

## 2.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT

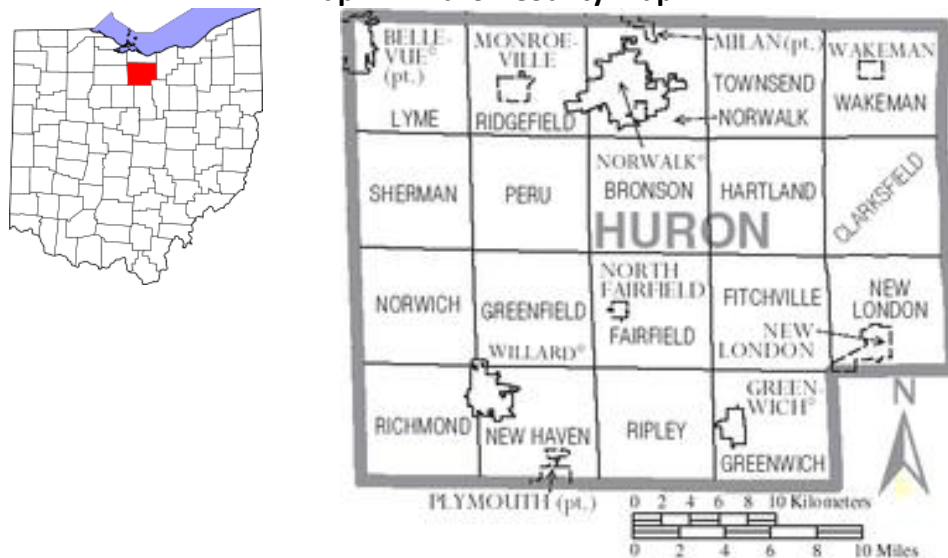
The Hazard Identification and Risk Assessment (HIRA) identifies the type and frequency of disasters that affect Huron County and the risk to people and property created by those hazards. The HIRA is addressed in four sections:

- County Profile: provides general information on Huron County and its jurisdictions.
- Hazard Identification: describes hazards that threaten Huron County and provides a brief history of significant past occurrences of each identified hazard.
- Vulnerability Assessment: discusses each jurisdiction's vulnerability to specific hazards.
- Risk Analysis: evaluates and ranks the hazards Huron County must address through mitigation efforts.

### 2.1 COUNTY PROFILE

Huron County is located in north central Ohio. This rural county has a land area of 493.1 square miles and a population of 58,439. The county is bordered by Erie, Lorain, Ashland, Richland, Crawford, Seneca, and Sandusky counties. The closest major city, Cleveland, is approximately 60 miles northeast of Huron County.

Map 2-1: Huron County Map



#### 2.1.1 Demographics

Huron County's population is 58,439 according to 2016 U.S. Census estimates. The county's population has remained relatively steady since 2000. By 2040, the population is expected to reduce by approximately 5%.

**Table 2-1: County Population Statistics**

Statistic	Figure
Population Density	119/sq. mile
Female Population	50.6%
Male Population	49.4%
Median Age	38.8 years
Population under 18	24.3%
Population over 65	16.8%
White	90.1%
Black or African American	1.4%
Hispanic or Latino	6.6%
Other	1.9%
Average Household Size	2.57 persons
Median Household Income	\$48,838
Persons in Poverty	12.2%

Huron County has 25,293 housing units. The owner-occupation rate is 70.7%; the median value of owner-occupied units is \$117,000. Multi-unit housing structures such as apartment buildings account for 18% of all housing units. There are approximately 1,739 mobile homes across the county. The median gross rent for all types of rental properties is \$630 per month while the median cost for homes with mortgages is \$1,109 per month.

Several special residential housing facilities, such as nursing homes and assisted living facilities, exist across the county. As of 2016, the types of facilities and statistics for each type are as follows:

**Table 2-2: Special Residential Facilities**

Facility	Facilities	Beds
Nursing Home Facilities	7	519
Residential Care Facilities	4	198

### 2.1.3 Incorporated Jurisdictions

Huron County has two cities and five villages. Several jurisdictions, as noted below, are partially located in Huron County. Because these jurisdictions are primarily located in an adjacent county, they are not addressed in this plan.

#### *Cities*

Approximately 40% of Huron County's population lives in one of the county's two cities. Norwalk is Huron County's largest jurisdiction and the county seat. The city was incorporated in 1881 but has served as the county seat since 1818. Norwalk is the center of commerce for the northern portion of Huron County. Many people travel to Norwalk for work, shopping, and other resources. The city is traversed by multiple busy highways, including U.S. Routes 20 and 250 and State Routes 13, 18, and 61.

Willard is located in the southwest section of Huron County. It is the second largest jurisdiction in the county and has been incorporated as a city since 1960. Willard is home to several key businesses, including a railyard for CSX Transportation, Midwest Industries, RR Donnelley, Pepperidge Farm, and Willard Mercy Hospital.

**Table 2-3: City Population and Demographics**

City	Population	Households	Median Income	Persons Below Poverty
Norwalk	16,824	6,708	\$41,316	17.2%
Willard	6,047	2,235	\$40,864	23.2%

The city of Bellevue is partially located in Huron County. For the purpose of hazard mitigation and other emergency plans, the city is considered part of Sandusky County.

#### *Villages*

Huron County has five incorporated villages, all of them small and rural. By definition, a village in Ohio has fewer than 5,000 residents.

**Table 2-4: Village Population and Demographics**

Village	Population	Households	Median Income	Persons Below Poverty
Greenwich	1,476	570	\$41,786	15.1%
Monroeville	1,400	528	\$51,667	8.1%
New London	2,461	960	\$41,683	23.5%
North Fairfield	560	182	\$54,500	7.6%
Wakeman	1,047	402	\$47,031	9.4%

The villages of Milan and Plymouth are partially located in Huron County. However, for the purposes of mitigation and other emergency management issues, these jurisdictions are considered part of Erie County (Milan) and Richland County (Plymouth).

#### **2.1.4 Unincorporated Areas**

The unincorporated areas of Huron County are divided into townships. In Ohio, townships are governed by an elected board of trustees. They meet monthly, at a minimum, and are responsible for the health, safety, and welfare of the township residents. Townships also have elected Fiscal Officers who manage the township's finances. Because townships are unincorporated, they are considered part of the county for the purpose of hazard mitigation planning and activities. Huron County has nineteen townships. Most of these jurisdictions are rural and have a relatively small population.

**Table 2-5: Township Population Statistics**

<b>Township</b>	<b>Population</b>
Bronson	1,973
Clarksfield	1,625
Fairfield	1,218
Fitchville	1,056
Greenfield	1,374
Greenwich	1,044
Hartland	1,112
Lyme	853
New Haven	2,621
New London	3,268
Norwalk	3,591
Norwich	1,070
Peru	1,105
Richmond	1,102
Ridgefield	2,329
Ripley	1,024
Sherman	510
Townsend	1,623
Wakeman	2,731

Townships in Huron County are rural; they fall under Huron County for the purpose of hazard mitigation planning and most grant administration. The elected township trustees and fiscal officers manage the business affairs of the township, which consist mostly of maintaining the roads, cemeteries, and critical facilities, and clearing debris from township ditches. Some townships have their own fire department while others are part of a fire district or shared service agreement with another department in the area. For law enforcement purposes, rural townships are covered by the Huron County Sheriff's Office.

#### *Unincorporated Communities and Neighborhoods*

Huron County has 29 unincorporated communities and four census-designated places. These small, informal neighborhoods are not organized municipalities nor do they have an official form of government. Instead, they function as part of the township in which they are located. In many instances, the locations have historical significance or were formerly incorporated but have ceased to have enough population to be considered a jurisdiction. Local residents generally still recognize the neighborhoods by their previous names.

**2.1.5 Institutions and Special Facilities**

Residents in Huron County have access to abundant educational and healthcare resources. These services contribute to the quality of life for residents and the successful development of Huron County’s economy.

*Education*

Families in Huron County have access to multiple educational opportunities. Students are served by eleven public school districts and several parochial schools.

**Table 2-6: Huron County Schools**

<b>Public School Districts</b>	<b>Private/Parochial Schools</b>
Bellevue City School District	Celeryville Christian School
Berlin-Milan Local School District	Norwalk Catholic Schools
Monroeville Local School District	St. Francis Xavier School
New London Local School District	St. Joseph Catholic School
Norwalk City School District	Trinity Christian Academy
Plymouth-Shiloh Local School District	
Seneca East Local School District	
South Central Local School District	
Wellington Exempted Village School District	
Western Reserve Local School District	
Willard City School District	

*Healthcare*

Throughout Huron County, residents have abundant access to healthcare services. Within Huron County, residents have access to comprehensive medical care at Fisher Titus Medical Center in Norwalk and Willard Mercy Hospital in Willard. Urgent care centers are also located in both cities, as well as multiple physician practices and specialty care centers. Just outside of the county, care is available at The Bellevue Hospital in Bellevue and Firelands Regional Medical Center in Sandusky.

**2.1.6 Infrastructure**

Infrastructure and related systems provide residents, workers, and visitors with access to critical services. This section describes the county’s road and rail infrastructure, airports, and utility systems.

*Transportation Systems*

Huron County has a strong highway system connecting the county to cities and regions across Ohio. This includes more than 447 miles of U.S. and state highways. The Huron County Engineer is responsible for maintaining and repairing 266 miles of county roads, 406 bridges, and 3,485 culverts.

**Table 2-7: Huron County Highways**

Interstates	U.S. Highways	State Highways	
None	20	4	162
	224	13	269
	250	18	303
		60	547
		61	598
		99	601
		103	603
		113	

*Rail*

Rail is another major transportation system in Huron County. Two major rail yards are located in the county. The Norfolk Southern Moorman Yard is located in Bellevue. Five major Norfolk Southern rail lines converge in this yard, distributing thousands of car loads of freight every day. The CSX facility in Willard was founded in 1827. This yard serves a rail network that spans 23 states, the District of Columbia, and two Canadian provinces.

The Wheeling and Lake Erie Railway operates a line running through Bellevue and Norwalk and another line through Greenwich and New London. Ashland Railway also operates several short line connections in the county.

*Airports*

Huron County has several small airports. These include the Huron County Airport, Willard Municipal Airport, and several private airstrips. These facilities provide service for small planes. The closest commercial passenger service is available in Cleveland and Akron.

*Utilities*

The majority of homes in Huron County, approximately 49.3%, are heated with natural gas. An additional 25.6% utilize electric heat. These utilities are provided by a variety of municipal and private entities. The Public Utilities Commission of Ohio regulates private companies that provide public utility services. These companies, along with municipal electric utilities, are identified in Table 2-15.

**Table 2-8: Huron County Utility Service Providers**

Electric Service	Natural Gas Service
AEP Ohio	Columbia Gas of Ohio
Firelands Electric	Consumers Gas Cooperative
Lorain-Medina Rural Electric	Village Energy Cooperative Association
North Central Electric	
Ohio Edison	
Village of Greenwich*	
Village of Monroeville*	
*Municipal Electric Utilities	

The remaining properties in the county are heated by other sources, including:

- Bottled, tank, or LP gas 15.0%
- Coal, coke or wood 6.1%
- Fuel oil, kerosene 2.4%
- Solar energy or other fuel 1.3%
- No fuel used 0.3%

### **2.1.7 Topography and Climate**

The terrain in Huron County is flat to slightly rolling, with steeper terrain in a few limited areas. Between the highest and lowest points, there is approximately 700 feet of difference. The county's highest point is approximately 1,348 feet above sea level. The lowest elevation is 633 feet above sea level.

#### *Soil Types*

Huron County is located mainly on till plains; only a small northwest section of the county is considered lake plains. The county is covered by glacial deposits ranging in thickness from two to 150 feet. These deposits are underlain by limestone, shale, and sandstone in various parts of the county. In the southwest part of the county, the area known as Willard Marsh features mucky soil that is prime for growing fresh market vegetable crops. For that reason, this area is sometimes referred to as the "Salad Bowl" of Ohio.

#### *Climate*

Like most of Ohio, Huron County experiences cold winters and hot summers. The average annual temperature is 50° F. July has an average high temperature of 82° F, making it the warmest month. January is generally the coldest month with an average low temperature of 19° F. Average rainfall is 37.92 inches per year. Average annual snowfall is 31 inches. June is typically the wettest month with average precipitation of 4.21 inches of rain. Huron County EMA collaborates with the National Weather Service (NWS) to provide weather information. There are five NWS weather stations located across Huron County. Huron County is also certified as a Storm Ready county.

### **2.1.8 Waterways and Watershed**

Huron County is part of four distinct watersheds as the county's water drains north to Lake Erie. The Huron River Watershed covers the bulk of the county, including all of Ridgefield, Norwalk, Sherman, Peru, Bronson, Fairfield, Greenfield, Norwich, and New Haven townships as well as part of Richmond, Ripley, Townsend, Hartland, Fitchville, and Lyme townships. The Vermilion River watershed covers much of Greenwich, Fitchville, New London, Hartland, Clarksfield, and Wakeman townships and part of Ripley and Townsend townships. The Sandusky River watershed covers a very small corner in the far northwest corner in Bellevue and Lyme Township and the Black River watershed covers a small section in New London and Clarksfield Townships on the eastern border with Lorain County.

Watershed in the rural areas of Huron County is facilitated in some areas by field drainage tiles, and in other areas by enhanced surface drainage. Some of the area is too hilly to install field drainage tiles. In the townships to the south and west, the terrain is rolling. Waterways flow through low-lying areas where small bridges and culverts are vulnerable to flooding when the water pools in areas alongside the ditches and streams. Much of this area is natural habitat, but some is farmed and crop losses are common. In the flatter areas to the east, such as (but not limited to) Bronson and Fairfield Townships, swales and French drains help farmers move standing water off their fields and into ditches and streams. Much of the soil is not well-drained and absorption takes a long, long time; when rain comes hard and heavy, the soils become saturated and surface runoff is excessive. Some rural roads have ditches along the roadway to provide a place for runoff and to keep the road clear of standing water while natural drainage takes place. It is not uncommon to see large areas of farmed fields standing full of water when rainfall reaches approximately 1.5 inches or more. This land then drains slowly, filling the small streams and ditches and carrying water to the rivers through the watershed.

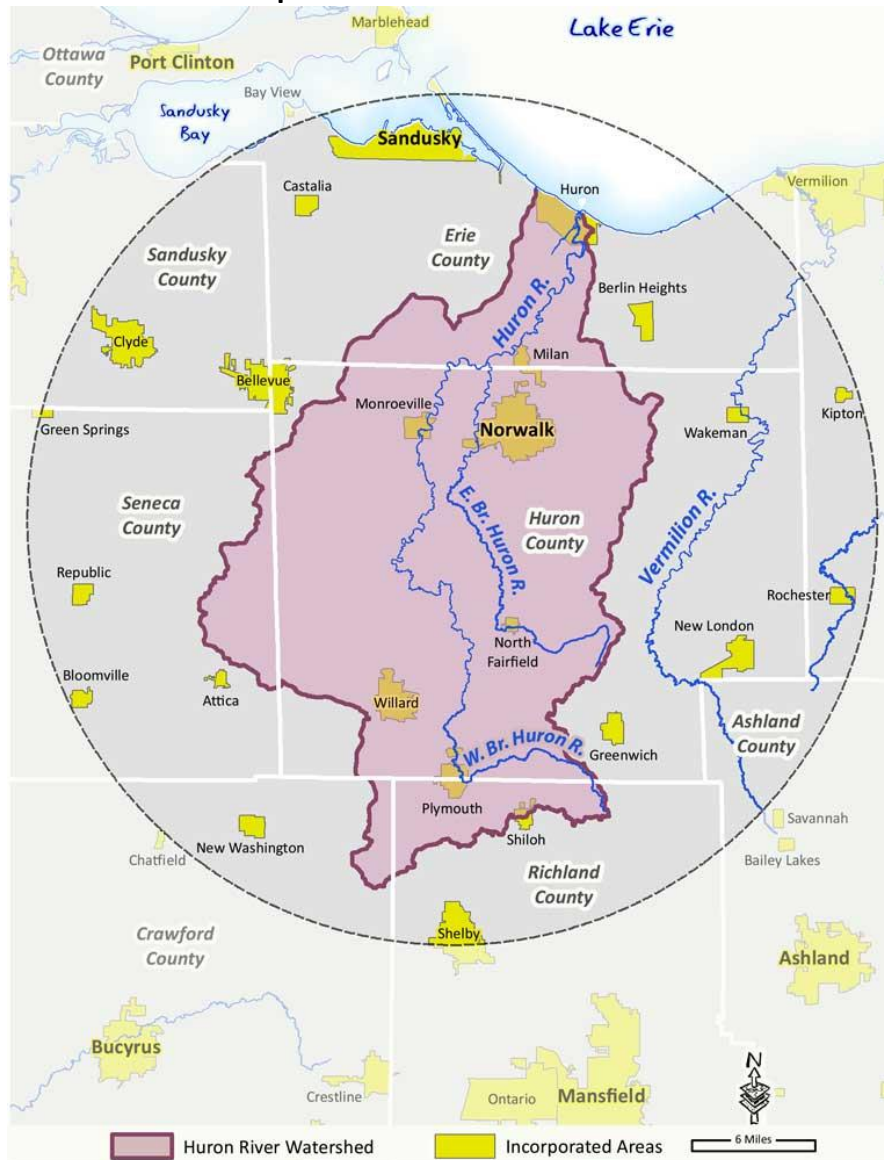
#### *Huron Vermilion Watershed*

While the Huron and Vermilion watersheds are distinct, they are closely connected and sometimes identified as a combined larger watershed, including in the most recent Discovery Report produced by FEMA. Collectively, these two watersheds encompass the majority of Huron County.

The Huron River begins as the West Branch of the Huron River that flows through New Haven, Ripley and Greenfield townships in the south part of the county and winds north and northwest into Monroeville as it flows towards Erie County. It is fed by Marsh Run, Walnut Creek, Seymour Creek, Mud Run, Slate Run, Frink Run, Haas Ditch, and Meggison Creek. The East Branch of the Huron River begins in Fairfield Township and flows north through North Fairfield and into Peru Township. Cole Creek joins the East Branch on the southwest side of Norwalk, adding drainage from most of Bronson Township to the East Branch of the Huron River. Norwalk Creek brings water from Hartland and Norwalk Townships through the center of the City of Norwalk, and then into the East Branch on the west side of the city where it then flows north into Erie County. The two branches of the Huron River join together just into Erie County, and flow north into Lake Erie in the City of Huron in Erie County.

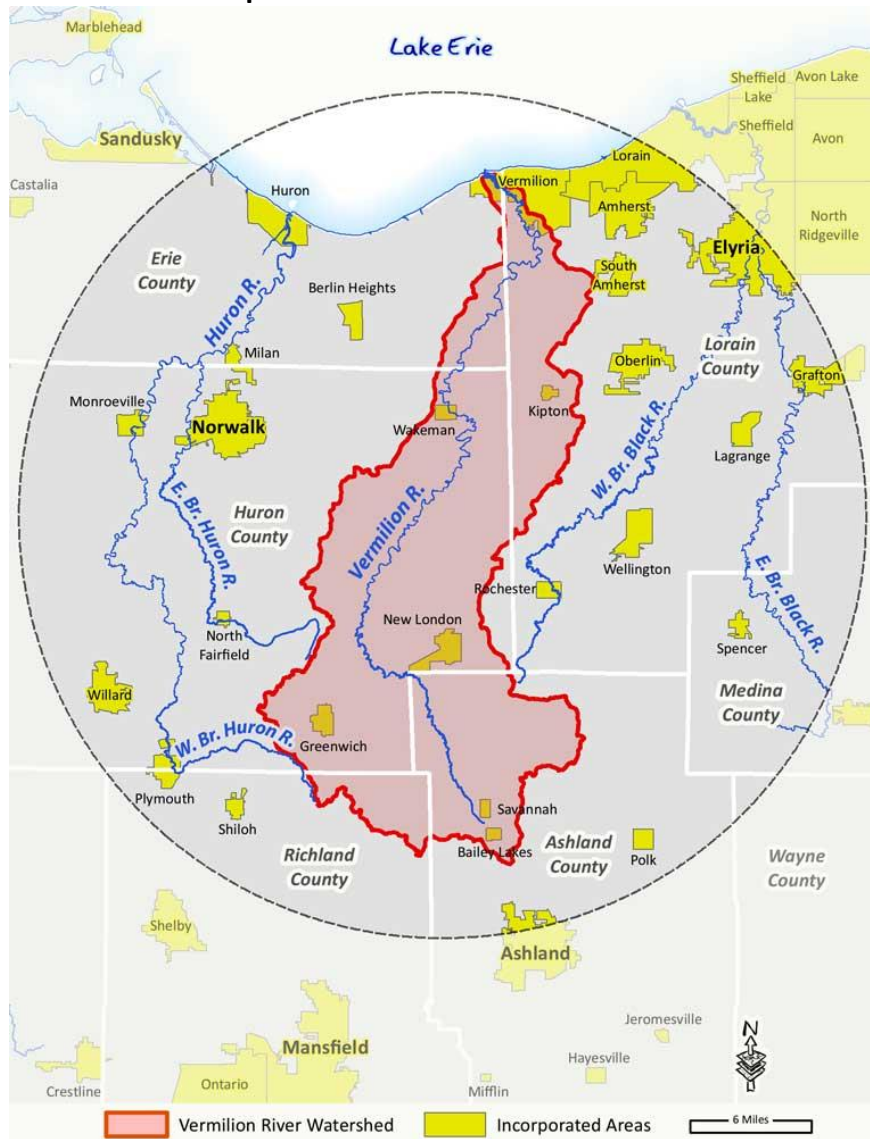


Map 2-2: Huron River Watershed



At its beginning, the Southwest Branch of the Vermilion River forms in Richland County to the south of Greenwich Township, and winds northeast through Fitchville, eventually joining the East Branch of the Vermilion River just south of Wakeman where it becomes the Vermilion River. The East Branch of the Vermilion River begins in Ashland County south of New London and winds north until it reaches Wakeman where it joins the other branch. These waterways and other smaller tributaries flow to the Vermilion River that then enters Lake Erie in the City of Vermilion in Erie County. Along this pathway, the Vermilion River Watershed includes Old Woman Creek and Chappel Creek in the north part of Huron County; Indian Creek in the central area; and Bonnie Creek on the southern end.

**Map 2-3: Vermilion River Watershed**

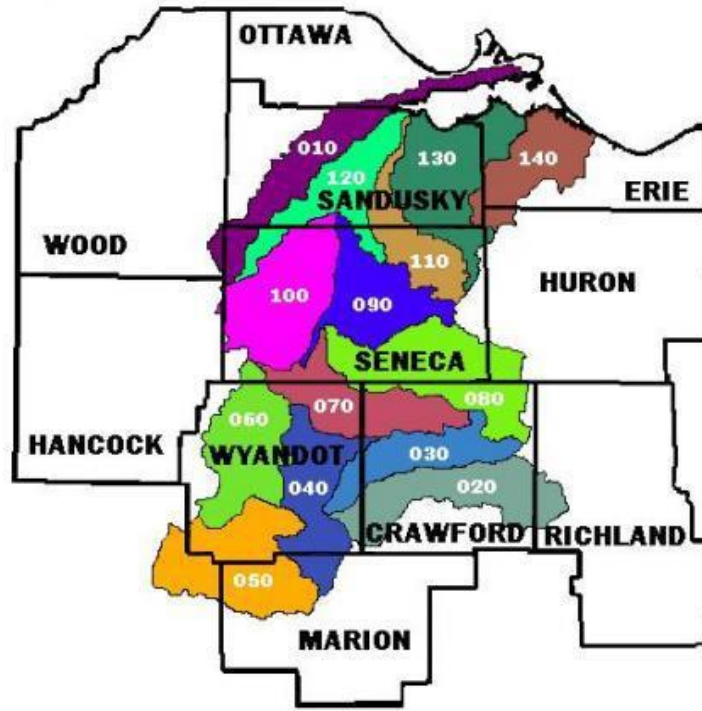


***Sandusky River Watershed***

The Sandusky River Watershed is fed by Honey Creek in the far southwest corner, and small tributaries in the remaining small area in Richmond and Lyme townships that is part of this watershed. The watershed moves to the west and northwest, and drains into the Sandusky River and the Sandusky Bay as water enters Lake Erie.

Map 2-4: Sandusky River Watershed

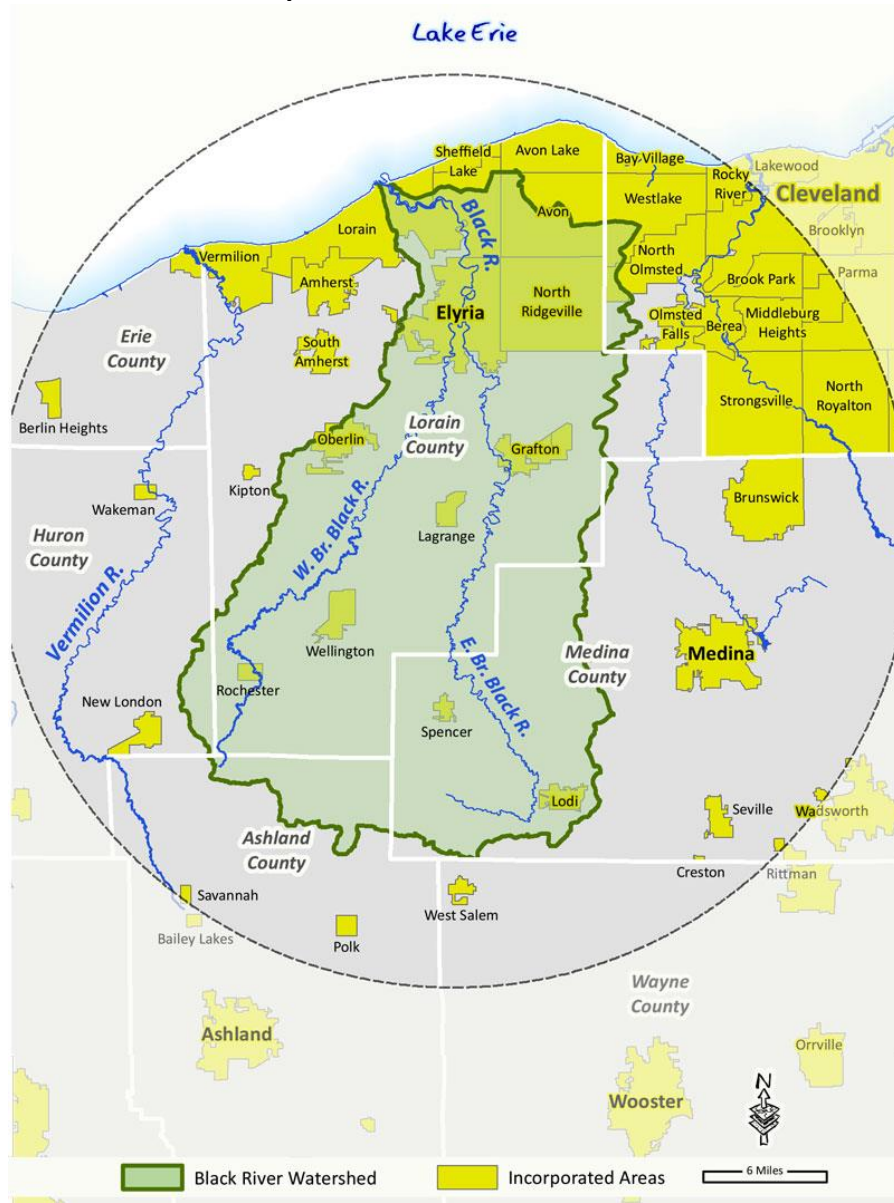
**THE SANDUSKY HYDROLOGICAL UNIT**



*Black River Watershed*

The Black River Watershed is fed by small tributaries and then East Creek that flow north and east to the Black River, and enter Lake Erie at the mouth of the Black River in Elyria.

**Map 2-5: Black River Watershed**



**2.1.9 Land Use**

Agriculture is the predominant land use in Huron County. Cultivated crops account for nearly 69% of all land use in the county. Countywide, there are 865 farms with an average size of 275 acres; farmland in the county totals 238,291 acres.

The forested areas, grassland, and wetlands in Huron County provide 1,845 acres of state parks, forests, nature preserves and wildlife areas.

**Table 2-9: Huron County Land Use**

Use Category	Percentage
Cultivated Crops	68.78%
Forest	16.83%
Developed, Lower Intensity	8.17%
Pasture/Hay	3.20%
Developed, Higher Intensity	1.07%
Open Water	0.81%
Wetlands	0.68%
Shrub/Scrub and Grasslands	0.27%
Barren (strip mines, gravel pits, etc.)	0.17%

**2.1.10 Regulation**

The Huron County Planning Commission is managed by the Huron County Soil and Water Conservation District. This office also provides floodplain management for the county. The planning commission is responsible for maintaining the county’s land use plan and developing and maintaining subdivision regulations.

Zoning regulations are enforced by each municipality and township. Zoning is in place in all cities and villages and the majority of townships, as indicated in table 2-10 below. Commercial building codes are enforced in Huron County as required by state law. Huron County contracts with the Richland County Building Department for all commercial code permit and enforcement services. Plumbing permits are issued through the state of Ohio.

**Table 2-10: Huron County Zoning Status**

Zoned		Not Zoned
Bronson Township	Norwalk	Fitchville Township
Clarksfield Township	Norwich Township	Hartland Township
Fairfield Township	Richmond Township	Norwalk Township
Greenfield Township	Ridgefield Township	Peru Township
Greenwich	Ripley Township	
Greenwich Township	Sherman Township	
Lyme Township	Townsend Township	
New Haven Township	Wakeman	
New London	Wakeman Township	
New London Township	Willard	
North Fairfield		

### 2.1.11 Economy and Development

Huron County has a generally diverse economy that includes a combination of agriculture, manufacturing, and service industries. Agriculture is Huron County's top industry. Manufacturing, primarily in the areas of food processing, automotive parts, plastics, construction materials, and outdoor power equipment, is also common. The county has a blend of large and small businesses across the rural landscape. Huron County also boasts a strong transportation system that supports the transport of goods through the county. Local development agencies like the Huron County Development Council and Norwalk Economic Development Corporation work diligently to recruit new businesses and support existing entities. business growth in the county.

Employment in Huron County is attributed to several employment sectors. Average employment for each sector, based on data available from the Ohio Department of Development, is listed in table 2-11. Table 2-12 identifies the county's major employers.

**Table 2-11: Average Employment by Sector**

<b>Employment Sector</b>	<b>Average Employment</b>
Manufacturing	5,771
Trade, Transportation, and Utilities	3,535
Education and Health Services	2,623
Local Government	2,249
Leisure and Hospitality	1,696
Construction	1,445
Professional and Business Services	781
Natural Resources and Mining	661
Other Services	616
Financial Services	553
Information	170
Federal Government	140
State Government	75

**Table 2-12: Major Employers**

<b>Employer</b>	<b>Sector</b>
Berry Plastics/Venture Packaging	Manufacturing
Campbell Soup Co/Pepperidge Farms	Manufacturing
Fisher-Titus Medical Center	Service
Huron County Government	Government
MTD Products/Midwest Industries	Manufacturing
New Horizons Baking Company	Manufacturing
Norwalk Area Health Systems	Service
Norwalk City Schools	Government
RR Donnelley and Sons Co.	Manufacturing

Huron County's employment statistics have improved significantly in recent years. Along with much of Ohio and the nation, Huron County experienced an increase in unemployment from approximately 2008 through 2014. Unemployment reached its peak in 2013 with a rate of 10.2%. Since then, the rate has decreased, falling to 6.5% in 2016. As of September 2018, the rate had dropped to 4.3%.

**Table 2-13: Employment Statistics**

	2012	2013	2014	2015	2016
Employed	26,100	25,800	25,700	25,700	26,100
Unemployed	2,900	2,900	2,200	1,800	1,800
Unemployment Rate	9.9%	10.2%	8.0%	6.6%	6.5%

### *Agriculture*

Agriculture is Huron County's leading economic sector. Huron County is the top vegetable producing county in Ohio and one of the top 100 vegetable producing counties in the United States. This production is largely attributed to the much soil area in the southwest corner of the county. This area near the city of Willard is commonly referred to as Ohio's "Salad Bowl." The Ohio State University operates the Muck Crops Agricultural Research Station in Celeryville. The station has 15.5 acres of prime muck soil used to research for the benefit of muck-crop growers in Ohio and around the world.

According to the most recent USDA Census of Agriculture, published in 2012, agricultural production statistics for Huron County are as follows:

- The market value of all products sold totaled \$190,664,000. Of this total, 81% was attributed to crops and 19% to livestock.
- The average farm received \$220,421 from production sales.
- There are 208,716 acres of land actively used for agricultural purposes.
- There are approximately 865 farms in the county with an average size per farm of 275 acres.
- Fewer than half of the principal farm operators identify farming as their primary occupation. 407 people indicate farming is their full-time job while 458 identify another occupation as their full-time employment.

The most prevalent crops grown in Huron County include corn, soybeans, vegetables, and wheat. Livestock production includes primarily poultry and eggs, milk from cows, cattle, and hogs.



### **2.1.11 Development Trends**

Huron County is primarily an agricultural community and many families who live in the county have been residents for multiple generations. Several municipalities feature beautiful century homes in the original neighborhoods. In the rural areas, many farm families reside in long-standing farm homes or in newer homes built on the family farm. Additionally, there is a slow and steady growth in residential development due to business growth and job availability in the county. Farmsteads now are joined by newer homes on small acreage in the rural areas and several subdivisions that have developed outside municipal boundaries. Over the past twenty years, there has been an effort to develop housing in subdivisions as a way to protect farmland, building new homes on smaller plots than was previously typical and limiting the number of homes along busy rural roadways. This focus has allowed Huron County to locate residential areas where water distribution and other public utilities are available. It helps with highway safety and road maintenance when homes are clustered and centralized, allowing for snow plowing and road maintenance to occur in a planned and organized way.

Industrial growth has focused on development of mid-sized companies with fewer than 500 employees and use of locations within existing industrial park areas that have been vacated. Developers have concentrated on filling empty buildings when possible and adapting vacant locations to meet the needs of new tenants. The City of Willard has re-developed properties that were once vacant, sometimes changing use and adapting the property to meet new needs. In Norwalk, several vacant properties that once housed divisions of very large companies with smaller and more locally-grown manufacturing have been filled. According to economic development officials, the remaining buildings in the city that are available for new business do not meet the needs of manufacturing companies considering development in the area. Therefore, new construction is necessary for further growth. Overall, this re-development has helped Huron County mitigate potential disaster loss because they've made use of existing paved areas rather than removing more natural space that help absorb ground water. It has also protected utility systems and infrastructure and reduced the number of vacant industrial properties in the county.

Huron County was hit hard by the economic downturn of the auto industry in 2007. Unemployment rose to over ten percent and has continued at a relatively high level for several years. This is gradually improving as smaller business and manufacturing facilities move into Huron County and the predominance of secondary auto markets changes to a more widespread manufacturing scope. Economic development officials have worked diligently to attract new businesses to the county and support growth and expansion of current businesses. They've also partnered with regional development entities and post-secondary educational programs to improve the county's workforce force. This is an important element in recruiting and retaining stable, high-wage jobs for the community.

Huron County's development professionals and many elected officials involved in recruiting and retaining business and industry have attempted to set the stage for enhanced building regulation. Many discussions have taken place regarding the absence of residential building codes and the gaps in zoning regulations. If left to the developers, the entire county would be



covered by zoning regulation and building codes for residential and commercial development. While commercial building codes are enforced and Huron County contracts with the Richland County Building Department to inspect commercial construction, there is evidence that residential building codes are necessary. Developers feel that building codes improve the resiliency of properties and structures, enabling them to withstand storms and damages without significant loss. The 2017 Land Use Plan for the county speaks in detail about this issue and how to improve local presence of code enforcement to become a resource for contractors.

In the process of development, floodplain regulations and NFIP participation has been enforced and maintained. Consideration has been given to waterway maintenance and infrastructure support in light of developing areas, projects, and structures. This has enabled the county to add homes, business, and industry to their county without increasing the damages from disaster incidents.

In the coming years, Huron County mitigation planning participants expressed an interest in maintaining the regulations in place, and even of improving regulation to be more supportive of wise and sustainable development. They expressed a desire to utilize regulation, as they have in the past, to prevent the addition of properties or structures that stand in the way of nature, but instead to encourage and support development that stays away from high-risk and high-impact areas.

**2.2 HAZARD IDENTIFICATION**

Huron County has experienced many disasters in its history, ranging from floods and tornadoes to blizzards and windstorms. In this section, the hazards that can impact Huron County are defined and county’s risk for each hazard is considered.

In developing this assessment, the Hazard Mitigation Planning Team analyzed the hazards and risks present throughout the county. The eleven hazards identified as relevant to Huron County are:

- Dam failure
- Drought/extreme heat
- Earthquake
- Flood
- Hazardous materials incident
- Invasive species
- Severe thunderstorm
- Tornado
- Water quality emergency
- Windstorm
- Winter Storm

Some hazards were excluded from this plan because they pose no risk to Huron County. The excluded hazards and the justification for the exclusion are identified in table 2-14.

**Table 2-14: Excluded Hazards**

<b>Excluded Hazard</b>	<b>Justification</b>
Coastal Erosion	The county has no open coastline.
Land Subsidence	Planning Team and hazard history did not identify as a concern
Tsunami	Geographically impossible
Volcano	Geographically impossible
Wildfire	Insufficient forested area

Huron County does not have a significant history of federal disaster declarations or assistance. The county has only been included in ten federal declarations. The most recent federal disaster declaration for the county occurred in March 2008 following a significant winter storm. A comprehensive list of incidents in Huron County that resulted in federal disaster declarations is provided in table 2-15.

**Table 2-15: Federal Disaster Declaration History**

<b>DR/EM Number</b>	<b>Incident Date</b>	<b>Incident Type(s)</b>
DR-90-OH	January 23, 1959	Flood
DR-266-OH	July 15, 1969	Flood, Severe Summer Storm, Tornado
EM-3055-OH	January 26, 1978	Winter Storm
DR-1444-OH	November 10, 2002	Severe Summer Storm, Tornado
EM-3187-OH	August 14, 2003	Other (Blackout/Power Outage)
DR-1580-OH	December 22, 2004	Flood, Winter Storm, Mudslide
EM-3198-OH	December 22, 2004	Winter Storm
EM-3250-OH	September 14, 2005	Hurricane Katrina Evacuation
DR-1651-OH	June 21, 2006	Flood, Wind, Severe Summer Storm, Tornado
EM-3286-OH	March 7, 2008	Winter Storm

To understand the risk posed by these hazards in Huron County, it is important to examine the characteristics of each hazard and evaluate the local history of occurrences. Historical information was obtained from the National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC) and supplemented with information from local officials. This section defines each hazard and describes Huron County's history with each.

### **2.2.1 Dam Failure**

A dam is an artificial barrier built across flowing water. This barrier directs or slows the flow of water and often creates a lake or reservoir. A dam is considered hydrologically significant if it has a height of at least 25 feet from the natural streambed and a storage capacity of at least fifteen acre-feet or an impounding capacity of at least 50 acre-feet and is six feet or more above the natural streambed. Dams are constructed for flood control purposes or to store water for irrigation, water supply, or energy generation. They can be composed of earth, rock, concrete, masonry, timber, or a combination of materials.

Levees are embankments constructed to prevent the overflow of a river and subsequent flooding of the surrounding land. They can be built using earth, rock, or other materials. Levees constructed from concrete or masonry materials are referred to as floodwalls.

Many of the structures classified as dams or levees in Ohio are part of municipal water or wastewater treatment systems. These structures are often referred to as upground reservoirs or lagoons. According to ODNR, an upground reservoir is defined as a reservoir formed by artificial barriers on two or more sides and which impounds water or liquefied material pumped or otherwise imported from an exterior source. Lagoons are considered upground reservoirs.

Dam failure is defined as the uncontrolled release of the water held back by the structure. Depending on the storage volume of the dam and the types of structures surrounding it, a breach or failure can have a significant or limited impact on the surrounding community. In the most significant dam failure incidents, there can be substantial flooding downstream, damage to property, and loss of life. Potential causes of dam failure include, but are not limited to, sub-

standard construction, geological instability, spillway design error, poor maintenance, internal erosion, and/or extreme inflow.

The Ohio Department of Natural Resources (ODNR) is responsible for determining the hazard potential for dams through their Dam Safety Program. ODNR classifies dams based on this scale:

Classification	Description
Class I	High hazard dam; Probable loss of life, serious hazard to health, structural damage to high value property (i.e. homes, industries, major public utilities)
Class II	Significant hazard dam; Flood water damage to homes, businesses, industrial structures (no loss of life envisioned), damage to state and interstate highways, railroads, only access to residential areas
Class III	Low hazard dam; Damage to low value non-residential structures, local roads, agricultural crops, and livestock
Class IV	Losses restricted mainly to the dam

#### *Dam/Levee Failure Risk Assessment*

There are 56 dams in Huron County and zero levees. These structures function as water retention structures on waterways, upground reservoirs for water supply, lagoon facilities within wastewater treatment plants, and privately-owned structures that affect the flow of runoff waters. Dams and classifications for the county, according to the Ohio Department of Natural Resources, are identified in table 2-16.

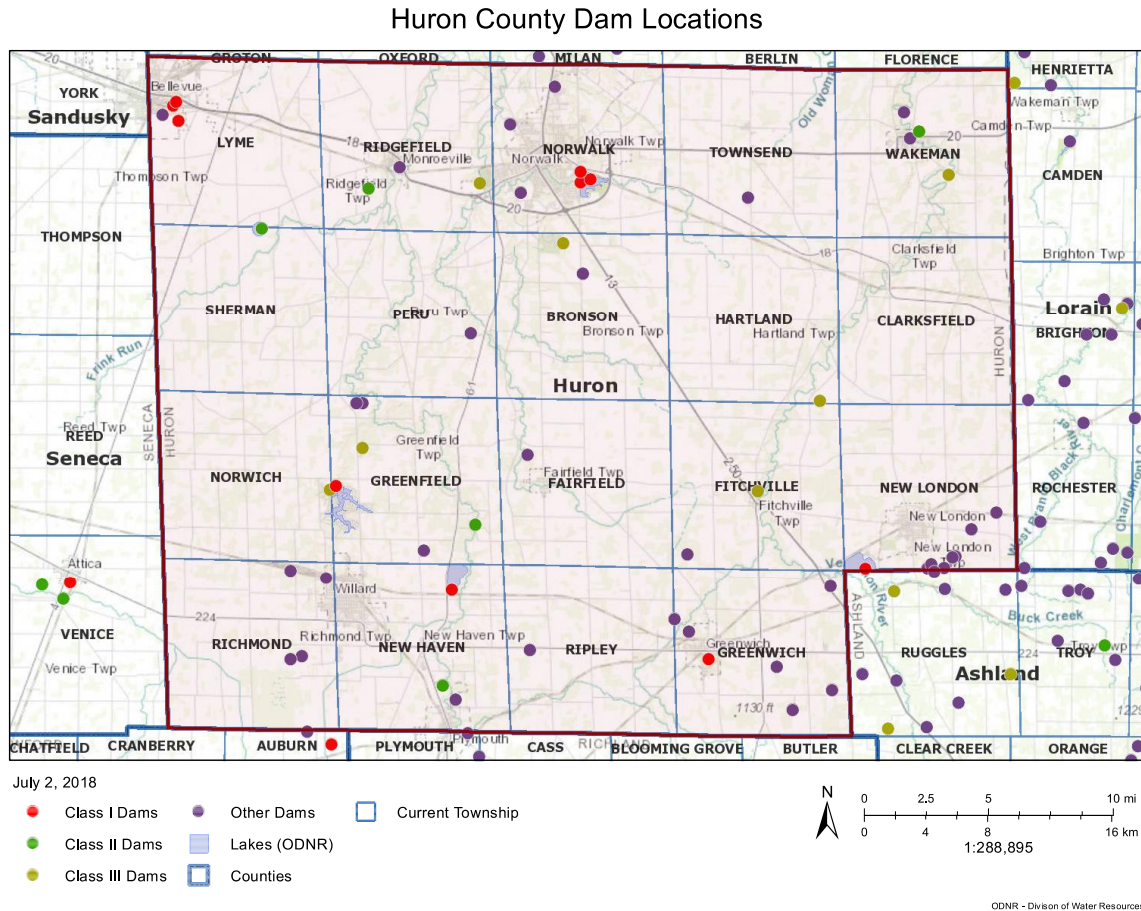
**Table 2-16: Huron County Dams**

Dam	Class	Location	Owner
Bellevue Upground Reservoir No. 1	I	Bellevue	City of Bellevue
Bellevue Upground Reservoir No. 3	I	Bellevue	City of Bellevue
Bellevue Upground Reservoir No. 4	I	Bellevue	City of Bellevue
Greenwich Reservoir Dam	I	Greenwich	Village of Greenwich
Holiday Lake Dam	I	Greenfield Township	Private
New London Reservoir	I	New London Township	Village of New London
Norwalk Lower Reservoir	I	Norwalk	City of Norwalk
Norwalk Memorial Reservoir	I	Norwalk	City of Norwalk
Norwalk Upper Reservoir	I	Norwalk	City of Norwalk
Willard City Upground Reservoir	I	New Haven Township	City of Willard
Bellevue Upground Reservoir No. 5	II	Sherman Township	City of Bellevue
Camp Conger Lake Dam	II	Greenfield Township	Private
Monroeville Upground Reservoir	II	Ridgefield Township	Village of Monroeville
Plymouth Wastewater Lagoon	II	New Haven Township	Village of Plymouth
Wakeman Wastewater Treatment Lagoon	II	Wakeman	Village of Wakeman
Big Bass Lake Dam	III	Norwich Township	Private

Dam	Class	Location	Owner
Bronson Norwalk Lake Dam	III	Bronson Township	Private
Hidden Lake Stable Dam	III	Hartland Township	Private
Indian Trail Campground Dam	III	Fitchville Township	Private
Ockenga Lake Dam	III	Wakeman Township	Private
Realty Investment Property Dam	III	Ridgefield Township	Private
Willard Lake Dam	III	Greenfield Township	Private
Abram Lake Dam	IV	Greenwich Township	Private
Arnold's Lake Dam	IV	Greenfield Township	Private
CSX Transportation Lake No. 1 Dam	IV	Richmond Township	Private
CSX Transportation Lake No. 2 Dam	IV	Richmond Township	Private
Deep Dale Lake Dam	IV	Norwalk Township	Private
Gahring Pond Dam	IV	Fairfield Township	Private
Gardner Lake Dam	IV	New London Township	Private
Greenwich Sewage Lagoons	IV	Greenwich Township	Village of Greenwich
Herr Lake No. 1 Dam	IV	New London Township	Private
Herr Lake No. 2 Dam	IV	New London Township	Private
Mill Pond Park Dam	IV	Bellevue	City of Bellevue
Miller's Lake Dam	IV	New Haven Township	Private
Monroeville Low Head Dam	IV	Monroeville	Village of Monroeville
Opper Lake Dam	IV	Peru Township	Private
Palmer Lake Dam	IV	Greenwich Township	Private
Parker Lake Dam	IV	New London Township	Private
Price Lake Dam	IV	Norwalk	Private
Riley Lake Dam	IV	Bronson Township	Private
Ripley Township Lake Dam	IV	Ripley Township	Ripley Township
Rural Coon Hunters Lake Dam	IV	Greenwich Township	Private
Schaffer Lake Dam	IV	Norwalk	Private
Schriner's Pond Dam	IV	Ripley Township	Private
Thomas Lake Dam	IV	New London Township	Private
Thomas Lake Dam	IV	New London Township	Private
Thomas Pond Dam	IV	Fitchville Township	Private
Unknown	IV	Townsend Township	Private
Unknown	IV	Wakeman Township	Private
Unknown	IV	Greenfield Township	Private
Unknown	IV	Greenfield Township	Private
Unknown	IV	New London Township	Private
Wakeman Low Head Dam	IV	Wakeman	Village of Wakeman
Willard Marsh Lake Dam	IV	Richmond Township	ODNR, Division of Wildlife
Willard Marsh Pond Dam	IV	Richmond Township	ODNR, Division of Wildlife
Zoll Lake Dam	IV	Greenwich Township	Private

Maps identifying the locations of all dams in table 2-16 are included below. The maps are provided by ODNR.

**Map 2-6: Huron County Dam Locations**



Huron County has ten Class I dams. Nine of these structures are upground reservoirs that function as part of a municipal water supply and treatment system. Included in these, the municipalities of Bellevue, Greenwich, Monroeville, Norwalk, New London and Willard have upground reservoirs that are considered Class I dams. The Holiday Lakes Dam in Greenwich Township is located on Holiday Lake and owned by a private homeowners’ association. This dam enhances water retention for recreational purposes. All of these structures are considered to be in good condition and have regular monitoring and observation for signs of structural failure, but emergency operations plans that include inundation areas and properties, emergency procedures, evacuation details, and monitoring and assessment of potential failure were not found.

The Norwalk Reservoir System consists of three separate creek-fed interconnected bodies of water that are partially upground from the surrounding areas, and partially on the same level as surrounding land on the south side. The elevated portion of the reservoir runs along Old State

Road at the southern boundary of the city where natural topography is rolling and land on the other side of the road is much lower than the reservoirs. There are two spillways that cross Old State Road at approximately 744 feet above sea level; Norwalk Creek carries this water through the city through significant numbers of residential areas, and out to the west where the creek joins the East Branch of the Huron River. A strip of natural habitat lies alongside the Norwalk Creek that would absorb and carry a majority of the water from a dam failure away, but depending on the level of water in the reservoirs and the saturation of the land prior to a failure, a very significant number of homes, businesses and streets could be affected. Some properties that lie in the lower areas throughout the path of Norwalk Creek would likely flood, and some may flood severely or become uninhabitable. Some of the city streets may be impassable. Property loss and loss of life, if a failure happened suddenly without notice or opportunity of evacuation, is possible. A water contingency plan was shared in the process of planning, but there was no emergency plan.

Bellevue's upground reservoirs do not have spillways; failure would have to involve a breakdown of the reservoir walls or overtopping due to extensive rainfall. These reservoirs are not fed by a waterway, and overtopping would not be made worse by drainage in the area. The system of reservoirs is surrounded by residential area, state and local roadways, and businesses. Elevations are only slightly higher than the reservoir for those close by, and should a failure occur, these homes could be flooded, uninhabitable, or damaged. Roadways could become flooded and be impassable. No emergency operations plan was shared. The New London Reservoir is covered by an emergency action plan that defines monitoring and detection of a breach or possible breach; it establishes emergency procedures and evacuation methodology and lists the properties that would be affected by flooding or lack of access through road flooding. It identifies approximately twelve residential structures that could be adversely affected as well as some sections of roadway, culverts, railroad bridges, and other infrastructure.

Willard's upground reservoir is located in New Haven Township and sits in a section of rural farmland. It is an upground structure that is filled from the Huron River branches. There are no houses or structures that would be inundated in an overtopping. State Route 61 could be flooded and the road damaged or closed. Loss of life or property is not highly likely.

The Greenwich reservoir sits southeast of the village. There is a spillway on the north end of the reservoir with recreational areas and some group housing immediately past the spillway. An inundation zone could potentially, in a worst case, involve the group homes and a few private homes to the north. There could be street flooding and several businesses in the downtown could be adversely affected. State Route 224 is prone to flooding during high precipitation events and a breach of the reservoir could cause serious highway flooding as well as residential flooding and damage.

Holiday Lake Dam is on the north end of a large, densely populated neighborhood and was created with the purpose of holding water back for recreational purposes. A large spillway releases water on the north end of the lake system. The release area is mostly farm land and

natural habitat. There are approximately six private homes that lie downstream from the spillway and would likely be inundated. Except for one, these houses lie to the east of the spillway; one lies directly in front of the spillway. These homes could, in a worst-case scenario, be flooded and significantly damaged by flooding and rapid water. If warnings were not issued to the potentially affected population, it seems likely that loss of life or injury could occur on at least one residential property.

Of the county's five Class II dams, four are upground reservoirs or wastewater treatment lagoons maintained by a municipality. The remaining Class II dam is Camp Conger Lake Dam, a privately-owned structure in Greenfield Township. The Camp Conger Lake Dam is located on the site of a youth camp. According to Huron County Soil and Water Conservation, the dam is well maintained and is a minimal risk to the surrounding area. The nearby youth camp is below the inundation zone but the camp is only used seasonally; when the camp is at capacity, there are approximately 100 people on site. Community planning participants did not rank the other class II dams as high for potential failure or for vulnerability should a failure occur.

There are seven Class III dams in the county, all of which are privately owned. The remaining 34 dams are Class IV. Several of these are owned and maintained by municipalities but the majority are privately owned. Most of these structures are used for agricultural purposes. They have a limited capacity and would cause little to no damage if the structure were to fail.

#### *Local Dam Failure History*

According to records from Stanford University's National Performance of Dams Program, there are no written reports of dam incidents, breaches, or failures in Huron County. There is a less than 1% probability of a dam incident at this time, according to Stanford University documents. However, local stakeholders recalled a serious emergency dam incident involving the Norwalk Reservoir dam as part of a widespread flooding event that affected most of the city. That incident occurred on July 4, 1969. In the aftermath of a severe thunderstorm and flood event, the dam that held water back into the three-reservoir system failed. The failure was due to an extreme amount of rain and overfilling of the reservoirs to the point that the gate of the dam could not hold the water. As the reservoirs filled, the water overtopped the dam. Eventually the gate gave way, and the floodwaters held in the reservoirs spilled into the city, inundating residential areas, streets, and anything else in its way. The area bound by Water Street to Benedict Avenue to Woodland Avenue was inundated with water, sweeping cars and other items through town and causing significant property damage. Because this was a widespread heavy rain event as well as a dam failure, it was difficult to know what was flooded due to the dam breach and what was flooded by excessive precipitation, storm sewer back up and storm sewer overflow. Most properties in the city lost power for a brief period of time and nearly half of the community suffered some level of flood damage. At that time, the dam was rebuilt. Today there is a small spillway that serves as a release route when the reservoir capacity is near, and a large spillway that can be used for additional release when the water is even higher.



### 2.2.2 Drought and Extreme Heat

A drought is a deficiency of moisture that adversely impacts people, animals, and vegetation over an area of significant size. Because drought is a creeping phenomenon characterized by the absence of water, there is no defined beginning or end, nor is there a specific amount of time required for an extended dry period to be considered a drought. An event is considered a drought when the dry period lasts long enough to impact the environment and economy of a region, typically a period of months or years.

Drought severity is measured using the Palmer Drought Severity Index (PDSI). The PDSI measures dryness based on recent precipitation and temperature statistics. Drought classifications are identified in the chart below:

Measurement	Description
-4 or less	Extreme Drought
-4 to -3	Severe Drought
-3 to -2	Moderate Drought
-2 to -1	Mild Drought
-1 to -0.5	Incipient Dry Spell
-0.5 to 0.5	Near Normal
0.5 to 1	Incipient Wet Spell
1 to 2	Slightly Wet
2 to 3	Moderately Wet
3 to 4	Very Wet
4 or more	Extremely Wet

A heat wave is a period of abnormally hot and unusually humid weather, typically lasting for two or more days. This can be an extended period of time with higher than normal temperatures or a shorter period of time with abnormally high temperatures. Regardless of the length of time or exact temperatures, heat waves are a safety hazard to anyone exposed to the high heat. People are at risk for heat exhaustion and heat stroke, which can be fatal in the most serious cases. When heat waves are accompanied by drought conditions, the potential for a serious natural disaster increases. Between injuries, fatalities, and crop/property damage, these disasters can significantly impact the economy of a region.

Heat waves can occur in Huron County and all of Ohio, but they are typically brief, lasting only a day or two. Extreme temperatures are considered anything above 90 degrees Fahrenheit. In the humid climate of the Midwest, these temperatures are often accompanied by high humidity. Temperatures rarely exceed the mid-90s, although the region does occasionally experience temperatures of 100 degrees or slightly higher. These brief heat waves are not uncommon, but rarely last more than a few days. A heat wave lasting longer than a week is extremely rare.

**Table 2-17: Average Temperatures and Rainfall**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. High	33°	36°	46°	59°	69°	79°	82°	81°	75°	63°	50°	37°
Avg. Low	19°	20°	28°	38°	49°	59°	63°	61°	54°	42°	34°	24°
Avg. Precip.	2.32"	2.01"	2.56"	3.54"	3.82"	4.21"	3.9"	3.62"	2.35"	2.76"	3.07"	2.76"

*Drought/Extreme Heat Risk Assessment*

Drought and extreme heat are uncommon in Huron County but are countywide hazards and can affect all areas and jurisdictions. Brief spells of abnormally dry conditions can last for several weeks but most months have sufficient rainfall to support crop growth. Drought conditions, when they do occur, have a significant impact on the county's significant agriculture industry.

During the primary growing season, Huron County can experience short periods of unusually dry conditions. The county's climate is moderate and does not turn arid at any time. Huron County does not have a history of extended drought that would cause casualties or property damage; the most common drought-related loss would be a reduction in crop yields for a single growing season.

Based on the 2012 Census of Agriculture published by the U.S. Department of Agriculture, Huron County's agriculture industry has a total market value of \$190,664,000. In a drought, the significant crop and livestock operations across the county would be exposed to loss. Table 2-18 identifies the quantities of the primary agricultural commodities in the county that could be impacted by drought-related loss. While many farmers insure their crops, it is not possible to determine how extensive crop insurance coverage is across the county. Insurance would only partially replace the economic loss caused by severe drought.

**Table 2-18: Drought Vulnerability Assessment**

Top Commodities	Crop Acres	Livestock Inventory
Soybeans	95,000	
Corn for grain	81,134	
Wheat for grain	8,565	
Vegetables	4,167	
Layers		93,347
Hogs		19,665
Cattle		15,877

*Local Drought/Extreme Heat History*

Drought is not common in Huron County but can cause significant damage, primarily to agriculture, when it does occur. According to NCDC records, five recorded droughts have caused \$15,000,000 in crop loss.

**Table 2-19: Huron County Drought/Extreme Heat History**

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Drought	5	0	\$15M	0	0
Extreme Heat	0	0	0	0	0

One of the more significant droughts to impact Ohio, including Huron County, was the 1988-1989 North American Drought. This event followed a milder drought in the Southeastern United States and California the year before. The drought spread to Ohio from the Mid-Atlantic, Southeast, Midwest, Northern Great Plains, and Western United States. It was widespread, unusually intense, and accompanied by heat waves that killed 4,800 to 17,000 people nationwide and substantial numbers of livestock. The nationwide use of marginally arable land for agriculture production and continued pumping of groundwater near the depletion mark are considered possible reasons this drought had such a significant impact on the agriculture industry. The Drought of 1989 destroyed crops almost nationwide. Lawns went brown and many cities and jurisdictions enacted water restrictions. This catastrophic drought continued to impact the Midwest and Northern Plains states during 1989. The drought was not declared over until 1990.

In the summer of 2012, Ohio was impacted by another severe drought, the 2012 North American Drought. This incident was an expansion of the 2010-2012 United States drought that began in the spring of 2012. Lack of snowfall in the United States caused very little melt water to absorb into the soil. The drought included most of the United States and all of Ohio. Huron County, along with many other counties in the state, was designated with moderate drought conditions by mid-June of 2012. This drought has been compared to similar droughts in the 1930s and 1950s but did not last as long. The drought caused catastrophic economic ramifications. According to most measures, this drought exceeded the 1988-1989 North American Drought, which is the most recent comparable drought. On September 5, 2012, the USDA issued a disaster declaration for all counties in Ohio affected by the drought; Huron County was included as a primary county.

The most recent drought to affect Huron County occurred in 2016. On January 5, 2017, the USDA issued a disaster declaration for drought conditions experienced from May through October 2016. The primary declaration was issued for five Ohio counties. While Huron County was not identified as a primary county, it was included in the declaration as a contiguous county. This declaration qualified farm operators for low interest emergency loans through the USDA Farm Service Agency.

### 2.2.3 Earthquake

An earthquake occurs when two of earth's plates move past one another beneath earth's surface. The location where the plates meet is called a fault. The shifting of the plates causes movement along the fault line. This movement can often be felt in areas surrounding the earthquake's epicenter and can cause damage ranging from insignificant to devastating. Damage caused by an earthquake can include rattling foundations, falling debris, and, in the

most severe cases, toppling buildings, bridges, and culverts. The severity of earthquake movement is measured using the Modified Mercalli Index scale as defined in this chart:

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

### *Earthquake Risk Assessment*

Ohio has experienced more than 120 earthquakes since 1776. While only a few of these events have caused structural damage, Ohio has a greater risk for earthquakes than many people realize. West central Ohio is the area of Ohio at the highest risk for earthquakes; northeast Ohio is the second most active earthquake risk area. Because Huron County is located in north central Ohio, the earthquake risk is low.

Earthquakes are geologically possible but extremely rare in Huron County. Earthquake is a countywide hazard and can affect all areas and jurisdictions. The county has experienced two very minor earthquakes in the past, as detailed in table 2-21 below. Neither of these incidents caused property damage. Therefore, there is little data to support committing extensive resources to earthquake-proofing buildings and other structures.

Because of the low risk and high cost of implementing mitigation strategies related to earthquake risk, the planning team did not identify any such actions. As they arrived at this decision, they considered historical earthquake damage data and HAZUS loss projections for a 5.0 magnitude earthquake with an epicenter in Norwalk. Table 2-20 is the vulnerability analysis made available to the committee.

**Table 2-20: Earthquake Scenario Vulnerability Analysis**

<b>Building Type</b>	<b>Number of Buildings</b>	<b>Exposure</b>
Residential	2,367	\$851,013,746
Non-Residential	1,698	\$525,085,568
Critical Facilities	74	\$23,030,909
<i>Totals</i>	<i>4,139</i>	<i>\$1,399,130,224</i>

#### *Local Earthquake History*

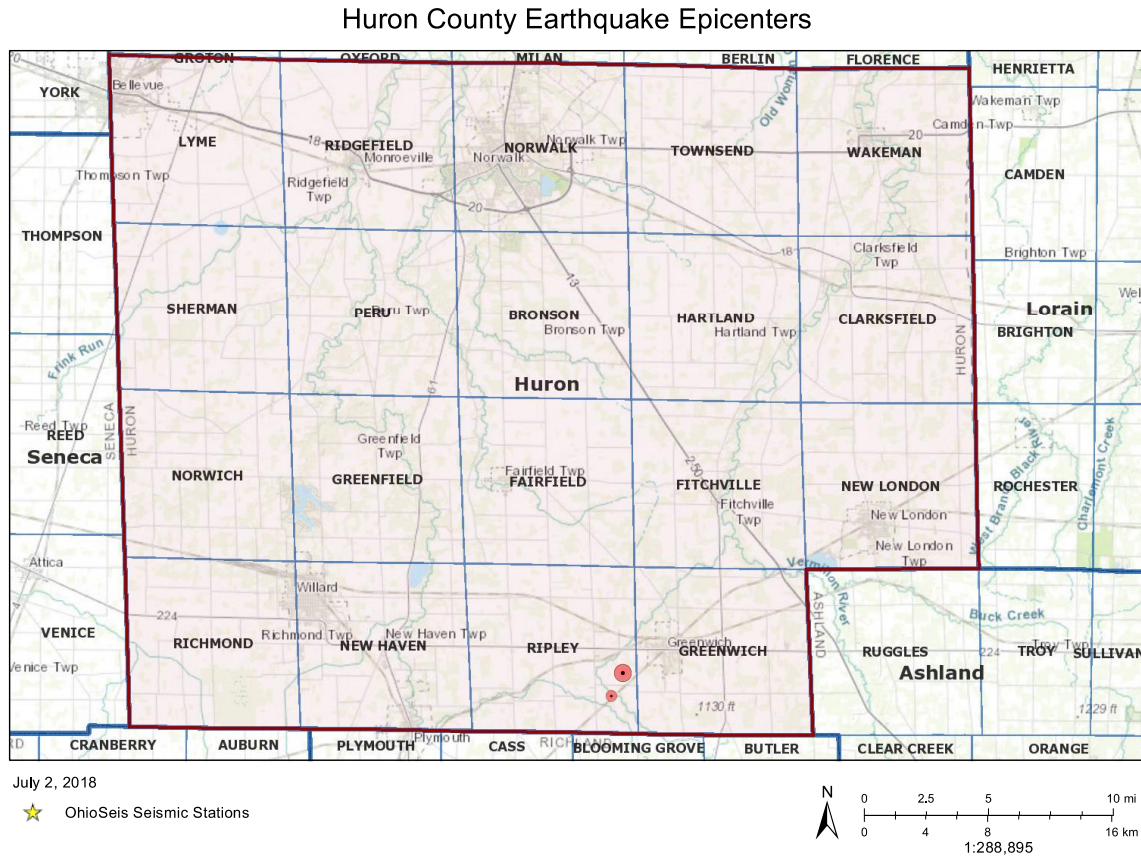
Records from the Ohio Department of Natural Resources indicate that Huron County has experienced two earthquakes with epicenters in the county. These earthquakes were minor in magnitude, ranging between 2.7 and 3.2 on the Richter scale. There is no documented evidence of structural damage in the county. Many of the counties adjacent to Huron, including Lorain, Ashland, Richland, and Sandusky, have experienced some minor earthquake activity. Like the Huron County incidents, these occurrences have all been low in magnitude and caused no structural damage.

**Table 2-21: Huron County Earthquake History**

<b>Date</b>	<b>Location</b>	<b>Magnitude</b>	<b>Modified Mercalli</b>
7/26/2001	Ripley Township	2.7	III
11/25/1998	Ripley Township	3.2	III

The following map provides locations for the incidents in table 2-21, according to ODNR records.

**Map 2-7: Huron County Earthquake Epicenters**



The strongest earthquake recorded in Ohio occurred in Shelby County, approximately 130 miles southwest of Huron County, in 1937 and was estimated to have a magnitude of 5.5 on the Richter Scale. This incident caused some damage in Anna and surrounding west central Ohio communities. The same area in Ohio also reported earthquake activity in 1875 and 1884. Residents in Anna also reported minor quakes in 1930 and 1931. The Pomeroy area, southeast of Columbus, experienced an earthquake in 1926. All of these earthquakes caused only minor damage, primarily shaking buildings, crumbling mortar with limited or no property damage. Impacts were only felt locally; no statewide damages were reported.

### **2.2.4 Flood**

According to the National Weather Service, a flood is defined as an overflow of water onto typically dry land. The inundation of a normally dry area is caused by rising water from a nearby waterway, such as a river, stream, or drainage ditch. Flooding generally occurs subsequent to a meteorological event such as substantial precipitation, rapid snowmelt, or extreme wind events along coastal waterways. This type of flooding, also known as riverine flooding can last days or weeks.

A flash flood is caused by heavy or excessive rainfall over a short period of time, typically less than six hours. These events are often characterized by raging torrents after heavy rains impact river beds, streets, or low-lying areas and can occur within minutes or hours of excessive rainfall. Flash flooding can also occur when the ground is too saturated, impervious, or flat to drain rainfall into waterways through storm sewers, ditches, creeks, and streams at the same rate as the precipitation falls.

Floods are the most common and costly disaster, resulting in significant loss of life and property. They have a substantial impact on infrastructure, including roadway breaches, bridge washouts, roadway wash away, and water-covered roadways. Fast-moving floodwater can wash away the surface and sub-surface of roads, creating holes, ruts, and other problems for vehicles. Floodwater that is one foot deep is strong enough to carry vehicles away, often with occupants inside. Rescuers are powerless against rapid, rising water because they are unable to exert enough strength to counteract the physics of moving water.

Floodwaters seek the path of least resistance as they travel to lower ground and will seep into and occupy any structure in their path. Basements and lower levels of buildings can become inundated with floodwater. Installing sandbags along the exterior of a building can be a temporary stopgap measure but, if floodwaters do not recede quickly, the force of the water will move through the sandbags and enter the structure.

The aftereffects of flooding can be just as damaging as the flood itself. Cleanup is often a long, protracted activity with its own set of hazards. Standing flood water can become contaminated with household and industrial chemicals, fuel, and other materials that have leaked into the water. All floodwater is considered contaminated, either from germs and disease or hazardous materials. This creates a hazard for responders and residents throughout the cleanup phase.

#### *Flood Risk Assessment*

Flooding is considered a significant risk in Huron County. The county's combination of flat and rolling terrain and the number of rivers, streams, creeks, and ditches contribute to the local flood risk. Flooding is a countywide hazard and can affect nearly all jurisdictions. Huron County experiences a combination of riverine and flash flooding.

Riverine flooding is a significant risk because of the two rivers and branches, as well as creeks, streams, and ditches that cross the county. The county is located in parts of four different watersheds. The Huron and Vermilion River watersheds cover the majority of the county, with the exception of two corners on the west side and one small area on the east. The extreme

southeast corner of the county falls in the Black River watershed and two small areas in the northwest and southwest corners are located in the Sandusky River watershed. The Huron River watershed encompasses the entire remaining western half of the county, and the Vermilion River drains the generally eastern half.

The soil types in Huron County are mostly poorly drained soils that retain water for a period of time, and that are prone to surface drainage in the absence of engineered tiling systems. With heavy or hard rain, the soils can become hardened and water runs across the surface into swales and ditches. In the flatter areas, some swales and French drains have been installed to guide and direct wastewater to the creeks and ditches. Some roadways have ditches alongside the pavement to contain runoff from the roads. Some production land areas are tiled; these areas are the flatter and more productive soils that produce grain. Other more rolling areas that make up ditch-bottoms and waste land along waterways are grazing land for cattle and other livestock, and natural habitat due to the frequent flooding and standing water.

The surface drainage areas can fill quickly with runoff and inundate the ditches. There is significant road and bridge flooding in the Huron and Vermilion River watersheds. This rolling area that is beautiful and natural on a dry day becomes a raging creek bottom after heavy precipitation. The many small rural roads in the county, mostly in the south and central portion of the county, flood quickly and deeply. Many roads are closed for hours to a few days after a heavy rain event. Even though most of this occurs south of Norwalk, there are roads that flood frequently in every part of the county due to the rolling terrain and low-lying bridges and culverts in many areas.

Flash flooding occurs in much the same way. There are many roads that are closed after heavy rain due to a low-lying bridge, or a winding turn in the road that is flooded over in one section or another. The water collects quickly in these areas as it runs across clay soils that harden and drain poorly. If ground is frozen or already saturated, this occurs very quickly. This can last for several days, impeding transportation and movement of goods and services within the county for an inconvenient length of time.

Flood damage in Huron County could include damage and destruction of physical buildings, infrastructure, crops, and livestock. Residential structural damages could include single and multi-family homes, group living facilities, and multi-family housing complexes. Commercial and industrial structural damages could include buildings used for manufacturing, product handling, transportation, warehousing, retail, business, and industrial, and the capital equipment associated with those uses. Agricultural structures would include barns used for livestock, storage buildings, equipment, and machinery. Grain bins and elevator systems could be damaged very easily by the force of water. Government, nonprofit, and educational institutions include critical structures like fire stations, police stations, hospitals, offices, schools, and special facilities like garages and maintenance buildings, and the capital contents of those structures. This damage would result in large amounts of debris to manage, including finish, structural, and foundation materials. It is unlikely that loss of life would be attributed to



flooding. If a death were to occur, it would likely be the result of two or more combined threats, such as lightning, tornado, or driving into standing water.

**Table 2-22: 100-Year Flood Scenario Vulnerability Analysis**

Building Type	Number of Buildings	Exposure
Residential	2,363	\$623,837,000
Non-Residential	475	\$125,345,000
Critical Facilities	84	\$22,160,000
<i>Totals</i>	<i>2,923</i>	<i>\$771,342,000</i>

#### *Floodplain Mapping and National Flood Insurance Program*

Huron County's floodplain maps were updated in 2011 as part of FEMA's Map Modernization Program. The current floodplain maps became effective 01/19/2011. As part of the Risk MAP process, FEMA initiated a Discovery project for the Huron Vermilion Watershed in July 2011.

The table below provides information on participation in the National Flood Insurance Program for communities in Huron County according to the FEMA Community Status Book Report for Ohio. The communities in table 2-23 participate in NFIP and are considered to be in good standing with the program.

**Table 2-23: NFIP Participating Communities**

Community	Initial FHB Identified	Initial FIRM Identified	Current Map Effective Date	Reg-Emer Date
Huron County	07/14/1978	08/01/1987	01/19/2011	08/01/1987
Greenwich	03/15/1974	09/30/1988	01/19/2011 (M)	09/30/1988
Monroeville	11/02/1973	08/01/1987	01/19/2011 (M)	08/01/1987
New London	05/03/1974	05/01/1988	01/19/2011 (M)	05/01/1988
North Fairfield	03/15/1974	01/19/2011	01/19/2011 (M)	06/05/2013
Norwalk	11/23/1973	02/15/1979	01/19/2011	02/15/1979
Wakeman	11/09/1973	09/01/1986	01/19/2011 (M)	09/01/1986
Willard	03/22/1974	11/02/1984	01/19/2011 (M)	11/02/1984

#### *Repetitive and Severe Repetitive Loss Structures*

Throughout Huron County, several structures suffer from repeated flood losses. These structures are identified as repetitive loss properties. Repetitive loss properties are insurable buildings for which two or more claims of at least \$1,000 in loss were paid by the National Flood Insurance (NFIP) program during any rolling ten-year period. The table below identifies the jurisdictions that have known repetitive loss properties. There are no known severe repetitive loss structures in the county at this time.

**Table 2-25: Repetitive Loss Properties**

Community	Properties	Losses	Building Payments	Contents Payments	Total Payments
Monroeville	1	2	\$8,255.38	0	\$8,255.38
Norwalk	6	15	\$312,194.07	\$32,238.58	\$344,432.65

Additional repetitive loss and/or severe repetitive loss structures may still exist in the county. As floodplain maps are updated, new or currently unidentified structures may fall within updated floodplain boundaries in the future.

#### *Local Flood History*

Huron County has experienced 9 floods and 23 flash floods since 1950., per NCDC records. Property damage from these incidents has exceeded \$24,000,000 and crop loss has exceeded \$8,000,000.

**Table 2-26: Huron County Flood History**

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Flood	9	\$13.56M	\$7.0M	0	0
Flash Flood	23	\$10.395M	\$1.065M	1	0

Huron County has experienced several devastating floods in the county's history. One of the most devastating floods, often referred to as the Independence Day Flood, occurred on July 4, 1969. A line of severe thunderstorms moved into north central Ohio in the evening and stalled, dumping more than nine inches of rain on Huron County over less than twelve hours. The storm inflicted heavy winds and lightning as well as several tornadoes on the region, magnifying the damage. The storm caused record floods on the Huron, Vermilion, and Black rivers. In Huron County, multiple highways were closed due to high water and hundreds of homes were damaged. The flood caused the Norwalk Reservoir to break, exacerbating flooding throughout the city. Records indicate that nearly every home in Norwalk suffered some level of damage from the storm and that power was out for two to three days. Across the county, residents suffered millions of dollars in property and crop damage.

In June 2006, Huron County suffered another record-breaking flood. On the evening of June 21, a line of thunderstorms dropped torrential rainfall on Huron County, causing devastating flooding across the county. Up to nine inches of rain fell over a four-hour period, causing rivers and streams to rise quickly. In Norwalk and Clarksfield, residents were evacuated from several neighborhoods as floodwaters quickly rose and became dangerous. Norwalk was effectively cut in half by floodwaters; Linwood Avenue was the only north-south street accessible to vehicle traffic. The city suffered extensive property damage; more than twelve homes were destroyed and 35-40 suffered major damage. Another 200 homes were considered to have minor damage and more than 600 experienced nuisance flooding, primarily in basements. New London was also especially hard hit, with more than 100 homes damaged by floodwater. In total, the property damage from the event exceeded \$20,000,000 and crop damage exceeded

\$8,000,000. After the Independence Day Flood, this incident is considered the worst flood event in Huron County's history.

### 2.2.5 Hazardous Materials Incident

A hazardous materials spill or release occurs when a hazardous substance breaches its container. The release can occur during operations at a fixed facility or during transportation of the substance, which can occur via ground or rail transport. Hazardous substances are stored in numerous types of containers, including drums, cans, jars, pipes, and other vessels. Some releases are incidental and can be safely cleaned up by on-site facility personnel. An incidental release does not threaten the health or safety of the immediate area or community because the spill involves only a small quantity. If the release involves a larger quantity than can be handled by facility personnel and requires action by first responders or agencies outside of the spiller's facility, the incident is considered an emergency response. To protect the community, evacuation from the facility or area surrounding the spill may be necessary.

Every hazardous substance is unique and can have toxic, flammable, explosive, and/or corrosive properties. Each material is assigned a class based on these properties; hazardous materials classifications are described in table 2-27 below. When a hazardous substance is released into the environment, it can negatively impact the safety and health of the community by contaminating the air, water, and/or ground.

**Table 2-27: Hazardous Material Classifications**

Class	Description
1	Explosives
2	Gases
3	Flammable liquids and combustible liquid
4	Flammable solid, spontaneously combustible, and dangerous when wet
5	Oxidizer and organic peroxide
6	Poison (toxic) and poison inhalation hazard
7	Radioactive
8	Corrosive
9	Miscellaneous

Traffic accidents on roadways can cause the vehicles carrying hazardous substances to overturn, collide with other vehicles, or ignite and burn. The runoff caused by chemical spills, the vapors created as a chemical dissipates, or the burning of a substance can expose anyone in the immediate vicinity of the incident to extreme danger. Vehicular accidents compound the vulnerabilities of people and the environment to include both traumatic injury due to the crash or kinetics of the incident and the negative effects of absorbing the chemical that is released into the atmosphere.

Injuries from exposure to hazardous substances can involve direct contact with the substance and traumatic injuries from explosions or fires. Most hazardous materials releases involve the

breach of a container or the unintended combining of chemicals. These spills and leaks can occur in businesses, homes, and industries or anywhere else that hazardous substances exist.

There is no unified reporting system for hazardous materials incidents. Industrial spills involving reportable quantities are documented in accordance with state and federal regulations. Smaller spills often go undocumented unless someone is hurt and requires medical attention. Large industrial spills and leaks are investigated by local hazardous materials teams, regulators, and government responders. Spills that occur on highways and railroads become known because local first responders and emergency management officials are involved in responding to the incident. Incidents of non-lethal exposure, such as a small chemical spill in a residence or a broken mercury thermometer, may not even be recognized as an emergency. Individuals do not always know the risks associated with these incidents so they clean up the spill as best they can without any additional reporting.

#### *Hazardous Materials Incident Risk Assessment*

Huron County has significant risk for hazardous materials incidents. The county is home to approximately 68 facilities that manufacture, utilize, and/or store hazardous substances. There are also many, many grain and livestock farms that use fertilizers, pesticides, and other agricultural chemicals in the course of production. Individual homes have substances to care for their property, including large lawns and lush landscaping. There are parks and recreational areas, as well as golf courses and other areas that boast of recreational use with well-groomed and richly fertilized grass. Hazardous substances are transported on county roads and state highways, which includes over 920 miles of roads and highways, two significant railyard facilities, and miles of roadways carrying thousands of rail cars and vehicles across the county every day. Populated jurisdictions along these highways and railroads are particularly vulnerable to hazardous materials incidents because of their proximity to the major transportation routes on which these substances are carried. Because of this, hazardous materials incidents are a countywide hazard and can affect all areas and jurisdictions.

#### *Local Hazardous Materials Incident History*

According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), Huron County has experienced 99 hazardous materials spills or releases on highways or rail between 2005 and 2018. Of these incidents, 75 occurred at a location with a Norwalk zip code, likely due to multiple commercial carrier bases within that area. All incidents except those in Willard were associated with highway transportation by a commercial carrier. The substances being hauled were not of any one type or category, but all were transported in a non-bulk manner and most were carried in a semi-tractor and cargo trailer type vehicle. Losses ranged from zero loss to under \$5,000 per incident. There were no deaths or injuries associated with the PHMSA data.

Willard experienced several rail incidents attributed to the rail switching yard located on the north side of the city. These incidents caused loss of up to \$20,000 per incident but there were no deaths or injuries associated with the PHMSA data.

Local responders indicated that most hazardous materials spills to which they respond are small releases of petroleum or fuel products. While highway traffic in the county creates the risk of a significant incident, especially if a semi-tractor were to collide with a train, most incidents are relatively small. Minimal incidents may occur at a fixed facility or a grain operation but the majority are highway or rail incidents.

The most notable recent hazardous materials incident was a November 2013 styrene release at the CSX yard in Willard. Over 400 homes were evacuated for several days because it was initially unknown when and where the rail car began leaking or the exact form of the chemical. Because of the risk for explosion and/or fire, hundreds of homes were evacuated just after midnight the day before Thanksgiving. Most residents were not allowed back into their homes for several days. CSX responded quickly and definitively, placing evacuees in hotels and providing food and sustenance for the entire period.

### **2.2.6 Invasive Species**

An invasive species is a plant or animal species that is not native to the local ecosystem and whose introduction is likely to cause economic or environmental harm or harm to human life. Across the United States, more than 5,000 species are recognized as invasive. Invasive species are classified as terrestrial plants, terrestrial wildlife, insects and diseases, and aquatic species.

Invasive terrestrial plants can displace native species, impact the wildlife that rely on native species as a source of food or shelter, or form monoculture plant communities that reduce biodiversity. While more than 25% of the plant species in Ohio originate from other areas, most are not invasive; fewer than 100 species are actually considered invasive.

Invasive terrestrial wildlife is much less common than other types of invasive species but can still cause significant damage to natural habitats. Aquatic invasive species are plants and animals that impact the quality of waterways. These can affect large bodies of water, such as Lake Erie and the Ohio River, and much smaller rivers, lakes, and streams. Invasive insects and diseases are insects, fungus, and other small organisms that can negatively impact plants, forests, and the health of wildlife. Table 2-29 identifies the invasive species across these categories that have the greatest impact in Ohio.

**Table 2-29: Invasive Species in Ohio**

<b>Species</b>	<b>Type</b>
Asian Carp	Aquatic
Curlyleaf Pondweed	Aquatic
Hydrilla	Aquatic
Round Goby	Aquatic
Ruffe	Aquatic
Red Swamp Crayfish	Aquatic
Sea Lamprey	Aquatic
White Perch	Aquatic
Zebra Mussel	Aquatic
Asian Longhorned Beetle	Insects & Diseases
Emerald Ash Borer	Insects & Diseases
Gypsy Moth	Insects & Diseases
Hemlock Woolly Adelgid (HWA)	Insects & Diseases
Walnut Twig Beetle	Insects & Diseases
Japanese Honeysuckle	Terrestrial Plant
Japanese Knotweed	Terrestrial Plant
Autumn-Olive	Terrestrial Plant
Buckthorns	Terrestrial Plant
Purple Loosestrife	Terrestrial Plant
Common Reed or Phragmites	Terrestrial Plant
Reed Canary Grass	Terrestrial Plant
Garlic Mustard	Terrestrial Plant
Multiflora Rose	Terrestrial Plant
Bush Honeysuckles	Terrestrial Plant
Feral Pig	Terrestrial Wildlife

#### *Invasive Species Risk Assessment*

As a rural county, Huron County has a significant number of trees and extensively wooded areas, all of which are vulnerable to damage from invasive species. The county's primarily flat terrain contributes to high winds that can impact trees that are dead or weakened from invasive species. When these trees fall, they become storm debris and can fall onto and damage homes, buildings, vehicles, and anything else in their path. Damaged and diseases trees also fall into rivers, creeks, and streams, clogging the waterways and impeding drainage and increasing the county's vulnerability to flooding.

The most recent invasive species to impact the region is the Emerald Ash Borer. With the area's significant tree cover, however, Huron County is vulnerable to damage caused by other tree-infecting insects. Waterways could also be impacted by invasive plant and animal species. An infestation of any time would cause extreme damage across Huron County, making invasive species a countywide hazard that can affect all areas and jurisdictions.

The cost to a community from invasive species is difficult to quantify because it comes from the cleanup rather than direct destruction of property. Actions like removal and disposal of diseased trees and vegetation, repair of properties damaged by falling trees, cleaning and dredging of waterways filled with debris, and repair of infrastructure damaged by the infestation are all costs associated with invasive species. These tasks are extremely expensive and can cost jurisdictions hundreds of thousands of dollars.

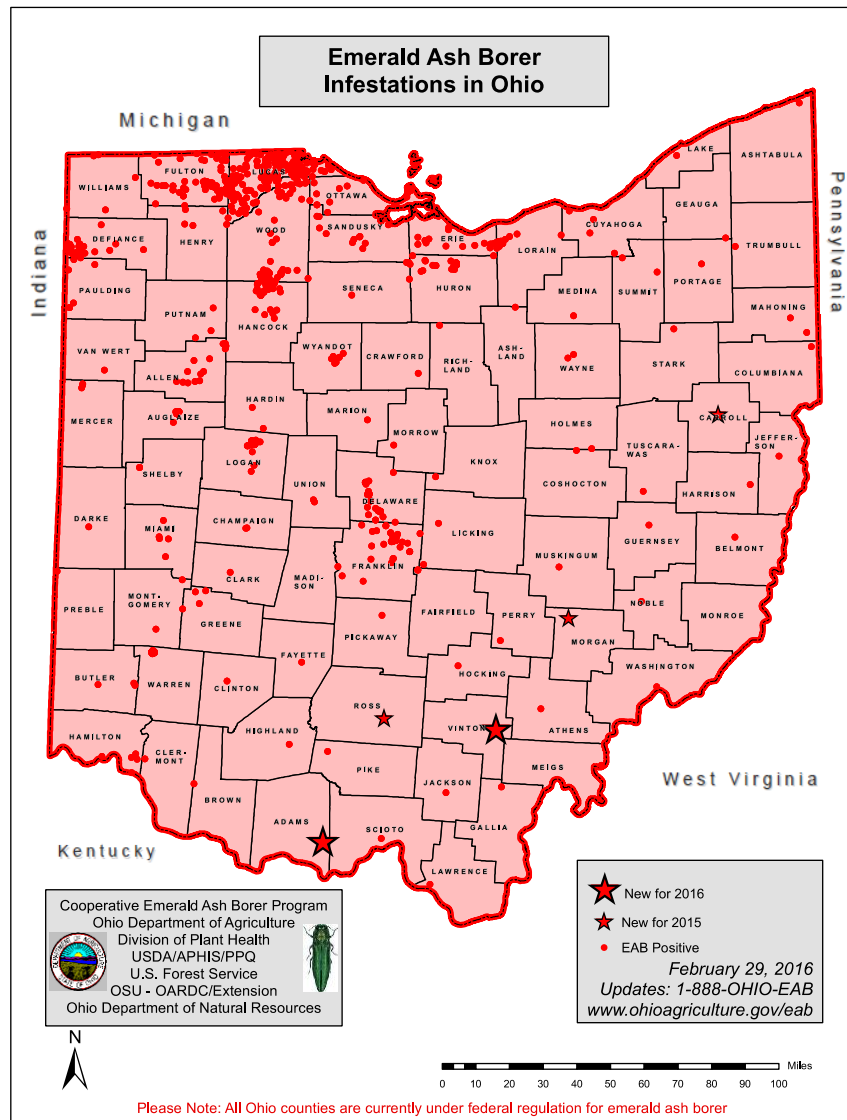
#### *Local Invasive Species History*

The most recent invasive species to impact Ohio, including Huron County, is the Emerald Ash Borer (EAB). EAB is an ash-tree killing insect native to Asia that kills trees within three to five years of infestation. It was first discovered in Ohio in 2003. Since that time, the Ohio Department of Agriculture and partner agencies have worked to protect the state's 3.8 billion ash trees. Map 2-7 identifies EAB infestation areas in Ohio. Area of Huron County, especially the northwest quadrant, were heavily affected by this infestation. The Ohio Department of Agriculture lifted the quarantine on ash wood in 2011, indicating that the worst of the infestation has passed. While the infestation is no longer spreading, most communities are still dealing with the thousands of dead and diseased trees that have not been removed. It will take individual property owners and communities thousands of dollars and years of time to remove these trees. From a disaster perspective, these weakened trees create an increased risk for property damage from high wind events. Dead and diseased trees are extremely susceptible to wind damage. Along waterways, diseased trees also increase flood risk as they fall into streams and impeded drainage.

Other invasive species that are currently under quarantine in parts of Ohio include the Gypsy Moth, Walnut Twig Beetle, and Asian Longhorned Beetle.

Across Huron County, all jurisdictions have experienced significant effects from the EAB infestation. As diseased trees along rivers and streams have died, they have fallen into waterways, impacting drainage and the flow of water. Diseased trees along the public right-of-way have also impacted infrastructure, as they are more likely to fall during a storm or high wind event. The County Engineer and municipal street and road departments have aggressively removed diseased trees along the public right-of-way. This has been effective at reducing the impact on utility lines and other infrastructure but has been a significant financial burden for jurisdictions. Public agencies are also not able to remove trees from private property. Individual landowners are responsible for removing dead and diseased trees from their personal property. Because this does not always occur, there are still hundreds of dead and diseased trees that will continue to cause problems across the county.

Map 2-8: Emerald Ash Borer Infestation Map



**2.2.7 Severe Thunderstorm**

A thunderstorm is a local storm produced by a cumulonimbus cloud accompanied by thunder, lightning, and/or hail. Lightning is a brief, naturally occurring electrical discharge that occurs between a cloud and the ground. Hail is frozen rain pellets that can damage buildings, vehicles, and other structures as they fall. Hail forms in the higher clouds and accumulates size as it falls as precipitation. If temperatures close to the ground are warm, the hail can partially melt or become freezing rain. Most thunderstorms include heavy precipitation and wind. These storms can produce hail, lightning, flash floods, tornadoes, and damaging winds that pose significant risk to people and property in the area. A thunderstorm that produces a tornado, winds of 58 mph or greater, and/or hail with a diameter of at least 1", is considered a severe thunderstorm. These storms typically develop as part of a larger storm front and are preceded and followed by regular thunderstorms.



*Severe Thunderstorm Risk Assessment*

Thunderstorms occur frequently in Huron County. They are most frequent during the spring and summer when heat builds in the afternoon hours, creating an atmosphere ripe for thunderstorms with hail, lightning, heavy rain and wind. Microbursts often include strong straight-line winds that can damage or destroy standing crops. These storms develop quickly and with little warning. Most thunderstorms include heavy precipitation, wind, and thunder. Hail and lightning are possible but occur much less frequently than wind and heavy precipitation. Incidents that include hail and lightning are less frequent but generally more severe. Thunderstorms are a countywide hazard and can affect all areas and jurisdictions. These storms range from minor to severe, although the most are minor or moderate. Thunderstorms are relatively frequent but generally result in limited property damage.

Thunderstorms that include hail are generally spotty and inconsistent. The varying temperatures in the atmosphere needed to create hail do not occur frequently. When hail does fall, it can damage vehicles, roofs, and siding. Injuries or loss of life are rare. The winds associated with thunderstorms can damage standing crops; these crops are vulnerable at different stages of growth, from the early growing stages to harvest. Wheat is harvested in July, but soybeans and corn are not harvested until early fall. Corn is frequently at the pollination stage in July; when stalks are mature, hail and wind can shred and tear the leaves, flatten the stalks, and destroy the ears. This situation can drastically reduce crop yields, causing significant or even extreme loss to farmers for that year’s crop.

**Table 2-30: Thunderstorm Scenario Vulnerability Analysis**

<b>Building Type</b>	<b>Number of Buildings</b>	<b>Exposure</b>
Residential	591	\$155,959,250
Non-Residential	119	\$31,336,250
Critical Facilities	21	\$5,540,000
<i>Totals</i>	<i>731</i>	<i>\$192,835,500</i>

*Local Severe Thunderstorm History*

Thunderstorms are a frequent hazard in Huron County. According to NCDRC records, the county has experienced more than 350 incidents since 1950. While many of these incidents are minor and cause little or no damage, some incidents in the county’s history have caused considerable property damage and injuries. Collectively, thunderstorm incidents have caused more than \$5,000,000 in property damage and \$100,000 in crop loss; two fatalities and thirteen injuries are also attributed to severe thunderstorms.

**Table 2-31: Huron County Severe Thunderstorm History**

<b>Hazard</b>	<b>Incidents</b>	<b>Property Loss</b>	<b>Crop Loss</b>	<b>Deaths</b>	<b>Injuries</b>
Thunderstorm Wind	234	\$5.365M	\$20K	0	9
Hail	113	\$145K	\$80K	0	0
Lightning	4	\$100K	0	2	4

While thunderstorms are common in Huron County and rarely cause significant damage, there are exceptions. One such exception occurred on August 6, 2000 when a thunderstorm downburst with winds of 100mph moved along US 224 in southern Huron County. The storm caused significant damage in Willard, New Haven Township, and Greenwich. Several mobile homes were destroyed, including one in Greenwich that flipped over and injured six people. Across the storm's seven-mile path, more than 1,000 trees were blown down and damaged. Property damage from this incident exceeded \$350,000.

Another severe thunderstorm caused major damage in Norwalk on June 18, 2012. As a warm front moved across the area, a line of strong thunderstorms developed. Winds of 60 to 70mph blew through Norwalk, toppling trees and damaging several residential properties. The city experienced some short-term power outages when the wind snapped multiple utility poles. No injuries were reported but property damage exceeded \$250,000.

### **2.2.8 Tornado**

A tornado is an intense, rotating column of air that protrudes from a cumulonimbus cloud in the shape of a funnel or rope whose circulation is present on the ground. If the column of air does not touch the ground, it is referred to as a funnel cloud. This column of air circulates around an area of intense low pressure, almost always in a counterclockwise direction. Tornadoes usually range from 300 to 2,000 feet wide and form ahead of advancing cold fronts. They tend to move from southwest to northeast because they are most often driven by southwest winds.

A tornado's life progresses through several stages: dust-whirl, organizing, mature, shrinking, and decay. Once in the mature stage, the tornado generally stays in contact with the ground for the duration of its life cycle. When a single storm system produces more than one distinct funnel clouds, it is referred to as a tornado family or outbreak.

Tornado magnitude is measured using the Enhanced Fujita scale, abbreviated as EF. The ratings range from EF-0 to EF-5 and are based on wind speeds and related damage. The Enhanced Fujita Scale has been used as the official tornado rating scale since 2007. The following table is provided by FEMA and indicates the type of damages typically caused by a tornado according to the Enhanced Fujita Scale.

EF-Scale	Wind Speed	Typical Damage
0	65 – 85 mph	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over,
1	86 – 110 mph	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
2	111 – 135 mph	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
3	136 – 165 mph	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
4	166 – 200 mph	Devastating damage. Whole frame and well-constructed houses completely leveled; cars thrown and small missiles generated.
5	>200 mph	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters; high-rise buildings have significant structural damage; incredible phenomena will occur
No rating		Inconceivable damage. Should a tornado with the maximum wind speed in excess of EF-5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. Will create serious secondary damage on structures.

Tornadoes are the most damaging of all atmospheric phenomena. While their frequency is low, the probability of significant damage is high. Because tornadoes occur as part of a storm system, they rarely occur as independent incidents. Emerging out of a storm front or super cell, the tornado can be extremely damaging, especially when accompanied by heavy rain, straight-line wind, lightning, and hail. Effects of a tornado include uprooted trees, damaged or destroyed buildings, and smashed vehicles. Twisting and flying debris turns into projectile weapons, which can cause injuries and fatalities.

#### *Tornado Risk Assessment*

Unlike in the Great Plains states, tornadoes in Ohio are typically narrow and do not reach width of the mega-tornadoes frequent in other parts of the country. Locally, tornadoes are generally 25-500 yards wide and stay on the ground for a few miles. Ohio ranks among the top twenty states in injuries, fatalities, and property damage from tornado events. While tornadoes are not a frequent occurrence in Huron County, their severity and impact can be substantial. The magnitude of past tornadoes has ranged from F/EF0 to F/EF3, with the highest number of incidents classified as F/EF-1. Tornadoes are most common in the spring, although they can develop throughout the summer and fall. In Huron County, tornadoes are a countywide hazard and can affect all areas and jurisdictions.

Most residential buildings in the county are constructed from wood, concrete, brick, and stone. Many older homes are constructed using limestone and other masonry materials; these homes

are built on traditional foundations with basements or crawl spaces. Newer residential construction is frequently built on concrete slabs without basements or crawl spaces. These homes are most prone to superficial damage, roof damage, and falling trees during tornadoes and severe windstorms. Mobile homes are more vulnerable to wind damage because they are less secured to the ground than buildings with foundations, are lighter weight, and constructed of less wind-resistant material than traditionally built homes.

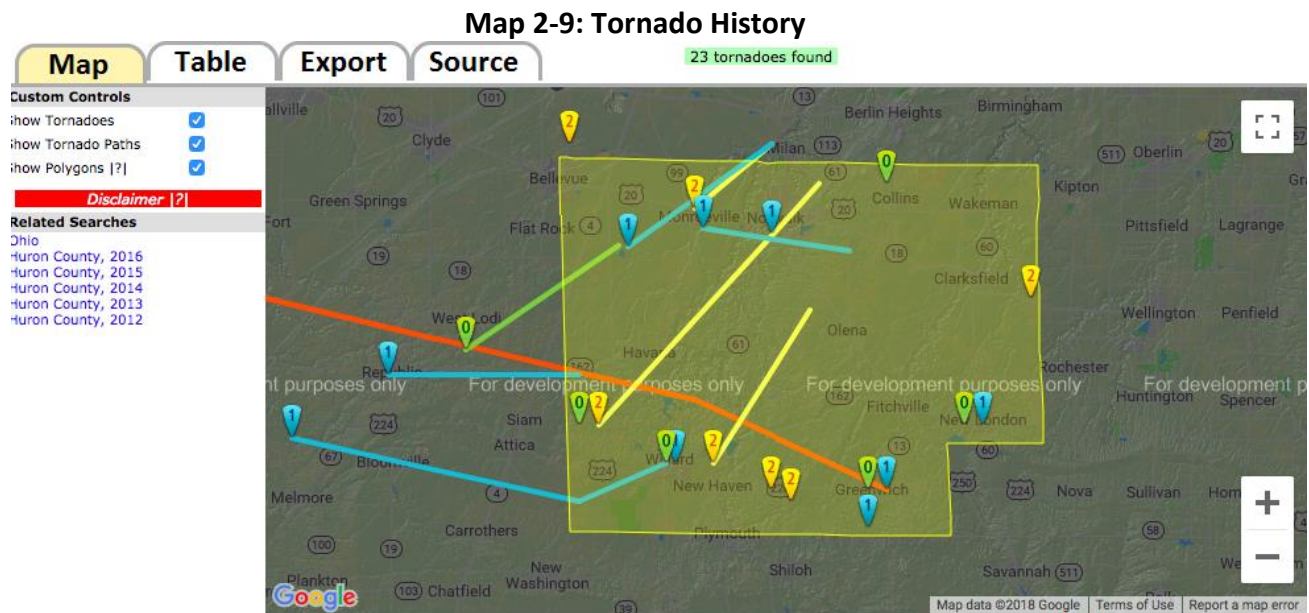
Property damage from tornadoes frequently includes damaged roofs, gutters, downspouts, trees, and, in severe cases, an entire building. Outbuildings, barns, and storage buildings are at risk for damage because these structures are less resistant to wind damage and are frequently built on concrete slabs or dirt foundations.

**Table 2-32: Tornado Scenario Vulnerability Analysis**

Building Type	Number of Buildings	Exposure
Residential	236	\$62,383,700
Non-Residential	48	\$12,534,500
Critical Facilities	8	\$2,216,000
<i>Totals</i>	<i>292</i>	<i>\$77,134,200</i>

*Local Tornado History*

The county has experienced 27 tornado incidents according to NCDRC records. While not all have been severe, the county has experienced significant loss of life and property as a result of some tornado incidents. The map below identifies the location of tornado incidents in Huron County.



**Table 2-33: Huron County Tornado History**

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Tornado	27	\$11.238M	\$45K	6	114

One of the most damaging tornadoes in Huron County's history occurred on May 10, 1973. On that day, multiple tornadoes moved through the Willard area along US 224 in southeast Huron County. Local officials recall at least two and possible three funnel clouds; at least one of the funnels was rated an F3 on the Fujita scale. Four people were killed and at least 100 injured during the storm. The twisters destroyed 160 mobile homes across three mobile home parks, leaving more than 300 people without homes. Multiple businesses suffered severe damage. Records indicate that property damage in the area exceeded \$2,500,000.

Most recently, Huron County was impacted by a tornado outbreak on November 5, 2017. During the afternoon hours, a cold front moved into the area, colliding with the unusually warm and humid air already in the area. This collision of warm and cold air caused a line of severe thunderstorms to develop and spawn multiple tornadoes. These twisters touched down in multiple areas in the central portion of Huron County. Structures in and around the unincorporated communities of Steuben, Peru, Fitchville, and Clarksfield were affected. Several homes and barns suffered extensive damage. The tornadoes were rated as EF0 and EF1 on the Enhanced Fujita scale. No injuries were reported but property damage totaled \$775,000.

### 2.2.9 Water Quality Emergency

Water quality refers to the chemical, physical, biological, and radiological characteristics of water. It is a measure of the water relative to the requirements of one or more biotic species and human need or purpose. A water quality emergency exists when the quality of water available for human consumption is compromised. In recent years, water quality has become a growing concern in northwest Ohio. Lake Erie and its associated rivers and streams are a primary water source for most communities in Huron County and the region. These waters are susceptible to hard algal blooms. These algal blooms occur when colonies of algae grow out of control and produce toxic harmful effects on people and animals. In Lake Erie, high phosphorous levels caused by runoff are considered a contributing factor to these harmful algal blooms. Inland lakes, reservoirs, and other water sources are also susceptible to algal blooms. Some of these algal blooms produce microcystin, which is a poisonous bacterium that can sicken or kill people, fish, birds, and other animals. When microcystin infiltrates a public water supply, the water becomes contaminated and is not safe for human consumption. If the water supply becomes unsafe, the human and economic toll on the region is significant.

In addition to harmful algal bloom risk, water treatment and distribution systems are susceptible to infrastructure failure. This can include anything from long-term lack of repair, maintenance and/or upgrade to contamination from lead pipes and other substances.

### *Water Quality Emergency Risk Assessment*

Because a water quality emergency can occur in any water treatment facility, water quality is a countywide hazard that can affect all areas and jurisdictions in Huron County. When water quality is compromised, the greatest risks to the community are public health and the local economy. If the community's water supply is contaminated, residents lose access to drinking water in their homes and restaurants, grocery stores, and businesses that rely on safe water are forced to close until water service is restored. Other retail businesses and services may be affected if the public travels to other areas for shopping and food service needs during the emergency. This revenue loss, even for a short duration, can have a significant economic impact. Businesses lose critical revenue, which can quickly reduce the wages received by employees. The longer the emergency lasts, the more significant the economic impact. From a public health perspective, contaminated water can cause serious illness when consumed. Persons with special medical needs, compromised immune systems, the elderly, and children are most susceptible to this. Animals, including family pets and livestock, are also susceptible to illness from contaminated water. Any compromise in the water supply can also negatively affect the public's trust of government officials. If the public is concerned about the safety of their water source and doesn't feel local officials are being transparent and fully communicating about the issue, they may question the information provided by local officials.

To protect the community's water supply, jurisdictions must continually monitor, repair, and upgrade their water treatment infrastructure. Because this work is expensive, jurisdictions must plan and budget for this type of work. If the infrastructure is not well maintained and emergency work must be completed when a water quality emergency occurs, the economic hardship inflicted on the community is increased. In addition to the direct economic loss resulting from the emergency, the jurisdiction must immediately identify funds to make the repairs. These costs are often recouped through increases in the fees charged to consumers, ultimately costing residents more money through increases to water rates, user fees, and local taxes.

### *Local Water Quality Emergency History*

The most significant water quality emergency in Ohio occurred on August 3, 2014. While this incident did not directly impact Huron County, it garnered national attention and forced municipalities to consider the impact a similar situation would have on their community. In the early morning hours of August 3, the water treatment plant for the city of Toledo, approximately 60 miles west of Huron County, detected microcystin from a toxic algal bloom in their water supply and declared the water unsafe to drink. Toledo supplies municipal water to much of the greater Toledo region and serves a population of approximately 400,000 people. Local emergency management and government officials scrambled to provide drinking water to the affected communities. Within hours, stores across the region, including some in Huron County, were sold out of bottled water as residents traveled farther from home to purchase critical water supplies for their families. Many restaurants and food service businesses were forced to close until safe water could be provided. Local hospitals also received a surge of patients who believed they were ill from consuming contaminated water. Within three days, Toledo's water was declared safe to drink but the economic and political ramifications lasted

much longer. More than four years later, the city is still determining how to fund critical improvements to their water treatment infrastructure and the municipalities who purchase water from Toledo are exploring alternate water sources.

While Huron County has not experienced a water crisis to this extent, municipalities across the county do have concerns about their water supply. Norwalk has detected algal blooms in one of the city's three reservoirs. Because they closely monitor the reservoirs, they have successfully isolated the affected reservoir and protected the city's water supply. Other municipalities have reported similar concerns. Across Ohio, research is underway to determine the root cause of the increase in toxic algal blooms and identify actions that can be taken to reduce their occurrence.

### **2.2.10 Windstorm**

A windstorm is a weather event with very strong winds but little to no precipitation. Wind speed in this type of event typically reaches at least 34 mph but can be any speed that causes light or greater damage to trees and buildings. Damage can be caused by gusts, which are short bursts of high-speed wind, or longer periods of sustained wind.

A derecho is a widespread, long-lived windstorm. It is often associated with bands of rapidly moving thunderstorms. This type of storm can produce damaging straight-line winds over extremely large areas, sometimes spanning hundreds of miles. To be classified as a derecho, the storm must produce damage over at least 250 miles, have wind gusts of at least 58 mph across most of the storm's length, and multiple gusts of 75 mph or greater. The destruction produced by a derecho can be very similar to that of a tornado. However, the damage from this type of storm generally occurs in one direction along a straight path.

#### *Windstorm Risk Assessment*

The flat to slightly rolling topography of north central Ohio is vulnerable to damage from high wind incidents. In Huron County, windstorms are a countywide hazard and can affect all areas and jurisdictions. The county has little change in elevation to counter the effects of strong windstorms. Most severe wind events are part of a larger storm system that generally include heavy rain, hail, ice, snow, or thunderstorms but extreme winds can occur as an independent hazard.

When wind incidents occur, the most frequent damage is downed trees, which can cause power outages and obstruct roadways. Damage to the county's significant agriculture industry is also a risk. High winds can damage crops and cause reduced yields, which has a negative effect on the county's economy.

**Table 2-34: Wind Storm Scenario Vulnerability Analysis**

Building Type	Number of Buildings	Exposure
Residential	473	\$124,767,400
Non-Residential	95	\$25,069,000
Critical Facilities	17	\$4,432,000
<i>Totals</i>	<i>585</i>	<i>\$154,268,400</i>

*Local Windstorm History*

Huron County has experienced 38 high wind incidents since 1950, according to NCDRC records. These incidents have caused considerable property and crop loss.

**Table 2-35: Huron County Windstorm History**

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
High Wind	38	\$5.9M	\$1.17M	0	0

For Huron County, and most of Ohio, the most severe windstorm on record occurred on September 14, 2008 when the remnants of Hurricane Ike moved across Ohio. Damage across Ohio exceeded \$500,000,000. In Huron County, winds gusts peaked at 60 mph. The severe wind caused extensive damage to tree and utility poles, leading to widespread multi-day power outages. Because the incident occurred as crops were ready for harvest, agricultural losses were significant. According to most estimates, corn and soy bean yields were reduced by at least 3-5% as a result of the storm. In total, the Huron County suffered \$4,000,000 in property loss and \$1,000,000 in crop loss.

More recently, Huron County experienced a significant wind event on October 29, 2012. This incident was also the result of a tropical weather event, Hurricane Sandy. As the remnants of Hurricane Sandy tracked up the east coast, the storm merged with an upper level trough. After combining, the storm surged inland beginning in New Jersey and eventually pushed into northeast Ohio. Damaging winds and rainfall occurred across northeast Ohio, from Cleveland to as far west as Wood County. In Huron County, power outages were reported in Wakeman. Countywide, trees and power lines were down and some homes suffered minor to moderate damage. While this storm was not nearly as damaging as the 2008 event, the county did suffer \$150,000 in property damage.

**2.2.11 Winter Storm**

A winter storm is a weather event that includes several winter weather hazards and can develop anytime between late fall and early spring. These storms can include any combination of extremely cold temperatures, wind, snowfall, sleet, ice, rain, or freezing rain. These severe winter storms are frequent in Ohio but the specific components of each storm depend on the weather conditions at the time. Winter temperatures can be mild and relatively warm (above freezing), or they can fall below zero and stay there for several days. A winter season may include several fluctuations between cold and warm spells or be relatively constant.



A blizzard is a specific type of winter storm characterized by sustained winds or frequent gusts of 35 mph or greater and falling or blowing snow that reduces visibility to less than ¼ mile; both of these conditions must be present for at least three hours to be considered a blizzard.

A non-blizzard version of a severe winter storm often begins with warmer air followed by very cold temperatures and heavy precipitation. An initial blast of warm air can cause temperatures to hover at the freezing point as precipitation falls, causing ¼ “to ½” ice (or more) to form on roads, trees, electrical lines, gutters and roofs, and vegetation. The precipitation starts out as freezing rain and/or sleet and, as the temperatures drop, turns to snow that adheres to the ice and forms heavy clumps that bring down power lines and trees. As the storm system moves through and winds kick up, temperatures drop and the heavy falling snow drifts across roads, ice damages trees and buildings, and road conditions becomes treacherous. This type of storm can drop several inches of heavy, wet snow across the county.

Another type of severe winter storm that can affect northwest Ohio begins with extremely cold weather (below 10 degrees Fahrenheit) and heavy snowfall, high winds, and extreme cold. A severe storm of this nature would likely pack sustained winds of 15-25 miles per hour, over ten inches of snow, and temperatures below ten degrees Fahrenheit for more than 24 hours. This kind of storm can easily dump a foot or more of snow on Huron County and disrupt daily activities for several days. Because the ice is not part of this kind of storm, damages are generally less as power lines are not destroyed and structural damage is not severe. However, the amount of snow is challenging in light of the extreme low temperatures. The snow tends to be fluffy and creates deep snowdrifts and blocks roads.

Ice storms are another type of winter storm event that can impact the area. An ice storm occurs when damaging ice accumulations occur during freezing rain situations. The accumulated ice can cause trees and utility lines to come down, resulting in loss of utilities and communications systems. As ice accumulates on roadways, travel also becomes dangerous. A significant ice accumulation is considered anything ¼ “or more.

#### *Winter Storm Risk Assessment*

Severe winter weather is a risk across all of Ohio. Winter storms range from short, mild bursts of snow and ice to incidents with significant snowfall that last several days. Winter storms are a countywide hazard and can affect all areas and jurisdictions of Huron County. The county’s generally flat terrain makes blowing and drifting snow a significant hazard, especially as it creates treacherous road conditions and reduces visibility for drivers.

Winter storms generally include a combination of hazards, such as ice and snowfall. Ice accumulates as temperatures fall then turns to snow, creating a dangerous layer of snow-covered ice. Sleet and ice create dangerous driving conditions, increasing the potential for vehicular accidents. Road crews work around the clock to clear roadways. On rare occasions, ice storms can occur independent of other winter weather hazards. When ice storms do occur, however, they can have a significant negative effect on the community. As precipitation accumulates on trees and power lines, power outages occur when the branches and lines

break. Extremely cold temperatures can also occur without other accompanying winter weather hazards, although this is infrequent. When it does happen, the incident is typically very short, often only a day or two, and is an inconvenience to residents and businesses rather than the cause of significant property loss.

Across the county, the greatest risk from winter storms is the loss of utilities. Power outages can occur during ice storms or winter storms that include significant wind or snowfall. The majority of the county’s electric lines are above ground, making them vulnerable to damage from wind and ice. Many electric providers have improved their distribution systems in recent years, providing additional resilience, and new construction generally includes underground utilities. However, the supply lines that enter the county are still above ground and vulnerable to weather-related damage. In spite of this, power outages are infrequent and generally not widespread.

Reasonably anticipated losses from winter storms include content loss, such as food and perishables due to power interruptions, and minor economic loss due to short-term business closures. With the exception of the extreme but rare winter storm event, losses would not include structures or infrastructure. Most winter storms are a temporary inconvenience that make residents uncomfortable but last for only a short period of a time, ranging from a few hours to several days. Casualties are extremely rare, with the exception of traffic accidents resulting from dangerous road conditions.

**Table 2-36: Winter Storm Scenario Vulnerability Analysis**

Building Type	Number of Buildings	Exposure
Residential	47	\$14,476,740
Non-Residential	10	\$2,506,900
Critical Facilities	2	\$443,200
<i>Totals</i>	<i>58</i>	<i>\$15,426,840</i>

*Local Winter Storm History*

Huron County has experienced 32 winter storm-related incidents since 1950, according to records maintained by NCDC. While none of these incidents caused loss of life, ice storms and winter storms have caused considerable property loss.

**Table 2-37: Huron County Winter Storm History**

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Blizzard	0	0	0	0	0
Extreme Cold/Wind Chill	7	\$150K	0	0	0
Ice Storm	1	\$4.4M	0	0	0
Winter Storm	24	\$8.274M	0	0	2

For most of Ohio, including Huron County, the most significant historical winter weather event is the Blizzard of 1978. On January 26, 1978, two low-pressure systems combined over Ohio to produce record-breaking snowfall, winds of up to 70 mph, and extremely low temperatures.

Most areas received fifteen inches of snow or more, in addition to the significant accumulation already on the ground. High winds caused severe blowing and drifting, making roads impassable and burying buildings and vehicles. Across the county, many roads were blocked for almost a week, forcing schools and businesses to close. Statewide, 50 people lost their lives and damages exceeded \$100,000,000. To date, this remains one of the most significant winter weather events in Huron County history.

More recently, Huron County experienced a severe winter weather event on December 22, 2004 when a strong winter storm moved across the state. Some areas of Huron County received up to two feet of snow. Strong winds caused blowing and drifting on county roadways, making travel extremely difficult and dangerous. A layer of freezing rain fell on top of the snowfall, worsening the already difficult travel conditions. Damage to utility poles and structures was significant, resulting in \$5,100,000 in property loss across the county.

## **2.3 VULNERABILITY ASSESSMENT**

The Vulnerability Assessment addresses each jurisdiction's vulnerability to the identified hazards.

### **2.3.3 Countywide Vulnerability**

Flooding is the biggest concern in the unincorporated areas of Huron County. Because of the rolling terrain, county and township roads experience flash flooding in many low-lying areas. The county is covered by narrow, two-lane roads that meander through picturesque rural areas; many of these roadways also cross creeks and ditches that can swell and breach their banks when several inches of rain fall over a one to two-day period. There are many one-lane bridges and narrow culverts that cross sizeable ditches, streams, and areas that retain runoff; floodwater can rise above the surface of the road with every drenching storm. While the areas south of Norwalk and west of US 250 are most likely to experience this type of flooding, there is no area in the county that is immune from roadway flooding. Generally, these flood events last at least a day or two but can last longer in extreme events. Three inches of rain in a 24-hour period will flood roadways countywide. Several primary county roads that flood frequently include, but are not limited to, South Norwalk Road in Norwalk Township, Zenobia Road in Hartland and Clarksfield Townships, and Snyder Road in Peru Township.

The Huron River and its tributaries on the west side of the county and the Vermilion River, including its tributaries on the east side, both grow in size and capacity as they flow north toward Lake Erie. They pick up drainage from many square miles of production farmland, residential areas, and development. Because much of this land is too rolling to be tiled, surface runoff is significant and the soils drain poorly. In areas where the terrain prevents effective tiling, many farmers and property owners have installed swales and French drains to facilitate drainage. These areas experience significant surface runoff that moves quickly into the larger ditches and streams. This surface runoff ultimately contributes to deterioration or wash away of roads, berms, stone-covered driveways, and farm lanes in fields, as well as damage to the supporting soil structure around culverts, storm drains, and other drainage infrastructure.

In the extreme southwest corner of the county, near an area in Richmond and New Haven townships referred to as Celeryville, there are areas of muck soil. This rich organic soil is highly erodible and easily displaced by precipitation. Heavy rains and surface runoff can cause the berms of roadways constructed in these muck soil areas to deteriorate quickly. Muck soil provides little solid foundation for pavement, guardrails and berms. When heavy rains and surface runoff conditions are present, these roads can become unsafe due to their extremely narrow two-lane capacity. If a truck, school bus, or car goes off the side of the road in these conditions, it is nearly impossible for drivers to steer back onto the road as the vehicle sinks into the muck very quickly. It is even difficult, due to the size and instability of the berms, for a tow-truck to pull the vehicle out.

Across Huron County, there are over 3,000 culverts under ten feet in size and almost 400 bridges that can incur damage from flood water. When water in creeks and streams rises above pavement, bridges, and culverts, it can damage the pavement and tiles, sometimes causing the foundation to be compromised. In the county's many agricultural areas, livestock can become isolated from barns and feed sources, equipment left in fields can be damaged, and crops can be ruined. When county and township roads are flooded, residents are sometimes unable to travel across the county for work and other purposes, farmers are unable to move equipment or livestock as necessary, and transportation routes across the county must be modified. In the past, the county has experienced loss of life as a result of flooded roadways. When floodwaters rise so quickly that it isn't possible to notify the public or adequately mark closed and flooded roadways, drivers can drive through flooded roadways and lose control of their vehicles. In the most serious circumstances, this can lead to injury or loss of life. In serious flooding events, homes and businesses can suffer structural damage in addition flooded yards, driveways, basements and garages. Flood incidents also cause loss of furnaces, appliances, and possessions and prevent residents from going to work or school.

Huron County's rural areas are incredibly vulnerable to any form of wind, including severe thunderstorms with a combination of lightning, hail and heavy rain, a wind event without precipitation, or a tornado. All three types of wind event are frequent and can be severe. Barn and home roofs are damaged or destroyed, trees are downed, power lines and transformers are damaged, and vehicles and farm equipment are destroyed. Grain operations on the county's many farms can be damaged when bins are pelted and dented, conveyors are bent, and holding bins are toppled. Siding on all types of buildings can be damaged by hail or pelting rain, including small businesses, homes, farm buildings, and barns. Generators are not widely available across the county so when the wind takes down power poles, many people experience power outages. This makes it difficult to feed livestock, maintain poultry and swine operations, and continue production in factories. Most schools in the county are not generator-powered for back-up electrical service, so school is closed when electric service is out.

In the southwest corner of the county, an area of rich, organic muck soil that is highly erodible in high winds poses a specific risk. In wind storms, the muck soil can infiltrate the HVAC systems in buildings, clog filters, and cause a great deal of discomfort to building occupants when the filtration systems are overwhelmed. In some cases, schools and other facilities have taken protective action by installing HVAC systems with additional filtration capacity to handle this nuisance situation. These actions are effective but do place additional financial burden on the facilities that choose to install these systems and require extra work on the part of facility staff.

Invasive species have had a significant effect on Huron County. When tree disease strikes, the wooded areas, rural homestead, roadways lined with deciduous trees and pines, and set aside areas suffer. There is more risk of wind damage, and a much higher risk of tree damage to buildings and businesses. Huron County has a history of damaged churches, homes, and businesses due to wind and ice, made worse by disease factors that weaken the trees. Infestations of various forms of herbicide-resistant vegetation negatively affect crops and choke out forage and other ground cover crops.

Hazardous materials incidents concern Huron County's rural population. The county is covered with both highways and railroad tracks. Norfolk Southern Railroad, CSX, Wheeling-Lake Erie Railroad, and Ashland Railway all have active railroad tracks in the southern part of the county. Wheeling-Lake Erie also has a track that crosses the northern portion of Huron County. These tracks are all very busy; some communities see more than 80 trains per day. These trains haul all sorts of hazardous and non-hazardous chemicals and substances. Every time they turn course, cross a road with traffic, or stop and start there is a potential for derailment or collision. With switching yards in Willard and Bellevue, there is risk for derailment, fire, or collision, and a resulting release or spill of a chemical in liquid, gaseous, or solid forms. Additionally, the county has over 200 miles of highway and 700-plus miles of local roadways that carry hazardous materials-hauling vehicles and rail cars. There are hundreds of small businesses, farms, and homes where hazardous chemicals are used for production, crops, and property maintenance. All pose a risk of a hazardous materials spill or release.

Winter storms are a major inconvenience and public cost for Huron County. With over 700 miles of local roads to plow, including many low-lying and winding rural roadways, it is expensive to deal with severe winter storms. When storms include ice and wind, the downed power lines, fallen trees, and drifting snow add to the difficulty. This stresses municipal budgets with extra overtime hours for employees, high fuel costs, and vehicle maintenance, and the risk for damage to vehicles and equipment. Because few facilities in the county are generator powered, most identified shelter locations, including churches and schools, lack secondary power sources.

Water quality concerns the rural residents of Huron County. Most residents receive water from Northern Ohio Rural Water while others get their water from wells. NORW purchases water from Elyria and Lorain as well as Erie County and the Village of New London. Should one of these water supplies be impaired or contaminated with a non-treatable or undetected toxin, there could be a water emergency for rural Huron County. In general, without regard to treated water supply, rural residents are aware of the nitrogen and phosphorous runoff that endangers the creeks and rivers and causes algal bloom to occur in reservoirs and other bodies of water. They are concerned about this possibility, as it is enhanced by and part of the entire hazardous materials risk assessment.

Drought and extreme heat concern the county from the perspective of potential economic impact on the agriculture industry and danger to people and livestock during extreme heat more than water supply. Grain crop yields can decrease significantly when precipitation levels plummet during the growing season or increase during planting and harvest. This negatively impacts the economy of the entire county. Extreme temperatures negatively affect people, especially those who work outside or in environments that are not temperature controlled.

Huron County has 56 dams. Nine of the ten Class I dams are reservoirs used for water supply, and are well maintained and monitored, have emergency plans, and are owned by municipalities. The Norwalk Reservoir failed in 1969 and many residents still remember the incident that caused a great deal of flooding and property damage. Since then, the dam has

been rebuilt and is monitored on a daily basis. Evacuation planning has been extensive and detailed, and the EMA and first responders are well aware of the plan components. The tenth Class I dam is owned by a homeowner's association at Holiday Lakes and is sometimes lifted during periods of heavy precipitation or snow melt. The water that flows from Holiday Lakes to Monroeville scoops up any available debris, which can become caught in the low-head dam in Monroeville. It does not cause flooding, but it causes debris jams the village of Monroeville then has to manage. All Class I dams have emergency plans. Seven of the twelve Class II and III dams are privately owned; two are wastewater lagoons and two are reservoirs. The remaining are recreational areas. There is little concern over any of these because they are maintained and owned by public entities. Those used for recreational purposes are part of a recreational facility. There are 34 Class IV dams in rural Huron County that are of little concern because they are small, privately owned structures on private property. Most are owned by farmers. While dams are very common in Huron County, dam failure is not considered a high concern in the rural areas because the damage potential is low.

The lowest concern in the rural areas is earthquake because there is little potential for damage. While roads, bridges, and culverts could be damaged, or possibly destroyed by a strong earthquake, the probability is very remote. Damage is more likely to occur to water lines and power poles in a moderate intensity event. There are no extremely tall buildings and most homes are one or two-stories. It is believed that damages would be minimal in the face of a low-intensity earthquake event.

### **2.3.2 Jurisdiction Vulnerability**

Although jurisdictions in Huron County share many characteristics, each individual jurisdiction is somewhat unique in how it is affected by the identified hazards. This section describes how each jurisdiction prioritized hazards and describes their impact.

#### *Greenwich*

Greenwich identified wind as its greatest concern. Wind incidents are most frequently part of severe thunderstorms but can also occur as a tornado or severe wind without accompanying precipitation. Based on frequency, the village ranked these forms of wind as their top three concerns. These incidents are very damaging to the homes and businesses in Greenwich. Roofs and siding are damaged, trees are blown down, and debris is scattered about the village. Streets can be blocked and residents lose access to their property. Power lines can fall, and transformers can be shorted out or damaged. The influx of larger and more aggressive farming practices has led to the removal of fence rows and wooded areas, reducing the number of windbreaks and increasing the amount of crop and landscape fodder that accumulates in culverts and storm basins. Secondary damage occurs to food supplies and electrical systems when wind causes power outages. Village officials explain that after storms, especially in the late summer and fall, the storm sewers, bridges and culverts quickly fill with crop and lawn fodder, clogging them completely until they are manually cleared. Trees can fall and block SR 224 that crosses the village, especially in the winter if ice combines with wind. With a very small

staff, the village is challenged to quickly reverse the damages and situations caused by wind of about any variety.

For similar reasons, winter storms are also an issue for the village. When snow falls quickly and several inches accumulate, street and road maintenance becomes difficult. If wind drifts the snow, it becomes even more difficult to keep up with road clearing. Residents are isolated inside the village or are unable to return home from jobs out of town. When winter storms are accompanied by ice, power outages are common and cannot be repaired until the ice melts. This can leave residents without power for periods ranging from a few hours to several days.

Water quality is becoming a greater concern every year for Greenwich. As local farms are bought by corporate farms, livestock operations are increasing in number and size. Raising mostly chickens, these large operations create manure management problems. The manure pits can leach into streams, raising chemical levels to a dangerous reading and increasing the risk of water table contamination. The use of farm chemicals is increasing significantly, putting the village at risk of vehicle accidents involving farm equipment and fertilizer application apparatus and creating spills or releases of liquid and gaseous chemicals. Surface runoff from untilled or inadequately tiled fields is concerning as it could easily contaminate ditches and streams, and endanger the water supply. The lack of manure management practices has leads to occasional odor issues in the village, making life there unpleasant for some.

Hazardous materials concern Greenwich officials because of the state highway that carries a wide variety of chemicals through town. Three railroad tracks also pass through the village, bringing dozens of trains carrying hazardous materials through the village every day. Officials are concerned that the railroads do not take care of their tracks and culverts, increasing the risk for derailments every year. The blocking of rail crossings is becoming more common, impeding the ability of public safety forces to respond to calls. Village officials indicated that crossings are sometimes blocked for several hours at a time. In addition to blocking roads, the types of chemicals and hazardous substances hauled through the village are a concern. As vehicle and rail traffic increases, the chance of collisions or loss of control also increases. An accident or derailment could contaminate the air, leach into the water that comes from wells, or run off as surface drainage into ditches and streams.

Greenwich ranked flooding as a minor concern. The village has one of the higher elevations in the county so natural drainage occurs easily. There are few areas where runoff pools or collects but most flooding is temporary street flooding or driveways and yards filled with water. The Southwest Branch of the Vermilion River carries water away, and there are numerous ditches that feed into the river that cross the village, carrying surface runoff away.

Greenwich has an aggressive program of tree maintenance, so tree damage from the recent Emerald Ash Borer infestation has been largely eliminated. However, if a new disease develops and affects other trees, this could cause a great deal of damage. The village did not rank invasive species high on their hazard list. They did say, however, that damaged and diseased



trees fall on houses and roadways, damaging whatever sits in their path and creating significant amounts of debris that is expensive and difficult to manage.

Dam failure is a low-ranking hazard for Greenwich. The village owns and operates a Class I dam inside the village on a waterway that flows into the Southwest Branch of the Vermilion River. Water naturally drains away from the village and follows a northern pathway to the Vermilion River. While an emergency plan is not yet complete, the dam is in good repair and ODNR is completing the emergency action plan. The likely inundation area is not highly populated and the most serious loss from a potential breach would likely be the dam itself.

Earthquake is also a very low concern for Greenwich. There are few buildings in the village, and especially very few that are multi-story. Tremors and movement could damage the infrastructure below the ground, such as sewers, water lines, wells, and other buried utilities; it would topple electric and telephone poles, and it would crack and damage pavement, concrete and asphalt. The damage to buildings, unless the earthquake were to be uncharacteristically strong for the area, would likely result in little structural damage.

### *Monroeville*

Hazardous materials incidents are the greatest concern for Monroeville officials. The village is located on US 20, a major four-lane highway that runs across northern Ohio from east to west, and slightly south of the Ohio Turnpike. Many, many commercial vehicles use US 20 to avoid tolls and turnpike delays. State Route 99 intersects the highway on the west side of the village, and many trucks and other commercial vehicles come from US 2 along Lake Erie into Monroeville via SR 99. SR 547 intersects US 20 in the downtown, providing a third route for commercial vehicles to reach other routes to the south. Truck traffic hauling hazardous chemicals along all of these highways is significant. Collisions, loss of control, spills, leaks, and releases of chemicals are concerns to Monroeville residents and officials. Air contamination, water contamination, and evacuation of residents and schools could be necessary. Depending on the specific location of a release, the damages could be extremely high. When farm chemicals and grain operations with grain dryers and transfer devices is added into the mix, the possibility of an incident that causes explosions or fire, extreme contamination, loss of property or life and extensive cleanup costs is a significant possibility. Because of these risks, Monroeville ranked hazardous materials incidents as their highest concern.

Monroeville is not protected by wooded areas or rolling terrain, and therefore any storm involving wind is a potential problem. This includes storms involving straight-line wind, thunderstorms, and tornadoes. The village is home to many trees. The cost of debris management in a significant wind event would be overwhelming. Residential structures are close together and near trees. Many homes could be damaged by falling trees and suffer roof, siding, and other structural damages. The grain elevator could have significant damage to its grain legs, transfer lines, and storage towers. Damage to historical buildings, including several local churches, could also be extensive. Power lines, telephone lines, and other utilities could be damaged.

A water quality emergency is of concern to Monroeville officials. Upstream in the Huron River, the Holiday Lakes homeowner's association controls the release of water from Holiday Lake into the river. When a significant release is made, the water released can be filled with algal bloom, toxins, and other chemicals. There is also a long stretch of farmland and residential areas draining into the river between Holiday Lakes and the village, contributing to nutrient management and runoff issues. There are concerns that a release at Holiday Lakes could trigger a water emergency in Monroeville because the village could not detect and treat the water fast enough. Monroeville has a 180-day supply of water stored in towers and tanks; the village is currently developing an interface with Northern Ohio Rural Water as an emergency backup connection. Even with these backups in place, a water emergency would be costly.

Losses from flooding are moderate, but only occur when rapid, heavy rain falls. Flash flooding can occur in some streets, driveways and parking lots and basements can take on water. As a result, appliances, water heaters, and furnaces are at risk of destruction. Three to five inches of rapid rain can cause the catch basins and flood streets, but it is brief. The police department experiences some basement flooding but, because the basement is not used for critical services, the actual loss is low. The greatest danger from flooding is when people decide to canoe or kayak in the river during dangerous high-water conditions, leading to possible injury or death.

Severe winter storms can be inconvenient for Monroeville residents but property damage and financial loss are minimal. The public cost to maintain the village, however, can be significant. The area's flat terrain allows for blowing and drifting snow, making it difficult for village crews to keep streets plowed and open. Two schools are located inside the village, enhancing the need to maintain safe and clear roads. Unless the winter storm is accompanied by extreme wind or ice, there is little property damage. If a storm does involve ice, power lines are apt to come down and outages occur, leading to private residence losses.

Monroeville officials are not greatly concerned about invasive species. They expect that any tree disease would cost village property owners some trees, but unless an infestation were rapid and extreme, the diseased trees would be treated and trimmed, and few would likely fall. The consequences of the Emerald Ash Borer that took out many, many ash trees over the last decade have been managed and trees weakened by that infestation have been removed by the village or private property owners.

Earthquake, drought/extreme heat, and dam failure were ranked as the lowest risk hazards by Monroeville officials. Within Monroeville, there are few large buildings that would be vulnerable to damage from an earthquake. There is an active grain elevator complex that has several tall grain towers and transfer legs with conveyors between towers. An earthquake could topple these towers and, because it is adjacent to residential areas, cause death or injury and property damage. Several of the multi-story buildings in the downtown area could incur some foundation damage if an earthquake were severe and strong; most homes are one or two stories and would not likely have extensive damages. Streets, highways, sewer and water lines,

electric and telephone poles, and communication towers would likely be damaged, but unless the quake were serious, the damage would be minor.

Monroeville officials report that the village rarely experiences drought or extreme heat. When these incidents do occur, the impact is generally limited to inconvenience to residents. The water supply from the river is ample and local wells are adequate and well supplied with groundwater. It is unlikely that a typical drought would have much impact on the village, and unless something happened to make extreme demands on the water system, losses are unlikely.

Within Monroeville, there is a low-head dam on the Huron River. This dam was built to run power mills in the early 1800s and does not hold back water. The water behind the dam creates a reservoir-like pool of water, which would be available for pumping if needed. There is little concern for failure. The village has considered removing the dam because there is some danger of vortex currents in the water when it runs over the concrete wall. The biggest problem the village has with the dam is when debris, like logs and large branches, get stuck behind it and has to be removed. The trees and debris are generally the outcome of weakened trees along the riverbank that eventually fall into the river. This poses little threat of significant blockage. There is no flood hazard associated with the dam. The village also owns an upground reservoir outside the village limits that is used for water. The reservoir is located amid farmland and there is little risk to the village from this facility; there are no structures in the inundation zone.

#### *New London*

New London officials and residents are most concerned about the potential impact of severe thunderstorms, wind, and tornadoes. The village is located in a flat, open area with little protective terrain or wooded area to protect it from damaging wind. Severe wind, whether from a tornado, thunderstorm, or independent, can remove roofs from barns, houses, and other buildings, and hail can put holes in siding and roofs. Glass windows and walls can be shattered by flying debris in the most serious incidents. Wind also damages power and utility lines and topples trees. Vehicles, emergency equipment, and farm equipment are damaged by flying debris or tipped over and damaged as they are tossed around. Tornadoes can collapse buildings, reducing them to a pile of rubble. Although the worst storms involving wind, thunder, lightning, and heavy rain are not frequent, and tornadoes less frequent yet, their presence leaves a path of damage that is expensive and time consuming to repair. Sometimes storms that include high winds are accompanied by power outages, although New London is home to Firelands Electric Company and outages are typically brief. Most village facilities and infrastructure have generator backup power but generators are aging and in need of upgrade.

Flooding occurs more frequently than wind, and although it does not cause major damage, it can wreak havoc on the village for a short period of time. When precipitation is heavy, Bonnie Creek rises out of its banks and floods properties. The creek is filled with debris and trees so it does not drain effectively unless individuals along the waterway clear those blockages. Other major ditches also flood, causing water to stand in yards, driveways, and an occasional basement. While the village's storm sewers have been improved in recent years, additional

upgrade and replacement would allow for better drainage and improve the system's ability to keep up with runoff from a heavy rainfall. Some streets will flood with rapid precipitation. In general, ditches are debris filled and storm sewers are inadequate, causing minor basement flooding, property flooding, and street blockages.

Severe winter storms can isolate New London from nearby resources and services. The terrain is slightly rolling and ice-coated roads can make it difficult to travel. Schools close because secondary roads are too slippery for buses and people miss work because of drifting and icing on streets and county roads. The village is able to clear roads under normal snowfall conditions but when wind and ice combine with heavy snow, it is difficult for a small village staff to keep up with road work. Extremely heavy snowfall in the spring, or when temperatures hover near freezing, can cause damage to flat roofs and barns when the weight of the snow exceeds the load bearing capacity of the roof. While this is very rare, it is a risk associated with winter storms.

New London has a reservoir that supplies water source to the village's municipal water treatment plant. The reservoir is partially owned by the State of Ohio and is inspected every five years. There is a dam on south side of the reservoir; dam failure would not cause any significant amount of damage to property except farm crops. Losses would likely be just the structure itself. The water in the reservoir is taken from the East Branch of the Vermilion River, and could contain phosphorus and nitrites that contribute to algal bloom and contamination. The reservoir sits amid thousands of acres of farmland, lusciously landscaped homes, and beautiful recreational areas. Therefore, water contamination is a concern to New London.

Because approximately 80-100 trains cross the railroad tracks that run through New London every day, the village is concerned with hazardous materials spills, leaks, and releases. Historically, there have also been significant vehicle accidents at the crossing on SR 162. As train speeds have increased in recent years, so has the likelihood of a collision or a derailment that could contaminate the soils, poison the air, or injure residents. There are also industries in the village that have chemicals on site, residences and businesses that use lawn chemicals and cleaning chemicals, and a host of other sources of hazardous substances. It is possible for chemicals to contaminate ditches, sewers, or streets and present danger to the village.

Drought and extreme heat, while unusual, can lead to an unusually high number of yard and field fires as well as occasional house fires. When dry conditions create readily available fuel to feed fires, the amount of water needed to fight the fire could lead to temporary water line breaks or temporary low pressure, impacting the water supply for business, industry, and homes. A short supply of water, even though it is rare, can prevent lawn and crop watering, recreational use of water, and optional use for maintenance of property. The high heat often accompanies drought can cause human illness as people are not tolerant of the heat index levels and normal activity outside.

Invasive species, depending on the specific type, would cause the trees to die, leading to weakened trees that can fall during storms or create excessive amounts of debris after a wind storm or winter storm. This can cause damage to property, blockage of roads, and extensive cleanup costs.

An earthquake is highly unlikely in New London; if one were to occur, based upon history, it would not be of significant magnitude. There are few buildings higher than two stories. Many downtown buildings are concrete and brick, so damage could be significant with just simple rumble. Infrastructure and roads/streets would likely be damaged, and bridges and culverts could be destroyed. It would take a very unusual and unlikely event to cause extensive damage.

### *North Fairfield*

North Fairfield residents are primarily concerned most about storms that involve wind. Homes and other buildings sit out in the open countryside without the advantage of windbreaks or other protection. In high wind events, roofs are damaged, siding is torn off, and farm equipment and vehicles can be destroyed. Power lines come down, transformers blow, and tall trees fall. These wind-related damages can be extremely expensive and the inconvenience to residents and businesses is extensive. Power outages caused by wind can take time to restore because of the number of new poles that would have to be set to reach the village. The village does not have backup generators for key facilities so residents will be without power for whatever period of time it takes to repair the impacted infrastructure. If winds are very strong or occur as a tornado, damage will be even more extensive and require more time to repair or replace damaged structures. When storms include heavy precipitation, flash flooding of some properties can occur, flooding some yards and basements and making some street impassable for a period of time.

Residents are concerned about hazardous materials because commercial trucks pass through the village on SR 162. As a rural community, the village also sees farm equipment and trucks hauling farm chemicals like anhydrous ammonia, fertilizers, and others move through town on a regular basis. A collision with another vehicle at the main intersection in the center of the village could cause a very large incident and affect all of North Fairfield.

Severe winter storms can isolate North Fairfield. Without so much as a gas station or grocery store in the village, residents would have a difficult time supplying their daily needs. Because of their limited budget, the village struggles to keep up with tree trimming, street maintenance, and snow plowing; an extreme storm could make that more difficult and cost more than the village can afford. While mostly an inconvenience as opposed to hard economic loss, winter storms could also prevent residents in need of medical assistance from obtaining it.

Flooding is not a significant problem in North Fairfield because their elevation is relatively high. Some of the streets experience flash flooding when a couple inches of rain falls. Water can reach some basements and flood yards and driveways but does not last for a long period of time. Navigating the many flooded roads between the village and the larger cities of Norwalk

and Willard is more problematic so residents end up isolated and unable to reach other areas for needed resources and services.

North Fairfield is a nicely landscaped village with many tall deciduous trees. If an invasive species creates weakened trees, this increases the amount of potential debris after storms. This would be a challenge for the village to manage in the aftermath of a significant incident. Infestations of other vegetation can cause difficulty in maintaining property, but the cost is mostly in time and energy of property owners.

Drought and extreme heat are usually of low concern. Unless accompanied by other storms, or if power outages last for several days or more, the village sees these incidents as mostly an inconvenience.

North Fairfield officials feel that water quality is an overall, general concern today but not an exceptional one for North Fairfield. The village is vulnerable to general concerns over the water supply, but they feel they have an adequate aquifer and would not incur huge losses due to this. The village is also developing backup water supplies with other local water providers.

An earthquake would likely have little effect on North Fairfield unless it were exceptionally strong. The houses are small and one or two stories; there is little other infrastructure. The roads and streets and some utility lines would be affected, but otherwise they feel there would be little loss for a low intensity earthquake.

North Fairfield is not vulnerable to dam failure.

### *Norwalk*

Norwalk officials ranked rain and wind as their top risks. Flooding ranked as their highest concern. Norwalk Creek winds through the south half of the city, carrying water from the Norwalk Reservoir on the south end to the East Branch of the Huron River on the west side. Residents report that one inch of rain can significantly raise the water level in the reservoirs and more than one inch causes a rise in Norwalk Creek. The three Norwalk Reservoirs are fed by drainage from farmland south and east of the city; in this area, elevations change quickly, increasing the speed at which water drains into the city's reservoirs. Water from Hartland and Bronson townships' rich grain producing acreage all flows to Norwalk Creek. In mitigation planning meetings, water department employees stated that, when the ground is already saturated or frozen, even moderate rainfalls can cause a significant rise in reservoir water levels. If four to six inches of rain falls, flash flooding is likely across the city and water will require release from the reservoir to prevent dam overtopping. Flash flooding occurs on most of the residential streets south and east of State Route 61. The entire city can experience storm sewer backup if storm sewers are unable to handle more than a few inches of rain at any given time. Norwalk is a rural city in the midst of farmland so flooding during the summer and fall months is accompanied by crop and lawn debris in culverts, clogging catch basins and impeding the drainage of storm water. Streets that follow Norwalk Creek as it meanders through the city will become flooded. Some of the most low-lying areas can have several feet of water that

collects when Norwalk Creek breaches its bank. While some of the high-risk flood areas have been converted to parks as a mitigation effort, many homes are at risk of flooding under heavy rainfall. Flooding will fill basements and yards and, on occasion, reach the main living area of some homes. Many residents experience the loss of furnaces, water heaters, appliances, and other property during heavy rain events. Some experience basement and first floor flooding due to storm sewer back-up.

Wind damage from severe thunderstorms, windstorms, and tornadoes can devastate Norwalk. Known as the “Maple City”, the local landscape is filled with stately maple trees, many over 100 feet high. Severe straight-line and rotational wind can severely damage these trees, destroying the city’s beautiful tree canopy. Wind also damages siding, roofs, and windows in private homes, destroys mobile homes, and harms commercial property. At-risk structures across the city include high-reaching church steeples, multi-story historical buildings in the downtown area, and city parks rich with trees and foliage. Crop fodder, yard waste, and debris from downed trees can be strewn across the city, creating a debris collection problem that is a challenge for the city’s limited street department staff, equipment, and budget. When hail occurs, storm damages extend to dented siding and vehicles, damaged roofs, and broken windows. Norwalk is vulnerable to storms that include multiple hazards, such as wind, rain, and hail, increasing the risk for significant damage across the city.

Winter storms are a source of significant public expense for Norwalk. Blowing and drifting snow clogs streets and highways, requiring continual work to maintain safe and clear roadways. Because multiple state highways are routed in and around Norwalk, large truck and commercial hauler traffic is heavy throughout the city. Some of these routes include sharp turns on somewhat narrow city streets. City crews work diligently to maintain open roads during winter storm events, at significant expense. Structural damage from winter storms is rare in all but the most extreme winter weather events. When snow is wet and heavy, however, flat roofs on commercial properties can collapse from the weight. If a winter storm involves ice, as it often does, electric lines, telephone lines, Internet cables and other utilities can snap and fall, leaving the city in the dark until repair crews can reset poles and replace lines. Power outages can occur during these storms.

Norwalk is very concerned about hazardous materials spills. Many large and small commercial vehicles and trains travel through the city on a daily basis. These vehicles carry many chemicals and dangerous substances. Trains pass through the center of city on the Wheeling-Lake Erie Railroad tracks. Multiple highways cross the city. Some of these routes include sharp turns on narrow streets increase the risk of vehicle accidents and spills as commercial vehicles navigate these routes. Stop-and-go traffic increases the risk of rear-end crashes and resulting cargo spillage. The city’s primary retail shopping areas are located along these highly traveled highway corridors. Because these areas require multiple entrances, exits, and traffic control devices, the risk of traffic accidents between passenger and commercial vehicles is high. All of this increases the chance of vehicle accidents and chemical spills and leaks. Evacuation would be a significant challenge because routing of evacuees around the affected area would be difficult.

Norwalk officials rank water quality as another concern. A water emergency caused by algal bloom in the reservoirs could be a costly problem for the city. Supplying potable water to all 18,000 residents would be expensive, inconvenient, and difficult at best. The cost of testing, monitoring, and treating raw water can be extensive, but would be necessary after any incident; daily monitoring and testing is required even if no toxins are detected. Officials also cite concern about the potential for zebra mussels in the reservoirs, which would clog treatment equipment and significantly complicate the water treatment process.

Invasive species are also a concern to city officials. With thousands and thousands of tall deciduous trees, any infestation that affects maples, oaks, ash, birch, or walnut trees would be a significant cost to the city. Expenses would include treating, trimming and/or removing damaged trees, and replanting new ones. Private property owners could rack up high bills for tree services to trim, remove or replace large trees. Additionally, tree disease increases vulnerability to wind damage and creates additional debris clean-up costs. With Norwalk's history of wind storms, the potential for a very expensive combination of storms and infestations is a concern for the city.

#### *Wakeman*

Storms that involve high winds are potentially very damaging to Wakeman and were ranked as the top concern by village officials. With little protection from wind rows, wooded areas or other structures to break the intensity of high wind, homes and buildings are openly exposed to damaging forces. Roof and siding damage, fallen trees, downed power poles and power lines, and flying debris can all damage property in this small village along the Vermilion River. There are many mobile homes in and around Wakeman; these structures are far less resistant to wind damage than other types of construction. In a wind event, mobile home residents could be displaced and need sheltering and other protective measures. They could also experience more structural damage to their property than other types of homes. Across the village, power outages could occur in the aftermath of a wind event. While the village has backup generators for most critical facilities, community facilities that would serve as shelters for residents are not generator-powered. As a small, rural community, Wakeman does not have many retail stores. In an extended power outage, residents would have to travel to nearby towns to purchase food and other necessities. From an infrastructure perspective, wind events can push crop debris, lawn clippings, and vegetation into culverts and storm basins. This can become an expensive issue for the village, as it takes extra man-power and resources to clear and dispose of this debris. If winds are accompanied by heavy rain, hail, lightning, or tornadoes, damage can be even more extensive. Twisted and mangled debris and destroyed buildings is even more costly and time consuming to repair. The cost and work necessary to collect and dispose of this amount of debris alone could be overwhelming for a community without extensive full-time staff or equipment.

Heavy rain can cause street flooding and water in basements and yards. There are sections of streets that will be temporarily flooded when rain comes fast and heavy. As the Vermilion River flows through town, there can be some riverine flooding in a few lower level properties, but



most of the flooding in the village is surface flooding. While it appears quickly, it also dissipates quickly in most areas.

Wakeman is dissected by US 20, a major two-lane highway that crosses all of northern Ohio. This route is heavily traveled commercial vehicles as a primary alternate to the Ohio Turnpike. Many hazardous chemicals are carried through the village on US 20 as well as state routes 303 and 60. The highways have some twists and turns and there are a few intersections where collisions could occur. Residents are concerned about collisions that would involve an array of chemicals and hazardous substances that could cause an evacuation by contaminating the air, waterways, or other property. The village also lies amid farmland where pesticides and other agricultural chemicals are used. The release of a farm chemical, the presence of one in storm runoff, or the leaking of something from an application tank could also cause problems.

Overtopping of the lagoon at the village's waste water treatment facility could theoretically cause homes in the northeast section of town near the facility to experience flooding or contamination of their property, depending on the specific incident. Failure of the pumping equipment or lift stations could back flow into the river, private property, or homes. However, the lagoon is well-maintained and a fair distance from any homes so the incident and the amount of water involved would have to be significant or driven by sudden equipment failure. Generator power would be helpful if an outage caused lift stations to fail.

Wakeman would experience tree damage and an increased debris field if an invasive species were to impact the village's tree population or other vegetation. Many properties are nicely landscaped with tall, old trees that could be negatively impacted by an infestation.

Drought/extreme heat and earthquake are not perceived to have extensive effects on Wakeman. The village's water supply is adequate and water shortages are very uncommon. Water is provided by Northern Ohio Rural Water. The village has a water contingency plan in place and a backup connection to Lorain Rural Water in the event of a shortage. Extreme heat, unless excessively long-lasting and severe, would be an inconvenience. Generators would be helpful in that case to provide environmental control to elderly and populations more prone to heat intolerance. An earthquake, unless extremely intense, would like damage some water or sewer lines and perhaps the bridge over the Vermilion River. This could cause travel inconvenience and, under the worst conditions, isolate parts of the population. However, damage to homes or critical properties would likely be low.

### *Willard*

Willard officials view severe thunderstorms and wind storms as their most probable hazards. The city's nicely landscaped residential neighborhoods and shaded recreational areas are vulnerable to lightning strikes and wind damage. With many older homes in the city, damage to roofs and siding is likely due to hail and wind. There are modular homes, homes built on concrete slabs, and mobile homes that are more vulnerable to wind damage than homes with block foundations and basements. Sheltering can be a challenge for the residents who live in homes without basements or those constructed with less resistant building materials or

methods. The rapid rainfall frequently associated with severe thunderstorms can temporarily flood low-lying sections of city streets and State Route 224, the highway that crosses the city from east to west. Many homes, schools, retail stores, and businesses have no protective underground shelter so those inside these buildings can be at risk of injury in the most extreme incidents.

Rapid rainfall of four inches can cause flash flooding of streets, property, and businesses. Parking lots can become temporarily flooded and viaducts under railroad tracks can be inundated. Approximately one-third of the city's sewers are combined sanitary and storm; although the city is engaged in a sewer separation program, heavy rain can overrun the storm sewers and cause back up into homes and businesses. It is uncommon, however, to find furnaces, water heaters, and other appliances ruined by basement flooding caused by weather conditions.

While not actually inside the city limits, a small area in the "Celeryville" neighborhood that has muck soils presents a problem for Willard City Schools transportation services as they attempt to transport students from that area to school in the city. The roads are unstable under heavy rain conditions, and the school has to take extra measures to accommodate this. School officials felt this was a strong concern for the city because the school is located within the city limits.

Willard officials are vigilant about water quality. Their reservoir system is located east of the city and pumps raw water from the West Branch of the Huron River. The reservoir does occasionally experience blue-green algae and some of the toxins associated with water quality risk. The water is pumped to the city's treatment plant and then into its distribution system, which includes two elevated tanks. The system is continually updated, well-maintained and constantly monitored. Willard supplies water to city residents, a nearby village, and regional water system. A problem with the city's water quality could affect an area far greater than the city itself.

Willard is a hub of rail activity with the CSX rail line operating a rail yard on the west side of the city. At one time, the Willard yard was one of the largest in the state but yard train traffic has diminished in recent years. The contents of the rail cars, however, continue to grow in complexity and the risk of a hazardous materials spill or release from one of the cars is present every day. The chemicals transported in these cars are too numerous to list, and many are toxic, poisonous, flammable, or corrosive. As the regional network of rail lines come together in the city, the risk of accidents is significant. If a spill were to occur, some Willard residents could need to evacuate their homes with no notice, possibly for multiple days depending on the severity of the incident and timeline for containment. Other risks include damage to property and soils and air contamination. Significant spills could leach into sewer lines, water lines, and other infrastructure. Additionally, there is a liquid gas pipeline just to the north of SR 224 as it traverses the south side of Willard that could experience a break or release. According to the Pipeline and Hazardous Materials Safety Administration, losses from hazardous materials incidents over the last thirteen years have been less than \$20,000. This does not account for

any cost of evacuation or personal loss to property owners, simply loss to the hauler of the offending chemical. Hazardous materials ranked as the city's fourth highest concern.

Dam failure is a concern because of the Willard City Upground Reservoir that holds water from the West Branch of the Huron River and feeds the city's water treatment plant. The dam is located at the southern tip of the 212-acre reservoir. At 64.5 feet high and 12,255 feet long, it is considered a Class I dam by the Ohio Department of Natural Resources. While the inundation area is primarily farmland and a few rural homes and does not include any residences within city limits, the dam is owned and operated by the city. Failure would impact the city in terms of workforce and responsibility. The reservoir is in good repair and well-maintained so a failure is not likely but is a possible risk. A Class IV dam on the northwest side of the city that is owned by CSX Transportation is a remote risk. It is an industrial dam that covers 12.3 acres. There are homes on several streets, grouped into three different neighborhoods, that could be impacted by dam failure in terms of impaired access, surface flooding, property damage, and infrastructure impairment under the worst-case scenario.

Willard has a history of strong winds, and damage to the many deciduous trees can be extensive. Tornadoes are a risk for all of Ohio; Willard experiences some level of tornado incident nearly every year. These cause destruction of buildings and other property, damage to roofs and siding, impairment of critical facilities like water treatment plants, water towers, schools, churches and government facilities. Some very large buildings will lose windows, roofs, and siding during periods of extreme wind. While tornadoes do not happen frequently, their damage can be extensive. Power outages, because power transmission lines and substations are still mostly above ground, can be taken out by severe wind and tornado. This leads to power outages that are partly, but not completely, managed by generators. Many critical facilities have alternate power sources that only operate essential functions like HVAC and emergency lighting. The school, which serves as the city's emergency shelter, has essential emergency power but does not have enough generator capacity to fully operate the building. The school is also vulnerable to wind damage because of the amount of glass surface that could break in heavy winds and tornadoes. The occupants of the school could be exposed to danger should this occur. Willard is quite susceptible to wind damage, whether rotational or straight line, and expensive repairs and replacement is necessary when these incidents occur.

Drought and extreme heat are rare but can cause significant damage. The city's climate is temperate and days that reach 90 degrees Fahrenheit are generally infrequent. When extended periods of extremely high temperatures and limited rainfall do persist, however, the area suffers from significant crop damage, destruction of ground covers, lawns, and pastures, and, in the worst cases, compromise of the water supply. On occasion, a field fire will ignite due to dry conditions. In the worst conditions, a small field fire may extend to buildings and other nearby structures. Most of the area's farmland is located outside the city limits but any agricultural loss of income is felt quickly and as retail centers and institutions in the city suffer lower sales and contributions.

Invasive species can negatively affect this tree-lined city by infecting oaks, maples, ashes, pines, and other species of trees. This exacerbates the amount of debris after severe thunderstorms and wind events and causes damage as weakened trees fall on buildings and other property. An aggressive program of tree trimming cannot keep up with infestations and losses from weakened and diseased trees can be extensive.

While earthquake is extremely rare in Huron County, an earthquake in Willard could damage underground infrastructure. Water lines, sewer lines, and any sub-surface electrical lines would easily be damaged in a strong earthquake. There are few buildings taller than three stories, but some of the old, traditional downtown structures may lack the strength or reinforcement to withstand earthquake shaking. Gas lines and pipelines for liquids could be damaged as well, releasing chemical substances into the air or the earth. While earthquake damages could be bad, the frequency and magnitude of an earthquake in this area, based upon history, would be low and minor. Therefore, earthquake rated the lowest concern as the city ranked hazards.

### **2.3.3 Vulnerability Summary**

Precipitation combined with wind is by far the most concerning event for county officials and residents overall. They experience storms that combine threats, such as severe thunderstorms that spawn tornadoes, have some lightning and hail during the storm, and include high winds that are straight line or rotating winds. Historically speaking, rotational wind vs. straight line wind has not resulted in extremely different consequences. Most storms that result in high damages or expensive repairs involve both precipitation and wind in Huron County. These storms cause much damage, of which a large amount is covered by either personal property owners or insurance companies. That said, damage occurs every year in every jurisdiction due to heavy precipitation and high wind. This is damage to structures, vehicles, crops, equipment, and natural resources like trees and lawns.

Hazardous materials incidents are relatively common in the county and that is mostly due to the combination of many miles of state and interstate highway and the prevalence of rail lines all across the area. Vehicular incidents as well as spills and releases at fixed facilities keeps haz-mat responders busy. The streams and rivers in the county could easily be contaminated, and therefore this ranked high as a threat of concern. The risk of evacuation and major inconvenience that interrupts business and life activities is significant.

Flooding is common in the context of closed rural roads and flooded rural properties. Most flooding causes a great deal of inconvenience, but areas that flood do so regularly enough that they are not lands farmed for profit nor are they heavily populated residential areas. Damage results in closed roads, inaccessible resources and businesses, and extreme inconvenience to institutions and individuals due to impaired access and damaged infrastructure. Some damage is done to structures, road berms and foundations are weakened by the water, and bridges can become impassable. Travelers must take alternate routes, and the risk of a flooded highway that is not marked is the result of rapidly rising water from fast-falling precipitation.

Winter storms interrupt business, prevent transportation of goods, keep workers at home, and close the schools. Drifting roads and slippery pavement make travel difficult, and if winds increase and blow the snow around, drifting is a part of the problem. While few roofs collapse under the weight of snow, many businesses and schools close, and commerce in the county comes to a halt. Vehicle accidents are increased, causing injury, loss of work and medical costs.

Water emergencies are possible but not highly likely. Water retention, whether in dams or reservoirs, is done with attention to maintenance and repairs of the structures. Most dams are small farmstead structures with the exception of two low-head dams that do not change the flow or collection of water but instead hold back a pool of water mostly for recreational uses. While the county is abundant production farmland, production practices prevent a great deal of contaminated runoff and pesticide pollution.

Invasive species has affected ash trees but most of those have been removed and cleaned up. The county is aggressive in detecting and treating infestations, and the consequence of invasive species is additional debris loads after storms. Weed type invasive species are treated chemically and removed from fields, preventing widespread prolific growth on production land or set aside natural plots.

Drought and extreme heat result in inconvenience, and those without air conditioning sometimes go to comfort stations established by the EMA. There is little actual loss associated with this hazard.

Dam failure is not a high concern. Most of the water retention structures are reservoirs that are well maintained and of little risk. The dams that do present risk are continually maintained and emergency action plans establish procedures for evacuation and recovery.

Earthquake would damage infrastructure, including roads, water towers and water lines, utilities, institutions and other critical infrastructure. Homes would be damaged and pipelines could rupture. However, the history of incidents and the likelihood of future incidents is extremely low. The risk is low enough that local officials feel little needs to be done but convey information about a response should the unlikely event ever take place.

Huron County's major concerns will likely always involve the combination of wind and water. Incidents than involve those components can come fast and furious, and leave must destruction in their path. If temperature extremes are concurrent with heavy precipitation, the consequences can be worsened. That results in the most concerning hazard not being one single hazard by itself, but the combination of two, three or four at the same time.

The following chart provides a summary of the hazard rank developed by each jurisdiction.

**Table 2-38: Jurisdictional Vulnerability**

Jurisdiction	Dam/Levee Failure	Drought/Extreme Heat	Earthquake	Flood	Hazardous Materials Incident	Invasive Species	Severe Thunderstorm	Tornado	Water Quality Emergency	Windstorm	Winter Storm
Huron County	10	9	11	1	5	8	2	4	9	3	6
Greenwich	10	9	11	7	6	8	1	2	5	3	4
Monroeville	11	10	9	6	1	8	2	5	4	3	7
New London	10	8	11	4	7	9	1	3	6	2	5
North Fairfield	N/A	8	10	6	4	7	1	3	9	2	5
Norwalk	6	10	11	1	5	9	2	3	7	4	8
Wakeman	9	10	11	6	5	8	1	3	7	4	2
Willard	9	6	11	7	4	10	1	5	8	2	3

## 2.4 RISK ANALYSIS

Based on the available hazard and vulnerability information, Huron County has risk for damage from a variety of disasters. To determine the county's overall level of risk, each hazard was evaluated and scored based on common criteria. The criteria included frequency, response duration, speed of onset, magnitude, and impact on businesses, people, and property. Table 2-39 describes the overall scale used to score each hazard. Table 2-40 explains the scale used to measure magnitude. The composite scores and overall rank for each hazard are in table 2-41.

**Table 2-39 Assessment Scale**

Score	Frequency	Response Duration	Speed of Onset	Magnitude	Business Impact	Human Impact	Property Impact
1	None	< ½ Day	> 24 Hours	Localized	< 24 Hours	Minimum	< 10%
2	Low	< 1 Day	12-24 Hours	Limited	1 Week	Low	10-25%
3	Medium	< 1 Week	6-12 Hours	Critical	2 Weeks	Medium	25-50%
4	High	< 1 Month	< 6 Hours	Catastrophic	> 30 Days	High	> 50%
5	Excessive	> 1 Month					

### *Frequency*

Hazard events that occur regularly are a higher risk than those that occur infrequently.

- 1 = None/Once in 100 years
- 2 = Low/Once in 50 years
- 3 = Medium/Once in 25 years
- 4 = High/Once in 1-3 years
- 5 = Excessive/More than annual

### *Response Duration*

Response duration is defined as the amount time the response to a particular hazard is anticipated to last.

- 1 = Less than ½ day
- 2 = Less than 1 day
- 3 = Less than 1 week
- 4 = Less than 1 month
- 5 = More than 1 month

### *Speed of Onset*

Speed of onset addresses the amount of advance warning before each hazard occurs.

- 1 = More than 24 hours
- 2 = 12-24 hours
- 3 = 6-12 hours
- 4 = Less than 6 hours
- 5 = No warning

### *Magnitude*

Magnitude is rated using standard damage scales such as the Enhanced Fujita Scale, or through development of a local comparative scale that is comparable in damages at like levels using the established damage scales. Some scales from other geographic regions, such as the North East Snow Index Scale, were used as models to develop a comparative tool in Huron County.

**Table 2-40: Magnitude Scale**

Score	Tornado	Windstorm	Flood	Earthquake	Drought	Winter Storm
1	EF-0/1	<65 mph	Minor	<5.9	D-0 Very Dry D-1 Moderate	<8" snow
2	EF-2	65-75 mph	Moderate	6.0-6.9	D-2 Severe	8-12" snow
3	EF-3	76-85 mph	Significant	7.0-7.9	D-3 Extreme	12-16" snow
4	EF-4/5	>86 mph	Major	>8.0	D-4 Exceptional	>16" snow

For all other hazards, the impact was measured as follows:

- 1 = < 10% of population affected directly
- 2 = 11-25% of population affected directly
- 3 = 26-50% of population affected directly
- 4 = > 50% of population affected directly

### *Business Impact*

Business impact refers to the potential economic impact a hazard event is likely to have on a community. The definition of each score refers to the amount of time critical facilities are likely to be shut down in the impacted community.

- 1 = Less than 24 hours
- 2 = 1 week
- 3 = At least 2 weeks
- 4 = More than 30 days

### *Human Impact*

Human impact is defined as the number of lives potentially lost for a particular hazard.

- 1 = Minimum/Minor injuries
- 2 = Low/Some injuries
- 3 = Medium/Multiple severe injuries
- 4 = High/Multiple fatalities



*Property Impact*

Property impact is defined as the number amount of property potentially lost during a given hazard event.

- 1 = Less than 10% damaged
- 2 = 10-25% damaged
- 3 = 25-50% damaged
- 4 = More than 50% damaged

The factors identified above were assigned values as described and rated against anecdotal analysis based upon history and past incidents. This scoring mechanism resulted in very similar assessment of risks and vulnerabilities for the countywide vulnerability analysis.

**Table 2-41: Risk Analysis**

Hazard	Frequency	Response Duration	Speed of Onset	Magnitude	Business Impact	Human Impact	Property Impact	Score	Rank
Dam Failure	1	3	2	2	1	1	1	11	11
Drought/Extreme Heat	4	1	1	3	1	1	2	13	9
Earthquake	1	1	3	1	1	1	1	9	11
Flood	3	3	3	2	2	2	2	17	5
Hazardous Materials Incident	5	2	5	1	2	3	1	19	4
Invasive Species	3	3	1	2	1	1	2	14	8
Severe Thunderstorm	5	4	5	5	1	1	4	24	1
Tornado	4	4	3	3	3	3	2	22	3
Water Quality Emergency	1	2	1	5	2	1	4	16	7
Windstorm	4	4	4	3	2	3	3	23	2
Winter Storm	3	2	1	2	2	2	4	16	6