5.4.1 Flood

The following section provides the hazard profile and vulnerability assessment of the flood hazard for Cattaraugus County Hazard Mitigation Plan (HMP).

5.4.1.1 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) Hazard Mitigation Plan (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 Cattaraugus 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.

Riverine (Inland) 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).

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 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 bypass 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 at different times of the year: fall freeze-up from the formation of frazil ice; mid-winter periods when stream channels freeze solid, forming anchor ice; and spring breakup when rising water levels from snowmelt or rainfall break existing ice cover into pieces that accumulate at bridges or other types of obstructions (NYS DHSES 2014).

Ice Jams Briefly

- ✓ **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)

Flood Control Measures

Levees exist in the county that provide the community with some degree of protection against flooding. According to the U.S. Army Corps National Levee Database, Cattaraugus County is home to seven levee systems, made up of 111 structures encompassing 15 miles. Levees protect portions of the City of Olean along the Allegheny Creek and Olean Creek, Portville along Dodge Creek, and Salamanca along the Allegheny River (U.S. Army Corps of Engineers [USACE] 2019).

A small portion of the Town of Allegany, southeast of the Village of Allegany, is protected from flooding by the Allegheny River by an extended section of the Olean flood control dike (Federal Insurance Administration [Flood Insurance Agency FIS 1978). In the Village of Ellicottville, a berm along the northeasterly bank of Plum Creek protects the village from flooding (FEMA FIS 1994).

In the Town of Franklinville, the Ischua Creek Watershed project includes five floodwater retarding structures and one multipurpose reservoir, along with one debris basin, channel improvements, stream protection, and levees. The project is for residential and industrial property protection. An earthen dam on Saunders Creek regulates flooding though it has limited impact in lowering flood elevations in Franklinville (FIA FIS 1978a, 1978b). The Village of Little Valley has drainage ditches that are designed to limit sheet flooding (FIA FIS 1977a).

A flood control levee system in the City of Olean was completed along the north bank of the Allegheny River and on both banks of Olean Creek by the USACE in 1952. The project includes pumping stations at the mouths of Two-mile Creek and Kings Brook, which are used to remove interior runoff from behind the levees during periods of highwater on the Allegheny River (FIA FIS 1978f).

In the Town of Portville, parts of the Allegheny River and Osawayo Creek are diked on their eastern sides. Dodge Creek has embankments on both banks in the Village of Portville (FEMA FIS 1983). During times of high stage on the Allegheny River, backwater is prevented from occurring on Lillibridge Creek by means of a flap valve of the outflow of a culvert through the levee (FIA FIS 1977).

The City of Salamanca has a flood control system that was constructed by the USACE in 1968. The project consists of a series of walls and dikes to protect three separate zones of the city. The first zone is on the south bank of the river and extends 1,200 feet upstream and 16,000 feet downstream of the Main Street Bridge. The second zone, which is on the north bank of the river, extends 400 feet upstream and 3,500 feet downstream of the Main Street Bridge. The third zone is on the north side of the river at the mouth of Little Valley Creek and prevents flooding in all West Salamanca (FIA FIS 1977a).

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 New York State Department of Environmental Conservation (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.

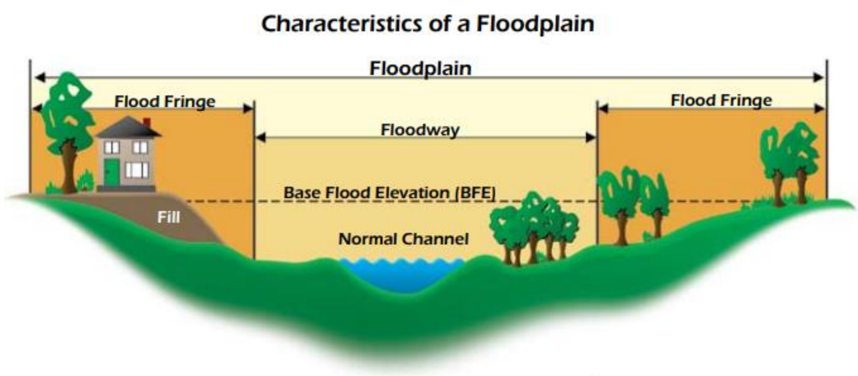
Location

Nearly all areas in Cattaraugus 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 Cattaraugus 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 Cattaraugus County, floodplains line the rivers and streams of the county. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques. Figure 5.4.1-1 depicts the flood hazard area, the flood fringe, and the floodway areas of a floodplain.

Figure 5.4.1-1. 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 Cattaraugus County as depicted from the FEMA Q3 data are illustrated in Figure 5.4.1-2 and the total land area in the floodplain, inclusive of waterbodies, is summarized in Table 5.4.1-1. Section 9 (Jurisdictional Annexes) includes a map of each jurisdiction depicting the floodplains. As depicted in Figure 5.4.1-2, flood hazard zones are present throughout the county. Large sections of the Allegheny River and feeder creeks are within the 1-percent annual chance floodplain. The county's west side contains large wetland complexes. Several communities along the Ischua Creek and Great Valley Creek contain flood hazard areas.

Q3 data provided Cattaraugus County and FEMA show the following flood hazard area:

- 1-Percent Annual Chance Flood Hazard: Areas subject to inundation by the 1-percent annual chance flood event. This flood boundary includes Zone AE and Zone A. Mandatory flood insurance requirements and floodplain management standards apply. The A Zones did not have determined flood depths provided in the Q3 data. As a result, the Q3 data boundaries were interpolated in ArcGIS to create a 3D water surface elevation and flood depth grid for the 1-percent annual chance flood event boundary.

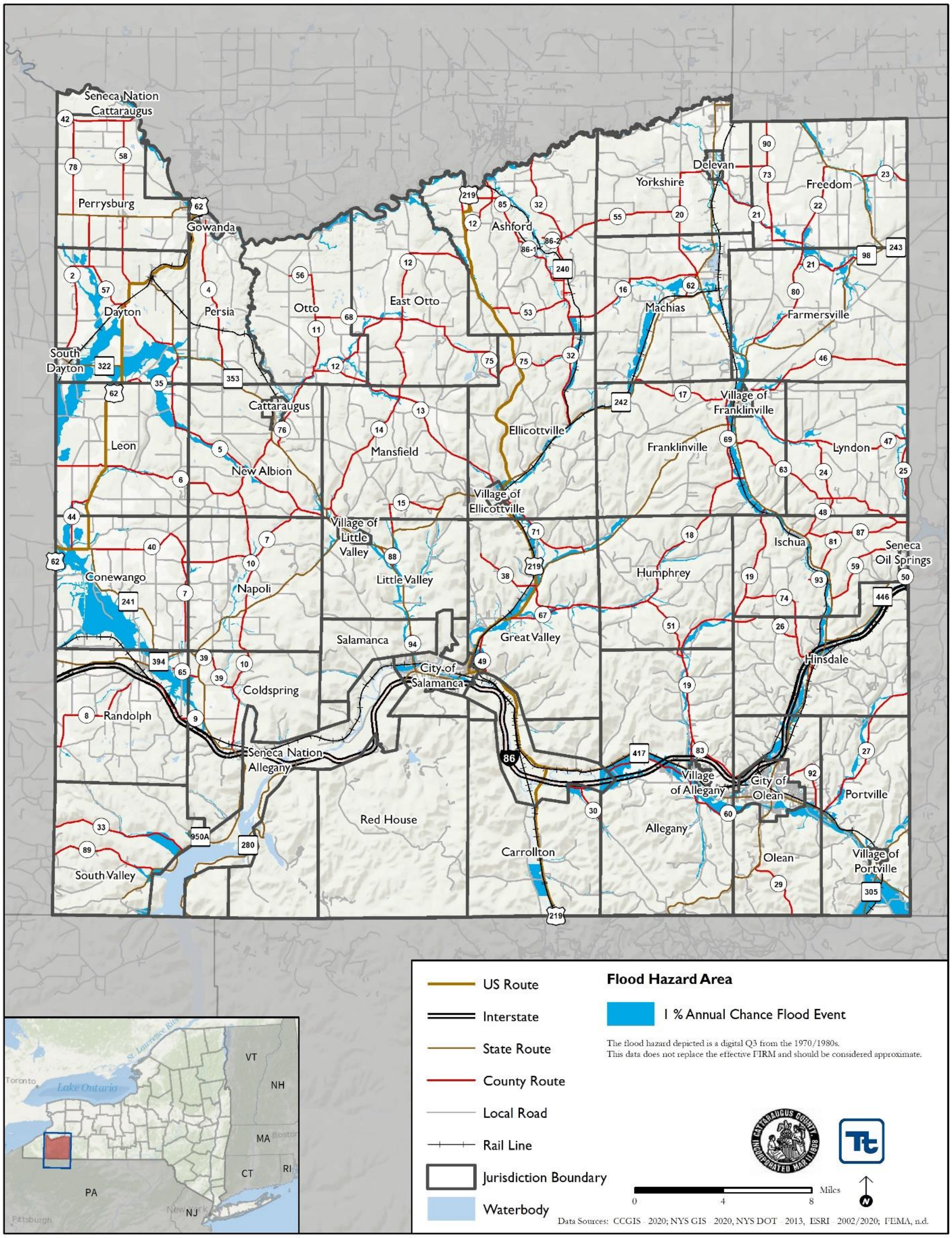
Table 5.4.1-1. Number of Acres Cattaraugus County is Exposed to 1-Percent Annual Chance Flood

Jurisdiction	Total Area (acres)	1-Percent Annual Flood Event Hazard Area	
		Acres Exposed	Percent of Total
Allegany (T)	45,434	2,680	5.9%
Allegany (V)	448	107	23.9%
Ashford (T)	32,878	1,316	4.0%
Carrollton (T)	27,486	865	3.1%
Cattaraugus (V)	716	34	4.8%
Coldspring (T)	33,391	477	1.4%
Conewango (T)	23,103	4,349	18.8%
Dayton (T)	22,565	4,045	17.9%
Delevan (V)	632	118	18.6%
East Otto (T)	26,668	703	2.6%
Ellicottville (T)	28,294	970	3.4%
Ellicottville (V)	531	149	28.1%
Farmersville (T)	30,772	1,173	3.8%
Franklinville (T)	32,569	1,576	4.8%
Franklinville (V)	690	120	17.3%
Freedom (T)	26,067	736	2.8%
Gowanda (V)	650	132	20.3%
Great Valley (T)	31,955	1,871	5.9%
Hinsdale (T)	24,872	1,221	4.9%
Humphrey (T)	23,336	775	3.3%
Ischua (T)	20,727	453	2.2%
Leon (T)	23,062	2,350	10.2%
Little Valley (T)	18,319	844	4.6%
Little Valley (V)	638	93	14.6%
Lyndon (T)	21,282	350	1.6%
Machias (T)	26,310	1,634	6.2%
Mansfield (T)	25,376	169	0.7%
Napoli (T)	23,474	225	1.0%
New Albion (T)	22,457	531	2.4%
Olean (C)	3,926	516	13.1%
Olean (T)	18,982	1,016	5.4%
Otto (T)	20,567	793	3.9%
Perrysburg (T)	18,306	119	0.7%
Persia (T)	12,837	417	3.3%

Jurisdiction	Total Area (acres)	1-Percent Annual Flood Event Hazard Area	
		Acres Exposed	Percent of Total
Portville (T)	22,607	2,764	12.2%
Portville (V)	498	63	12.8%
Randolph (T)	23,148	1,069	4.6%
Red House (T)	36,111	0	0.0%
Salamanca (C)	4,181	487	11.6%
Salamanca (T)	11,166	168	1.5%
South Dayton (V)	637	60	9.5%
South Valley (T)	23,739	978	4.1%
Yorkshire (T)	23,032	357	1.5%
Cattaraugus County (Total)	**814,441**	**38,875**	**4.8%**

Source: Cattaraugus County GIS 2020; Cattaraugus County Q3 Data from FEMA, 2020
Note: The area presented includes the area of inland waterways. The flood hazard area does not replace the effective DFIRM and should be considered approximate.
C = City, T = Town, V = Village, % = Percent

Figure 5.4.1-2. FEMA Flood Hazard Areas in Cattaraugus County



Riverine/Flash Flooding/Stormwater Flooding

Cattaraugus County includes parts of five watersheds that drain into the Great Lakes Basin and the Allegheny River Basin. The Allegheny River Watershed, encompassing land in the southern, central and eastern sections, is the largest watershed in the county. This area drains into the Allegheny River, the major river flowing through the county's southernmost communities. (Cattaraugus County 2015).

Two watersheds in the county contribute to the Allegheny River Basin. The Upper Allegheny Watershed encompasses much of the county. This area either drains directly into the Allegheny River as it flows through the area or it drains into streams that are tributaries to the Allegheny. Major tributary streams include Great Valley Creek and Little Valley Creek, which drain the central area of the county; both creeks flow into the Allegheny River at separate locations in Salamanca. Ischua Creek flows south, joining Oil Creek to become the Olean Creek, which flows into the Allegheny River in Olean. Tunungwant (Tuna) Creek, flows northward through the Town of Carrollton to the Allegheny River. Many other smaller streams are tributaries to these larger streams (Cattaraugus County 2015).

The Conewango Watershed, located in the western part of Cattaraugus County, is the other watershed that contributes to the Allegheny River Basin. Little Conewango Creek flows through the Town of Randolph and joins Conewango Creek in western Cattaraugus County. Conewango Creek flows southwest into Chautauqua County and then south into Pennsylvania, where it flows into the Allegheny River at Warren, Pennsylvania (Cattaraugus County 2015).

Three of Cattaraugus County's watersheds drain into the Great Lakes Basin. Two watersheds drain into Lake Erie and one drains into Lake Ontario. (Cattaraugus County 2015).

The Cattaraugus Creek Watershed consists of land drained by Cattaraugus Creek and its tributaries. All the northernmost towns in the county are in the Cattaraugus Creek Watershed, as well as parts of New Albion, Mansfield, Ellicottville, Machias and Farmersville. Cattaraugus Creek comprises the entire boundary between Cattaraugus County and Erie County. Major streams that are tributary to Cattaraugus Creek include Mansfield Creek, which originates in the Town of Ellicottville and flows westerly through the Town of Mansfield, eventually joining the South Branch of Cattaraugus Creek (Cattaraugus County 2015).

A very small portion of the Town of Perrysburg is in the Chautauqua-Conneaut Watershed. This watershed also drains into Lake Erie (Cattaraugus County 2015).

Portions of the Towns of Lyndon and Farmersville, in the northeastern section of the county, are in The Upper Genesee Watershed. This area is drained by Canadea Creek, which flows eastward into the Genesee River. (Cattaraugus County 2015).

In the Town of Allegany, heavy winter or spring rainfall augmented by melting snow. Flooding occurs along the Allegheny River (FIA FIS 1978). In the Village of Allegany, low lying areas are subject to periodic flooding caused by the overflow of the Allegheny River and Five Mile Creek due to heavy rainfall with melting snow (FEMA FIS 1991). In the Town of Cold Spring, the Village of East Randolph, the Village of Limestone, the Village of Little Valley, the Village of Randolph, and the Town of Hinsdale, steep terrain contributes to flash flooding during heavy rain events (FIA FIS 1977a, 1977b, 1978d, 1978g). Flooding in the Town of Ellicottville is most likely to occur in the late winter or early spring months when melting snow may combine with intense rainfall to produce increased runoff at Great Valley Creek (FEMA FIS 2000). In the Village of Ellicottville, flooding usually occurs along Plum Creek, Elk Creek, and Great Valley Creek as a result of heavy rainfall combined with snowmelt (FEMA FIS 1994). Flooding in the Town and Village of Franklinville and the Village of Limestone has occurred as a result of heavy rainfall combined with snowmelt, as well as ice jams (FIA FIS

1978a, 1978b, 1977). Flooding occurs on Clear Creek in the Town of Freedom, though data on frequency is limited (FEMA FIS 1991).

Due to the steep terrain of their watershed, Wrights Creek and Forks Creek in the Town of Great Valley are subject to flash flooding. Great Valley Creek has a large watershed and experiences flooding concurrent with the northern Allegheny River Basin (FIA FIS 1978c). Due to steep terrain in the surrounding area, the City of Salamanca is subject to flash flooding during heavy rain combined with snowmelt. Similarly, the Town of Salamanca also experiences flash flooding due to the steep terrain along Little Valley Creek, Dublin Creek, and Whig Street Creek. Flooding problems also result from backwater conditions on the Allegheny River, which can occur independently of flooding on Little Valley Creek (FIA FIS 1979).

The Town of Ischua experiences flooding on Olean Creek and Ischua Creek as a result of heavy rains and snow melt (FIA FIS 1978e). The City of Olean has low lying areas that are subject to periodic flooding caused by overflow of the Allegheny River, Olean Creek, Kings Brook, and Two-mile Creek as a result of heavy rains, usually accompanied by snow melt (FIA FIS 1978f). The Town of Portville experiences flooding as a result of heavy rains and snowmelt (FEMA 1983).

The Village of South Dayton is subject to flooding when rain falls on frozen ground or heavy rainfall events during the warm season. Flooding is aggravated by the reduction of channel capacities, due to erosion and sedimentation, to the point that existing channels are inadequate to remove heavy runoff in a reasonable period. In the eastern part of the village, poor drainage near the tributaries to Slab City Creek causes some flooding (FIA FIS 1977).

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).

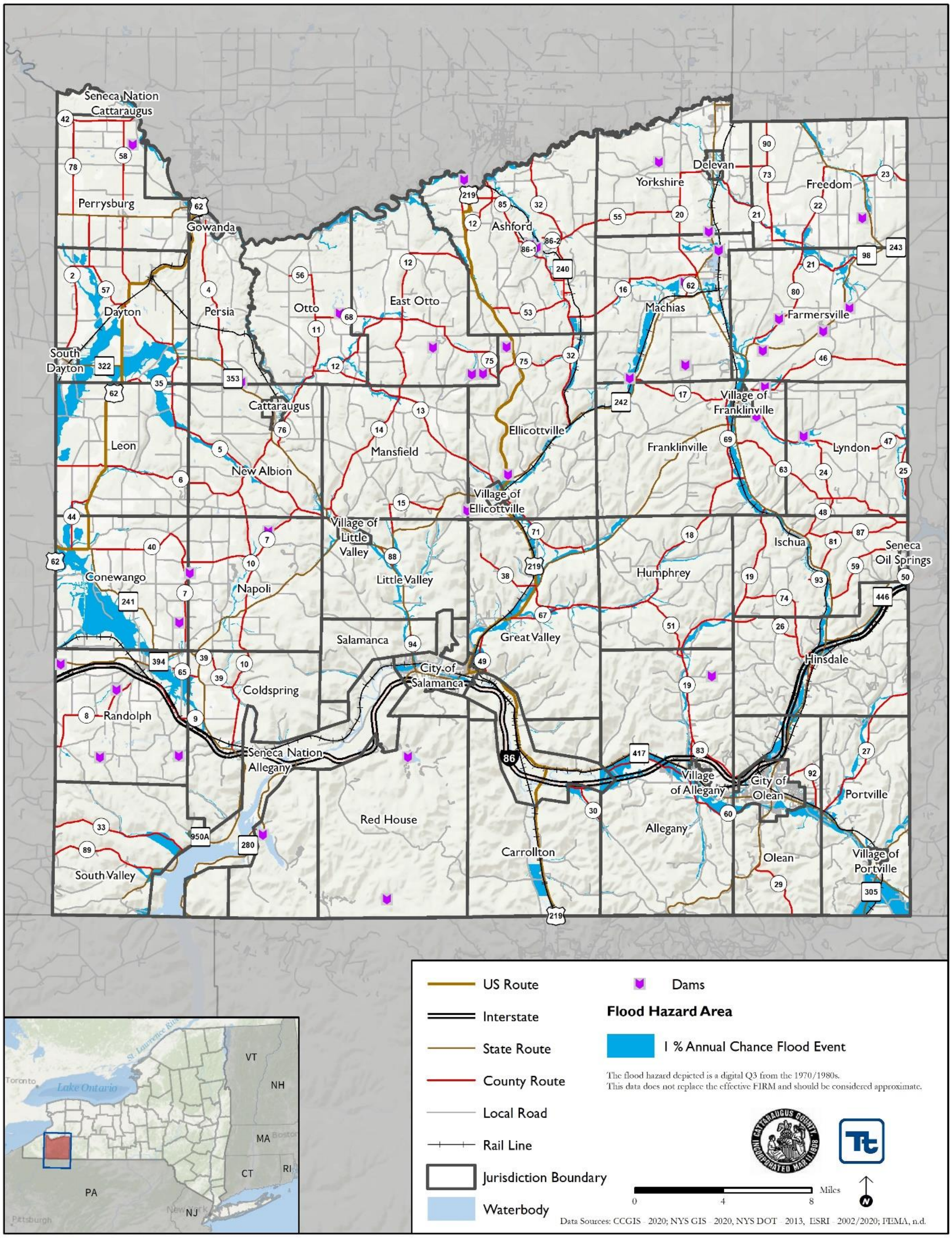
The two main types of ice jams are freeze-up and breakup. Freeze-up jams occur when floating ice slows or stops due to a change in water slope as it reaches an obstruction to movement. Breakup jams occur during periods of thaw, generally in late winter and early spring. Ice cover breakup is usually associated 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 any of Cattaraugus 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), Cattaraugus County experienced four historic ice jam events between 1780 and 2020 and these occurred along the Allegheny River and Cattaraugus Creek (USACE 2019).

Dam Failure

According to the National Inventory of Dams, Cattaraugus County has 40 dams (Figure 5.4.1-3), all 40 dams have emergency action plans in place, and all but one are regulated by the State of New York. However, these numbers differ from the New York State Inventory of Dams, which identifies 164 dams in Cattaraugus County: 85 low hazard, 14 intermediate hazard, 12 high hazard, 52 negligible or no hazard classification, and 1 with no classification code (NYSDEC 2020). In addition, the Cuba Lake Spillway Dam in neighboring Allegany County could impact Cattaraugus County during a dam failure event.

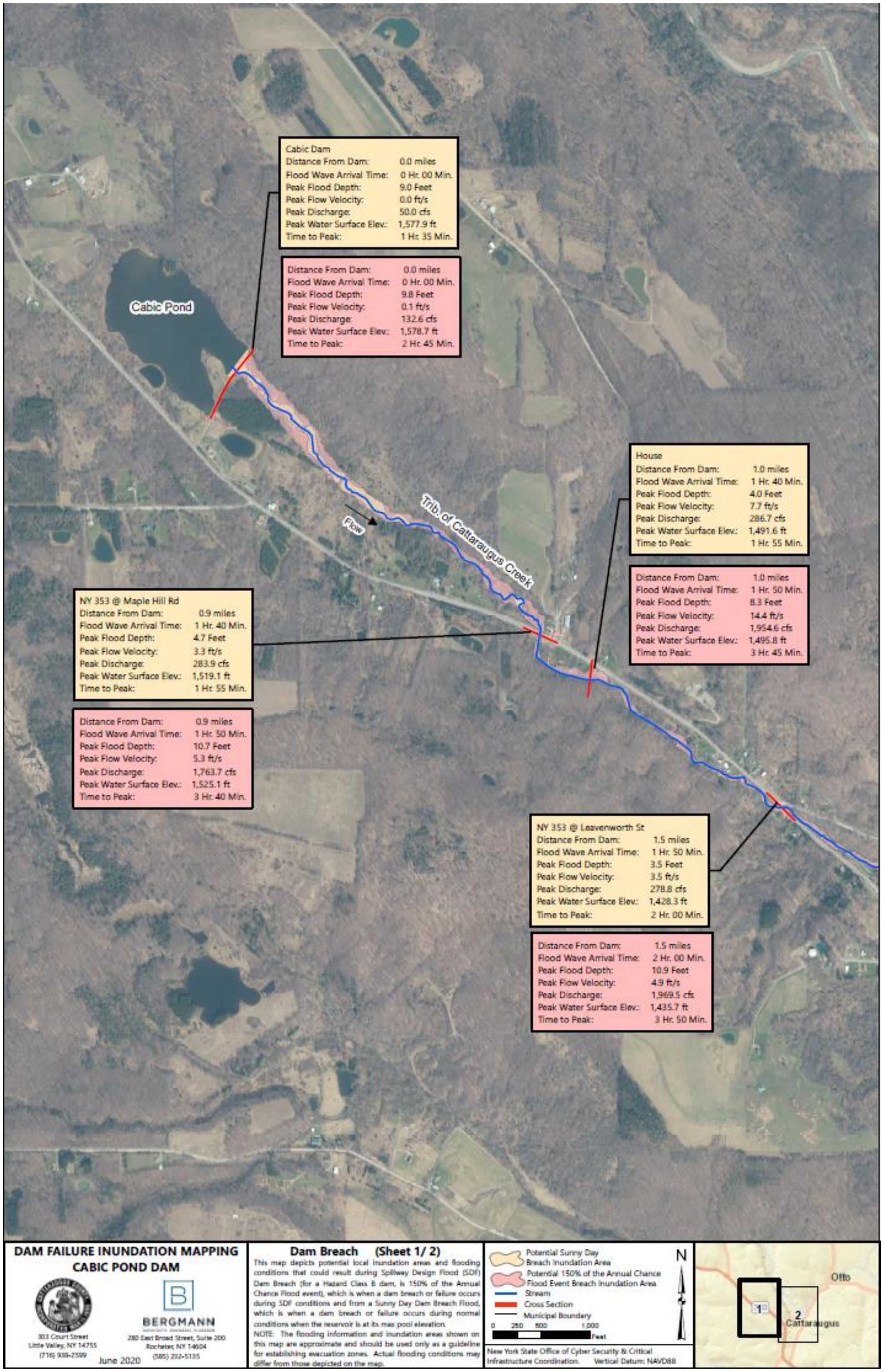
Figure 5.4.1-3. National Inventory of Dams in Cattaraugus County



Listed below are the Cattaraugus County dams with Emergency Action Plans (EAP), along with the population at risk in the event of dam failure and the available inundation maps:

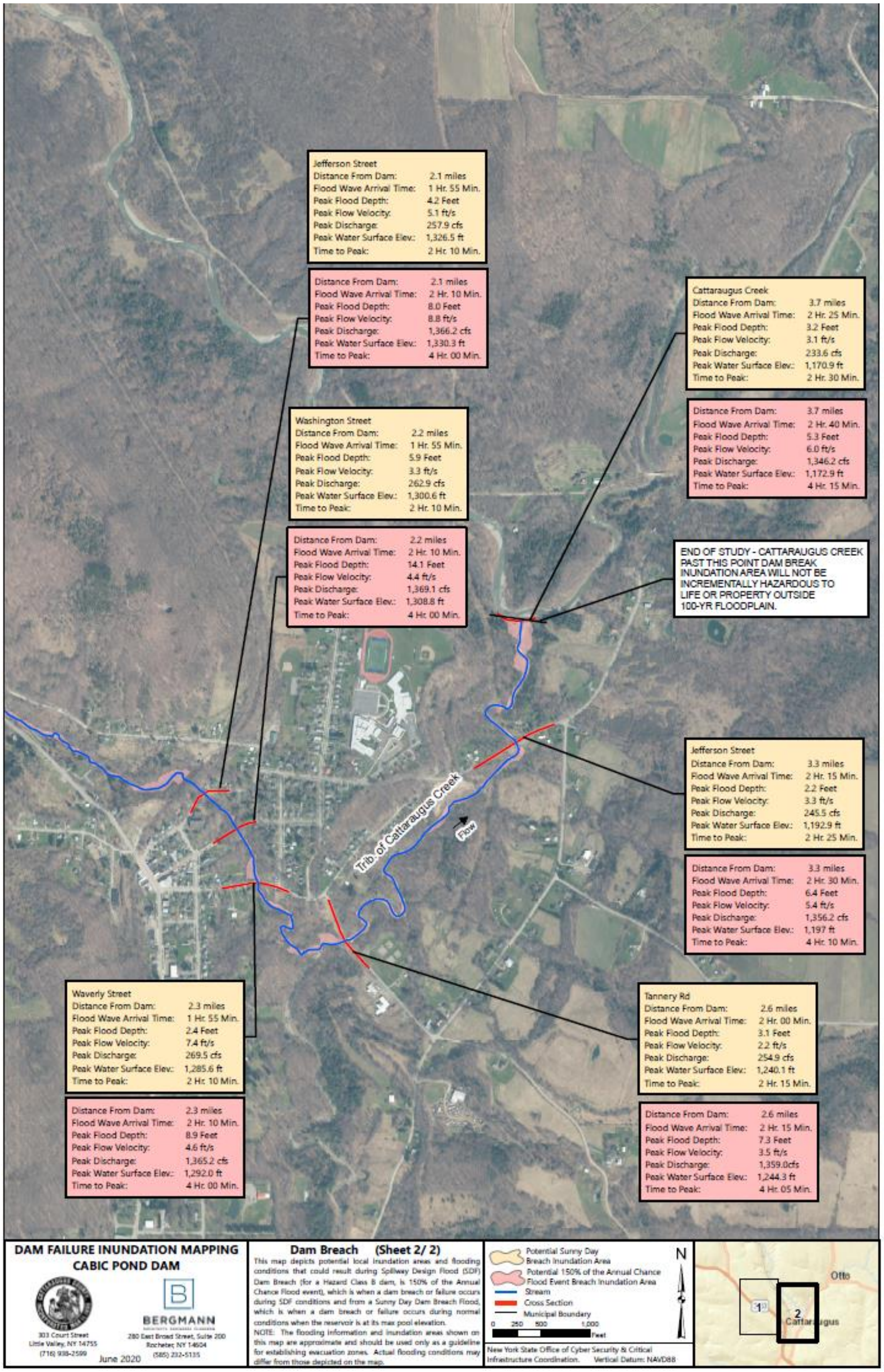
- Cattaraugus Creek Watershed, Cabic Pond Dam: 12-15 people at risk during dam failure, inundation maps below (Figure 5.4.1-4 and Figure 5.4.1-5).
- Conewango Creek Watershed, Dam #1: 650 people at risk during dam failure, inundation map below (Figure 5.4.1-6).
- Conewango Creek Watershed, Dam #13: 1,245 people at risk during dam failure, numerous inundation maps can be found in the EAP.
- Conewango Creek Watershed, Dam #16 and 16A: 629 people at risk during dam failure, inundation map below (Figure 5.4.1-7).
- Conewango Creek Watershed, Dam #19, 2,613 people at risk during dam failure, inundation map below (Figure 5.4.1-8).
- Ischua Creek Watershed Dam #1: no listing of people at risk during dam failure, inundation map below (Figure 5.4.1-9).
- Ischua Creek Watershed Dam #2: no listing of people at risk during dam failure, inundation map below (Figure 5.4.1-10).
- Ischua Creek Watershed Dam #3: 2,985 people at risk during dam failure, inundation map below (Figure 5.4.1-11).
- Ischua Creek Watershed Dam #4: 2,985 people at risk during dam failure, inundation map below (Figure 5.4.1-12).
- Ischua Creek Watershed Dam #5: 2,985 people at risk during dam failure, inundation map below (Figure 5.4.1-13).
- Ischua Creek Watershed Dam #6A: 2,985 people at risk during dam failure, inundation map below (Figure 5.4.1-14).
- Ischua Creek Watershed, Hardwood Lake Dam: 2,985 people at risk during dam failure, no map available.

Figure 5.4.1-4. Inundation Map: Cabic Pond Dam Map 1



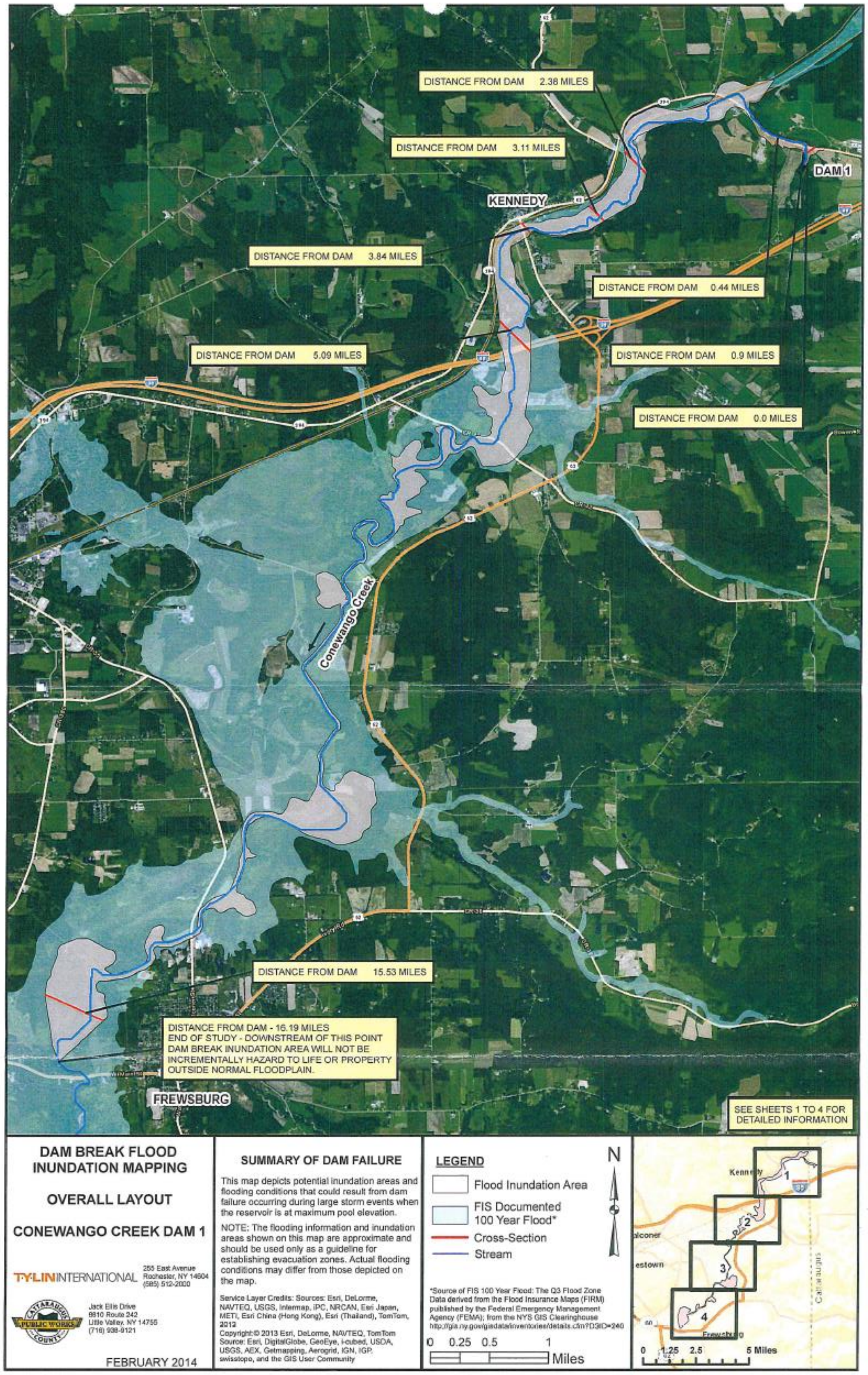
Source: Cabic Pond Dam EAP 2020

Figure 5.4.1-5. Inundation Map: Cabic Pond Dam Map 2



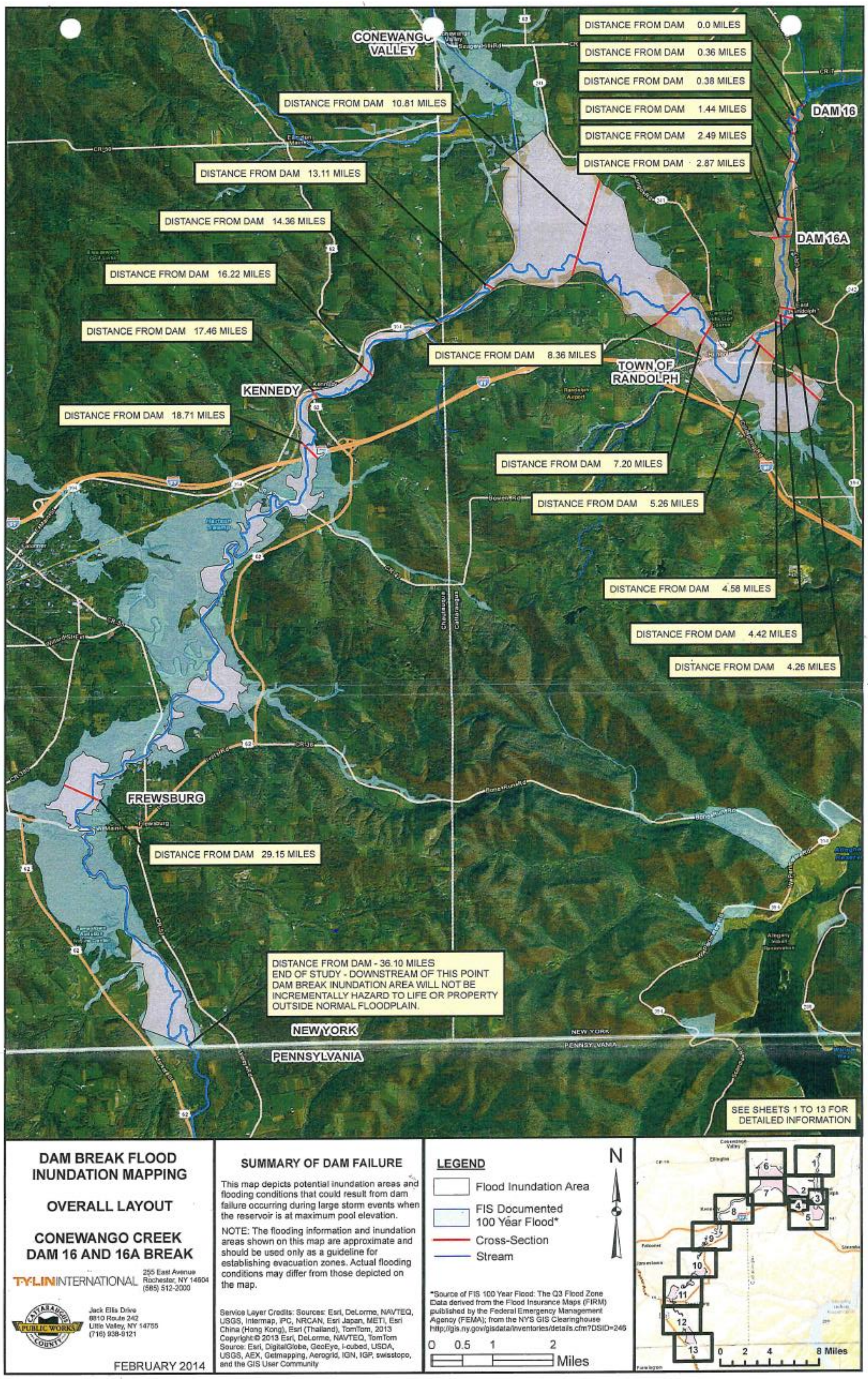
Source: Cabic Pond Dam EAP 2020

Figure 5.4.1-6. Inundation Map: Conewango Creek Watershed Dam #1



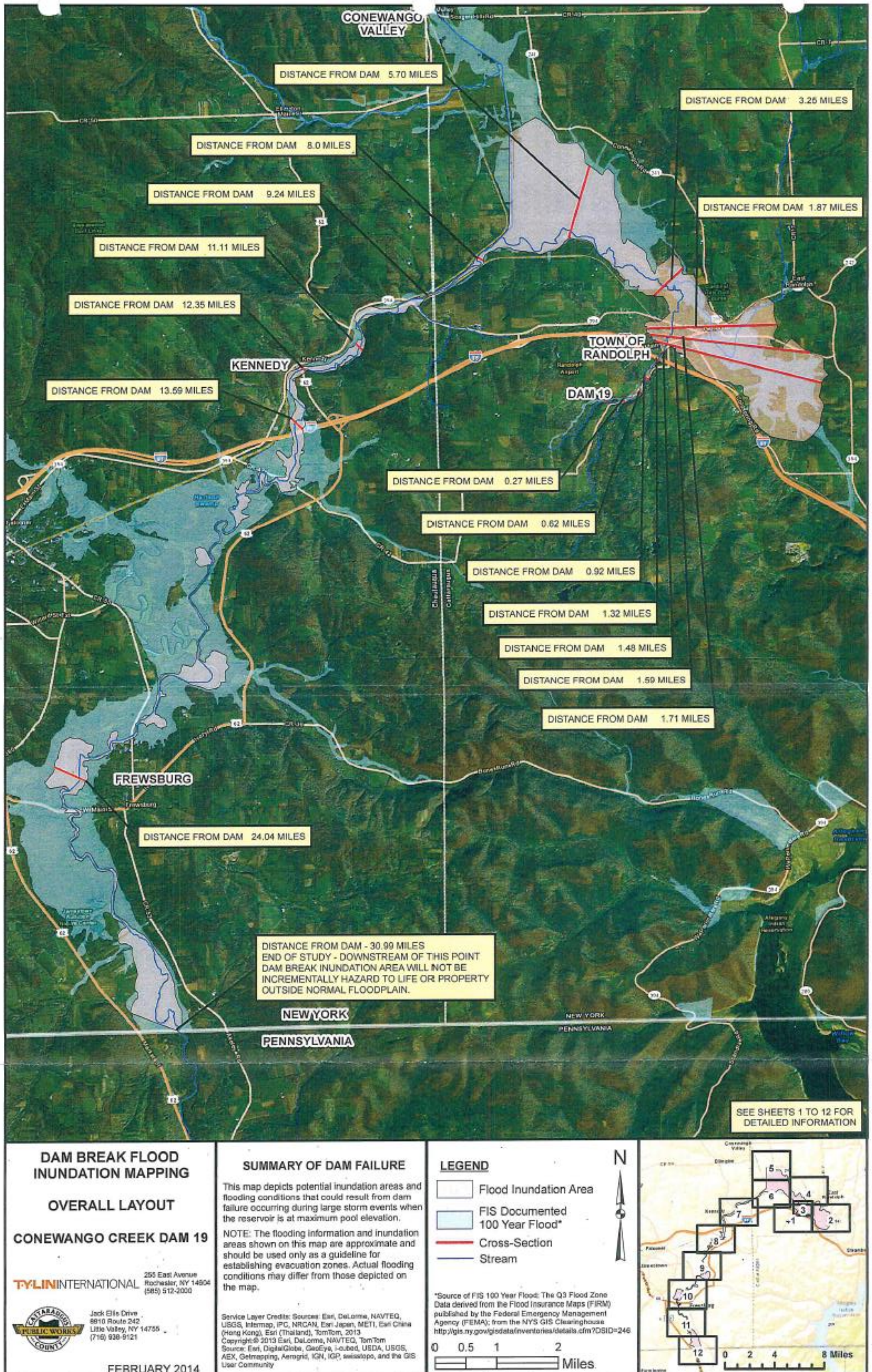
Source: Conewango Creek Dam 1 EAP, 2020

Figure 5.4.1-7. Inundation Map: Conewango Creek Watershed Dam #16 and #16A



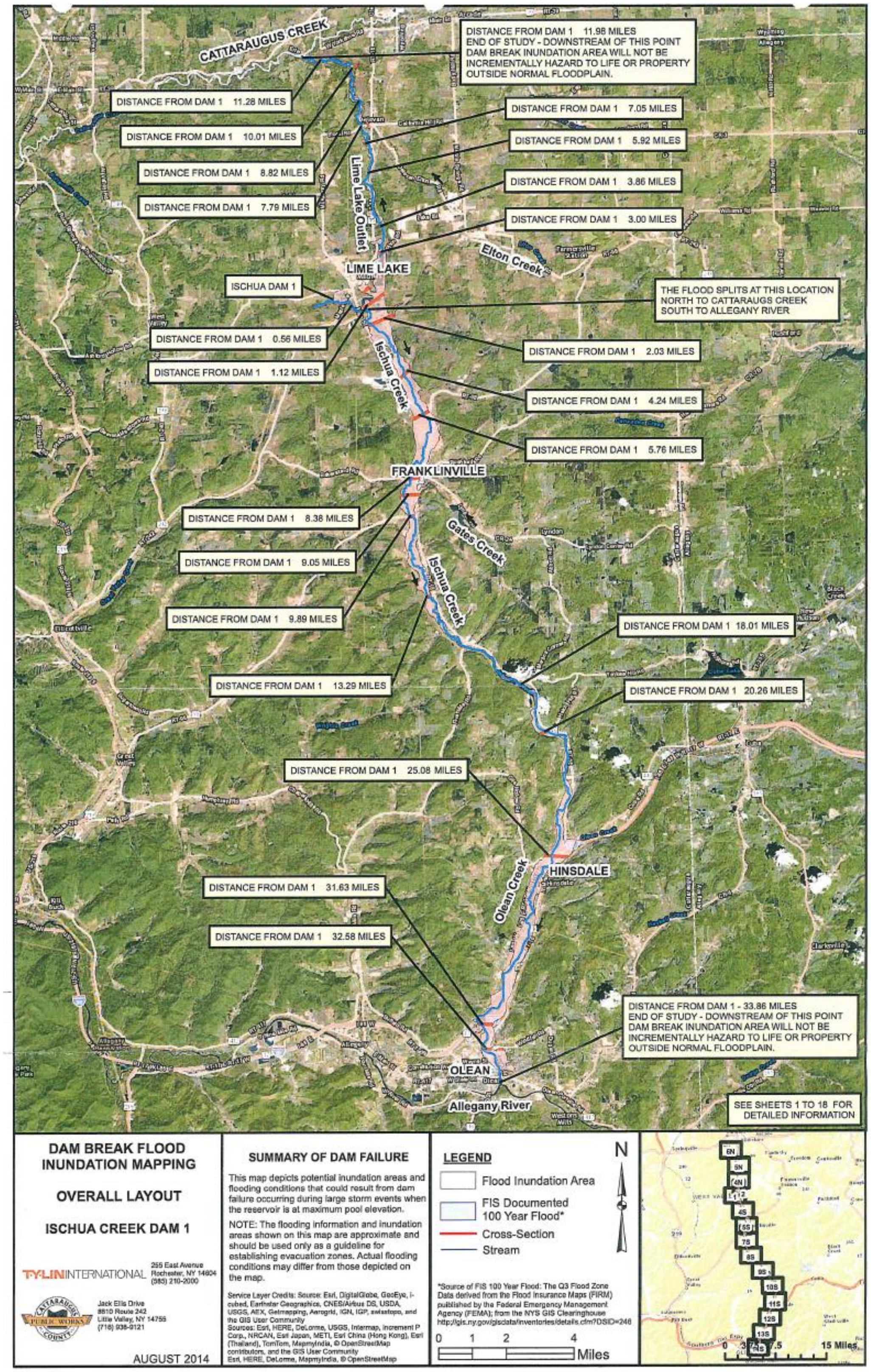
Source: Conewango Creek Dam 16 and 16A EAP

Figure 5.4.1-8. Inundation Map: Conewango Creek Watershed Dam #19



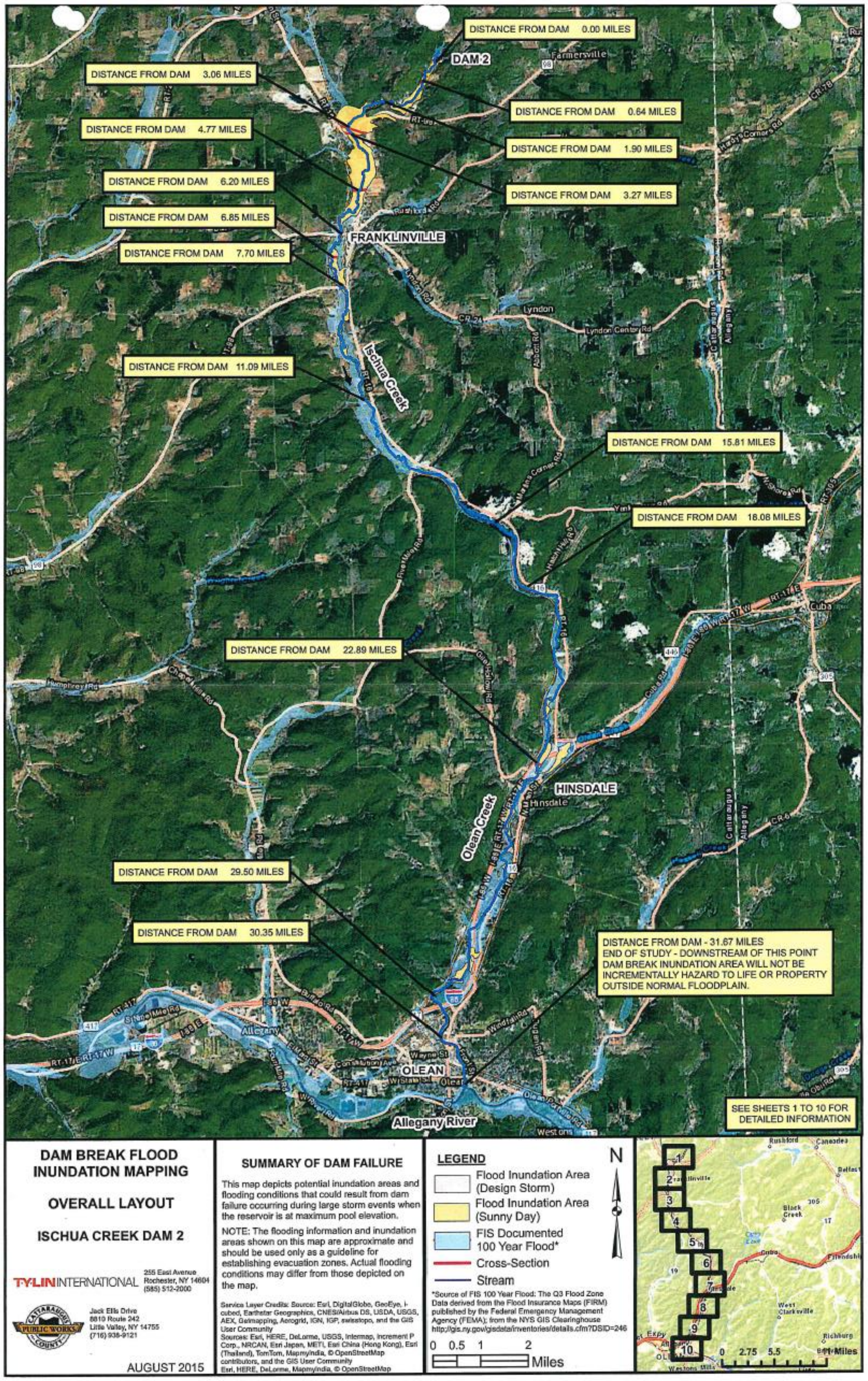
Source: Conewango Creek Dam 19 EAP

Figure 5.4.1-9. Inundation Map: Ischua Creek Dam #1



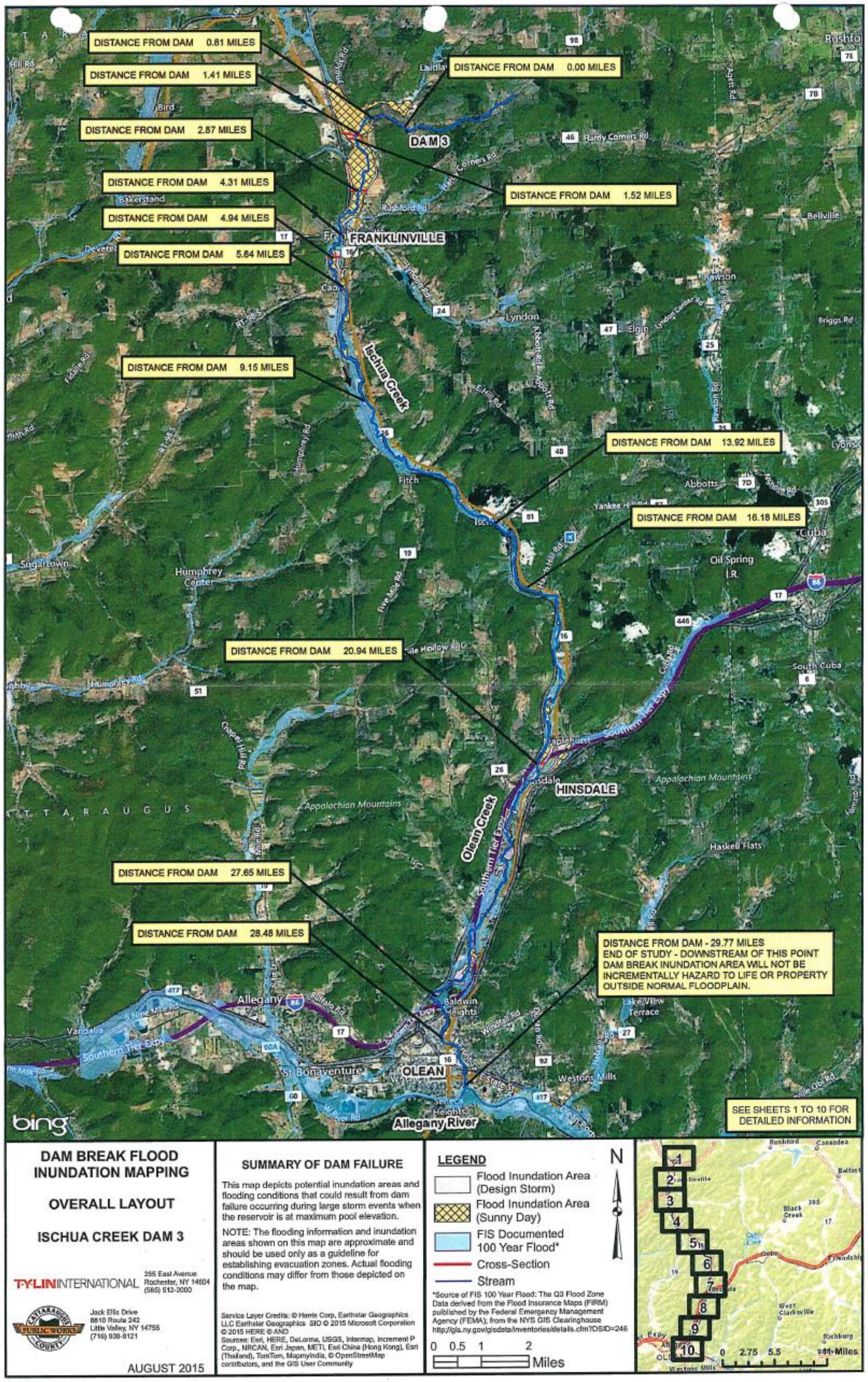
Source: Ischua Creek Dam 1 EAP

Figure 5.4.1-10. Inundation Map: Ischua Creek Dam #2



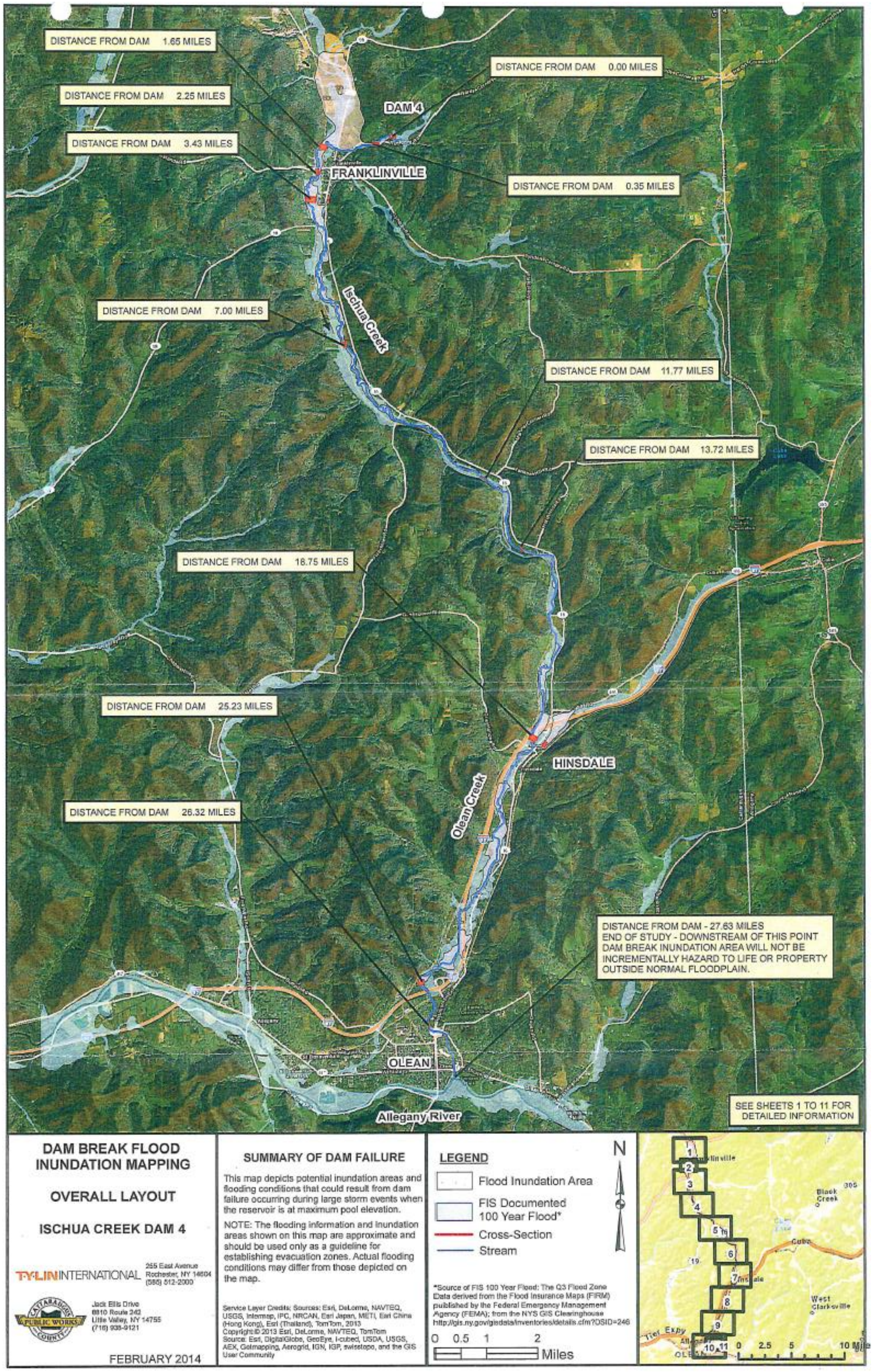
Source: Ischua Creek Dam 2 EAP

Figure 5.4.1-11. Inundation Map: Ischua Creek Dam #3



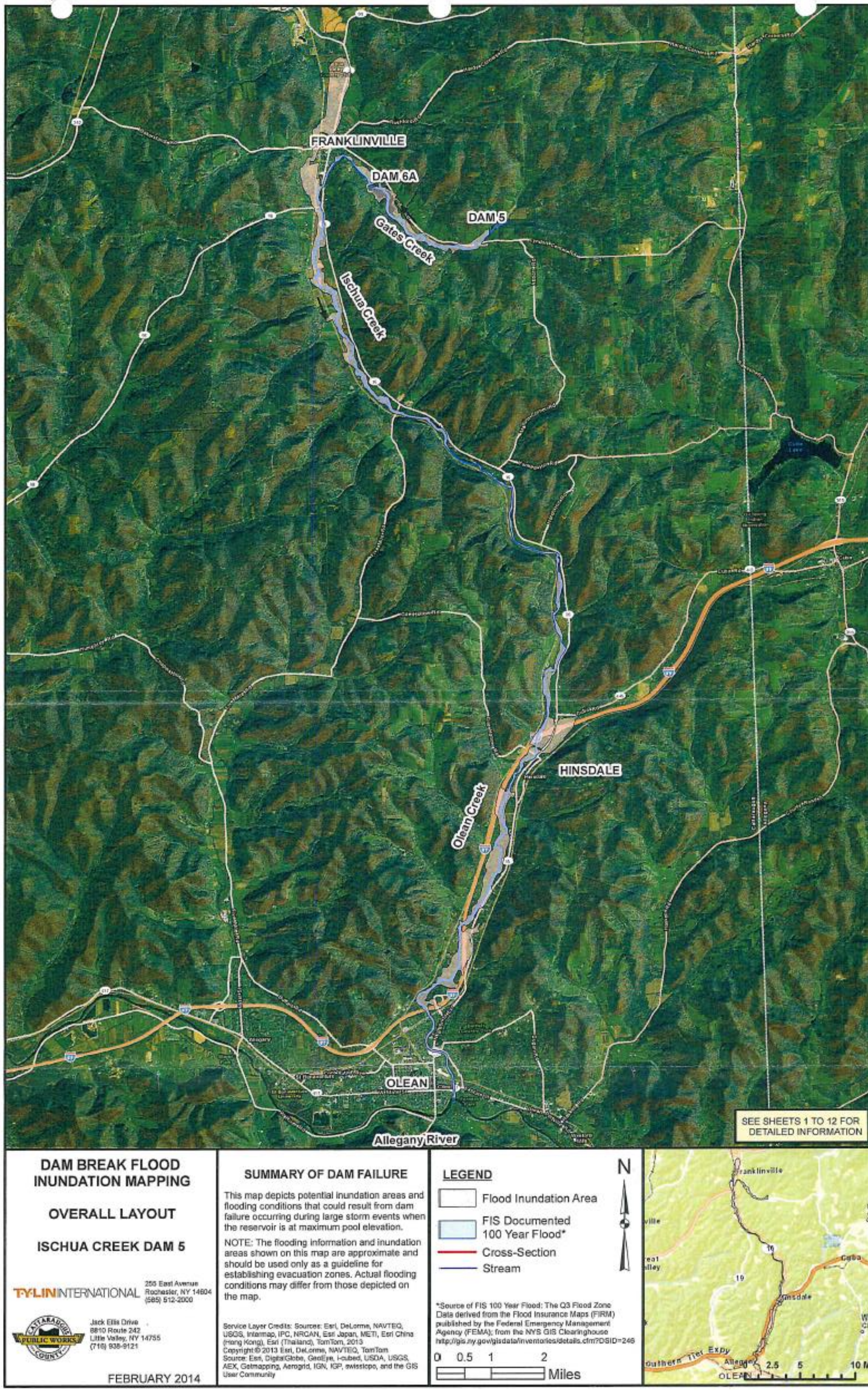
Source: Ischua Creek Dam 3 EAP

Figure 5.4.1-12. Inundation Map: Ischua Creek Dam #4



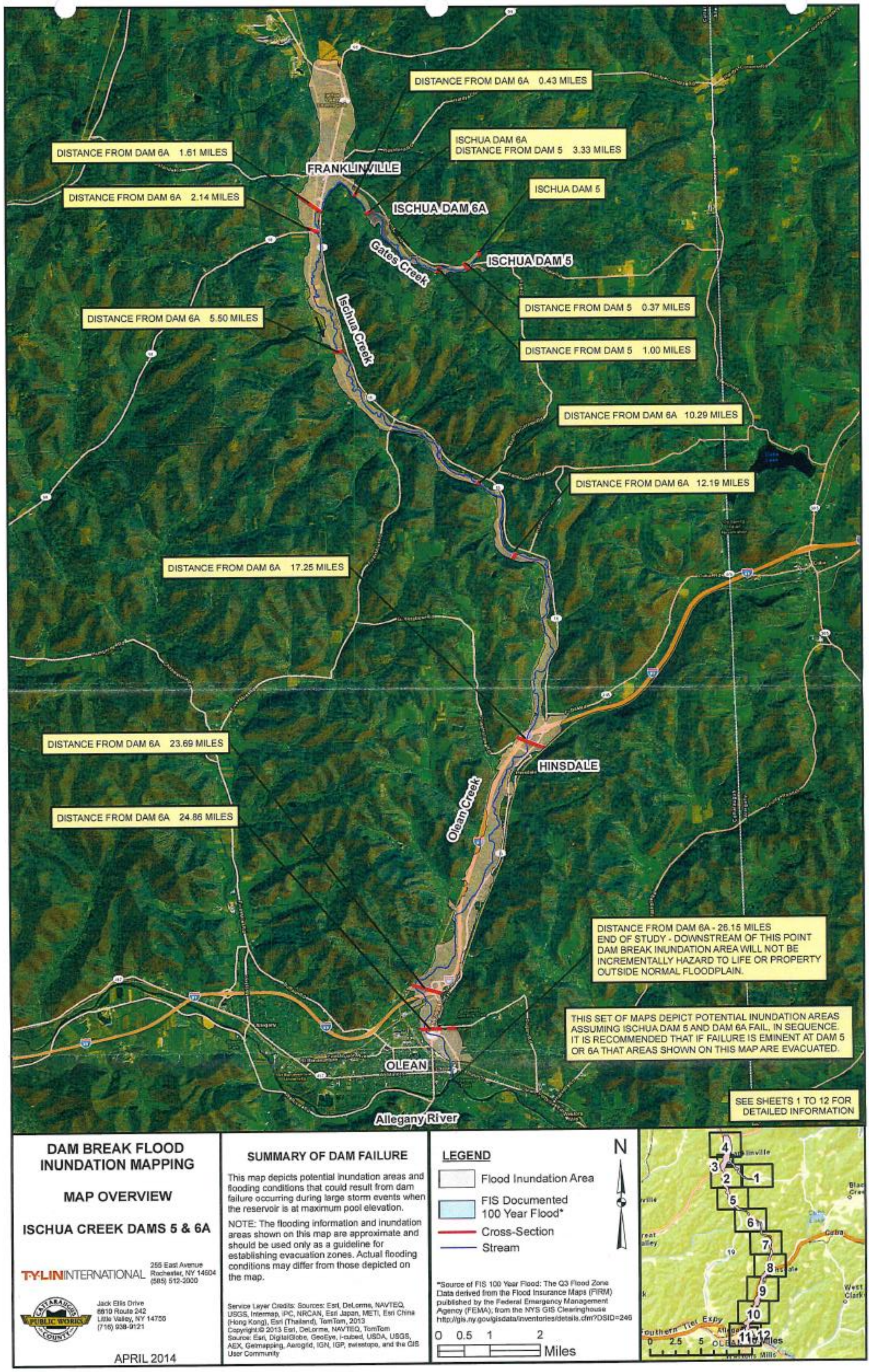
Source: Ischua Creek Dam 4 EAP

Figure 5.4.1-13. Inundation Map: Ischua Creek Dam #5



Source: Ischua Creek Dam 5 EAP

Figure 5.4.1-14. Inundation Map: Ischua Creek Dam #6A



Source: Ischua Creek Dam 6A EAP

Levee Failure

There are seven accredited levee systems within Cattaraugus County, made up of 111 structures encompassing 15 miles. These levees are operated and maintained by the New York State Department of Environmental Conservation. Failure of these levees could result in flooding of these jurisdictions. The location of these levee systems are displayed in Figure 5.4.1-15. The Right Bank Olean Creek levee is accredited and is maintained by the NYSDEC. The Olean Creek system consists of approximately 2.39 miles of levee embankment along the Olean Creek. A flood in the area behind the levee could impact nearly 1,953 people, 774 commercial and residential structures and cause an estimated $280 million of possible flood-related damages (USACE 2020).

The Left Bank Olean Creek levee system is located on Olean Creek and the Allegheny River in the Town of Olean. The system consists of 4.09 miles of levee embankment. A flood in the area behind the levee could impact approximately 5,083 people, 2,364 commercial and residential structures, and could cause an estimated $1.04 billion of possible flood related damages (USACE 2020).

The North of Dodge Creek levee system is located on the right bank of Dodge Creek and the right bank of the Allegheny River in the Town of Portville. The system consists of 2.4 miles of levee embankment. A flood in the area behind the levee could impact approximately 513 people, 255 commercial and residential structures, and cause an estimated $80 million of possible flood-related damages (USACE 2020).

The South of Dodge Creek levee system is located on the banks of the Oswayo Creek, the Allegheny River, and the south bank of the Dodge Creek in the Town of Portville. The system consists of approximately 2 miles of levee embankment. A flood in the area behind the levee could impact approximately 499 people, 275 commercial and residential structures, and cause an estimated $136 million in possible flood-related damages (USACE 2020).

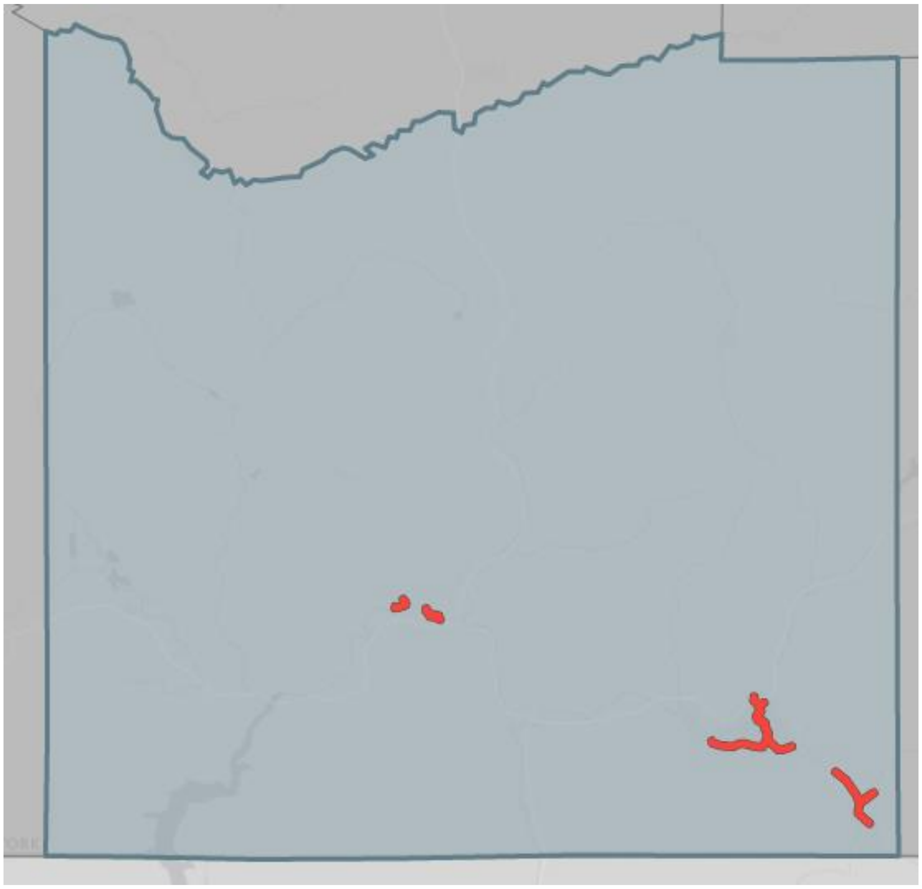
The Left Bank Allegheny levee system is located on the left bank of the Allegheny River in the Town of Salamanca. The system consists of approximately 0.5 miles of levee embankment on the left bank of the Allegheny River. A flood in the area behind the levee could impact approximately 71 people, 29 commercial and residential structures, and cause an estimated $20.6 million in flood-related damages (USACE 2020).

The Right Bank Allegheny River levee system is located on the left bank of the Allegheny River in the Town of Salamanca. It consists of approximately .73 miles of levee embankment on the left bank of the Allegheny River. A flood in the area behind the levee could impact approximately 61 people, 30 commercial and residential structures, and could result in an estimated $9.58 million in flood-related damages (USACE 2020).

The Right Bank West Salamanca levee system is located on the left bank of the Allegheny River in the Town of Salamanca. The system consists of approximately 0.88 miles of levee embankment on the left bank of the Allegheny River. A flood in the area behind the level could impact approximately 177 people, 92 commercial and residential structures, and could cause an estimated $18.5 million in flood-related damages (USACE 2020).

Levee systems in Cattaraugus County are mapped in Figure 5.4.1-15.

Figure 5.4.1-15. Location of Levee Systems in Cattaraugus County



Source: USACE 2020

Flood Gages

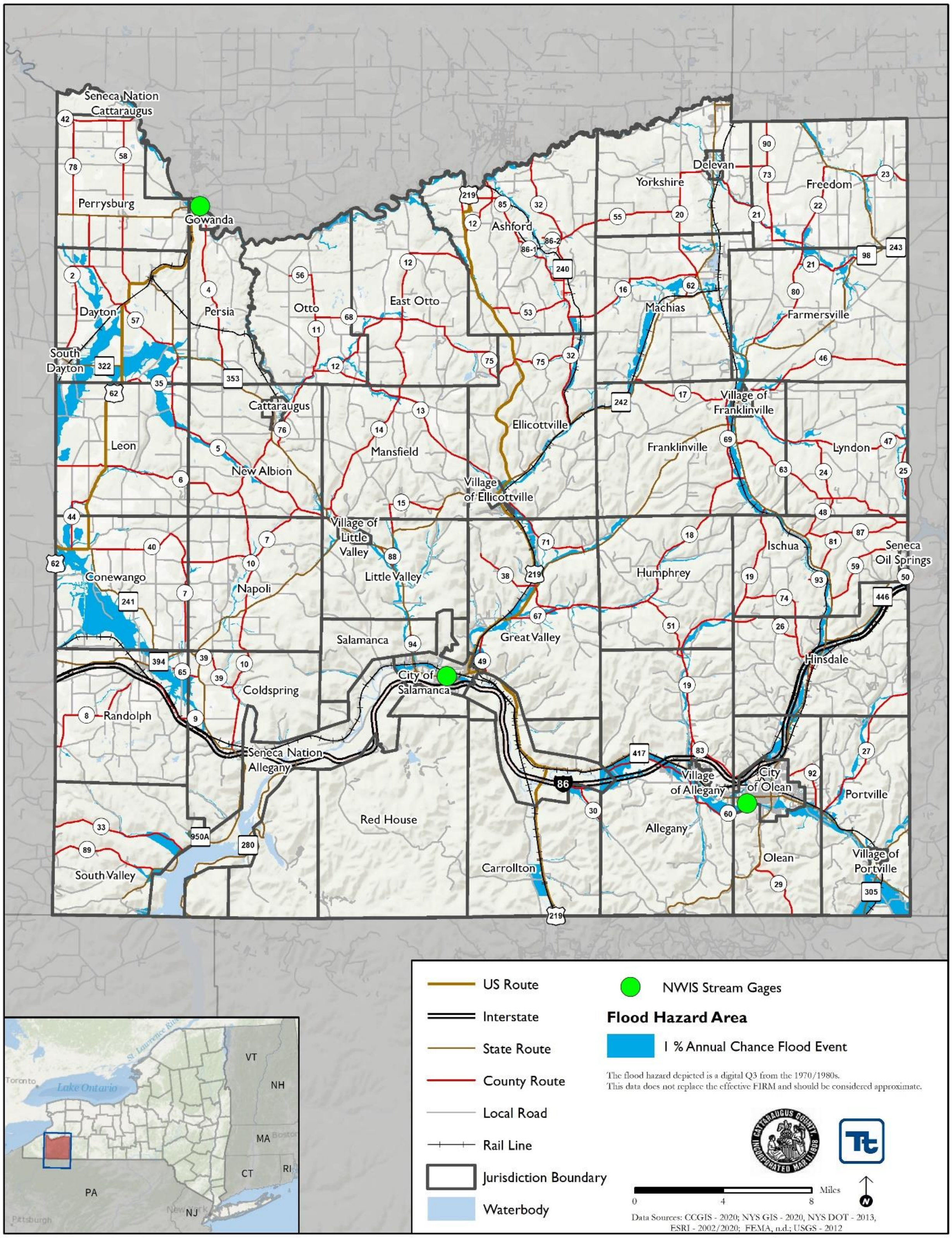
The USGS National Water Information System (NWIS) collects surface water data from more than 850,000 stations across the country. The time-series data describe stream levels, streamflow (discharge), reservoir and lake levels, surface water quality, and rainfall. The data are collected by automatic recorders and manual field measurements at the gage locations. USGS collects data in Cattaraugus County via three stream gages, as indicated in Table 5.4.1-2 and Figure 5.4.1-16.

Table 5.4.1-2. USGS Gages Located in Cattaraugus County

FID	Site Number	Site Name	Category	Agency	Longitude	Latitude
202	3010820	Allegheny River at Olean, NY	ST	USGS	-78.4511111	42.07305556
203	3011020	Allegheny River at Salamanca, NY	ST	USGS	-78.7152778	42.15638889
209	4213500	Cattaraugus Creek at Gowanda, NY	ST	USGS	-78.9341667	42.4633333

Source: USGS 2020

Figure 5.4.1-16. USGS Gage Locations in Cattaraugus County



Previous Occurrences and Losses

Table 5.4.1-3 documents historical flood events from 1950 to August 2020 in Cattaraugus County based on data collected from NOAA's National Centers for Environmental Information (NCEI), National Performance of Dams Program (NPDP), and Cold Regions Research and Engineering Laboratory (CRREL) databases.

Table 5.4.1-3. Flood Events 1950-2020

Hazard Type	Number of Occurrences Between 1950 and 2020	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Flash Flood	37	1	1	$64.34M	-
Flood	15	-	-	$2.50M	-
Dam Failure	-	-	-	-	-
Ice Jam	2	-	-	-	-
Levee Failure	-	-	-	-	-
Total	**54**	**1**	**1**	**$66.84M**	**-**

Source: NOAA-NCEI 2020; CRREL 2018
Note: Ice Jam data from CRREL do not include fatalities, injuries, property damage, or crop damage; that data are not available.

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. Cattaraugus County was included in ten of these flood-related declarations (Table 5.4.1-4).

Table 5.4.1-4. FEMA DR and EM Declarations for Flood Events in Cattaraugus County, 1954 to 2020

Date(s) of Event	FEMA Declaration Number	Declaration Date	Event Type
October 30, 1967	DR-645	October 30, 1967	Flood: Severe Storms and Flooding
June 23, 1972	DR-338	June 23, 1972	Flood: Tropical Storm Agnes
January 19-30, 1996	DR-1095	January 24, 1996	Flood: Severe Storms and Flooding
June 25-July 10, 1998	DR-1233	July 7, 1998	Severe Storm(s): Severe Storms and Flooding
May 3-August 12, 2000	DR-1335	July 21, 2000	Severe Storm(s): Severe Storms and Flooding
July 21-August 13, 2003	DR-1486	August 29, 2003	Severe Storm(s): Severe Storms, Flooding, and Tornadoes
May 13-June 17, 2004	DR-1534	August 3, 2004	Severe Storm(s): Severe Storms and Flooding
August 13-September 16, 2004	DR-1564	October 1, 2004	Severe Storm(s): Severe Storms and Flooding
August 8-10, 2009	DR-1857	September 1, 2009	Severe Storm(s): Severe Storms and Flooding
May 13-22, 2014	DR-4180	July 8, 2014	Severe Storm(s): Severe Storms and Flooding

Source: FEMA 2020

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. Cattaraugus County has experienced the following six USDA-designated agricultural disasters since 2013 that included or may have included losses due to flooding:

- S3593 – 2014 Excessive rain and related flooding, high winds, and hail
- S3747 – 2014 Excessive rain and related flooding, high winds, and hail
- S3885 – 2015 Excessive rain, high winds, hail, lightning, and tornado

- S4465 – 2018 Excessive rain, flash flooding, and flooding
- S4622 – 2019 Excessive rain
- S4623 – 2019 Excessive rain, flash flooding, and flooding

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 Cattaraugus County has experienced crop losses from flood events. Table 5.4.1-5 provides details regarding crop losses in Cattaraugus County according to USDA records.

Table 5.4.1-5. USDA Crop Losses from Excess Moisture/Precipitation/Rain and/or Flooding in Cattaraugus County

Year	Crop Type	Cause of Loss	Losses
2013	Wheat	Excess Moisture/Precipitation/Rain	$185
2013	Oats	Excess Moisture/Precipitation/Rain	$7,666
2013	Corn	Excess Moisture/Precipitation/Rain	$107,623
2013	Soybeans	Excess Moisture/Precipitation/Rain	$40,830
2014	Wheat	Excess Moisture/Precipitation/Rain	$5,245
2014	Oats	Excess Moisture/Precipitation/Rain	$1,133
2014	Corn	Excess Moisture/Precipitation/Rain	$554,311
2014	Corn	Flood	$792
2014	Processing Beans	Excess Moisture/Precipitation/Rain	$88,392
2014	Soybeans	Excess Moisture/Precipitation/Rain	$97,727
2015	Wheat	Excess Moisture/Precipitation/Rain	$6,520
2015	Oats	Excess Moisture/Precipitation/Rain	$7,349
2015	Corn	Excess Moisture/Precipitation/Rain	$359,712.5
2015	Processing Beans	Excess Moisture/Precipitation/Rain	$58,950
2015	Soybeans	Excess Moisture/Precipitation/Rain	$120,127.50
2015	All Other Crops	Excess Moisture/Precipitation/Rain	$8,425
2017	Wheat	Excess Moisture/Precipitation/Rain	$12,922
2017	Corn	Excess Moisture/Precipitation/Rain	$482,819
2017	Processing Beans	Excess Moisture/Precipitation/Rain	$25,870
2017	Green Peas	Excess Moisture/Precipitation/Rain	$17,479
2017	Soybeans	Excess Moisture/Precipitation/Rain	$185,447.85
2018	Wheat	Excess Moisture/Precipitation/Rain	$9,053
2018	Corn	Excess Moisture/Precipitation/Rain	$80,548
2018	Processing Beans	Excess Moisture/Precipitation/Rain	$15,810
2018	Soybeans	Excess Moisture/Precipitation/Rain	$547,678.50
2020	All Other Crops	Excess Moisture/Precipitation/Rain	$6,000
2020	All Other Crops	Excess Moisture/Precipitation/Rain	$11,000

Source: USDA 2020

For this update, flood events were summarized from 2013 to 2020. Known flood events that have impacted Cattaraugus County between 2013 and 2020, including FEMA disaster declarations, are identified in Table 5.4.1-6. Section 9 includes detailed information regarding flood impacts to each municipality. Appendix E, Risk Assessment Supplementary Data, includes information regarding events that have occurred prior to 2013.

Table 5.4.1-6. Flood Events in Cattaraugus County, 2013 to 2020

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
May 28, 2013	Flash Flood	N/A	N/A	Thunderstorms also resulted in brief periods of very heavy rain in some locations with one to three inches of rain falling in less than three hours. Roads were flooded and washout out in parts of Jamestown, New Albion, and Randolph. New Albion and East Randolph each reported $15K in property damages.
June 23, 2013	Flash Flood	N/A	N/A	Flash flooding across parts of Allegany and Cattaraugus counties. Law enforcement and emergency management reported road and low-land inundation as well as several road and bridge washouts. Hinsdale reported $25K in property damages.
December 21-22, 2013	Flood	N/A	N/A	Heavy rain combined with snowmelt to produce flooding. In addition to many of the gauged rivers and creeks reaching flood stage, flooding in low-lying and poor drainage areas was common. In urban areas, runoff of the heavy rain and snowmelt was hindered by snow and ice clogged storm drains. Gowanda reported $20K in property damages. Allegany reported $20K in property damages.
May 13, 2014	Flash Flood	DR-4180	Yes	Flash flooding across the region. Evacuations took place in Silver Creek and Gowanda. In Gowanda, several high water rescues took place. States of Emergency were declared in Cattaraugus and Chautauqua counties. The resulting damages were enough to warrant a State Disaster Declaration. Randolph and Gowanda each reported $5M in property damages. Perrysburg reported $500K in property damages. Salamanca, Little Valley, and Cattaraugus each reported $250K in property damages.
June 12, 2014	Flash Flood	N/A	N/A	Torrential rains produced flash flooding with roads inundated with flowing water. Conewango and Wesley each reported $50K in property damages.
August 12, 2014	Flash Flood	N/A	N/A	Quaker Bridge and Humphrey Center each reported $50K in property damages. Franklinville reported $25K in property damages.
July 14, 2015	Flash Flood	N/A	N/A	Flooding in Chautauqua and Cattaraugus Counties. Major damage occurred across the southern tier and the area received a State Disaster Declaration. Numerous reports of road washouts and extensive property damage. Hundreds of residents were evacuated. Major roads were closed Gowanda reported $750K in property damages. Leon reported $150K in property damages. Plato reported $100K in property damages.

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Event Details
September 18, 2016	Flash Flood	N/A	N/A	Flooding closed multiple roads in Hinsdale, Friendship and Cuba. Water rescues occurred near Friendship. In Cuba, forced evacuations occurred. In Allegany State Park widespread flooding occurred and campgrounds had to be evacuated. The flood waters slowly subsided during the early morning hours. Hinsdale reported $40K in property damages. Red House reported $25K in property damages.
January 12, 2017	Flood	N/A	N/A	Flooding occurred during the next couple days following the rain and snow melt, on January 12-13th. There was also widespread areal flooding across the Western Southern Tier, with numerous road closures near Jamestown. Gowanda reported $20K in property damages. Olean Giermek Airport reported $20K in property damages. Kill Buck reported $25K in property damages.
November 5, 2017	Flood	N/A	N/A	Gowanda reported $10K in property damages.

Source: FEMA 2020; NOAA-NCEI 2020; 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 Cattaraugus 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 State Energy Research and Development Authority [NYSERDA] 2011). Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Cattaraugus County is part of Region 3, Southern Tier. In Region 3, temperatures are estimated to increase by 4.4 to 6.3 ºF by the 2050s, and 5.7 to 9.9 ºF by the 2080s (baseline of 47.5 ºF, middle range projection). Precipitation totals will increase between 4 and 10 percent by the 2050s and 6 to 14 percent by the 2080s (baseline of 35.0 inches, middle-range projection). Table 5.4.1-7 displays the projected seasonal precipitation change for Southern Tier ClimAID Region 3 (NYSERDA 2014).

Table 5.4.1-7. Projected Seasonal Precipitation Change in Region 3, 2050s (Percent Change)

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

Source: NYSERDA 2014

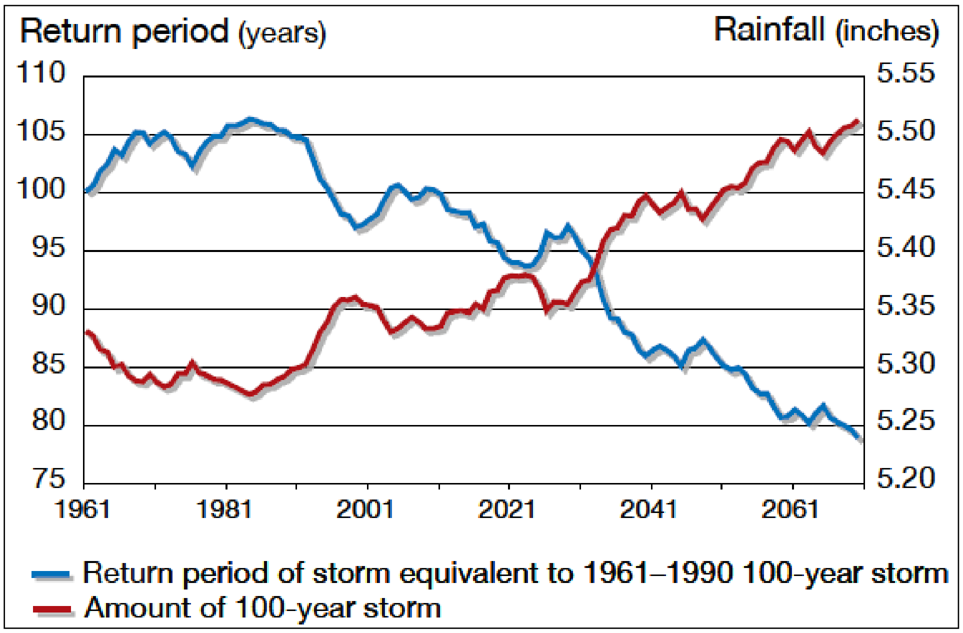
By the end of the century, the greatest increases in precipitation are projected to be in the northern parts of the state. Although seasonal projections are less certain than annual results, much of this additional precipitation is projected to occur during the winter months. During the late summer and 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 5.4.1-17 displays the project rainfall and frequency of extreme storms in New York State. The amount of rain fall 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 5.4.1-17. 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 Cattaraugus 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 Cattaraugus 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 Cattaraugus 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 Cattaraugus 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 2019 New York State HMP, Cattaraugus County had 70 flooding events between 1996 and 2017 that resulted in $59.1 million in property damage. Four of these events were classified as severe events. These statistics indicate that the flooding imposes an annualized cost to the county of $2.57 million (NYS DHSES 2019). However, according to the NOAA NCEI and the CRREL database, Cattaraugus County experienced 54 flood events between 1950 and 2020, including 15 floods, 37 flash floods, 2 ice jams, and no dam or levee failures. Table 5.4.1-8 shows these statistics, as well as the annual average number of events and the percent chance of these individual flood hazards occurring in Cattaraugus County in future years based on the historic record (NOAA NCEI 2020).

Table 5.4.1-8. Probability of Future Occurrence of Flooding Events

Hazard Type	Number of Occurrences Between 1950 and 2020	Rate of Occurrence or Annual Number of Events (average)	Recurrence Interval (in years) (# Years/Number of Events)	Percent (%) chance of occurrence in any given year
Flash Flood	37	0.54	1.89	52.86
Flood	15	0.22	4.67	21.43
Dam Failure	0	0.00	--	--
Ice Jams	2	0.03	35.00	2.86
Levee Failure	0	0.00	--	--
Total	**54**			

Source: NOAA-National Climatic Data Center (NCDC) 2020; CRREL 2018; NPDP 2018

Climate change is expected to increase the severity and frequency of heavy rain events in Cattaraugus 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 Cattaraugus 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.

5.4.1.2 Vulnerability Assessment

To assess Cattaraugus County's risk to the flood hazard, a spatial analysis was conducted using the best available spatially delineated flood hazard areas. The 1-percent annual chance flood event was examined to determine the assets located in the hazard areas and to estimate potential loss using the FEMA Hazards U.S.—Multi-Hazards (HAZUS-MH) v4.2 riverine model. These results are summarized below. Section 5.1, Methodology, presents additional details on the methodology used to assess flood risk.

Impact on Life, Health, and Safety

The impact of flooding on life, health and safety is dependent upon several factors including the severity of the event and whether 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. However, exposure is not limited to persons who reside in a defined hazard zone, but includes all individuals 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.

Based on the spatial analysis, there are an estimated 3,858 people living in the 1-percent annual chance flood event hazard area (Table 5.4.1-9). These residents may be displaced due to their homes flooding, requiring them to seek temporary shelter with friends and family or in emergency shelters. The Village of Ellicottville has the greatest percentage of its population located in the 1-percent annual chance flood event hazard area (approximately 38 percent). The Town of Portville has the greatest number of residents located in the 1-percent annual chance flood event hazard area; approximately 474 persons. For this project, the potential population exposed is used as a guide for planning purposes.

Table 5.4.1-9. Estimated Population Exposed to the 1-Percent Annual Chance Flood Event Hazard Area

Jurisdiction	Population (American Community Survey 5-Year 2014 - 2018) *	Population Exposed	
		Number of Persons	% of Total
Allegany (T)	5,741	356	6.2%
Allegany (V)	1,922	221	11.5%
Ashford (T)	2,192	86	3.9%
Carrollton (T)	1,429	83	5.8%
Cattaraugus (V)	959	0	0.0%
Coldspring (T)	672	39	5.8%
Conewango (T)	1,653	163	9.8%
Dayton (T)	1,352	40	3.0%
Delevan (V)	1,007	27	0.0%
East Otto (T)	1,055	40	3.8%
Ellicottville (T)	877	73	8.3%
Ellicottville (V)	283	107	38.0%
Farmersville (T)	1,075	52	4.8%
Franklinville (T)	1,303	35	2.7%
Franklinville (V)	1,575	35	2.2%
Freedom (T)	2,276	97	4.2%
Gowanda (V)	1,805	398	22.1%
Great Valley (T)	1,689	159	9.4%
Hinsdale (T)	2,074	88	4.2%
Humphrey (T)	860	26	3.0%
Ischua (T)	731	17	2.4%
Leon (T)	1,114	51	4.6%
Little Valley (T)	664	45	6.7%

Jurisdiction	Population (American Community Survey 5-Year 2014 - 2018) *	Population Exposed	
		Number of Persons	% of Total
Little Valley (V)	1,180	22	1.9%
Lyndon (T)	718	4	0.6%
Machias (T)	2,380	15	0.7%
Mansfield (T)	810	2	0.3%
Napoli (T)	1,218	6	0.5%
New Albion (T)	1,009	51	5.1%
Olean (C)	13,805	330	2.4%
Olean (T)	2,183	271	12.4%
Otto (T)	797	25	3.1%
Perrysburg (T)	1,598	21	1.3%
Persia (T)	653	60	9.2%
Portville (T)	2,630	474	18.0%
Portville (V)	965	3	0.3%
Randolph (T)	2,476	88	3.5%
Red House (T)	42	0	0.0%
Salamanca (C)	5,553	218	3.9%
Salamanca (T)	447	15	3.2%
South Dayton (V)	673	4	0.5%
South Valley (T)	276	7	2.4%
Yorkshire (T)	2,762	4	0.2%
Cattaraugus County (Total)	**76,483**	**3,858**	**5.0%**

Source: FEMA Q3 Data 1970/1980; American Community Survey 2018
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
% = Percent; C = City; T = Town; V = Village
** Note: Because of the estimated boundaries of villages and towns within Cattaraugus County, there is a small discrepancy of approximately 400 people reported in the 2018 American Community Survey versus the population data used in the GIS spatial analysis. A rough estimate was made based on land area for The Village of Gowanda; approximately 60 percent of the Village of Gowanda remains within Cattaraugus County. Therefore, an assumption was made that 60 percent of the reported population for the Village of Gowanda remains in Cattaraugus County. The population of the Village of Gowanda that resides in Cattaraugus County was subtracted from the Town of Persia. Tribal nations and reservation areas are not included in this population analysis.*

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 Cattaraugus County, there are approximately 14,046 people over the age of 65 and 12,222 people below the poverty level (American Community Survey 2018).

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. Cattaraugus County's overall score is 0.7106, indicating that its communities have moderate to high 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-MH v4.2 estimates the potential sheltering needs as a result of a 1-percent annual chance flood event. For the 1-percent flood event, HAZUS-MH v4.2 estimates 5,663 households will be displaced, and 121 people will seek short-term sheltering. These statistics, by jurisdiction, are presented in Table 5.4.1-10. The estimated displaced population and number of persons seeking short-term sheltering differs from the number of persons exposed to the 1-percent annual chance flood, because the displaced population numbers take into consideration that not all residents will be significantly impacted enough to be displaced or to require short-term sheltering during a flood event.

Table 5.4.1-10. Estimated Population Displaced or Seeking Short-Term Shelter from the 1-Percent Annual Chance Flood Event Hazard Area

Jurisdiction	Population (American Community Survey 5-Year Estimates 2014 - 2018)*	1-Percent Annual Chance Event	
		Displaced Population**	Persons Seeking Short-Term Sheltering**
Allegany (T)	5,741	939	30
Allegany (V)	1,922	256	23
Ashford (T)	2,192	55	0
Carrollton (T)	1,429	137	0
Cattaraugus (V)	959	5	0
Coldspring (T)	672	31	0
Conewango (T)	1,653	130	1
Dayton (T)	1,352	117	0
Delevan (V)	1,007	91	0
East Otto (T)	1,055	18	0
Ellicottville (T)	877	71	0
Ellicottville (V)	283	143	2
Farmersville (T)	1,075	84	1
Franklinville (T)	1,303	122	1
Franklinville (V)	1,575	105	1
Freedom (T)	2,276	132	2
Gowanda (V)	1,805	539	13
Great Valley (T)	1,689	334	4
Hinsdale (T)	2,074	198	4
Humphrey (T)	860	76	0
Ischua (T)	731	25	0
Leon (T)	1,114	95	0

Jurisdiction	Population (American Community Survey 5-Year Estimates 2014 - 2018)*	1-Percent Annual Chance Event	
		Displaced Population**	Persons Seeking Short-Term Sheltering**
Little Valley (T)	664	92	0
Little Valley (V)	1,180	28	0
Lyndon (T)	718	10	0
Machias (T)	2,380	67	0
Mansfield (T)	810	5	0
Napoli (T)	1,218	7	0
New Albion (T)	1,009	21	0
Olean (C)	13,805	414	6
Olean (T)	2,183	221	3
Otto (T)	797	13	0
Perrysburg (T)	1,598	19	0
Persia (T)	653	13	0
Portville (T)	2,630	614	27
Portville (V)	965	24	0
Randolph (T)	2,476	114	1
Red House (T)	42	0	0
Salamanca (C)	5,553	189	2
Salamanca (T)	447	19	0
South Dayton (V)	673	26	0
South Valley (T)	276	34	0
Yorkshire (T)	2,762	30	0
Cattaraugus County (Total)	**76,483**	**5,663**	**121**

Source: HAZUS v4.2; FEMA Q3 Data 1970/1980; American Community Survey 2018 (ACS 2014-2018)
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
C = City; T = Town; V = Village
** Note: Because of the estimated boundaries of villages and towns within Cattaraugus County, there is a small discrepancy of approximately 400 people reported in the 2018 American Community Survey versus the population data used in the GIS spatial analysis. A rough estimate was made based on land area for The Village of Gowanda; approximately 60 percent of the Village of Gowanda remains within Cattaraugus County. Therefore, an assumption was made that 60 percent of the reported population for the Village of Gowanda remains in Cattaraugus County. The population of the Village of Gowanda that resides in Cattaraugus County was subtracted from the Town of Persia. Tribal nations and reservation areas are not included in this population analysis.*
***HAZUS v4.2 uses 2010 Census data for displacement estimates. These numbers may be underestimated compared to the American Community Survey 2018 5-year estimates data.*

Total number of injuries and casualties resulting from typical riverine flooding are generally limited based on advance weather forecasting, blockades, and warnings. Injuries and deaths generally are not anticipated if proper warning and precautions occur. In contrast, warning time for flash flooding is limited. These events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard. Populations without adequate warning of the event are highly vulnerable to this hazard.

Additionally, the impact of dam/levee failure on life, health, and safety is dependent on several factors such as the area that the dam is protecting, the location, capacity, structural integrity, and the proximity of structures, infrastructure, and critical facilities downstream of the failure inundation area. According to the USACE, the level of impact that a dam failure would have can be predicted based upon the hazard potential classification (USACE 2020). Table 5.4.1-11 outlines the recommended hazard classifications.

Table 5.4.1-11. 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 to 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 assure public safety. OR Very high incremental risk: the combination of life or economic consequences with likelihood of failure 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

As mentioned in the earlier sections, 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/levee failure may mimic flood events, depending on the size of the dam reservoir and breach. Understanding potential outcomes of flooding for each dam/levee in Cattaraugus County would require intensive hydraulic modeling.

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 2019).

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-MH v4.2 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 2,210 buildings located in the 1-percent annual chance flood event hazard area with a value of approximately $2 billion of building and contents (based on replacement cost value). This represents approximately 5.3 percent of the county’s total general building stock inventory replacement cost value (approximately $38.5 billion). The Town of Portville has the greatest number of its buildings located in the floodplain (254 buildings or 18.5 percent of its total building stock). Table 5.4.1-12 summarizes the 1-percent flood inundation area exposure results by jurisdiction. Table 5.4.1-13 and Table 5.4.1-14 break down the 1-percent annual chance flood event exposure results for residential structures and commercial structures, respectively.

Table 5.4.1-12. Estimated General Building Stock Exposure to the 1-Percent Annual Chance Flood Event

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Total (All Occupancies)			
			1-Percent Annual Chance Flood Event			
			Number of Buildings	% Total	RCV	% Total
Allegany (T)	2,455	$1,995,224,472	178	7.3%	$164,918,894	8.3%
Allegany (V)	639	$754,717,827	89	13.9%	$101,300,462	13.4%
Ashford (T)	1,075	$922,022,498	46	4.3%	$37,559,190	4.1%
Carrollton (T)	626	$348,432,403	48	7.7%	$36,980,635	10.6%
Cattaraugus (V)	410	$625,337,729	0	0.0%	$0	0.0%
Coldspring (T)	448	$313,395,045	27	6.0%	$15,077,701	4.8%
Conewango (T)	1,019	$1,141,077,674	71	7.0%	$38,697,551	3.4%
Dayton (T)	700	$591,736,768	21	3.0%	$19,492,032	3.3%
Delevan (V)	285	$348,026,561	9	3.2%	$5,438,511	1.6%
East Otto (T)	597	$438,642,865	23	3.9%	$15,975,785	3.6%
Ellicottville (T)	1,649	$1,598,675,883	133	8.1%	$104,023,332	6.5%
Ellicottville (V)	496	$660,648,036	188	37.9%	$280,198,833	42.4%
Farmersville (T)	741	$419,542,828	44	5.9%	$44,407,480	10.6%
Franklinville (T)	970	$553,691,738	31	3.2%	$45,771,761	8.3%
Franklinville (V)	621	$634,263,362	20	3.2%	$22,241,520	3.5%
Freedom (T)	1,252	$986,939,932	49	3.9%	$27,791,127	2.8%
Gowanda (V)	672	$699,071,287	167	24.9%	$258,156,057	36.9%
Great Valley (T)	1,359	$906,431,658	134	9.9%	$103,642,680	11.4%
Hinsdale (T)	1,112	$667,353,019	53	4.8%	$36,681,838	5.5%
Humphrey (T)	483	$296,687,949	13	2.7%	$6,175,433	2.1%
Ischua (T)	521	$288,127,010	14	2.7%	$5,244,256	1.8%
Leon (T)	817	$915,671,381	36	4.4%	$53,782,617	5.9%
Little Valley (T)	452	$358,002,270	45	10.0%	$47,757,950	13.3%
Little Valley (V)	404	$561,442,185	14	3.5%	$30,613,433	5.5%
Lyndon (T)	545	$424,831,663	4	0.7%	$2,304,938	0.5%
Machias (T)	1,407	$880,491,464	10	0.7%	$7,663,360	0.9%
Mansfield (T)	778	$689,267,836	3	0.4%	$543,341	0.1%
Napoli (T)	725	$514,455,736	5	0.7%	$5,941,519	1.2%
New Albion (T)	671	$471,572,394	28	4.2%	$13,150,196	2.8%
Olean (C)	4,941	$7,169,192,523	116	2.3%	$91,104,716	1.3%
Olean (T)	1,018	$750,434,377	143	14.0%	$107,395,470	14.3%
Otto (T)	514	$376,418,830	16	3.1%	$7,838,958	2.1%
Perrysburg (T)	901	$642,404,678	11	1.2%	$9,060,799	1.4%
Persia (T)	315	$231,207,770	20	6.3%	$8,954,087	3.9%
Portville (T)	1,372	$1,044,666,295	254	18.5%	$168,683,735	16.1%

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Total (All Occupancies) 1-Percent Annual Chance Flood Event			
			Number of Buildings	% Total	RCV	% Total
Portville (V)	351	$346,884,521	1	0.3%	$304,629	0.1%
Randolph (T)	1,116	$1,284,336,162	38	3.4%	$34,913,564	2.7%
Red House (T)	329	$127,341,670	0	0.0%	$0	0.0%
Salamanca (C)	2,307	$4,706,213,138	85	3.7%	$75,127,829	1.6%
Salamanca (T)	304	$177,314,009	9	3.0%	$4,662,807	2.6%
South Dayton (V)	236	$244,313,568	1	0.4%	$620,934	0.3%
South Valley (T)	341	$138,238,926	11	3.2%	$4,619,251	3.3%
Yorkshire (T)	1,525	$1,259,882,782	2	0.1%	$1,248,016	0.1%
Cattaraugus County (Total)	**39,499**	**$38,504,630,718**	**2,210**	**5.6%**	**$2,046,067,226**	**5.3%**

Source: FEMA Q3 Data 1970/1980; Cattaraugus County Office of Real Property and GIS Services 2020; Microsoft 2018; RSMeans 2019
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
 # = Number; % = Percent; C = City; T = Town; V = Village

Table 5.4.1-13. Estimated General Building Stock Exposure to the 1-Percent Annual Chance Flood Event – Residential Occupancy Class

Jurisdiction	Total Number of Buildings (Residential Structures Only)	Total Replacement Cost Value (Residential Structures Only)	Residential 1-Percent Annual Chance Flood Event			
			Number of Buildings	% Total	RCV	% Total
Allegany (T)	2,114	$1,251,852,349	131	6.2%	$76,675,809	6.1%
Allegany (V)	548	$385,126,926	63	11.5%	$37,116,850	9.6%
Ashford (T)	938	$580,312,610	37	3.9%	$20,368,746	3.5%
Carrollton (T)	569	$278,798,788	33	5.8%	$18,607,119	6.7%
Cattaraugus (V)	357	$269,334,678	0	0.0%	$0	0.0%
Coldspring (T)	377	$201,593,626	22	5.8%	$10,741,454	5.3%
Conewango (T)	559	$373,300,573	55	9.8%	$19,629,704	5.3%
Dayton (T)	541	$323,777,479	16	3.0%	$13,559,316	4.2%
Delevan (V)	258	$185,651,231	7	2.7%	$4,926,717	2.7%
East Otto (T)	500	$296,853,039	19	3.8%	$10,302,482	3.5%
Ellicottville (T)	1,536	$1,330,557,124	127	8.3%	$89,698,948	6.7%
Ellicottville (V)	416	$358,268,226	158	38.0%	$165,866,536	46.3%
Farmersville (T)	663	$331,520,490	32	4.8%	$20,737,694	6.3%
Franklinville (T)	817	$415,780,763	22	2.7%	$9,717,640	2.3%
Franklinville (V)	539	$341,163,222	12	2.2%	$6,663,477	2.0%
Freedom (T)	1,037	$545,240,210	44	4.2%	$20,511,755	3.8%
Gowanda (V)	578	$466,963,000	136	23.5%	$175,454,703	37.6%
Great Valley (T)	1,200	$606,095,321	113	9.4%	$50,182,343	8.3%
Hinsdale (T)	1,016	$463,051,629	43	4.2%	$19,103,512	4.1%

Jurisdiction	Total Number of Buildings (Residential Structures Only)	Total Replacement Cost Value (Residential Structures Only)	Residential 1-Percent Annual Chance Flood Event Number of Buildings	% Total	RCV	% Total
Humphrey (T)	438	$210,568,911	13	3.0%	$6,175,433	2.9%
Ischua (T)	502	$250,640,964	12	2.4%	$4,249,031	1.7%
Leon (T)	414	$256,704,839	19	4.6%	$10,412,392	4.1%
Little Valley (T)	343	$173,403,791	23	6.7%	$11,029,918	6.4%
Little Valley (V)	324	$244,673,299	6	1.9%	$4,878,871	2.0%
Lyndon (T)	493	$239,431,218	3	0.6%	$1,693,349	0.7%
Machias (T)	1,230	$654,473,293	8	0.7%	$4,683,484	0.7%
Mansfield (T)	667	$470,928,781	2	0.3%	$295,302	0.1%
Napoli (T)	586	$334,948,805	3	0.5%	$3,952,287	1.2%
New Albion (T)	553	$307,813,917	28	5.1%	$13,150,196	4.3%
Olean (C)	4,345	$3,154,873,915	104	2.4%	$68,055,840	2.2%
Olean (T)	927	$518,859,247	115	12.4%	$69,919,367	13.5%
Otto (T)	418	$232,825,434	13	3.1%	$4,537,424	1.9%
Perrysburg (T)	768	$455,743,857	10	1.3%	$6,545,515	1.4%
Persia (T)	243	$131,831,342	19	7.8%	$8,760,272	6.6%
Portville (T)	1,248	$644,831,234	225	18.0%	$109,392,324	17.0%
Portville (V)	307	$223,104,996	1	0.3%	$304,629	0.1%
Randolph (T)	876	$591,202,760	31	3.5%	$26,625,084	4.5%
Red House (T)	13	$8,827,824	0	0.0%	$0	0.0%
Salamanca (C)	2,085	$1,725,400,859	82	3.9%	$70,799,478	4.1%
Salamanca (T)	277	$141,769,820	9	3.2%	$4,662,807	3.3%
South Dayton (V)	191	$127,262,911	1	0.5%	$620,934	0.5%
South Valley (T)	289	$114,993,664	7	2.4%	$2,722,984	2.4%
Yorkshire (T)	1,323	$650,203,894	2	0.2%	$1,248,016	0.2%
Cattaraugus County (Total)	**33,423**	**$20,870,560,854**	**1,806**	**5.4%**	**$1,204,579,741**	**5.8%**

Source: FEMA Q3 Data 1970/1980; Cattaraugus County Office of Real Property and GIS Services 2020; Cattaraugus County GIS 2020; Microsoft 2018; RSMeans 2019
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
 # = Number; % = Percent; C = City; T = Town; V = Village

Table 5.4.1-14. Estimated General Building Stock Exposure to the 1-Percent Annual Chance Flood Event – Commercial Occupancy Class

Jurisdiction	Total Number of Buildings (Commercial Buildings Only)	Total Replacement Cost Value (Commercial Buildings Only)	Commercial 1-Percent Annual Chance Flood Event Number of Buildings	% Total	RCV	% Total
Allegany (T)	183	$425,724,094	31	16.9%	$56,457,118	13.3%

Jurisdiction	Total Number of Buildings (Commercial Buildings Only)	Total Replacement Cost Value (Commercial Buildings Only)	Commercial 1-Percent Annual Chance Flood Event			
			Number of Buildings	% Total	RCV	% Total
Allegany (V)	83	$246,524,769	23	27.7%	$40,725,070	16.5%
Ashford (T)	44	$73,854,470	0	0.0%	$0	0.0%
Carrollton (T)	41	$45,881,587	12	29.3%	$17,502,941	38.1%
Cattaraugus (V)	32	$77,589,823	0	0.0%	$0	0.0%
Coldspring (T)	18	$39,338,860	1	5.6%	$481,702	1.2%
Conewango (T)	25	$17,925,954	1	4.0%	$502,482	2.8%
Dayton (T)	21	$15,775,797	3	14.3%	$4,362,163	27.7%
Delevan (V)	20	$145,411,292	2	10.0%	$511,794	0.4%
East Otto (T)	13	$15,403,241	2	15.4%	$4,014,242	26.1%
Ellicottville (T)	68	$176,688,861	5	7.4%	$12,639,782	7.2%
Ellicottville (V)	63	$193,882,180	26	41.3%	$84,751,743	43.7%
Farmersville (T)	35	$38,855,018	12	34.3%	$23,669,786	60.9%
Franklinville (T)	102	$70,954,245	4	3.9%	$30,183,459	42.5%
Franklinville (V)	63	$134,102,019	5	7.9%	$5,781,451	4.3%
Freedom (T)	80	$115,492,509	2	2.5%	$3,092,442	2.7%
Gowanda (V)	76	$190,898,678	25	32.9%	$67,217,566	35.2%
Great Valley (T)	54	$98,812,675	10	18.5%	$13,371,593	13.5%
Hinsdale (T)	37	$35,154,107	9	24.3%	$6,243,203	17.8%
Humphrey (T)	2	$29,045,862	0	0.0%	$0	0.0%
Ischua (T)	9	$18,099,970	2	22.2%	$995,225	5.5%
Leon (T)	12	$21,710,939	0	0.0%	$0	0.0%
Little Valley (T)	56	$92,045,562	12	21.4%	$19,779,371	21.5%
Little Valley (V)	71	$241,552,588	7	9.9%	$15,077,747	6.2%
Lyndon (T)	14	$12,431,740	0	0.0%	$0	0.0%
Machias (T)	124	$146,091,413	2	1.6%	$2,979,877	2.0%
Mansfield (T)	19	$19,663,323	1	5.3%	$248,039	1.3%
Napoli (T)	28	$12,884,369	0	0.0%	$0	0.0%
New Albion (T)	35	$39,897,476	0	0.0%	$0	0.0%
Olean (C)	468	$2,732,211,574	12	2.6%	$23,048,876	0.8%
Olean (T)	74	$121,525,428	27	36.5%	$37,207,246	30.6%
Otto (T)	7	$9,971,379	0	0.0%	$0	0.0%
Perrysburg (T)	28	$37,150,526	1	3.6%	$2,515,283	6.8%
Persia (T)	6	$4,036,395	1	16.7%	$193,815	4.8%
Portville (T)	88	$256,384,183	26	29.5%	$54,390,717	21.2%
Portville (V)	34	$79,751,622	0	0.0%	$0	0.0%

Jurisdiction	Total Number of Buildings (Commercial Buildings Only)	Total Replacement Cost Value (Commercial Buildings Only)	Commercial 1-Percent Annual Chance Flood Event			
			Number of Buildings	% Total	RCV	% Total
Randolph (T)	81	$158,657,874	6	7.4%	$6,574,245	4.1%
Red House (T)	28	$18,827,495	0	0.0%	$0	0.0%
Salamanca (C)	169	$2,594,562,887	2	1.2%	$3,766,291	0.1%
Salamanca (T)	14	$18,117,763	0	0.0%	$0	0.0%
South Dayton (V)	34	$49,294,213	0	0.0%	$0	0.0%
South Valley (T)	50	$22,823,505	4	8.0%	$1,896,267	8.3%
Yorkshire (T)	111	$135,427,204	0	0.0%	$0	0.0%
Cattaraugus County (Total)	**2,620**	**$9,030,435,466**	**276**	**10.5%**	**$540,181,535**	**6.0%**

Source: FEMA Q3 Data 1970/1980; Cattaraugus County Office of Real Property and GIS Services 2020; Cattaraugus County GIS 2020; Microsoft 2018; RSMeans 2019
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
 # = Number; % = Percent; C = City; T = Town; V = Village

Furthermore, HAZUS-MH v4.2 estimates approximately $193.7 million in building and content damage as a result of the 1-percent annual chance flood event (or 0.6 percent of the total building stock replacement cost value). Of the $193.7 million in potential loss, approximately $126.4 million is estimated to occur to residential structures. Table 5.4.1-15 summarizes the potential losses from the 1-percent annual chance flood event for all occupancies estimated by jurisdiction. Table 5.4.1-16 and Table 5.4.1-17 summarize HAZUS-MH v4.2 estimated damages for residential and commercial occupancy classes, respectively.

Table 5.4.1-15. Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event – All Occupancies

Jurisdiction	Total Replacement Cost Value (RCV)	All Occupancies 1-Percent Annual Chance Flood Event	
		Estimated Loss (RCV)	% of Total
Allegany (T)	$1,995,224,472	$22,900,918	1.1%
Allegany (V)	$754,717,827	$4,446,809	0.6%
Ashford (T)	$922,022,498	$4,265,797	0.5%
Carrollton (T)	$348,432,403	$3,229,472	0.9%
Cattaraugus (V)	$625,337,729	$0	0.0%
Coldspring (T)	$313,395,045	$1,385,419	0.4%
Conewango (T)	$1,141,077,674	$1,050,079	0.1%
Dayton (T)	$591,736,768	$1,413,508	0.2%
Delevan (V)	$348,026,561	$760,440	0.2%
East Otto (T)	$438,642,865	$2,011,735	0.5%
Ellicottville (T)	$1,598,675,883	$11,869,760	0.7%
Ellicottville (V)	$660,648,036	$12,683,702	1.9%
Farmersville (T)	$419,542,828	$394,993	0.1%
Franklinville (T)	$553,691,738	$12,294,133	2.2%

Jurisdiction	Total Replacement Cost Value (RCV)	All Occupancies 1-Percent Annual Chance Flood Event	
		Estimated Loss (RCV)	% of Total
Franklinville (V)	$634,263,362	$1,068,874	0.2%
Freedom (T)	$986,939,932	$2,413,966	0.2%
Gowanda (V)	$699,071,287	$12,815,154	1.8%
Great Valley (T)	$906,431,658	$13,472,902	1.5%
Hinsdale (T)	$667,353,019	$1,249,308	0.2%
Humphrey (T)	$296,687,949	$580,006	0.2%
Ischua (T)	$288,127,010	$908,551	0.3%
Leon (T)	$915,671,381	$824,694	0.1%
Little Valley (T)	$358,002,270	$5,142,520	1.4%
Little Valley (V)	$561,442,185	$1,979,030	0.4%
Lyndon (T)	$424,831,663	$0	0.0%
Machias (T)	$880,491,464	$605,625	0.1%
Mansfield (T)	$689,267,836	$11,284	0.0%
Napoli (T)	$514,455,736	$19,854	0.0%
New Albion (T)	$471,572,394	$2,428,527	0.5%
Olean (C)	$7,169,192,523	$14,259,197	0.2%
Olean (T)	$750,434,377	$7,907,073	1.1%
Otto (T)	$376,418,830	$2,810,257	0.7%
Perrysburg (T)	$642,404,678	$456,455	0.1%
Persia (T)	$231,207,770	$822,890	0.4%
Portville (T)	$1,044,666,295	$34,597,265	3.3%
Portville (V)	$346,884,521	$0	0.0%
Randolph (T)	$1,284,336,162	$891,397	0.1%
Red House (T)	$127,341,670	$0	0.0%
Salamanca (C)	$4,706,213,138	$7,959,950	0.2%
Salamanca (T)	$177,314,009	$322,869	0.2%
South Dayton (V)	$244,313,568	$0	0.0%
South Valley (T)	$138,238,926	$1,368,474	1.0%
Yorkshire (T)	$1,259,882,782	$60,236	0.0%
Cattaraugus County (Total)	**$38,504,630,718**	**$193,683,125**	**0.5%**

Source: HAZUS v4.2; FEMA Q3 Data 1970/1980; Cattaraugus County Office of Real Property and GIS Services 2020; Cattaraugus County GIS 2020; Microsoft 2018; RSMeans 2019

Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.

 # = Number; % = Percent; C = City; T = Town; V = Village

Table 5.4.1-16. Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event – Residential Occupancy Class

Jurisdiction	Total Replacement Cost Value (Residential Only)	Residential Losses Only 1-Percent Annual Chance Flood Event	
		Estimated Loss (RCV)	% of Total
Allegany (T)	$1,251,852,349	$13,035,632	1.0%
Allegany (V)	$385,126,926	$3,965,406	1.0%
Ashford (T)	$580,312,610	$3,747,025	0.6%
Carrollton (T)	$278,798,788	$0	0.0%
Cattaraugus (V)	$269,334,678	$2,355,807	0.9%
Coldspring (T)	$201,593,626	$523,050	0.3%
Conewango (T)	$373,300,573	$1,043,822	0.3%
Dayton (T)	$323,777,479	$1,413,301	0.4%
Delevan (V)	$185,651,231	$757,985	0.4%
East Otto (T)	$296,853,039	$1,984,082	0.7%
Ellicottville (T)	$1,330,557,124	$10,693,861	0.8%
Ellicottville (V)	$358,268,226	$6,095,022	1.7%
Farmersville (T)	$331,520,490	$291,975	0.1%
Franklinville (T)	$415,780,763	$560,492	0.1%
Franklinville (V)	$341,163,222	$211,983	0.1%
Freedom (T)	$545,240,210	$2,413,966	0.4%
Gowanda (V)	$466,963,000	$7,629,406	1.6%
Great Valley (T)	$606,095,321	$4,283,855	0.7%
Hinsdale (T)	$463,051,629	$482,266	0.1%
Humphrey (T)	$210,568,911	$580,006	0.3%
Ischua (T)	$250,640,964	$908,551	0.4%
Leon (T)	$256,704,839	$824,694	0.3%
Little Valley (T)	$173,403,791	$615,037	0.4%
Little Valley (V)	$244,673,299	$278,050	0.1%
Lyndon (T)	$239,431,218	$0	0.0%
Machias (T)	$654,473,293	$605,625	0.1%
Mansfield (T)	$470,928,781	$0	0.0%
Napoli (T)	$334,948,805	$19,854	0.0%
New Albion (T)	$307,813,917	$2,428,527	0.8%
Olean (C)	$3,154,873,915	$12,648,674	0.4%
Olean (T)	$518,859,247	$7,697,624	1.5%
Otto (T)	$232,825,434	$215,261	0.1%
Perrysburg (T)	$455,743,857	$456,455	0.1%
Persia (T)	$131,831,342	$819,130	0.6%
Portville (T)	$644,831,234	$26,956,444	4.2%

Jurisdiction	Total Replacement Cost Value (Residential Only)	Residential Losses Only 1-Percent Annual Chance Flood Event	
		Estimated Loss (RCV)	% of Total
Portville (V)	$223,104,996	$0	0.0%
Randolph (T)	$591,202,760	$890,380	0.2%
Red House (T)	$8,827,824	$0	0.0%
Salamanca (C)	$1,725,400,859	$7,951,326	0.5%
Salamanca (T)	$141,769,820	$322,869	0.2%
South Dayton (V)	$127,262,911	$0	0.0%
South Valley (T)	$114,993,664	$655,932	0.6%
Yorkshire (T)	$650,203,894	$60,236	0.0%
Cattaraugus County (Total)	**$20,870,560,854**	**$126,423,610**	**0.6%**

Source: HAZUS v4.2; FEMA Q3 Data 1970/1980; Cattaraugus County Office of Real Property and GIS Services 2020; Cattaraugus County GIS 2020; Microsoft 2018; RSMeans 2019
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
 # = Number; % = Percent; C = City; T = Town; V = Village

Table 5.4.1-17. Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event – Commercial Occupancy Class

Jurisdiction	Total Replacement Cost Value (Commercial Only)	Commercial Losses Only 1-Percent Annual Chance Flood Event	
		Estimated Loss (RCV)	% of Total
Allegany (T)	$425,724,094	$8,861,501	2.1%
Allegany (V)	$246,524,769	$481,402	0.2%
Ashford (T)	$73,854,470	$0	0.0%
Carrollton (T)	$45,881,587	$0	0.0%
Cattaraugus (V)	$77,589,823	$861,933	1.1%
Coldspring (T)	$39,338,860	$0	0.0%
Conewango (T)	$17,925,954	$6,256	0.0%
Dayton (T)	$15,775,797	$207	0.0%
Delevan (V)	$145,411,292	$2,455	0.0%
East Otto (T)	$15,403,241	$27,653	0.2%
Ellicottville (T)	$176,688,861	$1,172,838	0.7%
Ellicottville (V)	$193,882,180	$6,584,068	3.4%
Farmersville (T)	$38,855,018	$103,019	0.3%
Franklinville (T)	$70,954,245	$10,222,190	14.4%
Franklinville (V)	$134,102,019	$11,373	0.0%
Freedom (T)	$115,492,509	$0	0.0%
Gowanda (V)	$190,898,678	$3,825,366	2.0%
Great Valley (T)	$98,812,675	$112,503	0.1%
Hinsdale (T)	$35,154,107	$653,013	1.9%
Humphrey (T)	$29,045,862	$0	0.0%

Jurisdiction	Total Replacement Cost Value (Commercial Only)	Commercial Losses Only 1-Percent Annual Chance Flood Event Estimated Loss (RCV)	% of Total
Ischua (T)	$18,099,970	$0	0.0%
Leon (T)	$21,710,939	$0	0.0%
Little Valley (T)	$92,045,562	$4,127,058	4.5%
Little Valley (V)	$241,552,588	$1,700,981	0.7%
Lyndon (T)	$12,431,740	$0	0.0%
Machias (T)	$146,091,413	$0	0.0%
Mansfield (T)	$19,663,323	$11,284	0.1%
Napoli (T)	$12,884,369	$0	0.0%
New Albion (T)	$39,897,476	$0	0.0%
Olean (C)	$2,732,211,574	$1,610,523	0.1%
Olean (T)	$121,525,428	$209,449	0.2%
Otto (T)	$9,971,379	$0	0.0%
Perrysburg (T)	$37,150,526	$0	0.0%
Persia (T)	$4,036,395	$3,760	0.1%
Portville (T)	$256,384,183	$6,602,011	2.6%
Portville (V)	$79,751,622	$0	0.0%
Randolph (T)	$158,657,874	$1,017	0.0%
Red House (T)	$18,827,495	$0	0.0%
Salamanca (C)	$2,594,562,887	$7,515	0.0%
Salamanca (T)	$18,117,763	$0	0.0%
South Dayton (V)	$49,294,213	$0	0.0%
South Valley (T)	$22,823,505	$712,543	3.1%
Yorkshire (T)	$135,427,204	$0	0.0%
Cattaraugus County (Total)	**$9,030,435,466**	**$47,911,917**	**0.5%**

Source: HAZUS v4.2; FEMA Q3 Data 1970/1980; Cattaraugus County Office of Real Property and GIS Services 2020; Cattaraugus County GIS 2020; Microsoft 2018; RSMeans 2019
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
 # = Number; % = Percent; C = City; T = Town; V = Village

NFIP Statistics

FEMA Region 2 provided a list of NFIP policies, past claims, and repetitive loss properties (RL) in Cattaraugus 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 5.4.1-18 summarizes the NFIP policies, claims and repetitive loss statistics for Cattaraugus County. Note that specific locations of repetitive loss properties were not made available for this plan.

Table 5.4.1-18. Repetitive Loss Properties and NFIP Data for Cattaraugus County

Jurisdiction	Number of Repetitive Loss Properties	Number of Policies	Number of Claims	Total Losses Claimed
Allegany (T)	1	55	21	$67,137
Allegany (V)	8	38	27	$179,738
Ashford (T)	0	8	14	$37,852
Carrollton (T)	0	6	2	$0
Cattaraugus (V)	2	0	23	$33,394
Cold Spring (T)	2	2	9	$47,276
Conewango (T)	0	0	6	$5,571
Dayton (T)	0	3	1	$541
Delevan (V)	0	2	0	$0
East Otto (T)	8	2	25	$305,874
East Randolph (V)	3	2	4	$15,690
Ellicottville (T)	0	36	6	$43,067
Ellicottville (V)	0	37	22	$108,202
Farmersville (T)	0	3	2	$16,410
Franklinville (T)	0	3	2	$11,319
Franklinville (V)	0	5	1	$7,187
Freedom (T)	3	7	4	$81,006
Gowanda (V)	46	80	135	$2,332,781
Great Valley (T)	4	26	18	$119,521
Hinsdale (T)	0	10	7	$9,876
Humphrey (T)	0	1	0	$0
Ischua (T)	0	2	1	$41,951
Leon (T)	0	0	0	$0
Limestone (V)	0	5	1	$2,519
Little Valley (T)	0	10	0	$0
Little Valley (V)	0	2	1	$75
Lyndon (T)	0	1	0	$0
Machias (T)	0	1	0	$0
Mansfield (T)	0	1	2	$5,074
Napoli (T)	0	1	2	$43,720
New Albion (T)	2	2	4	$13,989
Olean (C)	0	68	29	$214,595
Olean (T)	4	30	25	$329,532
Otto (T)	0	0	0	$0
Perrysburg (T)	0	1	3	$2,234
Persia (T)	0	1	0	$0
Portville (T)	20	66	87	$568,118
Portville (V)	1	22	15	$530,647

Jurisdiction	Number of Repetitive Loss Properties	Number of Policies	Number of Claims	Total Losses Claimed
Randolph (T)	0	0	1	$261
Randolph (V)	0	2	5	$6,611
Red House (T)	0	0	0	$0
Salamanca (C)	0	12	6	$2,273
Salamanca (T)	0	4	2	$6,554
South Dayton (V)	0	1	0	$0
South Valley (T)	0	0	1	$127
Yorkshire (T)	2	1	3	$12,839
Cattaraugus County (Total)	**106**	**559**	**517**	**$5,203,561**

Source: FEMA Region 2, 2020
Note: NFIP = National Flood Insurance Program, V = Village, T = Town, C = City

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 flood hazard area. To estimate exposure for developed residential and non-residential land use types to the 1-percent flood hazard area, the floodplain boundary was overlaid upon land use data. Table 5.4.1-19 provides a complete summary of this analysis.

Table 5.4.1-19. Developed Residential and Non-Residential Land Use Exposed to 1-Percent Annual Chance Flood Event Hazard Area

Land Use Type	Total Acres for County	Land Use Type Exposure to 1-Percent Annual Chance Flood Event	
		Acres	% of Total
Residential Land	9,712	931	9.6%
Non-Residential Land	828,720	36,867	4.4%
Cattaraugus County (Total)	**838,432**	**37,798**	**4.5%**

Source: FEMA Q3 Data 1970/1980; Cattaraugus County GIS 2020; National Land Cover Database (NLCD) 2016
Note: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county. Land use areas do not include areas of water. Non-residential area = Agriculture; Barren; Developed – Open Space; Forest; Wetlands; This analysis does not incorporate areas delineated as water. Residential area = Developed – low intensity, developed – medium intensity and Developed – high intensity.
% = Percent; C = City; T = Town; V = Village

Impact on Critical Facilities

It is important to determine the critical facilities and infrastructure that may be at risk to flooding, and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to reach vulnerable populations or to make repairs.

Critical facility exposure to the 1-percent annual chance flood hazard event boundary was examined. In addition, HAZUS-MH v4.2 was used to estimate the flood loss potential to critical facilities located in the FEMA mapped floodplains. HAZUS-MH v4.2 results can be found in Volume II, Jurisdiction Annexes. Table 5.4.1-20 summarizes the number of critical facilities exposed to the 1-percent flood inundation areas by jurisdiction.

Table 5.4.1-21 summarizes the distribution of critical facilities in the 1-percent annual chance flood event boundary. Of the 232 critical facilities located in the 1-percent annual chance flood event boundary, 197 are considered lifelines for the county (Table 5.4.1-22). Section 4, County Profile, for more information about the critical facilities and lifelines in Cattaraugus County.

Table 5.4.1-20. Number of Critical Facilities Located in the 1-Percent Annual Chance Flood Hazard Area

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to 1-Percent Annual Chance Flood Event			
			Critical Facilities	% of Total Critical Facilities	Lifelines	% of Total Lifelines
Allegany (T)	54	28	14	25.9%	9	32.1%
Allegany (V)	17	10	6	35.3%	5	50.0%
Ashford (T)	41	30	7	17.1%	7	23.3%
Carrollton (T)	43	15	4	9.3%	2	13.3%
Cattaraugus (V)	21	12	1	4.8%	1	8.3%
Coldspring (T)	16	13	5	31.3%	4	30.8%
Conewango (T)	28	24	10	35.7%	9	37.5%
Dayton (T)	23	14	6	26.1%	4	28.6%
Delevan (V)	17	8	3	17.6%	3	37.5%
East Otto (T)	24	17	3	12.5%	3	17.6%
Ellicottville (T)	22	17	7	31.8%	6	35.3%
Ellicottville (V)	17	11	5	29.4%	4	36.4%
Farmersville (T)	19	14	5	26.3%	5	35.7%
Franklinville (T)	21	18	11	52.4%	10	55.6%
Franklinville (V)	27	16	3	11.1%	2	12.5%
Freedom (T)	35	26	16	45.7%	15	57.7%
Gowanda (V)	28	20	8	28.6%	1	5.0%
Great Valley (T)	26	19	6	23.1%	5	26.3%
Hinsdale (T)	37	25	8	21.6%	8	32.0%
Humphrey (T)	16	13	9	56.3%	9	69.2%
Ischua (T)	18	15	4	22.2%	3	20.0%
Leon (T)	32	29	17	53.1%	17	58.6%
Little Valley (T)	12	10	6	50.0%	6	60.0%
Little Valley (V)	26	19	5	19.2%	5	26.3%
Lyndon (T)	12	10	0	0.0%	0	0.0%
Machias (T)	28	17	5	17.9%	3	17.6%
Mansfield (T)	20	16	1	5.0%	1	6.3%
Napoli (T)	14	11	2	14.3%	2	18.2%
New Albion (T)	19	18	4	21.1%	4	22.2%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to 1-Percent Annual Chance Flood Event			
			Critical Facilities	% of Total Critical Facilities	Lifelines	% of Total Lifelines
Olean (C)	113	51	3	2.7%	2	3.9%
Olean (T)	33	22	4	12.1%	4	18.2%
Otto (T)	17	13	6	35.3%	6	46.2%
Perrysburg (T)	20	14	1	5.0%	0	0.0%
Persia (T)	7	6	3	42.9%	2	33.3%
Portville (T)	21	15	7	33.3%	5	33.3%
Portville (V)	19	10	0	0.0%	0	0.0%
Randolph (T)	47	36	12	25.5%	11	30.6%
Red House (T)	9	6	0	0.0%	0	0.0%
Salamanca (C)	64	37	8	12.5%	7	18.9%
Salamanca (T)	4	3	1	25.0%	1	33.3%
South Dayton (V)	17	7	1	5.9%	1	14.3%
South Valley (T)	8	7	2	25.0%	2	28.6%
Yorkshire (T)	34	23	3	8.8%	3	13.0%
Cattaraugus County (Total)	**1,126**	**745**	**232**	**20.6%**	**197**	**26.4%**

Source: HAZUS v4.2; FEMA Q3 Data 1970/1980; Cattaraugus County Office of Real Property and GIS Services 2020; Cattaraugus County GIS 2020
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
% = Percent; C = City; T = Town; V = Village

Table 5.4.1-21. Distribution of Critical Facilities in the 1-Percent Annual Chance Flood Event Floodplain by Type and Jurisdiction

Jurisdiction	Facility Types															
	Bridge	College/University	Dam	DPW	Electric/Power	EMS	Fire Station	Hazmat	Highway Barn	Library	Municipal Hall	Police	Polling Place	Potable Water	Religious	Wastewater
Allegany (T)	7	1	0	0	0	0	0	1	0	0	0	0	0	0	4	1
Allegany (V)	0	0	0	1	1	1	1	0	1	0	0	0	1	0	0	0
Ashford (T)	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carrollton (T)	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0
Cattaraugus (V)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coldspring (T)	3	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Conewango (T)	9	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Dayton (T)	3	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0

Jurisdiction	Facility Types															
	Bridge	College/University	Dam	DPW	Electric/Power	EMS	Fire Station	Hazmat	Highway Barn	Library	Municipal Hall	Police	Polling Place	Potable Water	Religious	Wastewater
Delevan (V)	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
East Otto (T)	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ellicottville (T)	5	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0
Ellicottville (V)	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Farmersville (T)	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Franklinville (T)	6	0	2	0	1	0	0	0	0	0	0	0	0	0	1	1
Franklinville (V)	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Freedom (T)	15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gowanda (V)	1	0	0	0	0	0	0	1	0	1	0	0	0	0	5	0
Great Valley (T)	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Hinsdale (T)	5	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0
Humphrey (T)	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ischua (T)	2	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Leon (T)	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Valley (T)	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Valley (V)	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lyndon (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machias (T)	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Mansfield (T)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Napoli (T)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Albion (T)	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Olean (C)	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0
Olean (T)	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Otto (T)	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Perrysburg (T)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Persia (T)	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Portville (T)	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Portville (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Randolph (T)	4	0	1	0	1	1	1	0	2	0	0	0	0	0	1	1
Red House (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salamanca (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	6
Salamanca (T)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
South Dayton (V)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Valley (T)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Jurisdiction	Bridge	College/University	Dam	DPW	Electric/Power	EMS	Fire Station	Hazmat	Highway Barn	Library	Municipal Hall	Police	Polling Place	Potable Water	Religious	Wastewater
	Facility Types															
Yorkshire (T)	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cattaraugus County (Total)	**152**	**1**	**9**	**1**	**9**	**3**	**2**	**6**	**7**	**2**	**3**	**1**	**6**	**3**	**18**	**9**

Source: FEMA Q3 Data 1970/1980; Cattaraugus County GIS 2020
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.
C = City; DPW = Department of Public Works; EMS = Emergency Management Services; T = Town; V = Village

Table 5.4.1-22. 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	10	0
Energy	94	9
Food, Water, Shelter	90	13
Health and Medical	50	3
Safety and Security	208	20
Transportation	293	152
Cattaraugus County (Total)	**745**	**197**

Source: FEMA Q3 Data 1970/1980; Cattaraugus County GIS 2020; FEMA 2020
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.

Furthermore, approximately 130 miles, or 5.2 percent, of major transportation routes are exposed to the 1-percent annual chance flood event boundary in the county (Figure 5.4.1-2 and Table 5.4.1-23). Additional transportation facilities, such as bridges, that become washed out or blocked by floods or debris may also cause isolation. This can be an issue for the commuter community that relies on these transportation routes to enter or leave the county after work.

Table 5.4.1-23. Number of Miles of Roadways Exposed to the 1-Percent Annual Chance Flood Event Boundary

Road Type	Total Miles for County	Exposure to 1-Percent Annual Chance Flood Event	
		Number of Miles	% of Total
Local and Private Roads	1,733	72	4.2%
County Roads	377	25	6.6%
State Routes	226	17	7.5%
US Highways	61	6	9.8%
Interstate	104	10	9.6%
Cattaraugus County (Total)	**2,502**	**130**	**5.2%**

Source: FEMA Q3 Data 1970/1980; Cattaraugus County GIS 2020
Notes: Flood hazard area is depicted by FEMA Q3 data from 1970/1980. These data do not replace any effective DFIRM data for the county.

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 5.4.1.2, Impact on General Building Stock, discusses direct impacts to buildings in Cattaraugus County.

Debris management may also be a large expense after a flood event. HAZUS-MH v4.2 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 5.4.1-24 summarizes the HAZUS-MH 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-MH v4.2 estimates that there will be 25,387 tons of debris generated during the 1-percent annual chance flood event in Cattaraugus County.

Table 5.4.1-24. Estimated Debris Generated from the 1-Percent Annual Chance Flood Event

Jurisdiction	Debris Created by 1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Allegany (T)	1,414	569	462	382
Allegany (V)	170	139	18	14
Ashford (T)	178	53	69	56
Carrollton (T)	219	128	53	39
Cattaraugus (V)	44	23	13	8
Coldspring (T)	42	19	13	10
Conewango (T)	138	76	34	28
Dayton (T)	124	83	23	19
Delevan (V)	438	148	167	123
East Otto (T)	493	112	211	170
Ellicottville (T)	505	244	148	113
Ellicottville (V)	225	195	13	18
Farmersville (T)	100	87	7	6
Franklinville (T)	653	221	244	188
Franklinville (V)	206	102	57	47
Freedom (T)	214	125	50	39
Gowanda (V)	1,033	582	187	264

Jurisdiction	Debris Created by 1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Great Valley (T)	618	312	163	143
Hinsdale (T)	985	365	341	280
Humphrey (T)	321	106	121	94
Ischua (T)	128	44	47	37
Leon (T)	176	121	31	23
Little Valley (T)	830	211	359	260
Little Valley (V)	28	24	3	2
Lyndon (T)	23	19	2	2
Machias (T)	152	79	42	30
Mansfield (T)	19	17	1	0
Napoli (T)	6	5	0	1
New Albion (T)	96	33	36	27
Olean (C)	3,694	897	1,465	1,332
Olean (T)	1,344	614	424	306
Otto (T)	161	45	66	51
Perrysburg (T)	10	5	3	2
Persia (T)	75	20	30	25
Portville (T)	5,072	1,561	1,954	1,557
Portville (V)	101	41	33	27
Randolph (T)	65	62	2	2
Red House (T)	0	0	0	0
Salamanca (C)	3,576	928	1,451	1,197
Salamanca (T)	149	60	50	38
South Dayton (V)	18	18	0	0
South Valley (T)	1,421	299	616	505
Yorkshire (T)	124	44	43	37
Cattaraugus County (Total)	**25,387**	**8,835**	**9,051**	**7,502**

Source: HAZUS-MH 4.2
Notes: V = Village, T = Town, C = City

Impact on the Environment

As Cattaraugus 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 Cattaraugus 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 76 percent of the county's total land area (NLCD 2016). Natural land areas from the 2016 land use type dataset includes areas of barren land, 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, 3.8 percent of the natural land area in the county is exposed to the 1-percent annual chance flood event boundary.

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 Section 5.4.2, Landslide, and Section 5.4.5, Utility Failure.

Future Changes That May Impact Vulnerability

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

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

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the county. Any areas of growth located in the 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 Cattaraugus County has decreased by approximately 5.3 percent between 2010 and 2018 (U.S. Census Bureau 2020). Estimated population projections provided by the 2017 Cornell Program on Applied Demographics indicate that the county's population will continue to decrease into 2040, reducing total population to approximately 63,500 persons (Cornell Program on Applied Demographics 2017). While less people will reside in the county, those that remain 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 2014 HMP

Since the 2014 analysis, population statistics have been updated using the 5-Year 2014-2018 American Community Survey Population Estimates (American Community Survey 2018). The general building stock was also updated using RSMeans 2019 building valuations that estimated replacement cost value for each building in the inventory. Updated 2018 building stock data downloaded from Microsoft were utilized to update the user-defined facility inventory and critical facility inventory dataset. Parcel information from the Cattaraugus tax assessor was used to update building attributes, such as year built, number of stories, basement type, property class, and square footage. In addition, 1970/1980 Q3 data from FEMA were referenced to assess the 1-percent annual chance flood extents. The updated building stock inventory and flood data were imported into HAZUS-MH v4.2 to complete a riverine analysis for the 100-year annual chance flood event.

Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2014 HMP. This information provides more accurate exposure and potential loss estimates for Cattaraugus County.