (airports, heliports, highways), bridges, tunnels, roadbeds, overpasses, transfer centers; railways (tracks, tunnels, bridges, rail yards, depots), and waterways (canals, locks, seaports, ferries, harbors, dry docks, piers).

Tropical Cyclone – A generic term for a cyclonic, low-pressure system over tropical or sub-tropical waters containing a warm core of low barometric pressure which typically produces heavy rainfall, powerful winds and storm surge.

Tropical Depression – An organized system of clouds and thunderstorms with a defined surface circulation and maximum sustained winds of less than 38 mph. It has no "eye"(the calm area in the center of the storm) and does not typically have the organization or the spiral shape of more powerful storms.

Tropical Storm – An organized system of strong thunderstorms with a defined surface circulation and maximum sustained wind between 39 to 73 mph.

Utility Systems – One of the lifeline systems categories. This category includes potable water, wastewater, oil, natural gas, electric power facilities and communication systems.

Vulnerability – Description of how exposed or susceptible an asset is to damage. This value depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. If an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect affects can be much more widespread and damaging than direct affects.

Vulnerability Assessment – Evaluation of the extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard occurrences on the existing and future built environment.

Watershed – Area of land that drains down gradient (from areas of higher land to areas of lower land) to the lowest point; a common drainage basin. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers, which become progressively larger as the water moves downstream, eventually reaching an estuary, lake, or ocean.

Zone – A geographical area shown on a National FIRM that reflects the severity or type of flooding in the area.

Zoning Ordinance – Designation of allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.