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.

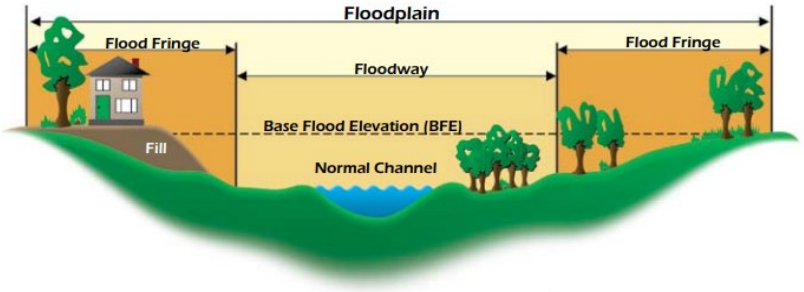
Location

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.

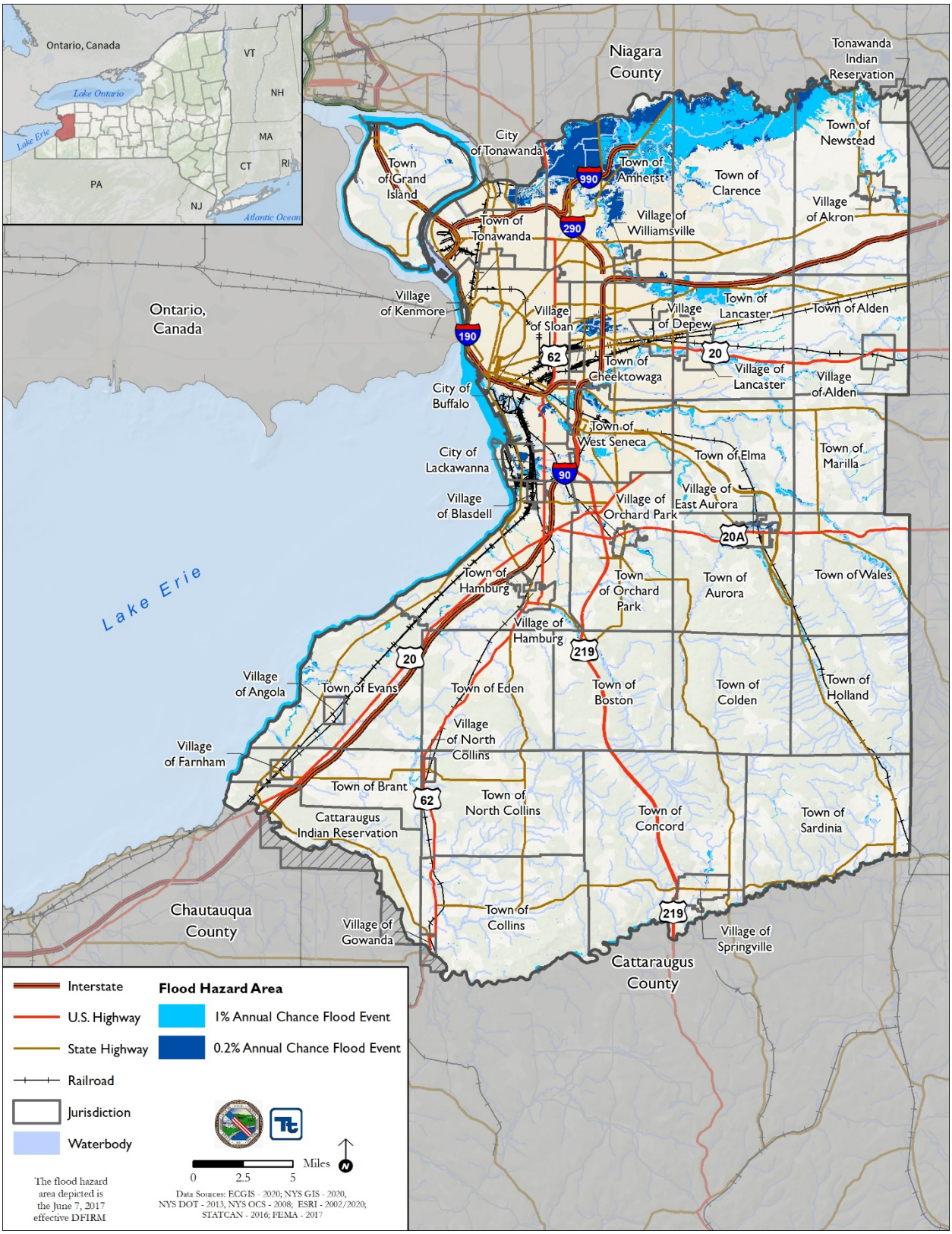
Table 5.4.6-1. Number of Acres Erie County Is Exposed to 1 Percent and 0.2 Percent Annual Chance Flood

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

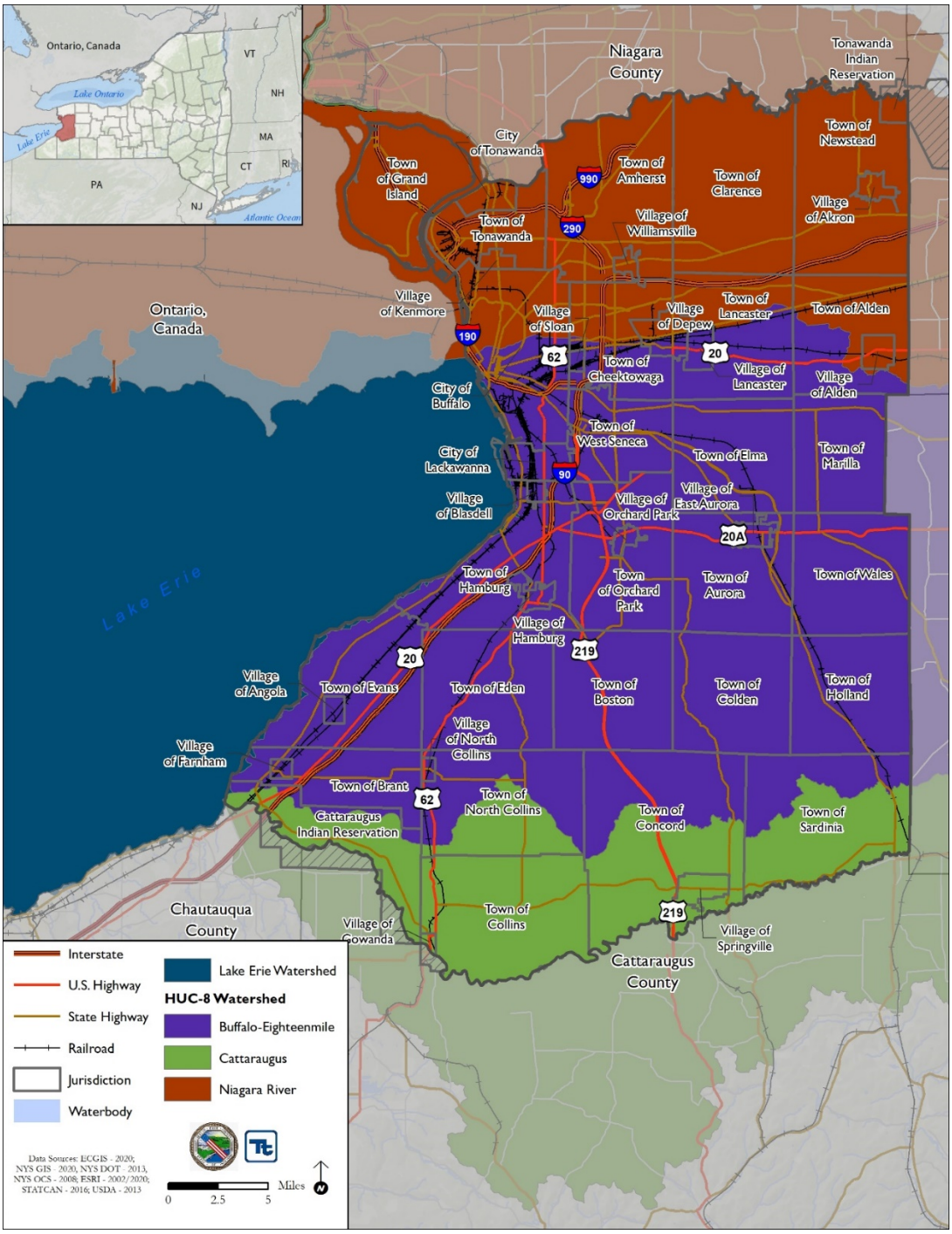
Figure 5.4.6-2. FEMA Flood Hazard Areas in Erie County



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

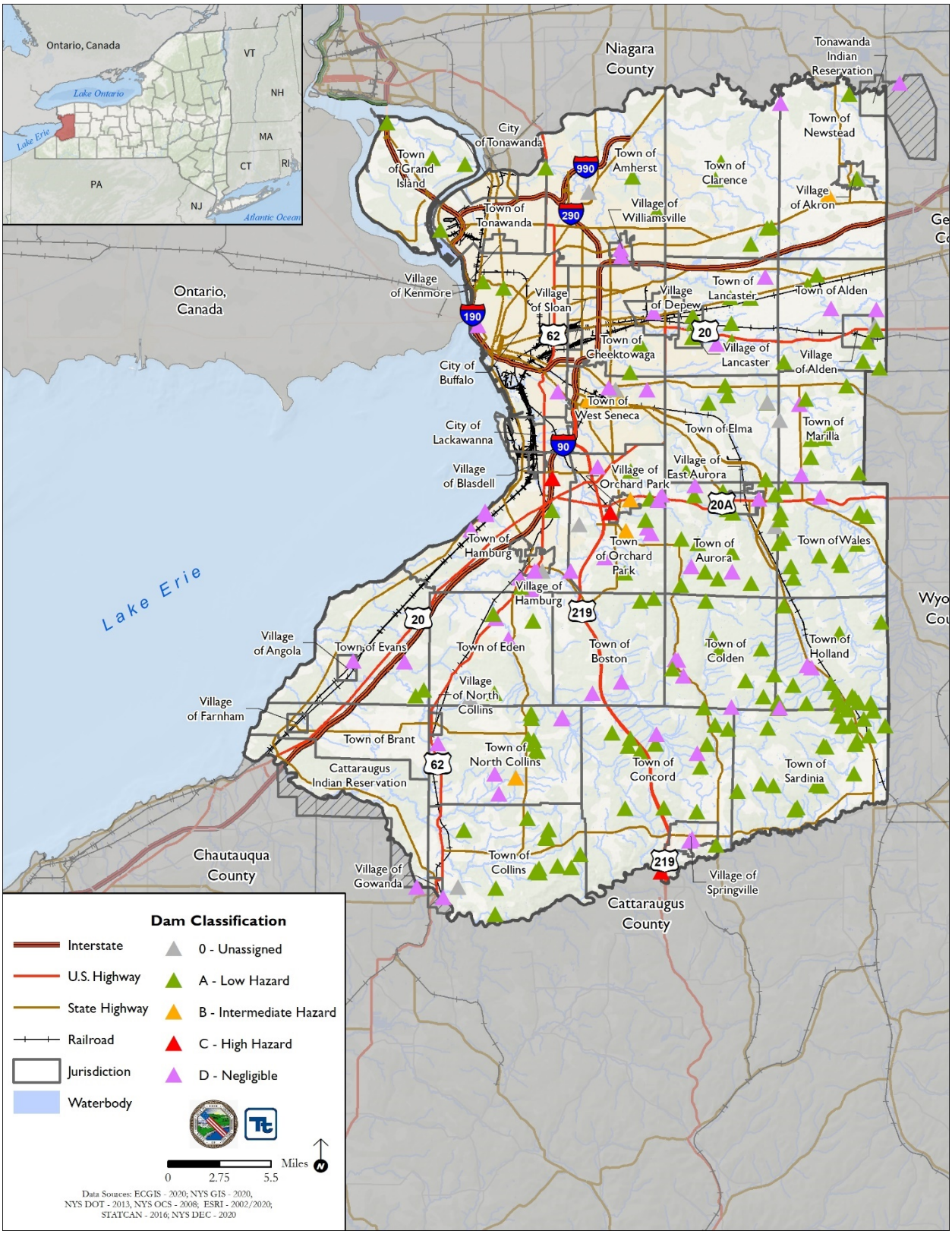
New York State uses four classifications to identify hazardous dams. These classifications - negligible, low, intermediate, and high - build upon each other, adding the consequences of the lower levels on the higher levels. According to the New York Inventory of Dams, Erie has 248 dams (Figure 5.4.6-4). 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



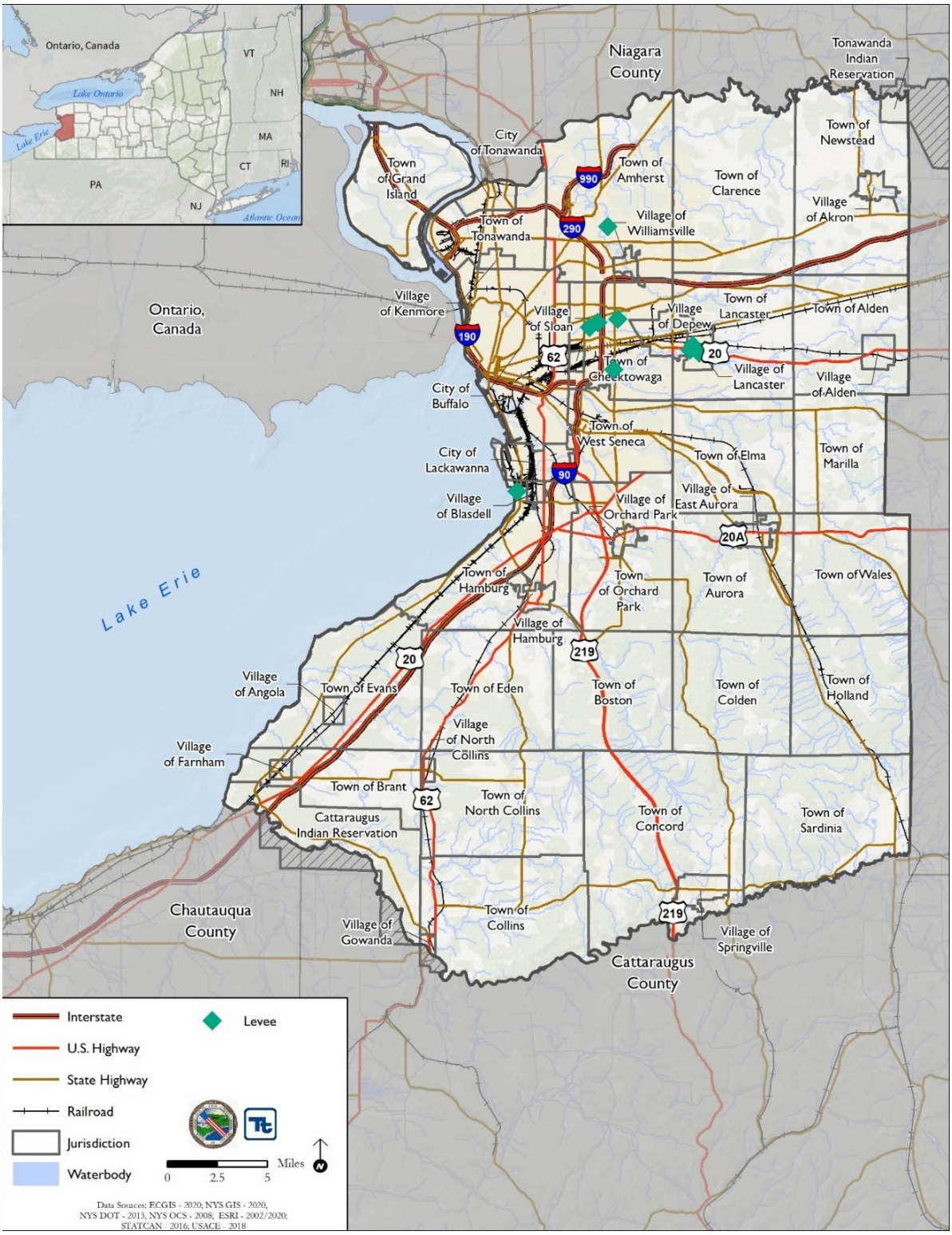
Levee Failure

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



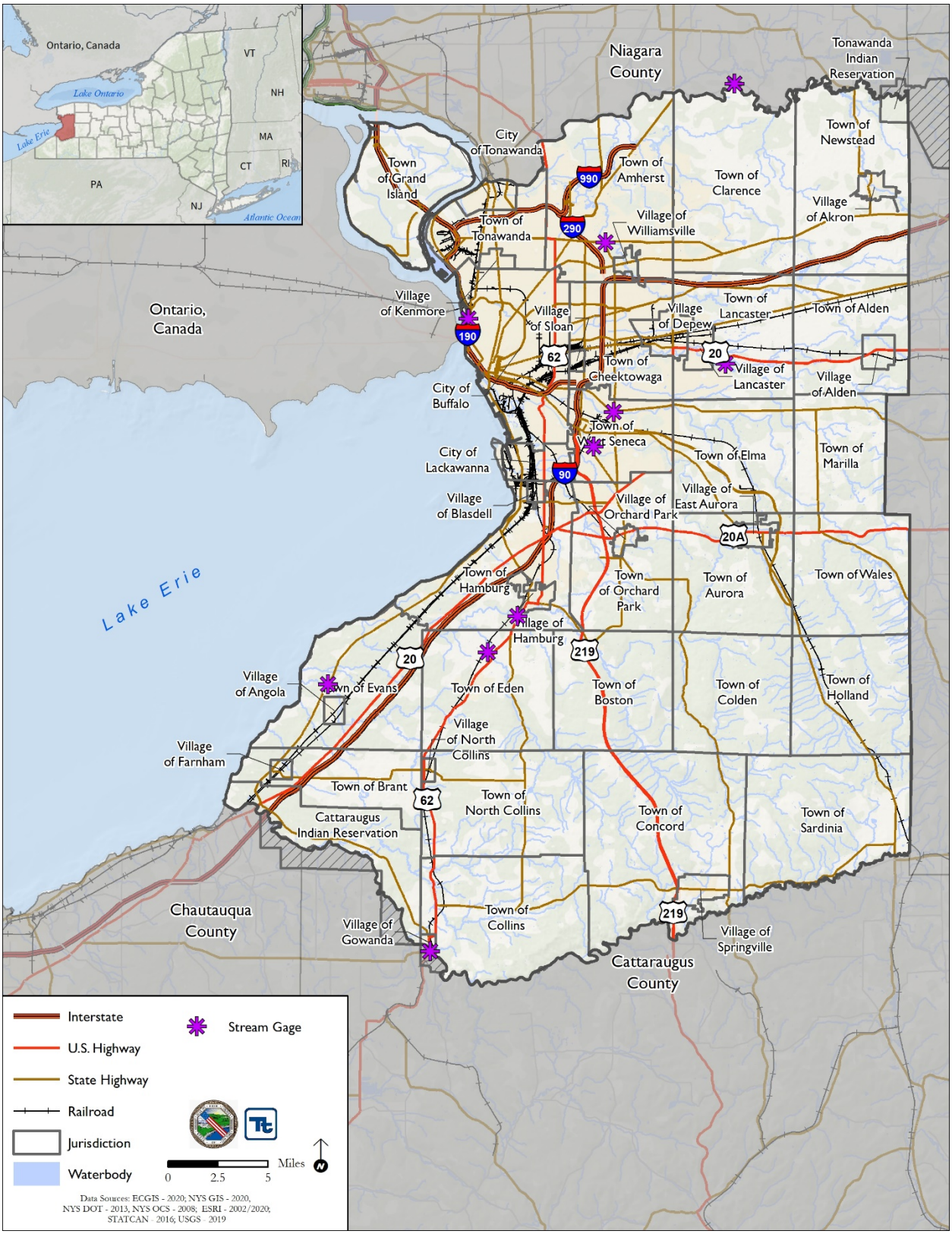
The United States Geological Survey (USGS) National Water Information System (NWIS) collects surface water data from more than 850,000 stations across the country. The time-series data describe stream levels, streamflow (discharge), reservoir and lake levels, surface water quality, and rainfall. The 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

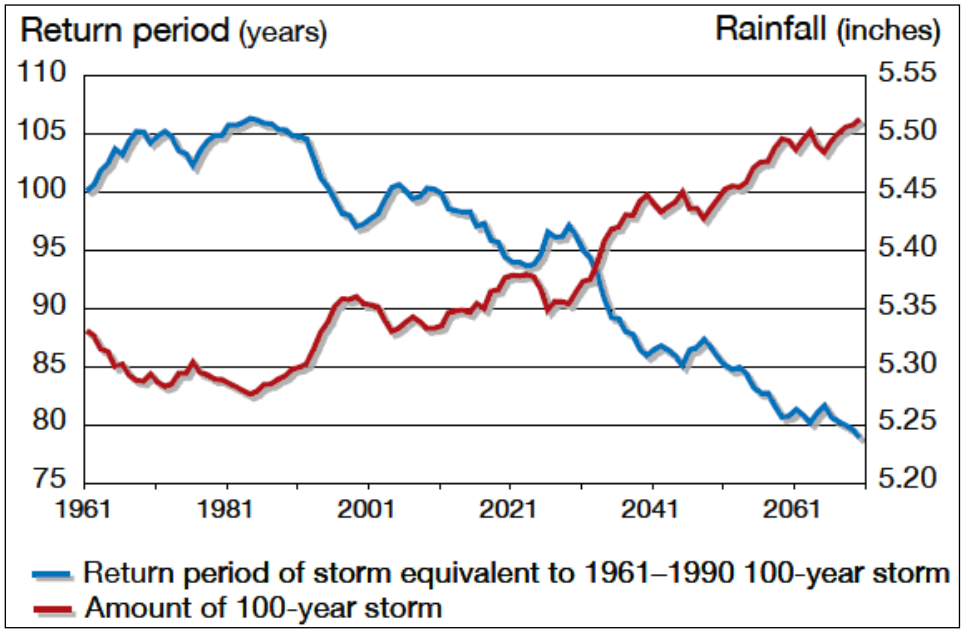
Source: NYSERDA 2014

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

Jurisdiction	No. of Bldgs.	Total RCV	Estimated Building Stock Exposed to 1 percent Annual Chance Flood: V Zones (VE Zones) No. of Bldgs.	% of Bldgs.	RCV	% of RCV	A Zones (A, AE, AH, AO Zones) No. of Bldgs.	% of Bldgs.	RCV	% of RCV	Total (All Flood Zones) No. of Bldgs.	% of Bldgs.	RCV	% of RCV	Estimated Building Stock Exposed to 0.2 percent Annual Chance Flood Total (All Flood Zones) 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) No. of Bldgs.	V Zones (VE Zones) % of Bldgs.	V Zones (VE Zones) RCV	V Zones (VE Zones) % of RCV	A Zones (A, AE, AH, AO Zones) No. of Bldgs.	A Zones (A, AE, AH, AO Zones) % of Bldgs.	A Zones (A, AE, AH, AO Zones) RCV	A Zones (A, AE, AH, AO Zones) % of RCV	Total (All Flood Zones) No. of Bldgs.	Total (All Flood Zones) % of Bldgs.	Total (All Flood Zones) RCV	Total (All Flood Zones) % of RCV	Estimated Building Stock Exposed to 0.2 percent Annual Chance Flood: Total (All Flood Zones) No. of Bldgs.	Total (All Flood Zones) % of Bldgs.	Total (All Flood Zones) RCV	Total (All Flood Zones) % 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.