ERIE COUNTY, OHIO NATURAL HAZARDS MITIGATION PLAN

DECEMBER 2020

PREPARED FOR:
Erie County Emergency Management Agency
2800 Columbus Avenue
Sandusky, Ohio 44870

1 Executive Summary

This plan is the successor to hazard mitigation planning efforts begun in Erie County in 2004 when the County received a grant to develop a Natural Hazards Mitigation Plan for the County and the participating jurisdictions and culminating in the adoption of that plan in 2005.

Erie County assets are at risk of damage due to flooding, severe storms, and other natural hazards. This plan provides a long-term approach to reducing the likelihood that a natural hazard will result in severe damage. This plan updates the data upon which the assessment of risk and identification of vulnerabilities is based and presents updated strategies for making Erie County a safer and more sustainable community.

The Erie County Natural Hazards Mitigation Plan represents the work of residents, business leaders, and elected and appointed government officials to develop a blueprint for protecting community assets, preserving the economic viability of the community, and saving lives. Endorsed by FEMA as following regulations based on the Disaster Mitigation Act of 2000, the plan will help the County to implement mitigation projects so that a natural hazard does not result in a natural disaster.

The hazard mitigation planning update consisted of gathering and analyzing data available from various sources within the county. The data show that the hazards most likely to result in costly damages are flooding, severe storms, and tornadoes. Erie County officials and representatives from local jurisdictions proposed and evaluated strategies that may be effective in mitigating the negative effects of natural hazards and the plan presents a conceptual-level approach for implementing these strategies. The plan recommends several public education efforts, structural efforts such as the development of safe rooms in public areas to provide shelter during tornadoes, and regulatory and planning efforts including monitoring and analyzing risks for future mitigation efforts.

Most mitigation activities require funding. Under the Disaster Mitigation Act of 2000 (DMA2K, 42 USC 5165), a mitigation plan is a requirement for eligibility for Federal mitigation funds. Therefore, a mitigation plan will both guide the best use of mitigation funding and meet the prerequisite for obtaining such funds from the Department of Homeland Security's Federal Emergency Management Agency (FEMA). This Mitigation Plan meets the criteria as set forth by FEMA in the DMA2K and provides a community with a comprehensive guide for future mitigation efforts as they relate to the natural hazards that affect Erie community.

This Mitigation Plan was developed in coordination with a Core Group of individuals from communities and agencies throughout Erie County. The Core Group met four separate times during the planning process to reevaluate the hazards that affect the County, the problems associated with these hazards, potential mitigation alternatives to minimize the effect of these hazards and goals that they would like to see achieved within the county.

Erie County has experienced many natural disasters in the past one hundred years. Through a strategic effort led by the Erie County Emergency Management Agency (EMA)

offices, the Core Group evaluated these hazards and chose to address the following hazards based on their impact on human health and property damage: damaging winds, droughts, earthquakes, flooding, lake/stream bank erosion, natural biohazards, severe summer weather, severe winter weather, and tornadoes/waterspouts.

The culmination of Erie County's Mitigation Plan was an Updated Action Plan for the communities to use to track progress on the implementation of their mitigation alternatives. By adopting this plan, county, township and incorporated jurisdictions of Erie County commit to working with citizens and business owners to make their communities safer.

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3 Introduction

This plan is an update of the Erie County Natural Hazards Mitigation Plan that was originally adopted in 2005 by the Erie County Commissioners and all incorporated jurisdictions within the County.

Erie County is at risk of damage from a variety of natural hazards: damaging winds, droughts, earthquakes, flooding, lake/stream bank erosion, natural biohazards, severe summer weather, severe winter weather, and tornadoes/waterspouts. This plan explains the analysis of the potential effects of these natural hazards on the structures and infrastructure within Erie County and proposes measures to reduce the risk of a natural hazard leading to a disaster with property loss, business disruption, or even loss of life.

In the past, natural hazards have led to costly disasters in Erie County resulting in Presidential Declarations of Major Disaster or Emergency Disaster Declarations. These declarations are listed in Table 1. There have been no Disaster Declarations for natural hazards since 2012 in Erie County. The COVID-19 Pandemic major disaster declaration in 2020 is not considered a natural hazard.

Table 1: Past Presidential Disaster and Emergency Declarations in Erie County[1]

Date	Disaster Declaration Number	Hazard	Public Assistance
July 15, 1969	DR-266-OH	Heavy Storms and Flooding	$43,478.26
November 24, 1972	DR-362-OH	Storms and Flooding	$123,172.60
April 27,1973	DR-377-OH	Storms and Flooding	$177,246.88
January 26, 1978	EM-3055-OH	Severe Blizzard Conditions	$40,303.06
August 4, 1992	DR-951-OH	Severe Storms, Tornadoes, and Flooding	$8,308,334
August 25, 1995	DR-1065-OH	Severe Storms and Flooding	None
August 23, 2003	EM-3187-OH	Power Outage	$20,353.54
January 11, 2005	EM-3198-OH	Snow Removal and Response	$174,178.85
September 13, 2005	EM-3250-OH	Hurricane Katrina Emergency Shelter Operations	$2,499,103
July 2, 2006	DR-1651-OH	Severe Storms and Flooding	None
June 30, 2012	EM – 3346-OH	Severe Storms	None

[1] (Federal Emergency Management Agency, 2020)

Flooding is a major hazard in terms of total damage costs. Out of the ten presidential disaster declarations, six of them are related to flooding.

3.1 Purpose of the Plan

The emergency management community, citizens, elected officials and others in Erie County recognize the potential impacts of natural hazards on their community and have developed this plan to mitigate potential damages and reduce future losses. Hazard mitigation actions reduce the potential for loss of life and destruction of property. Mitigation actions are taken in advance of the occurrence of a potential hazard and are essential for breaking the disaster cycle of damage, reconstruction, and repeated damage.

This plan presents an evaluation of the potential negative consequences of the natural hazards that may affect Erie County and proposes strategies that will reduce or mitigate losses.

Adoption and implementation of this plan ensures that Erie County and participating jurisdictions continue to be eligible to apply for and receive certain Federal grant funds that are administered by the Ohio Emergency Management Agency (Ohio EMA) for the Federal Emergency Management Agency (FEMA). This plan complies with the requirements of the Disaster Mitigation Act of 2000 and its implementing regulations published in Title 44 of the Code of Federal Regulations (CFR) Section 201.6.

3.2 Organization of the Plan

To make the plan easier to follow, this plan is organized by hazards identified by the Core Group. This plan explains all steps of the mitigation planning process for each hazard. By organizing the plan by hazard, the relationships among a hazard, the potential effect of the hazard, and the actions proposed for mitigating negative effects of that hazard are obvious.

The sections of this plan are as follows:

- **Introduction:** Identifies the purposes of this plan and the jurisdictions that have participated in plan development.
- **Planning Process:** Summarizes the earlier planning process as well as the process of updating this plan.
- **Community Profile:** Discusses existing conditions, including development trends and current local government capabilities.
- **Hazard Identification:** Identifies the natural hazards that may affect Erie County.

- **Hazard Risk Assessment:** Includes a profile of each hazard, updated occurrence data since the last plan update, and an assessment of the potential impact of each hazard.
- **Summary of Risk Assessment Findings:** Highlights the conclusions of the previous Risk Assessment Sections.
- **Mitigation Goals:** Presents planning principles, mitigation goals, and objectives.
- **Mitigation Actions:** Explains process by which new mitigation actions were developed and the cost benefit analysis and prioritization methods used for the newly developed mitigation actions. Provides the status of actions proposed in the previous plan, presents a comprehensive array of possible actions, and explains how actions were evaluated.
- **Plan Maintenance:** Explains how mitigation actions will be monitored and how the plan will be evaluated and updated.
- **Sources of Information:** Lists web sites and publications used to develop this plan.
- **Appendices:** Include sample plan adoption resolutions, public notices about the planning process, and the survey instruments used by participating jurisdictions.

3.3 Jurisdictions Represented in the Plan

This is a multi-jurisdictional hazard mitigation plan. The jurisdictions that participated in the development of this plan are the same jurisdictions that participated in the development of the initial version of this plan and passed legislation adopting the plan.

Along with the County government officials involved, the participating jurisdictions included:

- Village of Bay View
- City of Bellevue
- Village of Berlin Heights
- Village of Castalia
- City of Huron
- Kelley's Island
- Village of Milan
- City of Sandusky
- City of Vermilion

The following townships were also included in the planning process, but are not required to formally adopt the plan:

- Berlin Township
- Florence Township
- Groton Township
- Huron Township
- Margaretta Township
- Milan Township
- Oxford Township
- Perkins Township
- Vermilion Township

The adjacent Counties of Lorain, Huron, Ottawa, and Sandusky were invited to participate in the planning process and provide input on planning efforts. Evidence of invitations to participate is found in Appendix A.

3.4 Adoption Resolutions

Appendix A provides sample adoption resolutions that participating jurisdictions can use to officially adopt the plan after FEMA Region V determines that this plan is Approved Pending Adoption (APA). An approvable plan meets planning requirements specified in 44 CFR Section 201.6. A plan is fully approved after it is adopted. Signed adoption resolutions will be included in Appendix A when the plan is submitted for final approval by FEMA Region V.

4 Planning Process

The Erie County Natural Hazards Mitigation Plan represent the work of citizens, elected and appointed government officials, business leaders, and volunteers of non-profit organizations in developing a blueprint for protecting community assets, preserving the economic viability of the community, and saving lives.

4.1 Mitigation Core Group

During the Planning Process, the plan was led by a Mitigation Core Group. Representatives of the previous Mitigation Core Group as well as other community leaders were invited in November of 2019 by the County EMA Office to actively participate in updating the plan; those who accepted the invitation comprise the current Mitigation Core Group members.

Table 2: 2020 Mitigation Core Group Members

Jurisdiction	Organization	Name
City of Sandusky	Sandusky Police Department	Scott Dahlgren
City of Sandusky	Sandusky Fire Department	Steve Rucker
City of Sandusky	City of Sandusky	Josh Snyder
City of Vermilion	Vermilion	Jim Forthofer
City of Vermilion	Vermilion Fire Department	Rodney Johnston
City of Vermilion	Vermilion Fire Department	Chris Stempowski
Erie County	Erie County Soil and Water	Eric Dodrill
Erie County	Erie County Health Department	Ashley Franks
Erie County	Erie County Soil and Water	Breann Hohman
Erie County	Erie County EMA	Kim Johnson
Erie County	Erie County EMA	Tim Jonovich
Erie County	Erie County DOES	Dave Moyer
Erie County	Erie County Commissioner	Matt Old
Erie County	Erie County Sheriff's Office	Jared Oliver
Erie County	Erie County Commissioner	Pat Shenigo
Erie County	Erie County Commissioner	Stephen Shoffner
Erie County	Erie County Sheriff's Office	Paul Sigsworth
Erie County	Erie Regional Planning	Carrie Whitaker
Erie County	Erie County EMA	Gary Wobser
Erie County	Erie County Auditor's Office	Mark Worblewski
Groton Township	Fire Department	Kerry Jett
Margaretta Township	Margaretta Township Fire Department	Tom Johnson
Oxford Township	Township Trustee	Jim Stewart
Perkins Township	Perkins Township	Gary Boyle
Perkins Township	Perkins Police Department	Vince Donald
State of Ohio	ODNR	Douglas Johnson

Jurisdiction	Organization	Name
State of Ohio	Department of Natural Resources	Jancie Kerns
State of Ohio	Department of Natural Resources	Emily Kuzmick
State of Ohio	ODOT	Brendan Schlachter
Vermilion Township	Vermillion Township	Bob Kurtz
Village of Milan	Red Cross & Milan Village	Suzanne Boegli
Village of Milan	Village of Milan	Brian Rospert
State of Ohio	OVH Police	A.J. Alt
State of Ohio	OVH Police	Rick Ramos
N/A	Red Cross	Lora Taylor
Village of Kelleys Island	Councilman	John Longbrake

To aid in the development of the plan, the county contracted the services of All Clear Emergency Management Group (All Clear), a consulting firm with expertise in hazard mitigation planning.

4.2 Jurisdictional Participation

During the process of updating the plan, each meeting of the Mitigation Core Group was open to representatives of participating jurisdictions and the public. Representatives were invited to attend the first meeting in person or to take advantage of a conference call option to participate in the discussion. During the COVID-19 pandemic, all meetings were held virtually.

The first meeting of the Mitigation Core Group was held on December 17, 2019 at the Erie County Office Building. Representatives from each participating jurisdiction were invited by the Contractor via email to participate in the meeting, a copy of the e-mail invitation and notes from the meeting are included in Appendix B. During this meeting, Core Group members discussed the importance of mitigation, the planning process, an outreach strategy, and next steps needed by participating jurisdictions.

At the second Core Group meeting on March 6, 2020, the Core Group reviewed work previous completed, gaps in the data, and ways to incorporate mitigation planning into other avenues. The Core Group also had an in-depth discussion facilitated by the Contractor regarding the hazards to be addressed in the plan, and the impacts of those hazards. The Core Group approved the Contractor's recommendation of separating Severe Weather into Severe Winter Weather and Severe Summer Weather to better address the specific vulnerabilities of each. Additionally, it was agreed upon that Lake Level Rise, Karst, and Harmful Algae Blooms needed to be incorporated into the mitigation plan, either as their own hazards or as part of existing ones. Based upon the Contractor's recommendation, Lake Level Rise was to be incorporated into the Flooding hazard and the Lake/ Stream Bank Erosion hazard as mitigation against the cause of Lake Level Rise is not as feasible as mitigating the impacts of it. Harmful Algae Blooms was incorporated into the invasive species hazard and renamed "Natural Biohazards" to fully encompass the two related hazards.

The Contractor also reviewed the risk assessment process, in which each member of the Core Group was invited to submit an online form that asked that they rate the consequence, vulnerability, and frequency of each hazard, on a high, medium, low basis.

A third virtual planning meeting was held on September 4, 2020 with the Core Group. During this meeting, the Contractor reviewed the results of the risk analysis, the outreach strategy and information about the specific hazards. In addition, at this meeting, the Contractor recommended adding Damaging Winds as a separate hazard. Research showed that Erie County was subject to damaging wind events that were not associated with thunderstorms throughout the year, so incorporating into Severe Summer or Severe Winter Weather was not appropriate. Additionally, damaging winds have occurred in Erie County every year, and has resulted in costly damage.

At the third planning meeting, the Contractor reviewed the mitigation goals, and worked with the Core Group to develop a new goal to address damaging winds. The Contractor also explained the steps required to develop mitigation actions and reviewed the cost benefit analysis that was used in the previous plan. The Core Group made the decision to continue that cost benefit approach for the newly developed mitigation actions. The Contractor distributed a template that each of the Core Group's participating jurisdictions could use when developing their mitigation actions and evaluate them using the cost benefit analysis method.

A final meeting was held October 7, 2020, in which the draft plan was presented to the Core Group and any members of the public who chose to attend. As everyone participating in the meeting had been participating throughout the process, a review of the mitigation planning process was not included during the presentation. The Contractor pointed out key updates that occurred during this plan, including changes to the hazards addressed and the mitigation goals. To wrap up the meeting, the Contractor explained the final steps in the process, including the public comment period for the plan, which would be finalized October 21, 2020, for submission of the Plan to Ohio Emergency Management Agency. The Contractor also described the review and approval process, as well as the adoption process each participating jurisdiction must undergo to be a full participant in the plan.

Additional correspondence occurred throughout the planning process update through the Erie County Emergency Management Agency. When there were defined gaps in data, the Erie County EMA Director helped the Consultant either locate the source of the needed data or directly supplied the data to the consultant for inclusion in the Mitigation Plan. When representatives of a jurisdiction were unable to participate in one of the Core Group meetings, the contractor met with those representatives, virtually, to go over material covered during the larger planning meetings and to obtain any needed information.

Table 3 summarizes the participation by the various jurisdictions in the 2020 Natural Hazards Mitigation Plan Update Process. An X in a column indicates that at least one representative from that jurisdiction was present at a meeting or submitted requested information, or a member of the public completed the community survey.

Table 3: Participation by Jurisdiction in Natural Hazards Mitigation Plan Update Process

Jurisdiction	Meeting 12/17/19	Meeting 3/6/20	Meeting 9/4/20	Meeting 10/7/20	Capability Matrix	Risk Assessment	Comm. Profile	Comm. Survey	Add'l. Phone Meetings
Erie County	X	X	X	X	X	X	X	X	X
Village of Bay View					X	X	X	X	
City of Bellevue					X		X		
Village of Berlin Heights					X	X	X	X	X
Village of Castalia					X	X			X
City of Huron					X	X		X	X
Village of Kelleys Island			X		X	X	X	X	
Village of Milan	X				X	X	X	X	X
City of Sandusky	X	X	X	X	X	X	X	X	X
City of Vermilion	X		X		X	X	X	X	
Berlin Township					X	X	X	X	X
Florence Township					X	X	X	X	
Groton Township						X	X		
Huron Township			X		X	X	X		
Margaretta Township		X	X	X	X	X	X		
Milan Township								X	
Oxford Township	X				X	X	X		
Perkins Township	X	X	X	X	X	X	X	X	
Vermilion Township			X		X	X	X	X	

4.3 Public Involvement

Each Core Group meeting was open to the public, and private citizens other stakeholders in the County were encouraged to participate. Prior to each meeting, notices were posted on the Erie County website and social media. Local jurisdictions also shared the announcement on their social media or website, too. Evidence of these posting are included in Appendix D.

During the previous mitigation plan update, public involvement was limited. In order to provide another avenue for public participation, the Contractor developed a Mitigation Factsheet and an electronic survey that the County and Jurisdictions distributed. Copies of the Factsheet and the survey and survey results are included in Appendix D. Forty-three members of the public participated in the survey and represented unincorporated Erie County and most of the jurisdictions. The results provided meaningful information to the Core Group and each of the jurisdictions, as they reviewed and developed their new mitigation actions.

The public was provided an opportunity to review and provide comment on the draft Erie County Natural Hazards Mitigation Plan throughout the entire planning process. An electronic copy of the Plan was made available for download by the public to provide an opportunity for them to review the Plan following the October 7, 2020 Draft Plan meeting. Social media and website posts were created by the Contractor asking members of the public to review the plan and submit any comments people might have. The posts included the link to the Plan and contact information for the public to use to submit any comments. No comments were received by the public during the comment period. Minor editorial corrections were submitted by the Core Group and the Contractor included those edits in the plan that was submitted.

4.4 Other Planning Mechanisms

During the process of updating the plan, All Clear and the Mitigation Core Group reviewed existing planning mechanisms to ascertain community capabilities and identify opportunities for implementing mitigation actions. These plans are further referenced in the Capability Assessment section of this plan. The Erie County EMA office staff also worked directly with incorporated communities not present at any of the planning meetings so they have input into the planning process.

During the planning process the following existing plans were reviewed:

- Erie County Flood Damage Prevention and Floodplain Regulations
- Erie County Comprehensive Plan
- Erie County Stormwater Management Rules and Regulations
- Erie County Subdivision Regulations
- City of Sandusky Flood Damage Reduction
- Berlin Township Zoning Ordinances
- City of Bellevue Zoning Ordinances
- City of Huron Zoning Ordinance
- City of Sandusky Planning and Zoning Code
- City of Vermilion Zoning

- Florence Township Zoning Book
- Huron Township Zoning Resolution
- Margaretta Township Zoning Ordinances
- Milan Township Zoning Resolution
- Perkins Township Zoning Resolution
- Vermilion Township Zoning Resolution
- Village of Bay View Zoning Resolution
- Village of Berlin Heights Zoning Ordinance
- Village of Kelleys Island Ordinances
- Village of Milan Planning and Zoning Code
- City of Huron: Vision 2020 City-Wide Master Plan
- Sandusky 2018 Bicentennial Vision Comprehensive Plan

4.5 Gathering New Data

Gathering and analyzing new data about natural hazards and the community was critical to the process of updating the plan as well as verifying data that existed in previous plans. In instances where data from the previous plan could not be corroborated from existing sources, the data was replaced with what is currently available. Data that could be verified was included, with newer information added, as appropriate. Because data from the 2020 census is not yet available, population and housing figures came from the latest available data from the census bureau. However, Hazus-MH software, which was used in the analysis for Flood and Earthquake hazards, only has data available from the 2010 census. As the population of Erie County has decreased since the 2010 census, the Hazus results represent a conservative analysis in regard to impacts to people and structures.

5 Community Profiles

This section provides a large amount of information on the county for community leaders to make better informed decisions when dealing with mitigating natural disasters.

5.1 County Information

On March 15, 1838, the Ohio government authorized the creation of Erie County. The county was originally parts of Huron and Sandusky Counties. Residents named the county after the Erie natives. The county was originally a portion of the Connecticut Western Reserve and was part of the Fire Lands. Located on Lake Erie, the county and its residents played an important role in the Underground Railroad during the first part of the nineteenth century. Sandusky and Huron were once busy ports, allowing Ohio farmers and businesses to ship their products all over the world.

Erie County is heavily rural, with urban areas comprising six percent of the county's land mass. Most residents find employment in service industries, with manufacturing establishments and sales positions coming in second and third respectively. The county is a major tourist destination, with Cedar Point Amusement Park residing within its borders. Lake Erie also attracts a large number of visitors, who participate in boating and fishing.[2]

Erie County is located in north central Ohio, along the shore of Lake Erie. According to the U.S. Census Bureau, the County has a total area of 626 square miles, with 255 square miles of land and 371 square miles of water. Erie County is bordered on the east by Lorain County, on the south by Huron County, on the west by Sandusky and Ottawa Counties and on the north by Lake Erie. The northern boundary of Erie County consists of 35 miles of shoreline along Lake Erie and Sandusky Bay. Erie County extends 28 miles in an east-west direction and 11 miles in a north-south direction.

The City of Sandusky, which is the County Seat, forms the largest incorporated area, with 24,564 residents, according to estimated population data in 2019[3]. Sandusky is 55 miles east of Toledo, 60 miles west of Cleveland and 106 miles north of Columbus. Other cities in the County, in the order of descending population, include Huron, Vermilion and Bellevue. Villages in the County, in the order of descending population, include Milan, Castalia, Bay View, Berlin Heights and Kelleys Island.

Erie County is highly suitable for agriculture because of its relatively mild temperatures. The County has annual mean temperature of 49˚F, an average low of 20˚F in February and an average high of 86˚F in July. The average annual rainfall of Erie County is 34 inches. Over 50% of the County's land is used for farming various fruits and vegetables, as well as raising cattle and hogs.[4]

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[2] (Ohio History Connection, n.d.)
[3] (United States Census Bureau, 2020)
[4] (United States Department of Agriculture, 2017)

Erie County is accessible by land, water, or air. U.S. Highway 6 runs east-west along the coast of the County. The Ohio Turnpike (Interstates 80 and 90) also runs east-west through the County and provides access to the cities of Cleveland and Toledo. Six additional Federal and State Highways provide transportation access in the County. Two major railroads pass through Erie County. Shipping access to Lake Erie is available in Huron, Sandusky, or Vermilion. The primary airport utilized by Erie County residents is the Erie-Ottawa Regional Airport is located close to the city of Port Clinton and is within Ottawa County, as the Griffing Sandusky Airport has permanently closed. There are seven other airports within the County and four heliports. However, only three of the airports are accessible to the public.

The entire county population is 74,266 according to 2019 population estimates. Shown in Table 4 is the growth of the county since the 1800s.

Table 4: Erie County's Overall Growth 1810-2019

Year	Total Population	Year	Total Population
1800	N/A	1920	39,789
1810	N/A	1930	42,133
1820	N/A	1940	43,201
1830	N/A	1950	52,565
1840	12,559	1960	68,000
1850	18,568	1970	75,909
1860	24,474	1980	79,655
1870	28,188	1990	76,779
1880	32,640	2000	79,551
1890	35,462	2010	77,079
1900	37,650	2019	74,266
1910	38,327		

There are nine (9) townships in Erie County. Table 5, below, illustrates the change in population over the past decade.

Table 5: Changes in Population from 1990 to 2019[5,6]

Name	1990 Total	% Change 1990-2000	2000 Total	% Change 2000-2010	2010 Total	% Change 2010-2019	2019 Total
Erie County	76,781	3.6%	79,551	-3.1%	77,079	-3.6%	74,266

[5] (United States Census Bureau, 2005)
[6] (United States Census Bureau, 2020)

Name	1990 Total	% Change 1990-2000	2000 Total	% Change 2000-2010	2010 Total	% Change 2010-2019	2019 Total
Bay View Village	739	-6.4%	692	-8.7%	632	-4.7%	602
Bellevue City*	0	0%	0	NA	2	0	2
Berlin Heights Village	688	-0.4%	685	4.2%	714	-0.1%	713
Berlin Township	3,280	12.9%	3,702	0.6%	3,723	-2.1%	3,646
Castalia Village	945	-1.1%	935	-8.9%	852	-4.3%	815
Florence Township	2,024	23.5%	2,500	-2.1%	2,448	-3.4%	2,364
Groton Township	1,247	11.0%	1,384	3.1%	1,427	-4.2%	1,367
Huron City	7,158	11.2%	7,958	-10.2%	7,149	-3.9%	6,869
Huron Township	9,352	12.6%	10,530	1.6%	10,697	-2.0%	10,478
Kelleys Island Village	172	113.4%	367	-15.0%	312	-0.3%	311
Margaretta Township	6,334	-0.7%	6,289	-4.9%	5,981	-2.9%	5,806
Milan Township	3,153	16.9%	3,686	-2.2%	3,606	-2.4%	3,519
Milan Village*	1,061	-3.4%	1,025	-2.0%	1,004	-2.0%	984
Oxford Township	1,123	-2.4%	1,096	9.6%	1,201	-1.6%	1,182
Perkins Township	11,039	13.9%	12,578	-3.0%	12,202	-4.3%	11,678
Sandusky City	29,519	-5.7%	27,844	-7.4%	25,793	-4.8%	24,564
Vermilion City*	5,478	-9.9	4,937	-3.9	4,742	-3.3%	4,586
Vermilion Township	9,538	0.4	9,575	-48.4	4,945	-3.7%	4,763

*Erie County Portion Only

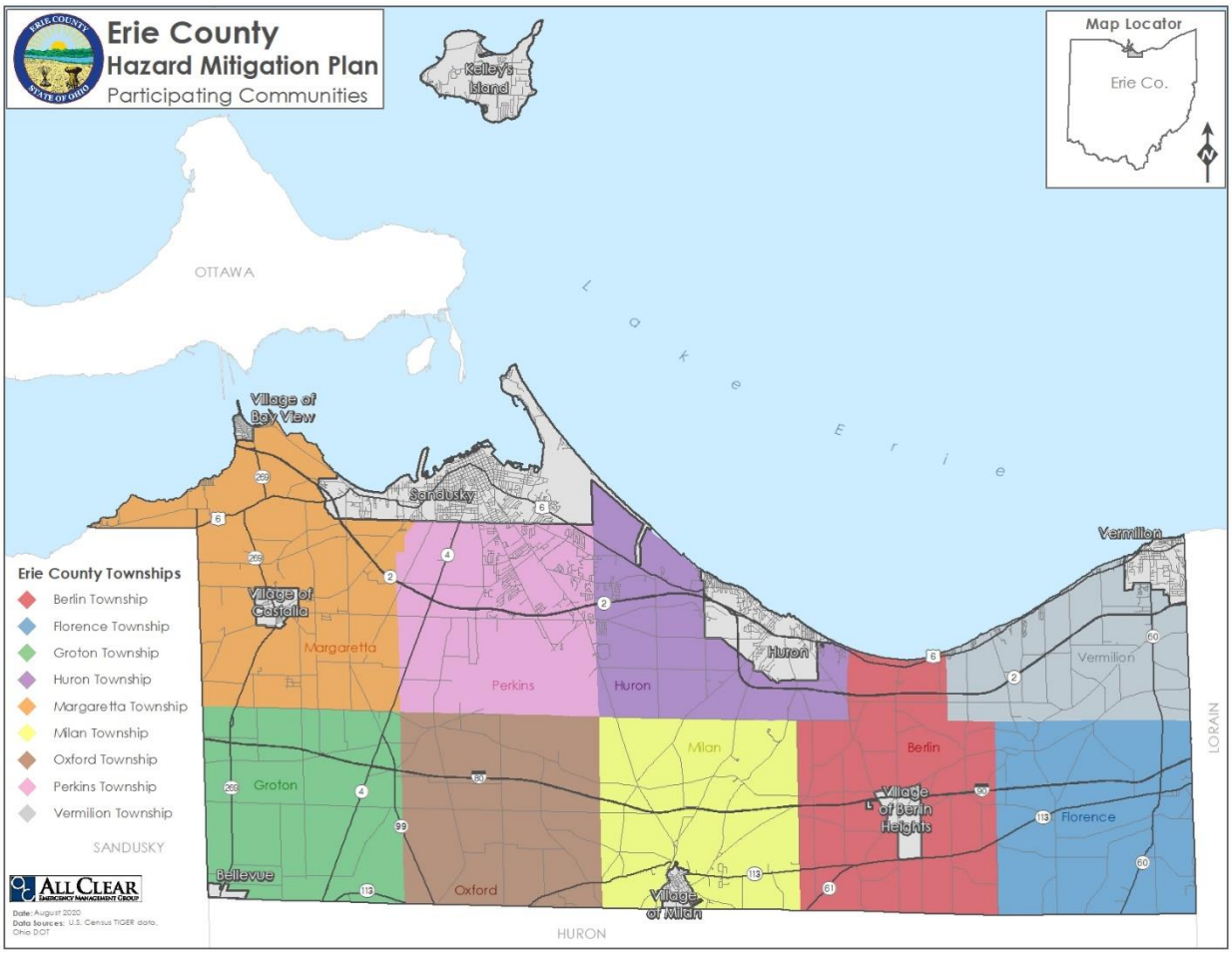


Figure 1: Erie County Map

5.2 Jurisdictions

The nine incorporated jurisdictions that participated in the development of the Erie County hazard mitigation plan are the Village of Bay View, City of Bellevue, Village of Berlin Heights, Village of Castalia, City of Huron, Kelleys Island, Village of Milan, City of Sandusky, and the City of Vermilion. According to 2019 population estimates, the largest areas of population are in City of Sandusky (24,564), City of Huron (6,869), and City of Vermilion (4,586). Information regarding the nine townships in Erie County is provided in this plan for informational and organizational purposes. The townships are not considered as separate participating jurisdictions. A map of Erie County is shown in Figure 1.

5.2.1 Bay View

The Village of Bay View is a small community located next to the Sandusky Bay. It is a tight knit community with a very low crime rate and is protected by police and fire department. The Village recently upgraded to sanitary sewers.

Bay View is in the northern part of Margaretta Township, 8 miles west of Sandusky, and comprises 0.3 square miles of land area. As of 2019 population estimates, there were 602 people residing in the Village. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 270 households in Bay View with an average of 2.6 people per

household. The population density was 2,007 people per square mile. There were 323 housing units at an average density of 1,077 units per square mile.[7]

5.2.2 Bellevue

Bellevue was home to Henry Morrison Flagler who was a partner with John D. Rockefeller in the formation of the Standard Oil Company. Flagler later built the Florida Overseas Railroad, to Key West Florida.

The city derives its name from James H. Bell a former railroad official.[8]

The City of Bellevue is in Huron, Sandusky, and Erie Counties. It is in the southwest corner of Erie County in Groton Township, 15 miles southwest of Sandusky, and comprises a total land area of 5.2 square miles. According to 2019 population estimates, there are 7,891 residents, but only two people who reside within the Erie County portion of Bellevue. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 2,233 households in Bellevue with an average of 2.4 people per household. The population density was 1,518 people per square mile. There were 3,531 housing units at an average density of 679 units per square mile. The City of Bellevue is participating in Sandusky County's Hazard Mitigation Plan.

5.2.3 Berlin Heights

The Village of Berlin Heights is in the south-central portion of Berlin Township, 18 miles southeast of Sandusky, and comprises a total land area of 1.6 square miles. As of 2019 population estimates, there were 713 people residing in the Village. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 287 households in Berlin Heights with an average of 2.3 people per household. The population density was 446 people per square mile. There were 318 housing units at an average density of 199 units per square mile.

5.2.4 Castalia

The Village of Castalia is in central Margaretta Township, 7.5 miles southwest of Sandusky, and comprised of 1.0 square mile of total land area. As of 2019 population estimates, there were 815 people residing in the Village. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 321 households in Castalia with an average of 2.8 people per household. The population density was 815 people per square mile. There were 363 housing units at an average density of 363 units per square mile.

5.2.5 Huron

The City of Huron is in the north central portion of the County in Huron Township, 10 miles southeast of Sandusky, bordering Lake Erie. The city has a total land area of 7.7 square miles. As of 2019 population estimates, there were 6,869 people residing in the City. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 3,078

[7] (United States Census Bureau, 2018)
[8] (Lantz, 2020)

households in Huron, with an average of 2.2 people per household. The population density was 892 people per square mile. There were 3,690 housing units at an average density of 479 units per square mile.

5.2.6 Kelleys Island

Kelleys Island, located in the Southwest basin of Lake Erie, was originally occupied by the Erie or Cat Indian nation. Around the year, 1655, the Mohawk Indians took over the island. During the colonial days the island passed from the French to the English. The island was eventually given to the Connecticut Land Company in 1794. The island eventually transferred to Huron County, then Erie County, then Ottawa County, then back to Erie County on January 1, 1805. An 1817 map, shows the island name changed to Cunningham Island by a French fur trader named Cunningham who settled there in 1803.

In 1833 two brothers, Datus and Irad Kelley, purchased all 3,000 acres from individual landowners. The main businesses on the island were limestone, cedar wood which was used primarily for fence posts and fuel. Eventually, a number of wheat fields and grapes were brought to the island by Datus, and also commercial fishing industry blossomed.

Eventually, many acres of the island were sold to individuals, who eventually became principle property landowners. The island blossomed and became a great tourist destination and remains so.[9]

Kelleys Island is in Lake Erie, 11 miles northwest of Sandusky, and has a land area comprising 4.6 square miles. As of 2019 population estimates, there were 311 people residing in the Village. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 103 households in Kelleys Island with an average of 2.0 people per household. The population density was 68 people per square mile. There were 927 housing units at an average density of 202 units per square mile.

5.2.7 Milan

Milan village was platted by Ebenezer Merry in 1817 on the site of a previously abandoned Moravian Indian mission village, named "Petquotting", (1805-1809). Merry dammed the Huron River below the village and established "Merry Mills", a gristmill and sawmill in the river valley. Milan Village, originally named 'Beatty', was incorporated as 'Milan' in 1833. The village is known for being the birthplace the world's greatest inventor, Thomas A. Edison, who was born in Milan village on February 11, 1847, and lived there until the age of 7. His birthplace is now a museum where the public is welcome to view and is located at 9 N. Edison Drive. The Milan Museum is just south from the birthplace is a seven-building campus that offers a family-centered day exploring the past through engaging exhibits and hands-on activities.

Still today Milan honors its historical past with a beautiful village square with many of its buildings from the early to late 1800's. The town hall is a majestic building that was

[9] (Ehrbar, 2020)

dedicated on July 4, 1876. The village hosts several events throughout the summer months in the Village Square including a car show each Tuesday night May through October, an Antique's Festival in July and the annual Milan Melon Festival each year on Labor Day.[10]

The Village of Milan is in southern Milan Township. It has a land area of 1.2 square miles. Milan is 13 miles south of Sandusky. As of 2019 population estimates, there were 984 people residing in the Village. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 493 households in Milan with an average of 2.5 people per household. The population density was 820 people per square mile. There were 533 housing units at an average density of 444 units per square mile.

5.2.8 Sandusky

The City of Sandusky, a "Welcoming City", was incorporated in 1824, and sits at the mouth of Sandusky Bay, claiming over 26 miles of Lake Erie's shoreline, not including the Chausee & Cedar Point Peninsula which extends over five miles into the lake and creates a protected bay. Sandusky's unique street grid is one of only two Masonic grids in the country (the other being Washington D.C.). It is known as the Kilbourne Plat after its designer, Hector Kilbourne, who surveyed and laid out the symbol of the Freemason over a typical block grid.

Sandusky, being rich in cultural and historic identity as well as centrally located, is the county seat and most densely populated city in Erie County. The city is home to robust tourism, manufacturing, and healthcare economies anchored primarily by lake recreation and Cedar Point. While best known as the home of the amusement park, Sandusky developed as an industrial Lake Erie port town.

Much of that history remains evident in the bones of the region and echoes through the present in every corner of the city. Days past of bustling ports and manufacturing combine with unique stories of the underground railroad and the ongoing successes of Sandusky natives to give this small city its vibrant soul.

Historic downtown Sandusky is a central business district that continues to experience a resurgence of investment and business attraction. Sandusky draws on its diverse historical identity to guide the way forward to grow as an inclusive and open-minded city.[11]

The city is comprised of 10.0 square miles of land area. As of 2019 population estimates, there were 24,564 people residing in the City. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 10,913 households in Sandusky with an average of 2.3 people per household. The population density was 2,456 people per square mile. There were 13,416 housing units at an average density of 1,342 units per square mile.

[10] (Rospert, 2020)
[11] (Orzech, 2020)

5.2.9 Vermilion

The City of Vermilion is in both Lorain County and Erie County. It is located on the western border of Lorain County and the eastern border of Erie County. The City has a total land area of 10.8 square miles. As of 2019 population estimates, there were 10,394 people residing in the City, with 4,586 within the Erie County portion of the City. As of the 2018 American Community Survey 5 year estimate for 2013-2017, there were 4,336 households in Vermilion with an average of 2.3 people per household. The population density was 962 people per square mile. There were 5,319 housing units at an average density of 493 units per square mile.

5.3 Land Use and Development Trends

Erie County lies in the Central Lowland Province. Lying in an area of lake plain and till plain physiography, the County has a relatively uniform, level topography. Berlin Township is the highest point in Erie County and is 320 feet above the approximate mean level of Lake Erie. Most of the County has a slope of six percent or less. The steeper areas are mainly a result of deep stream dissection. Beach ridges and bedrock ridges account for a small percentage of the steeper areas. Figure 2 below illustrates the existing general land use in the County.

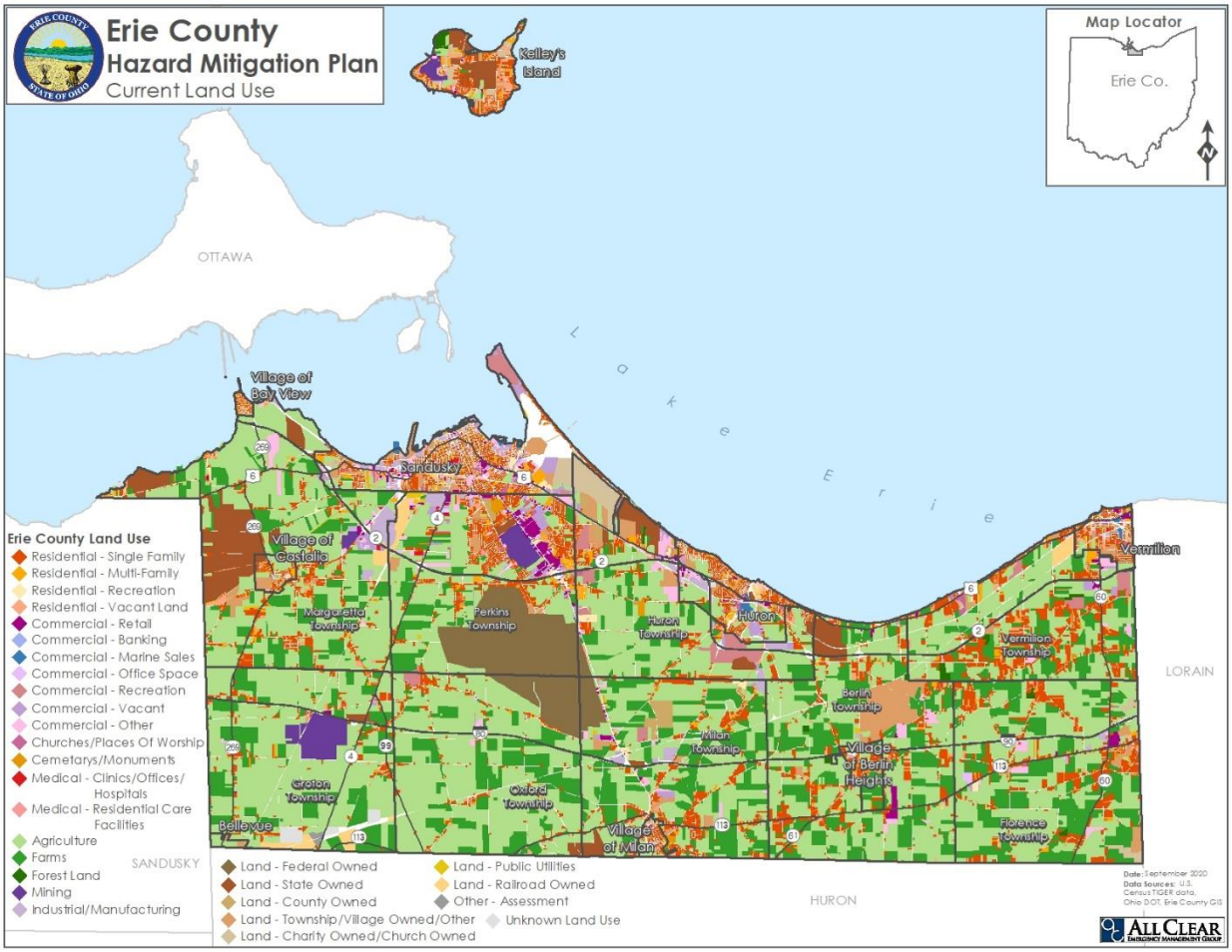


Figure 2: Erie County Land Use

Erie County drains northward into Lake Erie. There are 17 distinct watersheds in the County. Primary watersheds include Mills Creek and Pipe Creek to the west, the Huron River in the central part of the County, Old Woman Creek in the east-central part of the County and the Vermilion River on the eastern edge of the County. Small creeks drain the other watersheds.

Soil surveys contain information that affects the land use planning of a county. The United States Department of Agriculture Natural Resources Conservation Service provides the Web Soil Survey (WSS), replacing older Soil Survey reports. This database is considered the single authoritative source of soil survey information. The WSS can be used by community planners and the public to predict of soil behavior for selected land uses, as well as emphasize soil limitations, improvements needed to overcome the limitations and the impact of selected land uses on the environment[12]. Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high-water table makes a soil poorly suited to basements or underground installations.

The soils map of Erie County has 110 different map units, which are groups of soil components or miscellaneous areas (e.g. beaches) with unique characteristics. This alone shows the great advantage to the WSS over the older soil surveys and soil maps, as finer definition of the soil is possible. The 2020 Erie County Interim Soil Survey only had 38 different soil types, which were grouped into 11 broad classifications. Please see Appendix H for the Soil Survey Map Unit Legend with a listing of the different map units and the number of acres that are represented in Erie County. According to the Ohio State University Extension Water Resources, 27% of these soils are very poorly drained and 38% somewhat poorly drained.

[12] (United States Department of Agriculture, 2019)

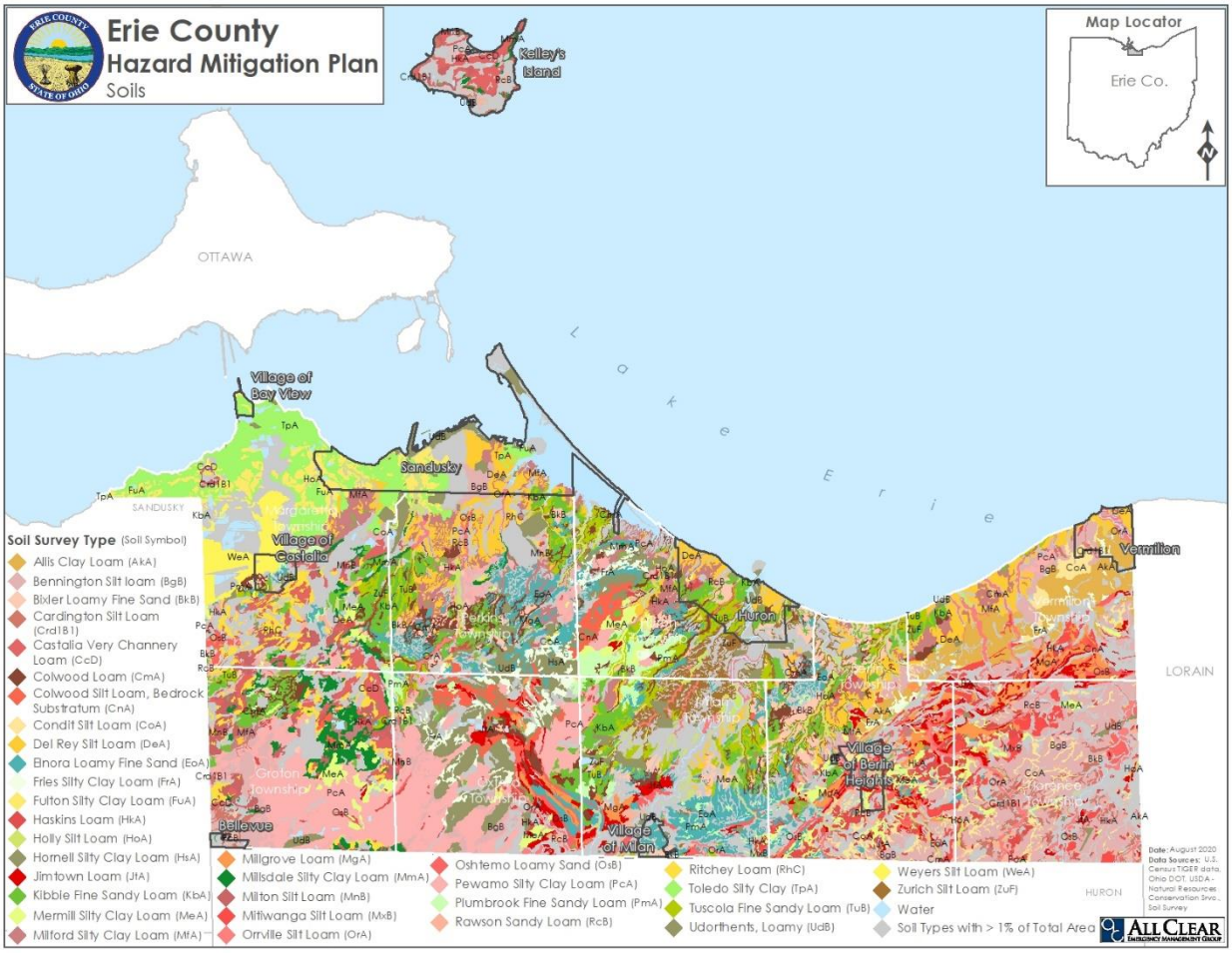


Figure 3: Soil Map of Erie County

The natural resources of Erie County include water, sand and gravel and some layers of bedrock. The groundwater in Erie County varies considerably in quality and quantity. Water is obtained from glacial material or bedrock, depending on the location of the well site. Surface runoff, infiltration rates and geologic material affect the water supply. Typically, good sources of water can be found in glacial deposits with lenses and stratified layers of sand and gravel and yield from 20 to 250 gallons per minute (gpm). However, most wells in glacial deposits have low yields on less than 10 gpm. Bedrock wells also vary considerably in suitability according to the area and type of geologic material. For instance, up to 500 gpm can be obtained from the wells drilled in the cavernous limestone bedrock found in the western portion of the County. A large quantity of ground water obtained from similar formations in the western portion of Erie County has potential for contamination resulting from underground disposal of wastewater or may have high concentrations of hydrogen sulfide. Aside from glacial or bedrock wells, water may also be obtained from Lake Erie, dug wells, cisterns, and ponds, as long as surface water and groundwater pollution are controlled to ensure a quality water supply.

The U.S. Department of Agriculture defines prime farmland as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Prime farmland includes cultivated

land, pastureland, forest land or other land that is not urban or built-up land or water areas. It has a, adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from zero to six percent[13].

Approximately 123,000 acres of Erie County, or nearly 76% of the total acreage, meets the soil requirements for prime farmland or prime farmland if drained; and are located primarily in the western part of the County[14]. Most agricultural land is used for cash grain crops, particularly soybeans and corn, and to lesser extents, wheat, popcorn, and hay. Specialty crops, such as sugar beets, cabbage, tomatoes, and melons, are also grown. Dairy and livestock are also important sources of revenue. In 2017, approximately 86,440 acres were used as farmland. This acreage consisted of 382 farms, averaging 226 acres per farm. In 2017, soybeans generated the largest amount of crop cash receipts while cattle produced the largest amount of livestock cash receipts. The farmland in Erie County is divided into 89% cropland, 1% pasture, 6% woodland and 3% other.[15]

A small percentage of land is devoted to woodlands, usually on steep slopes along major streams and in undrained areas. According to the Ohio Development Services Agency as of 2018, about 18.6% of the county land is forested[16]. Most woodlands have been harvested repeatedly, and many have been pastured. Although farm products provide a larger income for the County residents, in effectively managed and harvested woodlands, most Erie County soils may potentially provide income per acre that is similar to other agricultural products through the sale of timber products. Woodlands are also beneficial because they provide wildlife habitat, serve as windbreaks from erosion, produce nuts, lumber, and fuel wood, and have aesthetic value. Pastures are common in areas where soils present severe limitations affecting row crops. The common pasture and hay plants include alfalfa, red clover, alsike clover, bluegrass, orchard grass, tall fescue, timothy, and brome grass.

With good management practices, most soils are highly productive for crops and pasture. The major soil management concerns are seasonal wetness (including ponded areas), erosion, soil structure damage (compaction, crusting, clod formation), droughtiness, and soil fertility. Seasonal wetness and ponding are major concerns on approximately 117,026 acres of land in Erie County. The very poorly drained Colwood, Condit, Holy, Mermill, Milford, Millgrove, Miner, and Pewamo soils are naturally so wet that crop production is typically not possible unless surface or subsurface drainage is installed. The somewhat poorly drained Bennington, Elliot, Haskins, Jimtown, Mahoning and Orrville soils are naturally so wet that crops are damaged during most years and planting and

[13] (United States Department of Agriculture, 2019)
[14] (United States Department of Agriculture, 2020)
[15] (United States Department of Agriculture, 2017)
[16] (Ohio Development Services Agency, 2018)

harvesting is delayed unless artificial drainage is installed. Existing County and private drainage systems should be maintained as adequate outlets for present and future land uses. Urban construction activities can damage and disrupt these existing systems. As a result, renewed wetness and ponding of these previously drained cropland areas now impact homeowners' use of this land. In order to maintain or improve these drainage systems, cooperation is necessary between the urban and agricultural communities.

Agriculture is the primary land use in Erie County with about 53% of the land occupied by farms. Since 1982, when farms comprised 100,000 acres of the County, or 55% of Erie County's land, the number of acres farmed, and the number of farms has decreased. In 1982 there were 535 farms, with an average size of 185. Thirty-five years later, the number of farms had decreased by 153. Thus, although there was less farmland and a smaller number of farms, the average farm size increased. The difference in number of acres of farmland is most likely due to the conversion of farmland to urban or nonfarm uses.[17]

In addition to land acres, the County is bordered by Lake Erie across the northern boundary of the County. The County also contains approximately 800 acres of lakes within its borders. According to an Environmental Protection Agency (EPA) estimate, Erie County also contains approximately 340 linear miles of streams and rivers. In addition, 55.9 miles of County-maintained open ditches, 17.3 of tile ditches and approximately 200 miles of privately maintained ditches are used for land drainage. Approximately 8,600 acres of Erie County are considered wetlands.

The community of Erie County has expressed several ideas and concerns about future land use in their 1995 Erie County Comprehensive Development Plan. Erie County is faced with development pressures due to expanding residential areas in and near villages. Below are some guidelines Erie County has established:

- Promote community development through redevelopment, economic development, and constructing infrastructure to meet the demands for development.
- Provide all residents in the County adequate, affordable housing.
- Preserve the County heritage and those structures significant to its salvation for future generations.
- Maintain harmony between the man-made and natural environment by sustaining the County's dedication to protecting the environment through its support of legislation and programs intended to preserve open spaces and natural habitat.
- Provide high quality recreation facilities to meet the increasing demands of all residents who reside within the planning area.
- Ensure growth in employment will not be obtained through excessive costs to the environment or jeopardize the livability of the community.
- Become efficient and accessible through improvements to street systems, developing along roadways, and through transportation planning.

[17] (United States Department of Agriculture, 2017)

- Encourage growth in areas physically suited and already serviced by infrastructure.

When the State Route 6 overpass was built, it opened up emergency access to the western portions of Sandusky. Other improvements to transportation networks can also affect the future development of Erie County. As US 250 continues to expand southward past Bogart Road, there could be an increase in development. NASA's Plumbrook Station is a space testing facility, is situated off of US 250 in an area that is undeveloped. Further expansion of the highway or the Plumbrook Station could drive development in that area.

The continued resurgence of downtowns is apparent in local cities. Younger and older demographic groups tend to cluster in urban areas reducing sprawl and vehicle usage, but further concentrating the population. And small residential units will most likely increase within the urban areas of the county including the Cities of Sandusky, Huron, Vermilion and Perkins Township to house the increasing elderly population. Conversion of former brownfield and/or industrial spaces to residential areas is also common as land re-use is preferred over sprawl and manufacturing continues to decline in the area.

Commercially, oil and gas extraction is expected to continue to increase in the southeastern portion of Erie County. And as tourism increases, AirBnbs are also anticipated to grow, especially in the Cities of Sandusky and Huron and along the lake front.[18]

The following sections detail specific development potential for the local jurisdictions of Erie County.

5.3.1 Bay View

Due to constraints of the Village of Bay View's limits, additional development is not expected. Figure 4 shows the current land use within the Village's limits.

[18] (King & Grohe, 2020)

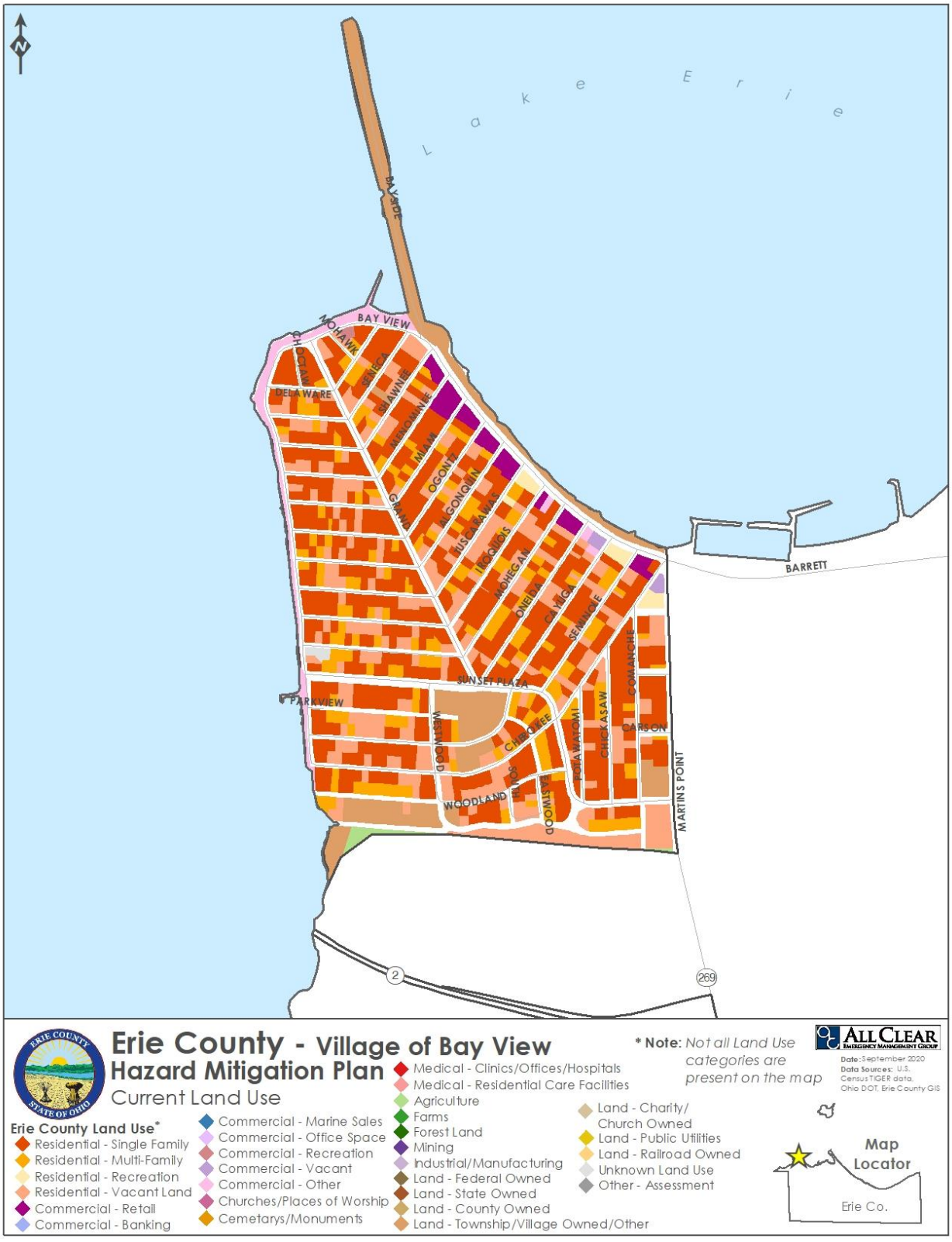


Figure 4: Land Use Map for the Village of Bay View

5.3.2 Bellevue

Bellevue has seen a lot of growth since 2014. In 2015, retail development occurred in or near the downtown area, including a new gas station for Bassett's Market, Advanced Auto Parts opening, Gilbert's Coffee and Old Time Soda Shop, Forget Me Not Flowers, and First Choice of Ohio.

In 2016, one new retail store opened in the downtown area, Bone Boys BBQ. Other development that year occurred in the manufacturing industry. Amcor on the west end added a new addition costing around $37 million. Amcor makes food grade bottles for many brands. Magretech, a company focused on recycled magnesium processing was purchased by a Chinese company, and jobs were added as part of the purchase. Mitsubishi Chemical Performance Polymers (MCPP) made a large investment with rail upgrades near their plant for access to do more bulk processing. This plan is northeast of downtown Bellevue (in Huron County). Four new homes were built around the city, taking advantage of the city-wide CRA enacted on March 10, 2016, which allows for a 15-year real estate tax exemption.

Retail openings in 2017 included Rayz 20 (Restaurant/Bar) and Arby's along with State Farm Insurance office being purchased by a new owner. Two large projects were the 200,000 square foot warehouse built by Ohio Logistics taking advantage of the rail upgrades provided by their close neighbor MCPP in a shared endeavor. Bellevue Hospital (TBH) invested $9 million with the addition of two operating rooms and a redesigned emergency entrance for the facility. Five new homes were built in various areas of the city.

2018 saw an extension of Moore Avenue by the City, which benefitted increased truck traffic anticipated by the newly operating Ohio Logistics building. Tower International invested $31 million for a new E-coat building and Eco paint line for the Ford F-150 truck line frames. Thomas Steel Incorporated, a long-time local fabricator added a new office complex, tooling and production area upgrades. Magretech added a new melt building, warehouse, office, and finished goods building with a total investment of $4.8 million. Bellevue Hospital finished renovations on the recently acquired building across from their Main Campus on S R 20 West with a total investment of $5.5 million adding several doctor offices, a rehab facility and an Anytime Fitness gym. Nine new residential homes were built around the city.

The Prairie Ridge Subdivision, a residential condo and housing development funded by the Bellevue Hospital Foundation was started in 2019, just west of the Bellevue Hospital with the potential of 150 building lots. Infrastructure installed and one model condo was constructed. Phase one allows nine condo lots as well as 10 residential. Goodwill added a 48,000 square foot warehouse/production facility. Mad River/NKP Railroad Museum constructed a new engine building on the site of the museum. Fireland Federal Credit Union (FFCU) kicked off construction of the Corporate Headquarters located on North St. with an estimated cost of $4 million, the headquarters began operations in May of 2020.[19]

[19] (Lantz, 2020)

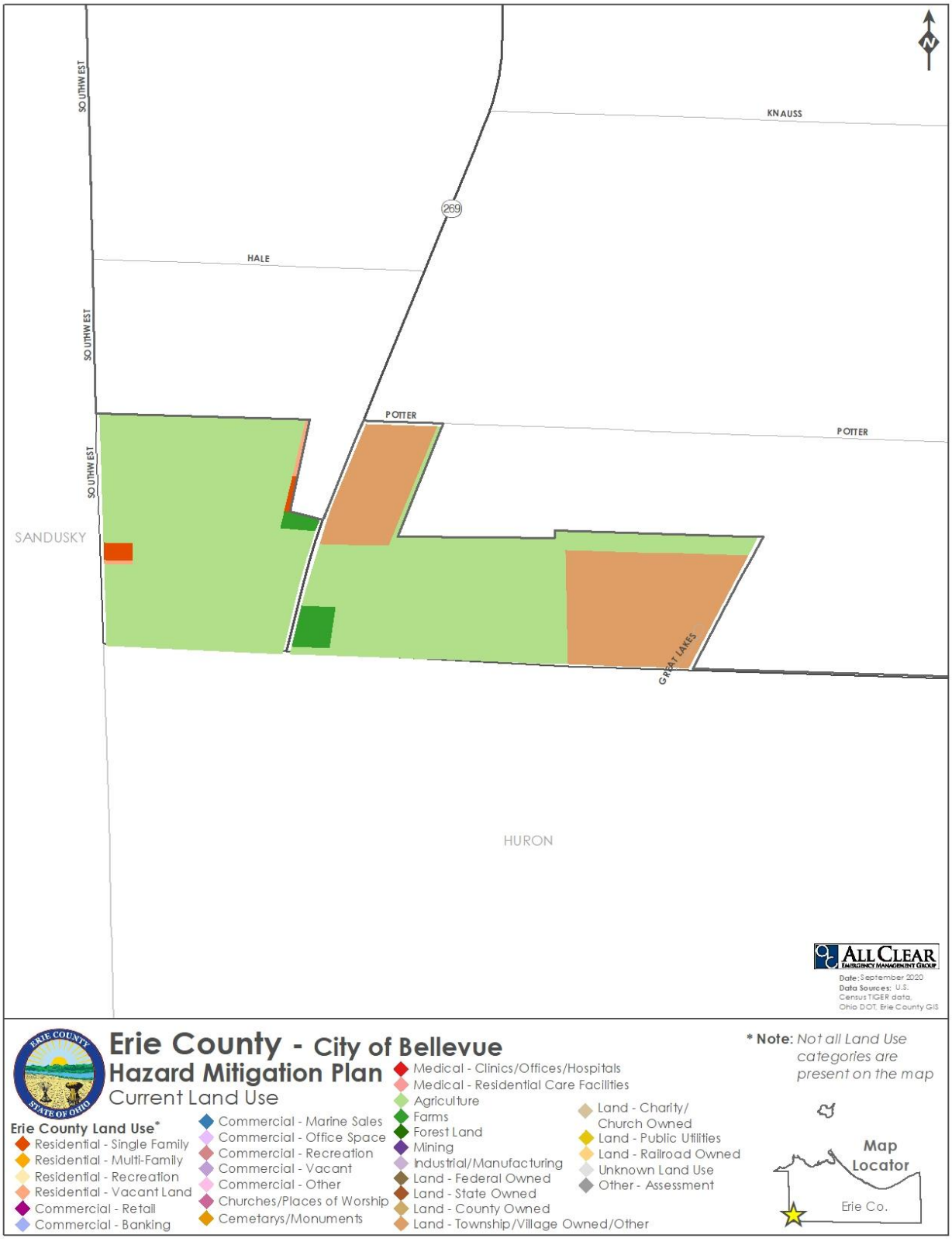


Figure 5: Land Use Map for City of Bellevue (Erie County Portion Only)

First National Bank (FNB) added to their Corporate Headquarters with a $2 million addition and interior renovations. Two new retail shops opened in the downtown area with Linen & Birch and Shoppe 19. Buckeye One Eleven opened as a new rental hall on Buckeye St. McDonalds on East Main St. went through a complete renovation of the interior and exterior in late 2019. Three new homes were built around the city.

In 2020, Dollar Tree started a complete renovation of a building in the Village Square Plaza on Castalia St. The site will offer three additional retail spaces available for lease later in 2020. Bellevue Family Dentistry broke ground for their 16,000 square foot office and retail building across from Bellevue Hospital and anticipate a late 2020 opening. Three new homes have been completed in the city with an additional five homes under construction throughout the city.[20]

5.3.3 Berlin Heights

Figure 6 below shows the current land use map for the Village of Berlin Heights. No additional development is expected in the near future.[21]

5.3.4 Castalia

Figure 7 below shows the current land use map for the Village of Castalia. No additional development is expected in the near future.

5.3.5 Huron

In the City of Huron, there are two areas identified for potential expansion. The Huron Business Park, located south of the S R 2 and Rye Beach Road intersection, is one possibility. The other area of potential new development/expansion in Huron is the former ConAgra site.[22] Figure 8 below shows the current land use map for the City of Huron.

5.3.6 Kelleys Island

No new development of Kelleys Island is planned.[23] Figure 9 below shows the current land use map for the Village of Kelleys Island.

5.3.7 Milan

Since 2014 the Village of Milan has not experienced much development due to its "landlocked" nature. Growth has been limited to several houses erected in the Landsdown subdivision. The Village is in the infant stages of developing several areas, including biking and walking paths and other downtown revitalization plans.[24] Figure 10 below shows the current land use map for the Village of Milan.

[20] (Lantz, 2020)
[21] (Schafer, 2020)
[22] (King & Grohe, 2020)
[23] (Ehrbar, 2020)
[24] (Rospert, 2020)

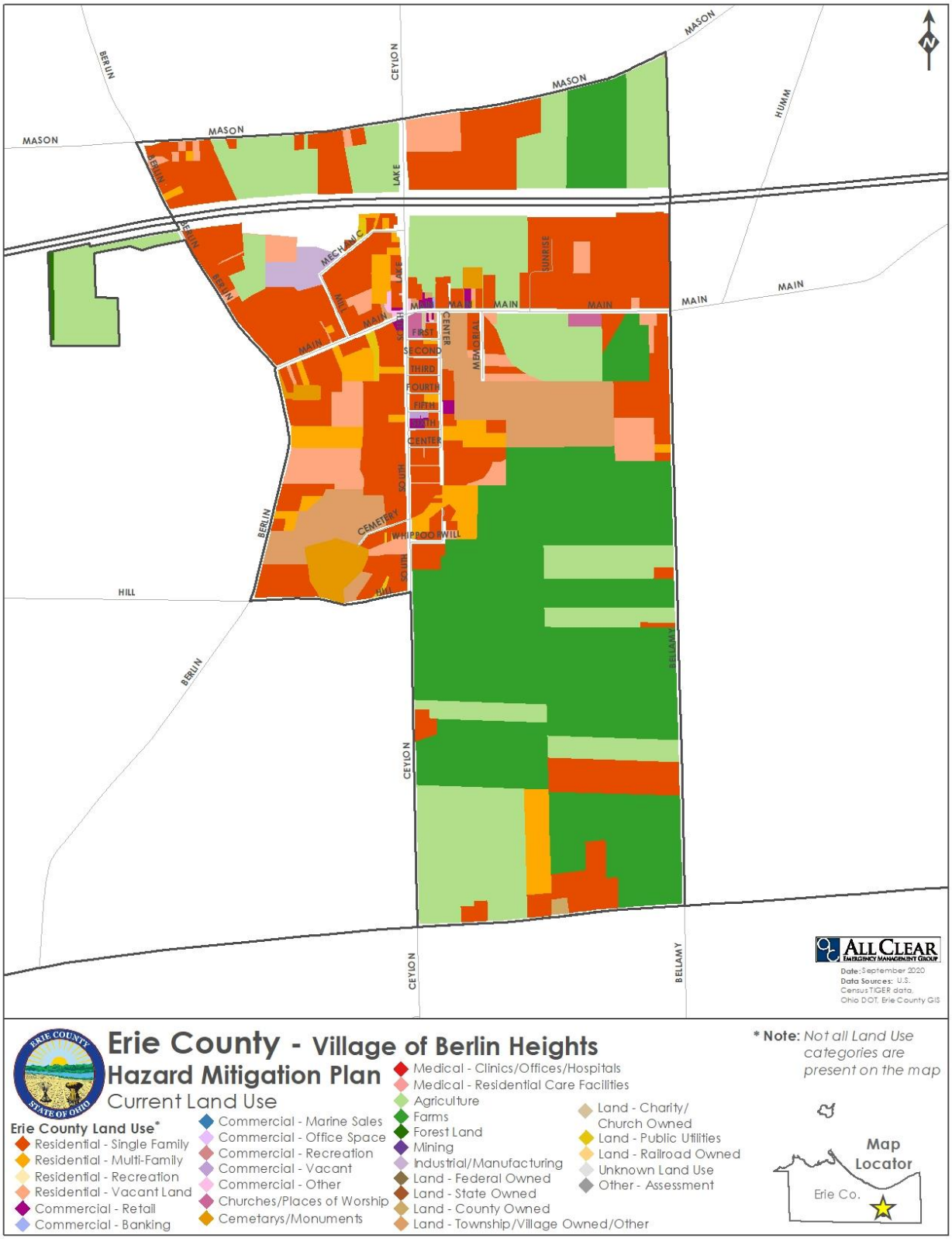


Figure 6: Land Use Map for the Village of Berlin Heights

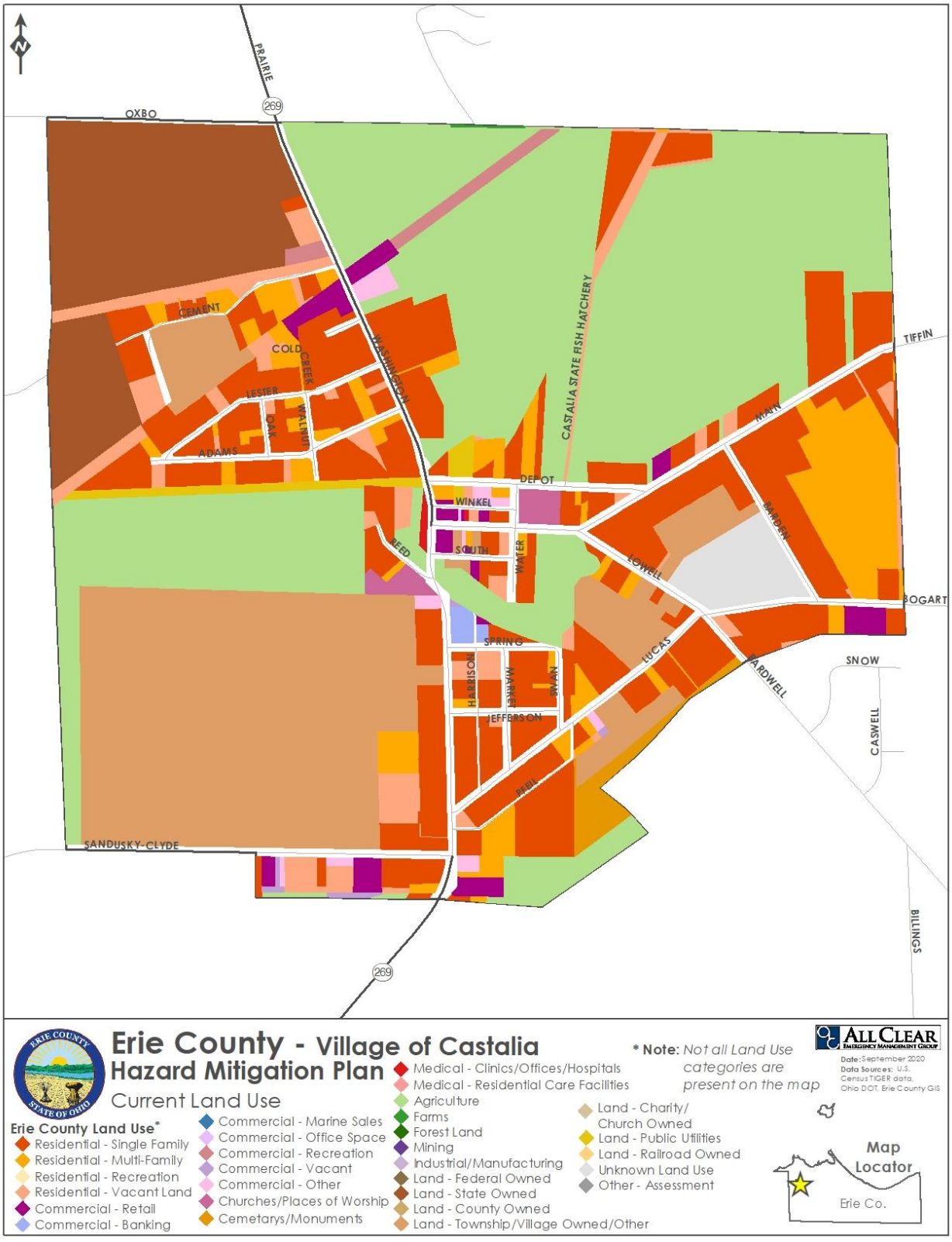


Figure 7: Land Use Map for the Village of Castalia

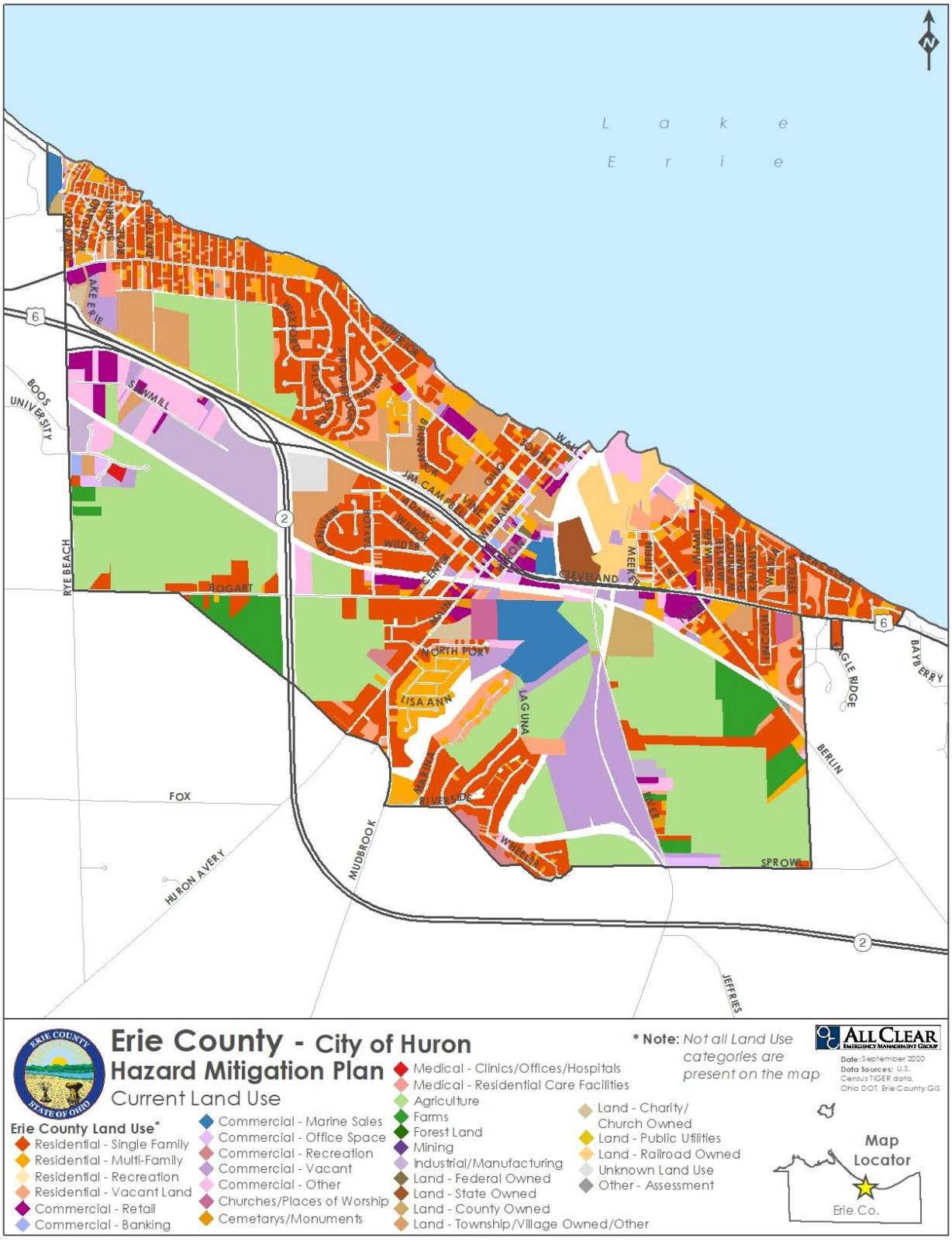


Figure 8: Land Use Map for the City of Huron

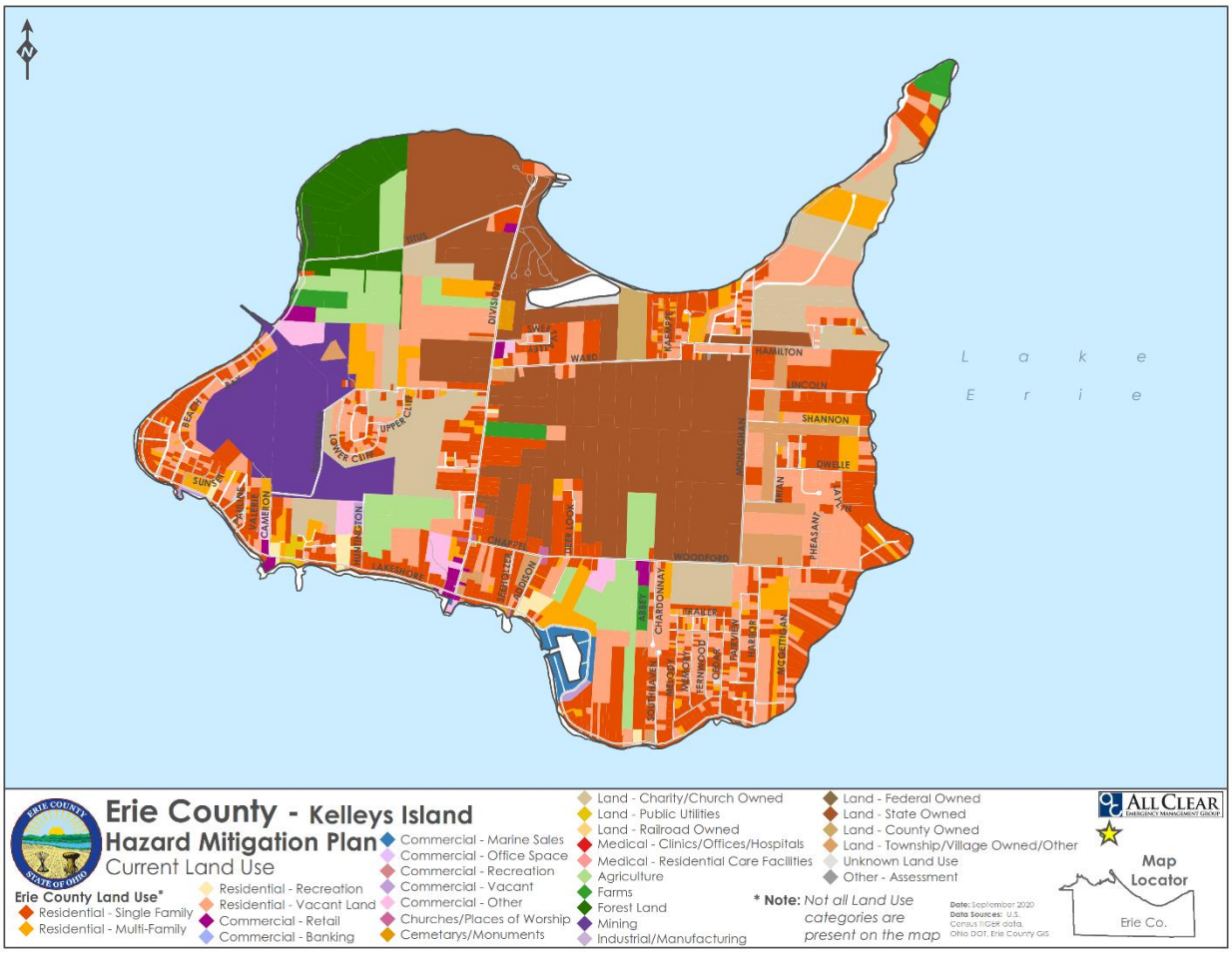


Figure 9: Land Use Map for the Village of Kelleys Island

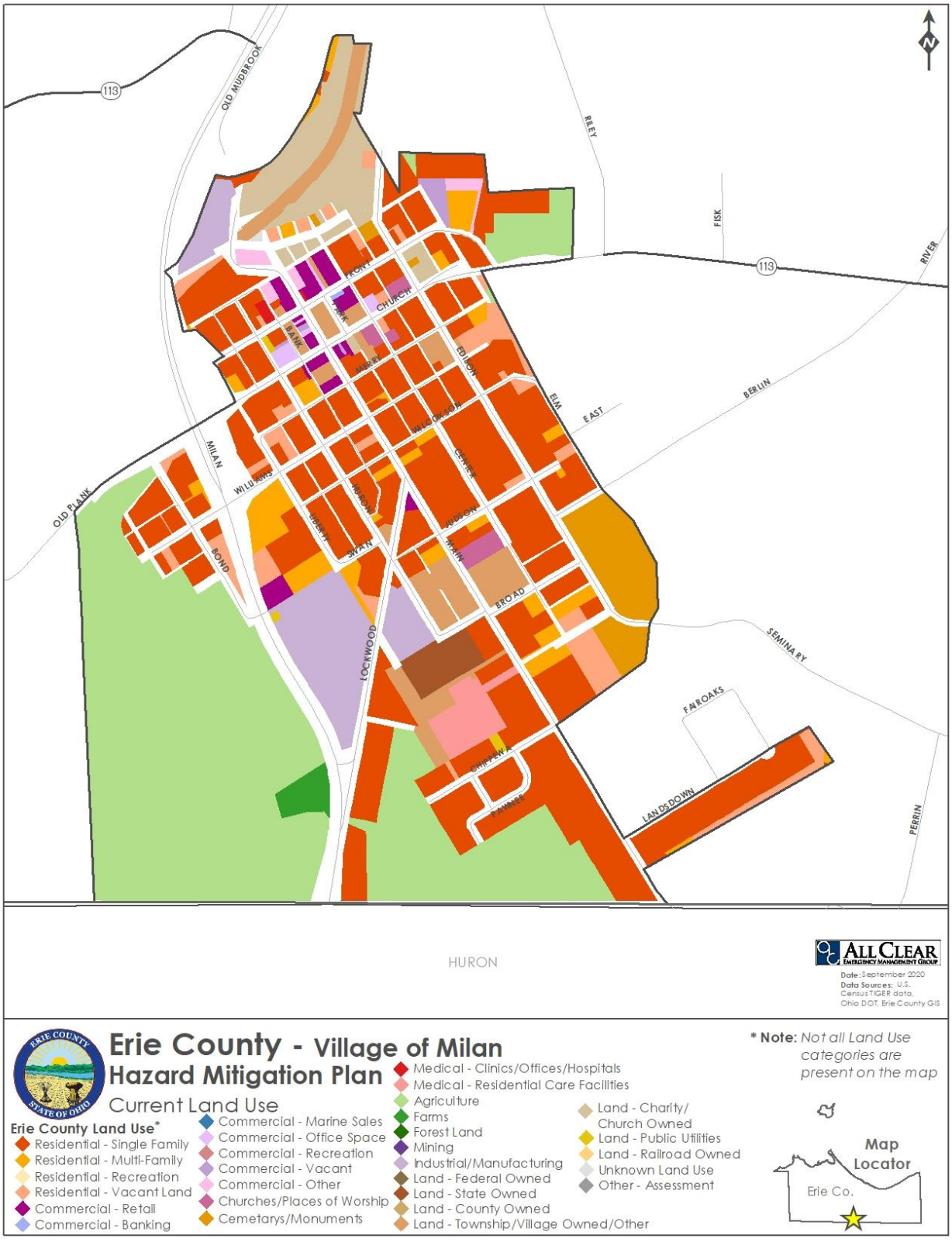


Figure 10: Land Use Map for the Village of Milan

5.3.8 Sandusky

In terms of current development areas, based on noticeable activity and extent of monetary investment and additional square footage – the two main areas include "downtown" Sandusky and also the far east end. With regards to downtown, this is defined as the area between Washington Street to the south, Shoreline Drive to the north, Decatur Street to the west and Franklin Street to the east. Between 2018 and 2020, there has been or is ongoing over $100 million in both public and private investment. This includes public infrastructure projects but is mainly private investment into rehabilitation of once vacant buildings and new construction. Examples of recent investments include the $15 million Columbus Avenue revitalization project which now houses the new Sandusky City Hall and a mix of retail and residential uses, the $15 million BGSU School of Resort and Attraction Management which will house post-secondary education space and residential units, and the $4 million Water Street lofts which will bring new for-sale housing units to downtown. All told, the new projects will add an approximate 150 new housing units (225 new residents), but also well over 100,000 square feet of new or rehabilitated commercial space. The downtown renaissance currently underway is truly mixed-use in nature combining both residential (rental and for sale), commercial and retail/restaurant.

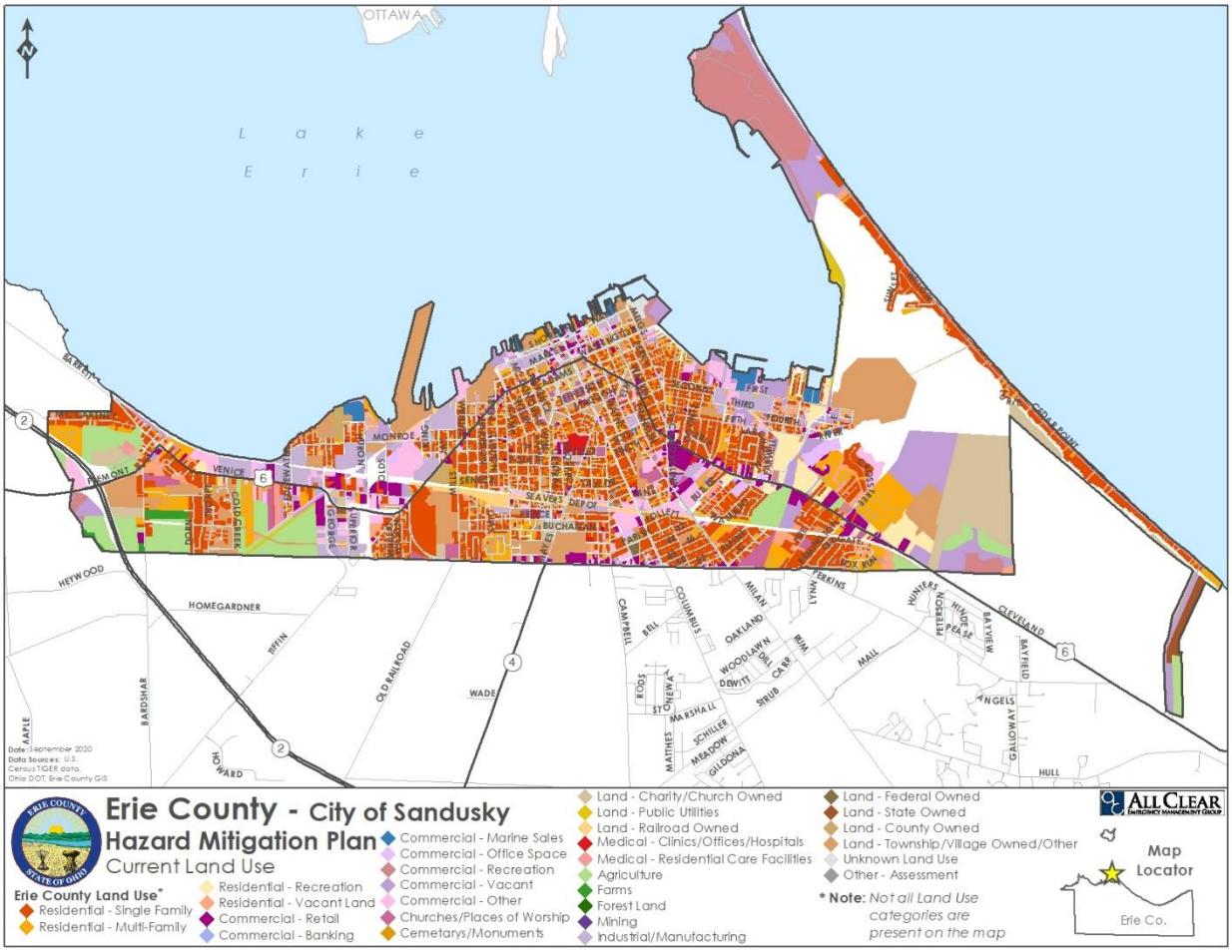


Figure 11: Land Use Map for the City of Sandusky

The second notable area of current development includes the eastern terminus of the city limits along Cleveland Road. This is where the current Cedar Point Sport Center indoor and outdoor facilities have been built. The two facilities combined total an over $75 million investment. The outdoor facility includes a mix of baseball, softball, soccer and lacrosse fields as well as recreation and food amenities. The 180,000 square foot indoor facility include a mix of basketball and volleyball courts. The indoor facility also includes a new sports medicine tenant – which is operated by Fireland Regional Medical Center.

As with any urban development in a downtown core or the construction of large entertainment venues, there is a major increase in vehicular traffic and related concerns such as vehicular crashes or conflicts between vehicles and pedestrians. Secondarily, the large level of construction has results in a major increase in heavy equipment and vehicles entering the downtown core and several street closures which also have the ability to elevate the number of conflicts.

In terms of areas of future development, there are three main areas, in addition to the above two that will continue to develop:

- First Street Corridor between Cedar Point Drive and Meigs Street. This long dormant area is mainly known as one of the main traffic avenues into Cedar Point and also houses the overwhelming majority of dormitories for employees of Cedar Point. This street also houses several commercial and industrial operations that relay on a substantial amount of shipping and receiving to bring and ship products. From a development standpoint, it has traditionally been a mix of marinas and boat/vacation houses and industrial. However, in the upcoming years, some of which is already beginning to occur, there is major mixed-use development planned. The city anticipates upwards of 30-50 new residential units to be constructed in the townhome or condo variety that will house both primary residents and those seeking second homes, namely on the north side of the street. Additionally, there is between 50,000-100,000 square feet of new boat storage and maintenance space to be developed. Finally, many of the existing commercial and industrial entities are exploring expansions to their footprint to add both square footage to their facilities and also employees.
- East end of downtown towards Battery Park. Currently, this area is mainly a combination of vacant land (totaling 10 acres) and the site of the former Sandusky City Hall/current City Justice Center and Battery Park Marina (30 acres). This area is drawing significant development interest through a combination of most of the land being undeveloped and the amazing waterfront access and views provided by its location. The area, per the city's masterplan calls for mixed-use development mainly focused on residential and retail/restaurant. From a residential standpoint, it is envisioned as a mix of single-family houses/townhomes and high-rise apartments/condo with ground floor retail and restaurant uses. It is also possible that there may be a hospitality use that would include upward of 150 new hotel rooms and modest conference space. In total, these two areas could see (in the next decade), 300+ newly constructed housing units, 150 hotel rooms and over 50,000 square feet of commercial and retail space along with beautifully redeveloped public spaces and waterfront access point.

- MacArthur Park. This park is a post-WWII workforce housing development located at the northwest intersection of Camp Street and Perkins Avenue. The development, comprised of a mix of 1/2/3/4 unit properties centered around a public park – was developed with inadequate construction that was not meant to stand the test of time. Today, many of these units still remain, however many of them are in haphazard condition. As such, the city has identified MacArthur Park as a major target of redevelopment and has been aggressively acquiring and demolishing housing. The ultimate goal is to acquire and clear as much land as possible and completely masterplan the entire area to include new sustainable and affordable housing, a completely revamped and safer street grid and major park redevelopment and amenity creation. The developments location on two major thoroughfares and adjacency to Sandusky School property, makes it both a major eyesore – but more importantly and amazing opportunity for redevelopment and re-visioning.[25,26]

5.3.9 Vermilion

Figure 12 shows the Land Use for the Erie County portion of the City of Vermilion.

[25] (Orzech, 2020)
[26] (Snyder, 2020)

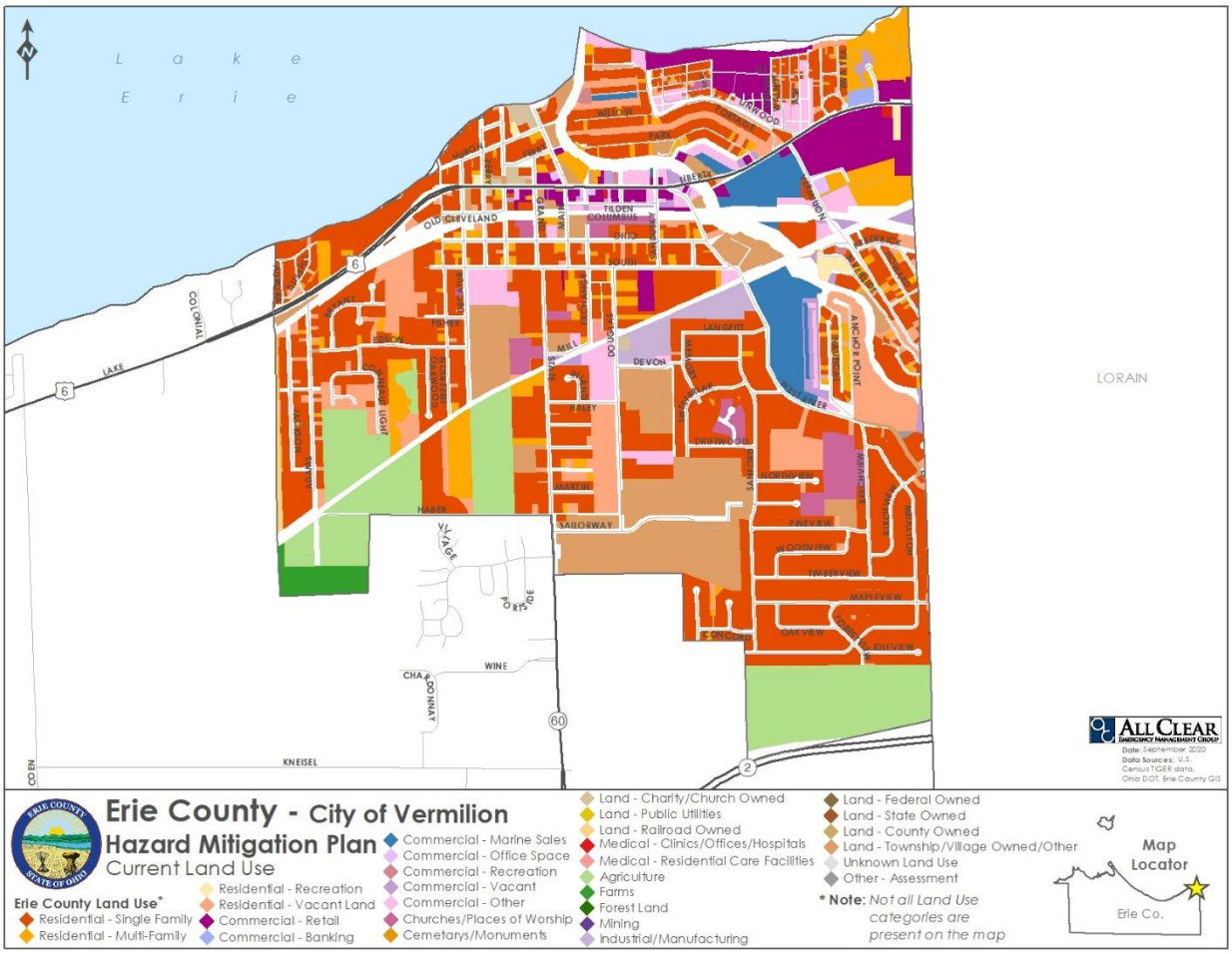


Figure 12: Land Use Map for the City of Vermilion (Erie County Portion Only)

Land Use Maps for the Townships of Erie County are Included in Appendix E for reference.

5.4 Community Capability Assessment

The purpose of the Community Capability Assessment is to identify strengths and weaknesses that will affect the ability of the county and participating jurisdictions to implement mitigation actions. Capabilities include a variety of regulations, existing planning mechanisms, and administrative capabilities provided through established agencies or authorities.

5.5 Capability Matrix

Table 6 summarizes the regulatory tools and resources used in Erie County and participating jurisdictions. These regulations and resources can be used to provide opportunities for further improve and mitigate the potentially negative effects of natural hazards through regulation.

Table 6: Community Capability Matrix for Erie County, and its Municipalities and Selected Townships

	Erie County	Village of Bay View	City of Bellevue	Village of Berlin Heights	Village of Castalia	City of Huron	Kelley's Island	Village of Milan	City of Sandusky	City of Vermilion
Comprehensive Plan	Yes	Yes	No Data	No Data	No Data	Yes	No Data	No	Yes	Yes
Planning Commission	Yes	No	No Data	No	Yes	Yes	Yes	Yes	Yes	Yes
Land Use Plan	Yes	No	No Data	No Data	No Data	Zoning Map	No Data	No	Yes, Zoning Department	Yes Building Department
Subdivision Ordinances	Yes	No	No Data	Yes	Yes	Yes	No Data	No	Yes, Zoning	No
Development Regulations	Yes	Yes	No Data	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zoning Ordinance	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hazard Mitigation Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Floodplain Regulations	Yes	Yes	No Data	Yes	No	Yes	No	Yes	Yes	Yes
Floodplain Management Regulations	Yes (2008)	No	No Data	No	No	Yes	No	No	Yes	Yes
- Floodplain Administrator	Yes	Yes	No Data	Yes	No Data	Yes – Eng. Dept.	No Data	Yes	Yes - Eng. Dept.	Yes - Engineer
- # Structures in Floodplain	No Data	No Data	No Data	No Data	No Data	No Data	No Data	4	No Data	No Data
- # NFIP policies	195	28	1	No Data	1	64	No Data	3	383	165
- # Repetitive loss structures	24	0	3	0	0	12	0	0	25	34
Community Rating System Rating	No	No	No Data	No Data	No Data	No Data	No Data	No Data	Class 3	Yes
Storm Water Management Program	Yes	Yes	No Data	No	Yes	Yes – Erie County Soil and Water	Yes	No	Yes	Yes
Building Codes	No	Yes	No Data	No	Yes	Yes	Yes	Yes - Huron Township	Yes	Yes

	Erie County	Village of Bay View	City of Bellevue	Village of Berlin Heights	Village of Castalia	City of Huron	Kelley's Island	Village of Milan	City of Sandusky	City of Vermilion
- Building Official	No	Yes	No Data	Yes	Yes	Yes	No Data	Yes - Huron Township	Yes - Bldg. Dept.	Yes Building Dept.
- Building Inspections	No	Yes	No Data	Yes	Yes	Yes – through Township	No Data	Class 3 Residential, Class 4 Commercia l/ Industrial	Yes	Yes
- Building Code Effectiveness Grading Schedule (BCEGS) Rating	No	No	No Data	No	No Data	No Data	No Data	Yes	Yes	No Data
Warning Systems	Yes	Yes	No Data	Yes	No Data	Yes	No Data	Yes	Yes	Yes
- Outdoor Warning Sirens	Yes	Yes	No Data	Yes	Yes	Yes – through County	Yes	Yes	Yes	Yes
- NOAA Weather Radio	No Data	No Data	No Data	No Data	Yes	Yes	No Data	Yes	Yes	No
- Reverse 911	Yes	No Data	No Data	No	No Data	No Data	No Data	No	Yes (Through County)	No
- Other	No Data	No Data	No Data	No Data	No Data	Social Media, Direct Text, Email, Apps	No Data	OneCall Now	No Data	Text Marketing
Capital Improvement Budget	No Data	No	No Data	No Data	Yes	Yes	Yes	$250K	Yes	Yes
Public Works Budget	No Data	No	No Data	No	No Data	Yes	No Data	$3.2M	Yes	Yes
Structural Protection Projects	No Data	Yes	No Data	No	No Data	Yes	No Data	$100K Wastewater Treatment Plant Upgrades	No	No Data
Property Protection Projects	No	Yes	No Data	No	No Data	No	No Data	None	Yes - Annually	No Data
Critical Facility Protection	No	No	No Data	No	No Data	Yes	No Data	$500K Electrical Substation Upgrade	No	No

	Erie County	Village of Bay View	City of Bellevue	Village of Berlin Heights	Village of Castalia	City of Huron	Kelley's Island	Village of Milan	City of Sandusky	City of Vermilion
Cultural or Natural Resource Inventory	No	No	No Data	No	No Data	No	No Data	No	Tree Inventory - GIS	Tree Inventory GIS
Erosion/Sediment Control	Yes	No	No Data	No	No Data	Yes	No Data	Erie County Soil and Water	Yes - form and permit	No
Public Information/ Educational Program	No	No	No Data	No	No Data	Yes – Social Media, Quarterly Newsletter, Direct Mail, Direct Texting	No Data	Working on Disaster Plan	No	Working on a Disaster Plan

	Berlin Township	Florence Township	Groton Township	Huron Township	Margaretta Township	Milan Township	Oxford Township	Perkins Township	Vermilion Township
Comprehensive Plan	Yes	Yes	No Data	Yes	No Data	No Data	Yes	Yes - under revision	Yes
Planning Commission	Yes – through County	Yes – through County	No Data	Yes	No Data	Yes	Yes - through County	Yes	Yes
Land Use Plan	Yes	Yes	No Data	Yes	No Data	Yes	Yes	Yes	Yes
Subdivision Ordinances	Yes	No Data	No Data	Yes – through County	No Data	Yes	No Data	Yes, through Erie Regional Planning Commission	Yes- through County Regional Planning
Development Regulations	Yes	Yes	No Data	Yes – through County	No Data	Yes	Yes	Yes	Yes
Zoning Ordinance	Yes	Yes	No Data	Yes	No Data	Yes	Yes	Yes	Yes
Hazard Mitigation Plan	Yes - through County	Yes - through County	Yes - through County	Yes	Yes - through County	Yes - through County	Yes - through County	Yes, through County	Yes- through County
Floodplain Regulations	Yes - through County	Yes - through County	Yes - through County	Yes	Yes - through County	Yes - through County	Yes - through County	Yes, through County	Yes- through County
Floodplain Management Regulations	Yes - through County	Yes - through County	Yes - through County	Yes	Yes - through County	Yes - through County	Yes - through County	Yes, through County	Yes- through County
- Floodplain Administrator	Yes - through County	Yes - through County	Yes - through County	Yes - through County	Yes - through County	Yes - through County	Yes - through County	Yes, through Erie Regional Planning Commission	Yes- through County
- # Structures in Floodplain	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
- # NFIP policies	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
- # Repetitive loss structures	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	Unknown
Community Rating System Rating	No	No	No Data	No Data	No Data	No Data	No	Unsure	Unknown

	Berlin Township	Florence Township	Groton Township	Huron Township	Margaretta Township	Milan Township	Oxford Township	Perkins Township	Vermilion Township
Storm Water Management Program	Yes – through County	Yes – through County	No Data	Yes – through County	No Data	Yes	Yes - through County	Yes, contract with County Soil and Water	Through County
Building Codes	Yes	Zoning	No Data	Yes	No Data	Yes	Yes	Yes, Ohio Building Code (Commercial), Residential Code of Ohio. Perkins is state-certified Building Dept.	Yes State Certified Building Dept.- Residential and Commercial/Industrial
- Building Official	Yes	Zoning	No Data	Yes	No Data	Yes	Zoning	Yes	Yes
- Building Inspections	Yes	No Data	No Data	Yes	No Data	Yes	Yes	Yes	Yes
- Building Code Effectiveness Grading Schedule (BCEGS) Rating	No Data	No Data	No Data	3	No Data	No Data	No Data	No Data	No Data
Warning Systems	Yes	Yes	No Data	Yes	No Data	No Data	Yes	Yes	Yes
- Outdoor Warning Sirens	Yes	Yes	No Data	Yes	No Data	Yes	Yes	Yes	Yes
- NOAA Weather Radio	Yes	Yes	No Data	No Data	No Data	No Data	No Data	Yes	No Data
- Reverse 911	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No	No
- Other	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Capital Improvement Budget	No Data	No Data	No Data	Yes	No Data	Yes	No Data	Yes	Yes
Public Works Budget	No Data	No Data	No Data	Yes	No Data	No Data	No Data	Yes	No Data
Structural Protection Projects	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No data	No Data
Property Protection Projects	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No data	No Data
Critical Facility Protection	No Data	No Data	No Data	Yes	No Data	No Data	No Data	No data	No Data

	Berlin Township	Florence Township	Groton Township	Huron Township	Margaretta Township	Milan Township	Oxford Township	Perkins Township	Vermilion Township
Cultural or Natural Resource Inventory	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No data	No Data
Erosion/Sediment Control	No Data	No Data	Yes – through County	No Data	No Data	No Data	No Data	Yes, contract through County Soil & Water	No Data
Public Information/ Educational Program	No Data	No Data	Yes	No Data	No Data	No Data	No Data	Yes	No Data

Zoning Ordinances**:** Regulates development by dividing the community into zones or districts and establishing the type of development allowed within each district. The floodplain can be designated as one or more separate zoning districts in which development is prohibited or allowed only if it is not susceptible to flood damage. Some districts that are appropriate for floodplains are those designated for public use, conservation, or agriculture. Zoning works best in conjunction with a comprehensive plan or "road map" for future development and building codes.

While Erie County does not have a countywide zoning ordinance, the each of the townships have zoning ordinances and many of the jurisdictions either have their own zoning regulations or they use their township's. In Erie County, zoning regulations are the primary mechanism used to address hazard mitigation by many of the jurisdictions and townships.

- Berlin Township Zoning Ordinances – includes Article 12 addressing conservation/recreation district and acts to protect the public health, safety, comfort and welfare and reducing financial burdens imposed by flooding by restricting use in the designated areas and Article 27 addressing the floodplain, floodway and wetland overlay district, designed to protect lands that are subject to predicable, frequent flooding. Also includes some directives towards stormwater management plans and erosion control for certain land uses. Potential improvements could be included in the mobile home park section, requiring storm shelters for the residents.

- City of Bellevue Zoning Ordinances do not address floods, erosion or stormwater management. However, their Building code includes Flood Damage Reduction Regulations that restrict development on the floodplain and require that facilities that are at risk of flood damage be protected during initial construction.

- City of Huron Zoning Ordinance – Includes a Flood Hazard Zoning/Flood Damage Reduction chapter that restricts development on the floodplain, encourages appropriate uses for land that falls under special flood hazard areas, and regulates how the land may be developed in order to ensure flooding is not worsened in that location or other locations.

- City of Sandusky Planning and Zoning Code – Includes a Flood Damage Reduction chapter that pertains to any special flood hazard area annexed by the City of Sandusky. The regulations restrict or prohibit development in the flood hazard areas and require uses vulnerable to flooding be constructed in ways to protect them.

- City of Vermilion Zoning – Includes a Flood Plain District and requires that a Flood Plain Evaluation Study must be submitted for any exterior project in the flood plain.

- Florence Township Zoning Book – does not have a specific section restricting development in a floodplain or floodway. Instead all new zoning permit applications must identify any areas within a floodplain on the property. Plan must

be written to prevent soil erosion, excessive runoff, excessive raising or lowering of the water table, and flooding of other properties.

- Huron Township Zoning Resolution – Includes a Flood Hazard Area section that specifically permits crop farming and gardening, open recreational uses, public rights-of-way, private drives and porous parking lots, and public utilities and accessory surface structures. Other uses may be permitted as well but are subject to special conditions aimed at reducing flood damage risk, such as having a minimum elevation of three or more feet above the floodplain level.

- Margaretta Township Zoning Ordinances – Does not have a specific section restricting development on floodplains and floodways, but states that new site plan applications must identify areas that are within a floodplain and include plans to prevent erosion, excessive run-off, excessive raising or lowering of the water table. It is further stated that all storm-water drainage plans must be developed in accordance with the Erie County Storm-water and Sediment Control regulations. Elevations plans may also be required by the Zoning Board.

- Milan Township Zoning Resolution – Contains Article 24 Floodplain, Floodway & Wetland Overlay District, which is designed to protect lands that are subject to predictable flooding. Allowable uses in the floodplain include general farming, pasture, outdoor plant nurseries, horticulture, forestry, wildlife sanctuary, game far, or other similar agricultural or wildlife related uses; unpaved parking lots or heliports; lawns, gardens, play areas; and outdoor recreation areas that do no require paved surfaces. The Resolution specifies strict requirements for any structure on the floodplain and requires that landscaping plans be reviewed and approved.

- Perkins Township Zoning Resolution – As does Milan Township's Zoning Resolution, Perkins Township Zoning Resolution contains Article 24 Floodplain, Floodway & Wetland Overlay District which is designed to protect lands that are subject to predictable flooding. Allowable uses in the floodplain include general farming, pasture, outdoor plant nurseries, horticulture, forestry, wildlife sanctuary, game far, or other similar agricultural or wildlife related uses; unpaved parking lots or heliports; lawns, gardens, play areas; and outdoor recreation areas that do no require paved surfaces. The Resolution specifies strict requirements for any structure on the floodplain and requires that landscaping plans be reviewed and approved.

- Vermilion Township Zoning Resolution – Contains Article 21 Floodplain, Floodway and Wetland Overlay District which is designed to protect lands that are subject to predictable flooding. Allowable uses in the floodplain include general farming, pasture, outdoor plant nurseries, horticulture, forestry, wildlife sanctuary, game far, or other similar agricultural or wildlife related uses; unpaved parking lots or heliports; lawns, gardens, play areas; and outdoor recreation areas that do no require paved surfaces. The Resolution specifies strict requirements for any structure on the floodplain and requires that landscaping plans be reviewed and approved.

- Village of Bay View Zoning Resolution – Does not have specific references to development on the floodplain nor erosion control regulations. Culverts to drain stormwater are to be sized to meet engineering standards.

- Village of Berlin Heights Zoning Ordinance – Mandates that a pre-development plan must identify any areas that are located within a floodplain and that plans must be in place to prevent pollution of surface or groundwater, erosion of soil during and after construction, excessive run-off, and excessive raising or lowering of the water table. Landscape plans must also indicate all existing water sources, including wetlands, floodplains and drainage retention areas, and indicate what changes will be made.

- Village of Kelleys Island Ordinances – Includes floodplain regulations as a step to become a participant in the National Flood Insurance Program. The ordinance is applicable to new development and restricts or prohibits development on the floodplain if it would endanger the health, safety or property during a flood. Also has subdivision regulations and zoning ordinances which also address limiting damage caused by flood by restricting development.

- Village of Milan Planning and Zoning Code – Do not include specific flood, stormwater or erosion control measures. However, the Village of Milan's Building Code specifies that the Building Inspector shall determine whether the proposed building site is safe from flooding, or if it is located in a flood hazard area, specific actions are taken to minimize flood damage. Additional regulations are included in the Flood Damage Reduction section of the Building Code, which restrict or prohibit land uses which are dangerous to health, safety and property due to flooding, and requires buildings with potential for flood damage to be constructed in ways to minimize damage.

Development Regulations: Further specify how development can occur. Subdivision Regulations govern how land will be broken up into individual lots. These regulations set construction and location standards for the infrastructure built by the developer, including roads, sidewalks, utility lines, storm sewers, stormwater retention or detention basins, and drainage ways.

The National Flood Insurance Program (NFIP): A voluntary program which requires the development of a floodplain ordinance. Erie County has an approved floodplain management ordinance that protects human life and health, preserves property, and minimizes damage to public facilities and utilities. Erie County Regional Planning Commission plans to update these regulations as soon as the new coastal flood maps from FEMA are finalized.

Stormwater Management Regulations: Provide for the conveyance of stormwater to decrease flooding. In Erie County, the Stormwater Management Rules and Regulations and Erosion Control have been adopted by the Board of County Commissioners and are included in the Subdivision Regulations of Erie County. These rules and regulations inform the public about the stormwater policy and design practices and assist professionals in

the review and development of proposals. It includes regulations with the intended purpose of allowing development without increasing downstream flooding, erosion or sedimentation; maintain water quality goals; and reduce damage to streams that may inhibit their capacity. Erie County's Stormwater Management Rules and Regulations address the hazards of flooding, lake/stream bank erosion, and natural biohazards.

Adoption and enforcement of building codes ensure that both residential and non-residential structures are safe. Building codes provide some of the best methods of addressing all the hazards in this plan. They are the prime measure to protect new property from damage by high winds, tornadoes, earthquakes, hail, and winter storms. When properly designed and constructed according to code, the average building can withstand the impact of most of these forces. The Core Group indicated that it is unlikely that they would pass more stringent building codes than the State of Ohio has adopted.

A local historic district ordinance enables a community to regulate development in a specific, designated area of historic significance. A historic district ordinance is included in Erie County's comprehensive plan.

5.6 Planning Capabilities

Comprehensive Planning: Is a type of long-range planning for a particular community that determines goals and a vision for the future. Erie County last developed a Comprehensive Plan in 1995 and the Cities of Huron, Sandusky, and Vermilion all have their own, more recent Comprehensive Plans. Oxford, Perkins and Vermilion Townships also have their own comprehensive plans; however, Perkins Township is in the process of revising their plan. Comprehensive plans and land use plans can specify how a community should be or should not be developed. Through these plans, uses of land can be tailored to match the hazards present. When mitigation ideas are incorporated into comprehensive plans, they become a powerful tool for a community to address the hazards they face. Upon review of the existing comprehensive plans for the County and jurisdictions within Erie County, there is room for improvement where integrating mitigation concepts are concerned.

Comprehensive planning reflects what a community wants to see happen to their land in the future. A comprehensive plan can look 5, 10, or even 20 years into the future to help a community plan and shape how they envision their community.

Emergency Operations Planning: The Erie County Emergency Operations Plan (EOP) is a requirement of the Ohio Revised Code, Section 5502.271. The purpose of this EOP is to predetermine, to the extent possible, actions to be taken by the governmental jurisdictions of Erie County to prevent avoidable disasters and respond quickly and adequately to emergencies in order to protect the lives and property of the residents of Erie County.

The EOP is designed to work for all types of natural and man-made disasters. The document has a Base Plan which defines and identifies areas of potential risk, lists people and organizations involved in response, and discusses plan development and maintenance. The Base Plan is augmented with annexes that describe the details of

various aspects of emergency response. Some examples of these annexes include Direction and Control, Notification and Warning, Law Enforcement, Medical, Anti-Terrorism, and Resource Management.

The plan also contains guidelines with respect to roles and responsibilities. The Emergency Operations Center (EOC) is responsible for directing and controlling the conduct of emergency operations from that center, or from an alternate facility during emergencies. The EOC, in coordination with the Incident Commander at the site, will be the point of contact for all operating/responding departments and agencies, other counties and the State.

Watershed Planning: Four river basins influence drainage in Erie County: The Black River and Rocky River in Lorain County drain the northeastern corner of Erie County, the eastern portion of the county drains to the Huron River and Vermilion River, the western portion of the county is drained by the Sandusky River and Green Creek, and the islands of Erie County drain into Lake Erie. All four river basins flow into Lake Erie.

Currently the only state endorsed watershed action plan in Erie County is for Old Woman Creek[27]. In addition, the Firelands Coastal Tributaries Watershed Program covers Erie County's small watersheds.[28]

Emergency Action Planning for Dams: In Ohio, most dams are constructed of earthen materials. Dams must have spillway systems to safely convey normal stream and flood flows over, around, or through the dam. Spillways are commonly constructed of non-erosive materials such as concrete. Dams also have a drain or other water-withdrawal facility to control the pool or lake level and to lower or drain the lake for normal maintenance and emergency purposes.

There are no Class I dams in Erie County and no Emergency Action Plans (EAPs) for existing dams. Typically, an EAP addresses ways to safeguard lives and reduce property damage within the inundation area; procedures for effective dam surveillance; procedures for prompt notification of emergency management officials; warning and evacuation procedures; and emergency response actions that will be taken in the event of potential or imminent failure of the dam.

Ohio Administrative Code Rule 1501:21-13-01, dams are classified as follows:

[27] (Ohio Environmental Protection Agency, 2020)
[28] (Ohio State University Extension, 2020)

Table 7: Ohio Dam Classification Systems[29,30]

Ohio Dam Classification	Description	Corresponding Federal Classification
Class I	Probable loss of life, serious hazard to health, structural damage to high value property (i.e., homes, industries, major public utilities)	**High**
Class II	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	**Significant**
Class III	Damage to low value non- residential structures, local roads, agricultural crops and livestock	**Significant**
Class IV	Losses restricted mainly to the dam	**Low**

Erie County has two dams that are classified as Class III, and 16 dams that are classified as "Other" according to the GIS data available from the Ohio Department of Natural Resources. The "Other" category includes Class IV dams as well as dams not requiring classification. There are no Class I or Class II dams in Erie County.

There is one dam, Work Lake Dam No. 2, in Erie County recorded in the National Inventory of Dams (NID). According to the National Performance of Dams Program (NPDP) the dam is a low hazard without any previous incidents.

5.7 Additional Capabilities

A variety of additional capabilities are established in Erie County. These capabilities can support the implementation of mitigation actions that are proposed in this plan. One of these capabilities is the State of Ohio Rain Snow Monitoring System, also known as STORMS. The State of Ohio Rain/Snow Monitoring System (STORMS) is an automated rain gauge system that monitors an area's snow and rainfall for potential flooding while transmitting current, real-time precipitation data to the State of Ohio Emergency Operations Center, the ODNR, the NWS and county emergency management agencies. The rain gauges are usually positioned near watersheds and report data 24 hours a day to computers in Columbus and are used by NWS as a prediction tool for flood and flash flood watches and warnings. Local governments are also able to access the data through special computer systems connected to the gauges.

5.8 Other Resources

Support for mitigation planning also is provided by the State of Ohio and the Federal Government. Programs that complement Erie County mitigation planning initiatives are:

- Ohio administered programs include the following:
    - Ohio Department of Development: Provide grants for job ready sites and community development block for economic development.

[29] (Ohio Department of Natural Resources, 2020)
[30] (Ohio Emergency Management Agency, 2019)

- Ohio Department of Natural Resources: Provide support for land and water conservation efforts.
- Ohio Environmental Protection Agency: Provide grants and loans for capital improvements within a community.

- Federal Government programs include the following:
  - Unified Hazard Mitigation Assistance Grant Programs: Provide grants for cost-effective mitigation projects either in the absence of a disaster or after a disaster declaration has occurred.
    - Pre-Disaster Mitigation Assistance Program (PDM)
    - Flood Mitigation Assistance Program (FMA)
    - Repetitive Flood Claims Program (RFC)
    - Severe Repetitive Loss Program (SRL)
    - Hazard Mitigation Grant Program (HMGP)
  - Community Development Block Grants: Provides funds to address a wide range of community development needs.
  - Small Communities Program Fund: Supports water quality infrastructure projects.
  - Weatherization Assistance Program: Enables low-income households to make their homes more energy efficient.
  - Firewise Communities Program: Involves homeowners and community leaders in protecting structures from fire damage.

5.9 Structure Assessment

The purpose of this section is to identify type, quantity, and value associated with each structure within Erie County. This information is utilized when determining the vulnerability of the built environment for each hazard as well as helping to quantify the potential damages when a disaster occurs. Table 8 was created from information provided in the Hazus-MH software and shows the type and approximate value associated with each structure within Erie County.

Table 8: Structure Inventory

	Residential		Non-Residential	
	Number of Structures	Average Building Value	Number of Structures	Average Building Value
Erie County	31,940	$249,280	3,164	$875,158

6 Hazard Identification

To reduce the potential for damage due to hazards, it is necessary to identify hazards that may affect the county. This process is completed using published information and online sources that address hazards globally, nationally, within Ohio, or specifically within Erie County as well as subject matter expertise provided by members of the Mitigation Core Group and the public.

Hazards which were identified and examined in this plan update as required by the Disaster Mitigation Act of 2000 are as follows:

- Damaging Winds
- Drought
- Earthquakes
- Flooding
- Lake/Stream Bank Erosion
- Natural Biohazards (including Invasive Species and Harmful Algae Blooms)
- Severe Summer Weather
- Severe Winter Weather
- Tornadoes/Waterspouts

6.1 Description of Hazards

The descriptions of hazards included in the 2020 Plan are based on publicly available data provided by the National Oceanographic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) and the Ohio Department of Natural Resources. The hazard data was evaluated by the Mitigation Core Group during the first planning meeting and during an online survey following the meeting. The Mitigation Core Group modified the prioritization used in the last plan update to include considerations of vulnerability, consequence, and frequency of each hazard type rather than solely on previous occurrences. Table 9 summarizes each hazard that may affect Erie County, in alphabetical order.

Table 9: Descriptions of Natural Hazards Addressed in This Plan

Hazard	General Description of Hazard
Damaging Winds	Damaging winds are sometimes called straight-line winds to differentiate them from tornadoes. There are many different types of damaging winds: downdrafts, macrobursts, microbursts, gust fronts, derechos, and haboobs (these do not occur in Ohio other than the impacts from dust). Damaging winds are usually associated with thunderstorms but can also be caused by a strong weather system or can flow down a mountain. Isolated damage is possible when winds have a sustained speed of 40-50 miles per hour. Higher wind speeds can cause substantial damage, and cause injuries or death to people through blown debris or destroyed structures.
Droughts	A drought is a period of prolonged dryness that contributes to depletion of ground water and surface water. Adverse consequences of drought include insufficient supplies of water for

Hazard	General Description of Hazard
	human consumption as well as agricultural and industrial uses and deterioration of water quality. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought. The probability of wildfires increases as the severity and duration of a drought increases.
Earthquakes	Earthquakes are the sudden motion or trembling of the ground caused by the breaking and shifting of rock beneath the surface of the earth. Ground shaking from earthquakes can collapse buildings and bridges and disrupt gas, electric, and phone service.
Flooding	A flood is a natural event for rivers and streams. In Erie County excess water from snowmelt or rainfall accumulates and overflows the stream banks into adjacent floodplains. Floods are considered hazards when people and property are affected. Nationwide, hundreds of floods occur each year, making it one of the most common hazards in all 50 states and U.S. territories. In Ohio, flooding can occur during any season of the year. Serious flooding occurs regularly along Ohio's major rivers and streams. Additionally, ice jams can cause flooding during winter months. Ice jams occur when water builds up behind a blockage of ice. Typically, these are due to a heavy rain that causes a frozen river to swell, which breaks the ice on the surface of the river. Ice is carried by the current and accumulates at narrow passages or obstructions. Karst geology can also lead to unique flooding problems. During periods of heavy precipitation, rain water or snow melt can quickly infiltrate the groundwater through sinkholes, causing the groundwater level to rise. This can cause other areas that typically act as a basin to collect runoff to turn into springs and flood the surrounding area.
Lake/Stream Bank Erosion	Lake erosion is the gradual wearing and carrying away or land or beach materials by wave action, water, wind, general weather conditions and tidal currents. Stream bank erosion is the direct removal of banks and beds by flowing water. These types of erosion are typically caused by a rise in sea level and high stream flow.
Natural Biohazards	Natural biohazards are natural elements that can pose a threat to human health or the ecosystem under certain conditions. In this plan, two separate natural biohazards are considered: Invasive Species and Harmful Algae Blooms (HABs). The National Invasive Species Council defines an invasive species as one that "is both non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause

Hazard	General Description of Hazard
	economic or environmental harm, or harm to human health." Invasive species include plants, aquatic life, and insects. The Ohio Sea Grant Program states Harmful Algal Blooms (HAB) are caused by a combination of warm water temperatures (above 60 degrees Fahrenheit) and high concentrations of phosphorus in the water. Typically, a high concentration of phosphorus and nitrogen in cold weather will produce a bloom of diatoms, in cool weather this causes a bloom of green algae, and in warm weather often blue-green algae is found.
Severe Summer Weather	Severe Summer Weather includes thunderstorms, hail, and lightning. Thunderstorms may occur at any time of the year and just about anywhere in the world. A thunderstorm forms when moist, unstable air is lifted vertically into the atmosphere. Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere, where they freeze into ice. Hail forms only in thunderstorms, in cumulonimbus clouds that contain vast amounts of energy in the form of updrafts and downdrafts. Lightning occurs in all thunderstorms. It is one of the major causes of storm related deaths in the United States. In addition to deaths and injuries, lightning can cause significant damage to communication networks and electrical networks, leading to power and communication outages. Lightning can also cause wildfires.
Severe Winter Weather	Heavy snow and ice are caused by winter storms bringing frozen precipitation and cold temperatures to an area. Heavy accumulations of ice can cause extensive damage by bringing down trees and toppling utility poles and communication towers, which disrupts power and communications. Winter storms may also lead to the collapse of roofs in deteriorated structures.
Tornadoes/ Waterspouts	A tornado is an extraordinary feature generally associated with severe thunderstorms or hurricanes. A tornado is characterized by a funnel of violently rotating winds. While the extent of tornado damage is usually localized, the extreme winds of a tornado are among the most destructive and can cause millions of dollars of damage and loss of life when they move through populated, developed areas. Tornadoes can occur at any time but most frequently occur during the late afternoon or early evening, the warmest hours of the day. Peak months for tornado activity are April, May, and June.

Hazard	General Description of Hazard
	There are two types of waterspouts, tornadic waterspouts and fair weather waterspouts. Tornadic waterspouts are tornadoes that are either formed over water or move from land to water. They can be as dangerous as a tornado, and can be accompanied by severe thunderstorms, lightning, dangerous hail, and high winds and seas. Fair weather waterspouts are not typically associated with thunderstorms and typically move very little. They form at the surface of the water, and rise, so by the time they are noticed, they are nearly fully developed.

Lake Level Rise was under consideration for inclusion as its own hazard for this plan update. However, after additional research was done, the committee decided that lake level rise was determined to be more appropriately included as an exacerbating factor in flooding and lake/stream bank erosion hazards and was included in those sections.

7 Hazard Risk Assessment

7.1 Damaging Winds

7.1.1 Hazard Profile

Damaging winds can also be called wind storms or straight-line winds to differentiate them from tornadoes. Like tornadoes, they are frequently associated with severe thunderstorms, however, they can occur without an obvious thunderstorm, which is why they are considered a separate hazard in this mitigation plan. Wind can cause isolated damage at sustained wind speeds of just 40-50 miles per hour but is considered severe if it exceeds 58 miles per hour. Damaging winds can occur any time of year, so they are not considered just summer weather or winter weather.

Damaging winds that are not associated with thunderstorms can be caused by strong weather systems, daytime heating of the ground surface, or can flow down a mountain. Damaging winds associated with thunderstorms can take on many types: downdraft, macroburst, microburst, downburst, gust front, derecho or a haboob.

Downdrafts occur when a column of cold, dense, moist air, originating at high altitudes, sinks down towards the surface of the earth, and spreads out along the ground. Intense downdrafts can be classified as macrobursts or microbursts.

Macrobursts occur when a downdraft causes the strong winds at the ground surface to extend more than 2.4 miles. Macrobursts usually form with a thunderstorm but can also form during storms too weak to produce thunder.

Microbursts are smaller in scale than macrobursts, not exceeding 2.5 miles, and shorter in duration, lasting only 5-10 minutes. Microbursts can be accompanied by heavy precipitation or they can have little or no precipitation. The dry microbursts are more common in the high plains or intermountain regions of the western United States.

A gust front happens when the leading edge of a thunderstorm is cooled by rain, and clashes with the warmer air of the thunderstorm. It is characterized by temperature drops, gusty winds, and changing wind directions.

Derechos are very long lasting and widespread windstorms that is typically composed of several microbursts or macrobursts. If the damage path exceeds 250 miles and includes wind gusts of at least 58 miles per hour, meteorologists may classify the storm a derecho.

Haboobs are dust storms caused by downdrafts and are characterized by a wall of dust.[31] Ohio often is exposed to the dust caused by haboobs in other parts of the world carried by strong wind currents.

[31] (National Oceanic & Atmospheric Administration, n.d.)

7.1.2 Location

In the United States, anywhere that a thunderstorm can occur is at risk for damaging winds. However, as previously stated, certain types of damaging winds, such as dry microbursts are more common in other parts of the US and are not likely in Erie County. Damaging winds are equally likely to occur anywhere in Erie County and its jurisdictions. Individual damaging wind storms may affect the entire County or a localized portion.

7.1.3 Extent

Wind can produce damage with gusts as low as 40-50 miles per hour but are not considered severe until wind speeds reach 58 miles per hour. In Erie County, the highest wind speed for a damaging wind event, not associated with a thunderstorm was 68 miles per hour. However, Erie County has had wind storm events with recorded property damage with wind speeds of just 35 miles per hour.

7.1.4 Previous Occurrences

Between 1996 and 2019, there have been 46 reported occurrences of damaging winds not associated with thunderstorms. Table 10, below, is a list of these storms.

High Winds September 2008. High winds associated with the remnants of Hurricane Ike began during the early evening hours of September 14th and continued through late evening. Peak wind gusts were estimated to be around 60 mph with the strongest winds occurring between 6 pm and 8 pm. Damage in the county was extensive with hundreds of trees and many utility poles downed. Widespread power outages occurred as well with some customers without power for a few days. Many homes and buildings were damaged across the county. The damage ranged from a few shingles torn off to significant structural damage caused by fallen trees landing on roofs. Numerous vehicles were damaged by fallen trees and limbs and also from flying debris. This storm hampered travel as downed trees and power lines forced the closure of many roads. Substantial cleanup costs were incurred by local governments. Some of the schools in the county were forced to close on Monday the 15th because of the power outages. Significant crop losses occurred as well. Corn yields were reduced between 3 and 5 percent in many areas with lesser losses to the soybean crop.

Hurricane Sandy October 2012. Winds in Erie County gusted to over 60 mph for a sustained period of time. A peak gust of 62 mph was measured by an automated sensor at the Huron Lighthouse. Hundreds of trees were downed in the county with most of the damage near the Lake Erie shoreline. Up to 4,000 electric customers lost power. There were reports of trees on houses and vehicles. Many homes also lost sections of roofing and siding. A lot of streets had to be closed because of downed trees and power lines. The following table details the occurrence of damaging winds in Erie County between 1996 and 2019.

Table 10: Previous Occurrences of Damaging Winds in Erie County 1996-2019

Location	Date	Type	Magnitude (MPH)	Deaths	Injuries	Property Damage	Crop Damage
Erie (Zone)	1/27/1996	High Wind	68	0	0	$-	$-
Erie (Zone)	1/29/1996	High Wind	50	0	0	$-	$-
Erie (Zone)	2/10/1996	High Wind	50	0	0	$3,000	$-
Erie (Zone)	3/25/1996	High Wind	50	0	0	$10,000	$-
Erie (Zone)	4/25/1996	High Wind	50	0	0	$-	$-
Erie (Zone)	9/7/1996	High Wind	50	0	0	$3,000	$20,000
Erie (Zone)	10/30/1996	High Wind	52	0	0	$50,000	$50,000
Erie (Zone)	2/21/1997	High Wind	50	0	0	$1,000	$-
Erie (Zone)	2/27/1997	High Wind	50	0	0	$5,000	$-
Erie (Zone)	9/29/1997	High Wind	-	0	0	$2,000	$-
Erie (Zone)	3/28/1998	High Wind	-	0	0	$10,000	$-
Erie (Zone)	11/10/1998	High Wind	-	0	0	$20,000	$-
Erie (Zone)	11/11/1998	High Wind	52	0	0	$500,000	$-
Erie (Zone)	5/6/1999	High Wind	-	0	0	$15,000	$-
Erie (Zone)	12/11/2000	High Wind	-	0	0	$150,000	$-
Erie (Zone)	2/9/2001	High Wind	-	0	0	$10,000	$-
Erie (Zone)	2/25/2001	High Wind	-	0	0	$10,000	$-
Erie (Zone)	4/12/2001	High Wind	-	0	0	$15,000	$-
Erie (Zone)	10/25/2001	High Wind	-	0	0	$15,000	$-
Erie (Zone)	2/1/2002	High Wind	-	0	0	$500,000	$-
Erie (Zone)	3/9/2002	High Wind	-	0	0	$400,000	$-
Erie (Zone)	2/12/2003	High Wind	50	0	0	$125,000	$-
Erie (Zone)	5/11/2003	Strong Wind	35	0	0	$50,000	$-
Erie (Zone)	10/14/2003	Strong Wind	35	0	0	$10,000	$-
Erie (Zone)	11/12/2003	High Wind	50	0	0	$60,000	$-
Erie (Zone)	3/5/2004	High Wind	50	0	0	$75,000	$-
Erie (Zone)	11/27/2004	Strong Wind	35	0	0	$5,000	$-
Erie (Zone)	12/1/2004	High Wind	50	0	0	$25,000	$-
Erie (Zone)	12/7/2004	Strong Wind	43	0	0	$10,000	$-
Erie (Zone)	11/6/2005	High Wind	50	0	0	$20,000	$-
Erie (Zone)	2/17/2006	High Wind	50	0	0	$50,000	$-
Erie (Zone)	3/10/2006	Strong Wind	44	0	0	$10,000	$-
Erie (Zone)	12/1/2006	High Wind	50	0	0	$15,000	$-
Erie (Zone)	12/23/2007	High Wind	50	0	0	$8,000	$-
Erie (Zone)	1/30/2008	High Wind	55	0	0	$30,000	$-
Erie (Zone)	1/30/2008	High Wind	60	0	0	$250,000	$-
Erie (Zone)	9/14/2008	High Wind	52	0	0	$2,500,000	$750,000
Erie (Zone)	2/11/2009	High Wind	53	0	0	$350,000	$-
Erie (Zone)	12/9/2009	High Wind	53	0	0	$200,000	$-
Erie (Zone)	4/28/2011	High Wind	52	0	0	$10,000	$-
Erie (Zone)	3/2/2012	High Wind	50	0	0	$-	$-
Erie (Zone)	10/29/2012	High Wind	54	0	0	$750,000	$-
Erie (Zone)	11/24/2014	High Wind	52	0	0	$150,000	$-
Erie (Zone)	12/31/2018	Strong Wind	44	0	0	$2,000	$-
Erie (Zone)	2/24/2019	High Wind	50	0	0	$150,000	$-
Erie (Zone)	11/27/2019	High Wind	50	0	0	$100,000	$-
Totals				**0**	**0**	**$6,674,000**	**$820,000**

7.1.5 Probability of Future Events

The recurrence interval is the average time between hazard events and is calculated by dividing the years on record by the number of events that occurred during that time period. For damaging winds in Erie County, the recurrence interval is 0.52 years. This

means Erie County is likely to experience at least two damaging wind events every year. This equates to a probability of damaging winds to occur in Erie County 192%. As probabilities cannot realistically be over 100%, any hazards with a calculated probability greater than 100% will be limited to 100% probability in any given year.

7.1.6 Vulnerability

Winds are capable of damaging property, including buildings and automobiles, infrastructure, such as electrical power grids, and crops. In Erie County, property is much more vulnerable than crops, based on the historical record. The most severe wind storm on record affecting Erie County, based on losses, occurred in September 2008, when wind storms associated with Hurricane Ike, caused $2.5 million in property damage and $750 thousand in crop damage, in Erie County alone. It is possible that another wind storm in Erie County could cause as much in losses as those that occurred in 2008.

While it is possible that well-designed and well-constructed buildings might sustain damage during a damaging wind event, it is much more likely that a building with inadequate design, poor maintenance or poor construction will sustain the damage. Buildings constructed prior to current regulations and mobile homes are particularly vulnerable to damaging winds.

Table 11: Summary of Past Losses Due to Damaging Winds

	Estimated Property Damages
Total Losses Due to Damaging Winds (1996–2019)	$6,674,000
Average Annual Losses for 24years	$278,083

According to NCDC and reflected above in Table 11, estimated significant property damage in Erie County attributable to damaging winds during the years 1996 through 2019 is $6,674,000. The average annual loss for these 24 years is $6,674,000/24 = $278,083.

7.2 Droughts

7.2.1 Hazard Profile

Drought is typically defined as a period of time with abnormally low precipitation, leading to a shortage of water. Droughts are natural occurrences, but human behavior can exacerbate existing problems if water sources are not managed well. There is no strict definition of what constitutes a drought due to widely varying precipitation amounts based upon location. In the United States, drought is the second most expensive natural hazard, with an average cost of $9.6 billion per event. Droughts can not only impact people, crops, and farmland, but they can impact more of the ecosystem if waterways such as lakes and rivers experience low water levels that can threaten the plants and animals dependent on the water.

Drought can be divided into four categories that measure the impact of the drought. These categories are not mutually exclusive and often overlap. Meteorological Drought is when the precipitation over an area is much lower than normal. Agricultural Drought occurs when the available water supply is not enough to meet the needs of the farms and ranches in a region. The inadequate water supply may be due to a meteorological drought. A Hydrological Drought occurs when a Meteorological Drought is prolonged enough, that water levels in lakes, rivers, creeks, and groundwater are low. A Hydrological Drought can also impact an Agricultural Drought if the farmers and ranchers in an area depend on surface or groundwater. [32]

7.2.2 Location

History has shown that in the event of a drought, entire counties, regions, states and areas of the country may be affected. They are usually widespread events, so drought conditions are typically monitored by areas rather than jurisdictions. Erie County is in Ohio Climate Division 2. During an average year in Ohio, an estimated 15,000 wildfires and natural fuel fires occur. Although droughts can persist for several years, even a short drought with intense heat can cause significant damage and harm to the local economy. With Erie County's proximity to the Lake Erie, most droughts will have smaller effect on water supplies, however, drought can negatively impact agricultural and recreational areas.

7.2.3 Extent

The Palmer Drought Severity Index (PDSI) is used to describe abnormally wet to abnormally dry conditions. Zero represents normal rainfall and temperature conditions; drought condition indices are described in Table 12.

Table 12: Palmer Drought Severity Index

Index	Description of Conditions
4.0 or more	Extremely wet
3.0 to 3.99	Very wet

[32] (National Resources Defense Council, 2018)

Index	Description of Conditions
2.0 to 2.99	Moderately wet
1.0 to 1.99	Slightly wet
0.5 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.5 to -0.99	Incipient dry spell
-1.0 to -1.99	Mild drought
-2.0 to -2.99	Moderate drought
-3.0 to -3.99	Severe drought
-4.0 or less	Extreme drought

Data provided by NCDC show that drought conditions in Ohio Climate Division 2 have resulted in Palmer Drought Severity Index level as low as -5.85 for a four-month period in 1934. Figure 13, below, shows the PDSI between 1895 and 2020. Ohio has a generally temperate climate and infrequently has severe droughts over an extended period. Ohio Climate Division has only experienced 25 moderate droughts and 13 severe drought conditions (4 of which were categorized as extreme drought) during the typical summer timeframe when droughts are most likely to impact water supply and crops.

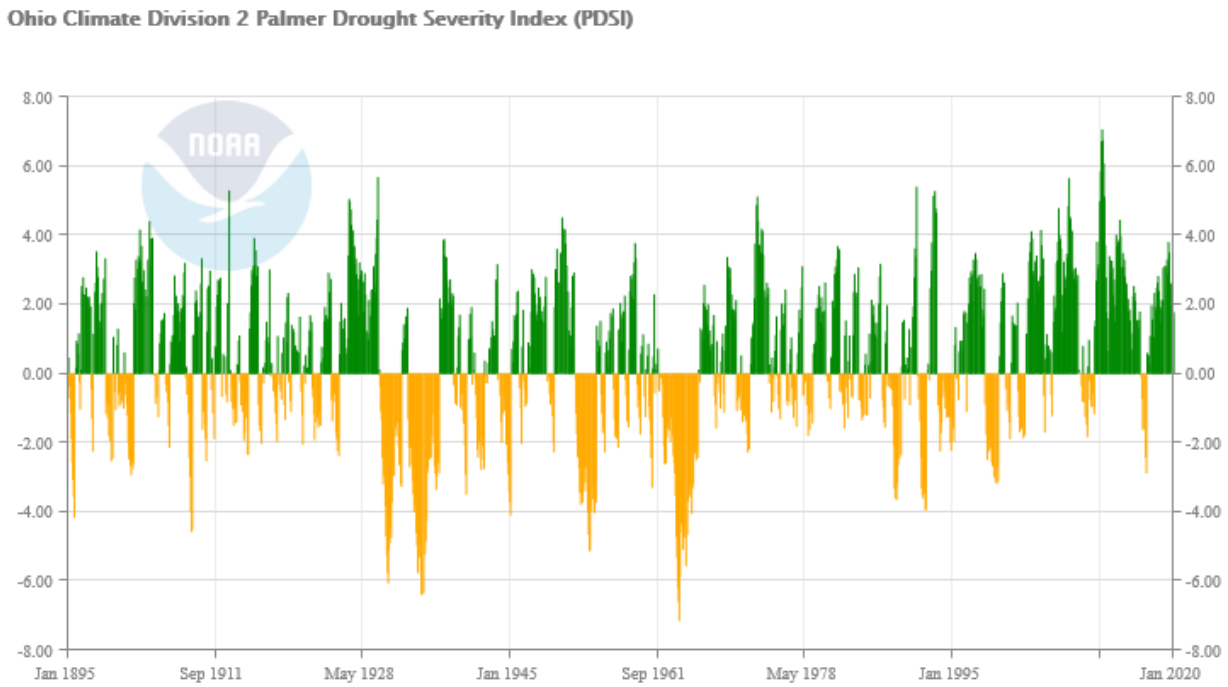


Figure 13: PDSI in Climate Division 2 for the past 125 years

7.2.4 Previous Occurrences

According to the NCDC, Erie County has experienced one drought of significance in the past 118 years, in September of 1999. This drought registers as a -2.58 on the PDSI, which classifies the event as moderate drought. This drought caused $7,000,000 in crop losses. Since the NCDC data conflicts with the PDSI data available, below is an examination of

a time series of the PDSI for Sandusky (as a representative of the County as a whole). This graph shows that there have been 55 mild or worse periods of drought between 1908 and 2018. The average duration of a drought was 8 months, with the longest lasting 68 months. Overall, Erie County has spent 36.8% of the time between 1908 and 2018 in at least a mild drought.[33]

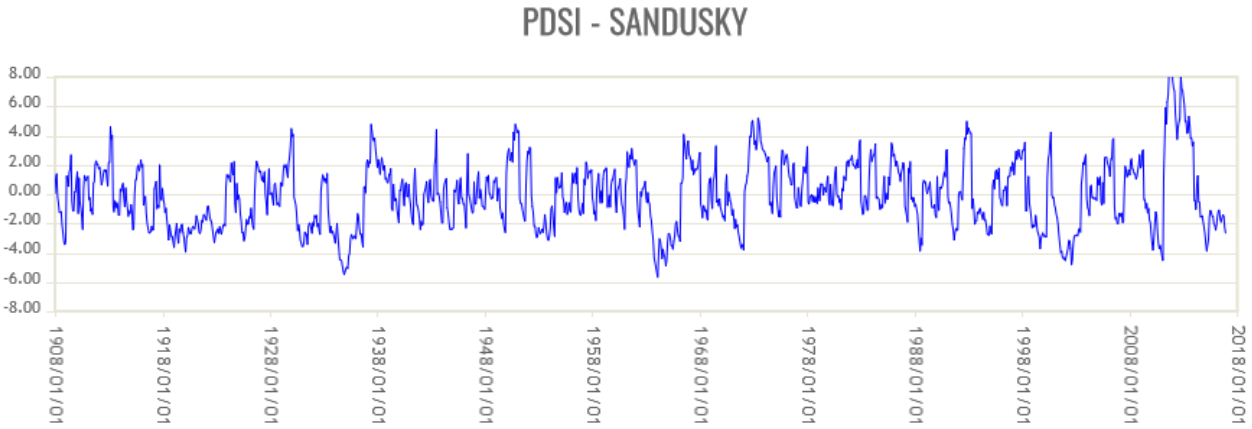


Figure 14: PDSI for Station in Sandusky, Ohio 1908 - 2018

Although not recorded by NCDC, the 2012-2013 North American Drought included most of the US, including Ohio. The drought was an expansion of the 2010-2012 United States drought which began in the spring of 2012, when the lack of snow in the United States caused very little melt water to absorb into the soil. Among many counties, Erie County was designated with moderate drought condition by mid-June. It has been equated to similar droughts occurring in the 1930s and 1950s. In most measures, the drought has exceeded the 1988-1989 North American Drought, which is the most recent comparable drought.

On July 30, 2012, the Governor of Ohio sent a memorandum to the USDA Ohio State Executive Director requesting primary county natural disaster designations for eligible counties due to agricultural losses caused by drought and additional disasters during the 2012 crop year. The USDA reviewed the Loss Assessment Reports and determined that there were sufficient production losses in 85 counties to warrant a Secretarial disaster designation. On September 5, 2012, Erie County was one of those designated counties.

Historic drought conditions in most of the corn-growing states caused corn crop conditions to decline rapidly. As of July 29, 2012, only 24 percent of the corn acreage was rated good to excellent, compared to 62 percent rated at the same time in 2011. In Erie County, hay (alfalfa) growers produced 5,900 tons in 2012, compared to the 7,300 tons in the 2011 crop. Winter wheat productions for 2012 totaled 378,000 bushels, down from 574,000 bushels in the 2011 crop. Commodity loss statistics from the 2012 drought are shown below for Erie County in Figure 15. Production of other crops declined as well. As an example, U.S. production of all dry hay is estimated at 120 million tons, this is the lowest level since 1964.

[33] (The National Drought Mitigation Center, 2020)

COMMODITY LOSS STATISTICS
2012 DROUGHT

COUNTY: Erie

COMMODITY		2011	2012	UNITS	CHANGE	AMOUNT
Corn - planted		27,500	32,100	acres	up	4,600
Corn, grain - harvested		26,400	30,700	acres	up	4,300
	Yield	96.00%	95.64%		down	0.36%
Corn, grain - production		3,837,000	4,452,000	bushels	up	615,000
Corn, grain - yield		145.3	145.0	bushels/acre	down	0.30
Hay, alfafa - yield		1,700	1,600	acres	down	100
Hay, alfafa - production		7,300	5,900	tons	down	1,400
Hay, alfafa - yield		4.30	3.70	tons/acre	down	0.60
Soybeans - planted		35,200	34,500	acres	down	700
Soybeans - harvested		35,100	34,500	acres	down	600
	Yield	99.72%	100.00%		up	0.28%
Soybeans - production		1,540,000	1,635,000	bushels	up	95,000
Soybeans - yield		43.9	47.4	bushels/acre	up	3.5
Winter wheat - planted		8,900	6,100	acres	down	2,800
Winter wheat - harvested		8,600	5,910	acres	down	2,690
	Yield	96.63%	96.89%		up	0.26%
Winter wheat - production		574,000	378,000	bushels	down	196,000
Winter wheat - yield		66.7	63.9	bushels/acre	down	2.8

Source: U.S. Dept. of Agriculture, National Agricultural Statistics Service

Figure 15: Commodity Loss Statistics for Erie County, 2012 Drought

7.2.5 Probability of Future Events

According to the National Drought Mitigation Center, Erie County has spent 36.8% of the time between 1908 and 2018 in at least mild drought conditions. It is likely that this trend will continue. For other severities, Erie County has been in at least a moderate drought 26% of the time, at least a severe drought 18% of the time, and at least an extreme drought 6% of the time.

7.2.6 Vulnerability

A drought in Erie County can have significant detrimental effect on the domestic water supply, especially for well-water, agriculture, and water-dependent recreational activities. Economic effects in Erie County would likely include crop loss and an impact to the agricultural industry. No structural damage due to drought is anticipated in Erie County or its jurisdictions. The community may also need to conserve water and water-dependent businesses may be forced to alter operations in an extreme drought.

Since no structures would experience damage due to drought, this updated plan, like the previous plan, does not identify existing or future buildings at risk of loss due to drought. No future buildings will be exposed to damage due to drought.

According to the NCDC, the 1999 drought in Erie County cost $7,000,000 in crop losses. While there may not be any losses to property, a drought can affect crops, and cause losses similar to the 1999 drought in the future.

7.3 Earthquakes

7.3.1 Hazard Profile

The crust of the earth is made up of giant sections called tectonic plates. These plates float on top of the earth's mantle and are in constant slow movement. This movement causes energy to build up when there is friction between two plates. If the energy built up overcomes the force of friction, the two plates will suddenly slip past each other, causing the energy to be released. When this happens, the earth shakes and moves while the energy is dissipated, causing an earthquake. The earthquake's energy is transmitted through the ground as a series of waves. Earthquakes are not limited to the tectonic plate movements. There are many smaller sections of the earth's crust that can slowly move against other sections of the earth's crust, building up energy that is released as an earthquake. Often earthquakes are accompanied by other, smaller earthquakes called foreshocks or aftershocks, depending on whether they occur before or after the big quake.

Scientists use seismograms to record how much movement an earthquake caused, which is then used to calculate how much energy was released. This allows earthquakes to be classified based on their magnitude, which is a measurement of the amount of energy released. In the past, the Richter magnitude scale was used. The Richter magnitude was calculated from the logarithm of the amplitude of the earthquake waves, as measured by the seismograph. The logarithm means that for each whole number increase of the Richter magnitude scale, the earthquake has an amplitude ten times greater, corresponding to 31.6 times more energy released. The Richter magnitude scale was replaced with other scales, in part, because for earthquakes with a magnitude greater than 8, the Richter scale is not accurate.

Scientists now the Moment magnitude scale to describe the strength of an earthquake and is based on the amount of mechanical work the earthquake accomplished. Like other earthquake magnitude scales, the Moment magnitude is also a logarithm. At lower magnitudes, the Moment magnitude scale and the Richter magnitude scale are nearly identical. The Moment magnitude scale is the preferred magnitude scale as it is the most accurate and more objective than other scales.[34]

Another way to describe an earthquake is by its intensity, which describes how much the ground shakes at a particular location. The Modified Mercalli Intensity (MMI) scale is calculated solely based on damage assessments and personal accounts of those who experienced the shaking. The MMI scale ranks earthquake on a scale from I-XII. This scale is not typically used by scientists, as rural areas have fewer buildings in which to sustain damage, and fewer people to provide eyewitness accounts. While the Moment magnitude scale and the MMI cannot be compared directly as they measure different things, at the epicenter, they can be roughly correlated, as is shown in Figure 16.

[34] (United States Geological Survey, n.d.)

Modified Mercalli Scale		Moment Magnitude Scale
I	Detected only by sensitive instruments	1.5
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing	2
III	Felt noticeably indoors, but not always recognized as earthquake; standing autos rock slightly, vibration like passing truck	2.5
IV	Felt indoors by many, outdoors by few, at night some may awaken; dishes, windows, doors disturbed; motor cars rock noticeably	3
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects	3.5
VI	Felt by all, many frightened and run outdoors; falling plaster and chimneys, damage small	4
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of automobiles	4.5
VIII	Panel walls thrown out of frames; fall of walls, monuments, chimneys; sand and mud ejected; drivers of autos disturbed	5
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken	5.5
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides	6
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent	6.5
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up into air	7
		7.5
		8

Figure 16: Modified Mercalli Intensity Scale compared to the Moment Magnitude Scale[35]

[35] (Kansas Geological Survey, 2020)

7.3.2 Location

The State of Ohio has experienced more than 200 earthquakes since 1776, and 15 of these events have caused minor to moderate damage. The largest historic earthquake in Ohio was centered in Shelby County in 1937. This event, estimated to have had a magnitude of 5.4 on the Richter scale, caused considerable damage in Anna and several other western Ohio communities, where at least 40 earthquakes have been felt since 1875. Northeastern Ohio, east of Cleveland, is the second most active area of the state. At least 20 earthquakes are recorded in the area since 1836, including a 5.0 magnitude event in 1986 that caused moderate damage. A broad area of southern Ohio has experienced more than 30 earthquakes.

Figure 17 shows the epicenter of all the earthquakes that have occurred in or near Erie County. The largest earthquake near Erie was 3.7M in 1961, which was centered in Seneca County. All of Erie County and its jurisdictions are equally likely to experience the effects of an earthquake.

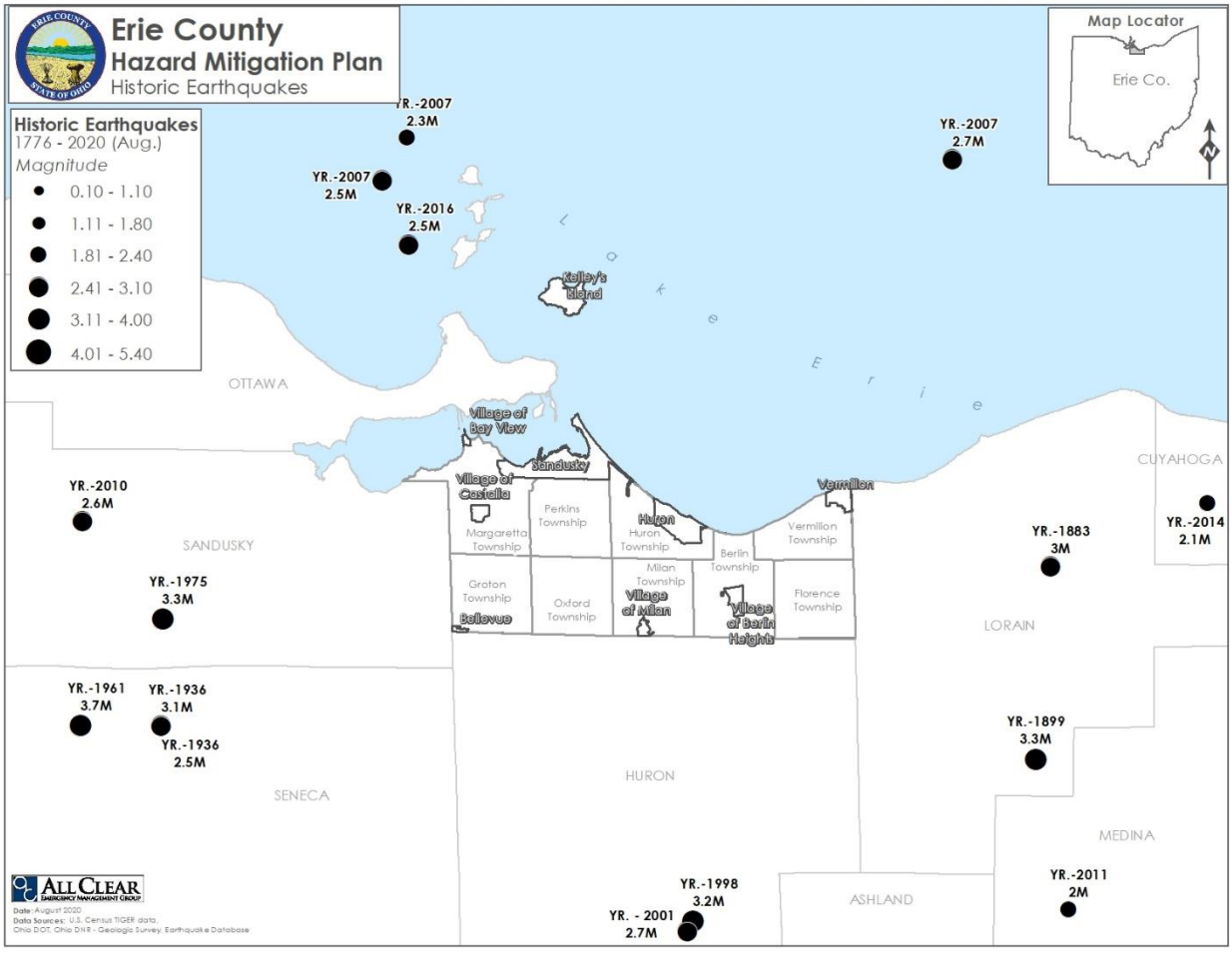


Figure 17: Earthquake Epicenters near Erie County

7.3.3 Extent

Most of the earthquakes in Ohio have been felt only locally, if at all, and have caused no damage or injuries. Ohio is on the periphery of the New Madrid Seismic Zone, an area

in Missouri and adjacent states that was the site of the largest earthquake sequence to occur on record in the continental United States. In 1980, an earthquake with a magnitude of 5.3 on the Richter Scale and centered in Sharpsburg, Kentucky, was strongly felt throughout Ohio and caused minor damage in communities along the Ohio River in southwestern Ohio. In 1998, a Magnitude 5.2 earthquake occurred in western Pennsylvania and caused some damage at the epicentral area. Two regions of Ohio have been identified as susceptible to seismic activity; however, neither Erie County nor its contiguous counties are included in these regions.

7.3.4 Previous Occurrences

No earthquakes have previously been documented with an epicenter in Erie County. Due to the infrequency of earthquakes occurring in Erie County, the impact on the county's infrastructure is very low.

7.3.5 Probability of Future Events

Given that USGS lists zero damaging earthquakes occurring between 1776 and 2019 in Erie County, one might conclude that the probability of a damaging earthquake is less than one percent in any given year. However, Figure 18 shows long term probability of an area to experience peak ground accelerations having a 2 percent probability of being exceeded in 50 years. Peak ground acceleration is the maximum horizontal ground acceleration measured in centimeters per second per second (cm/sec^2). Peak ground acceleration can range from zero for an earthquake that is noticed by very few people to 350, which would a catastrophic event. A peak ground acceleration of 10 cm/sec^2 means that the shaking is equivalent to about 1 percent of the acceleration due to gravity. Generally, ground acceleration must exceed 15 cm/sec^2 for significant damage to occur. All of Erie County is at a low risk of experiencing an earthquake of that size.

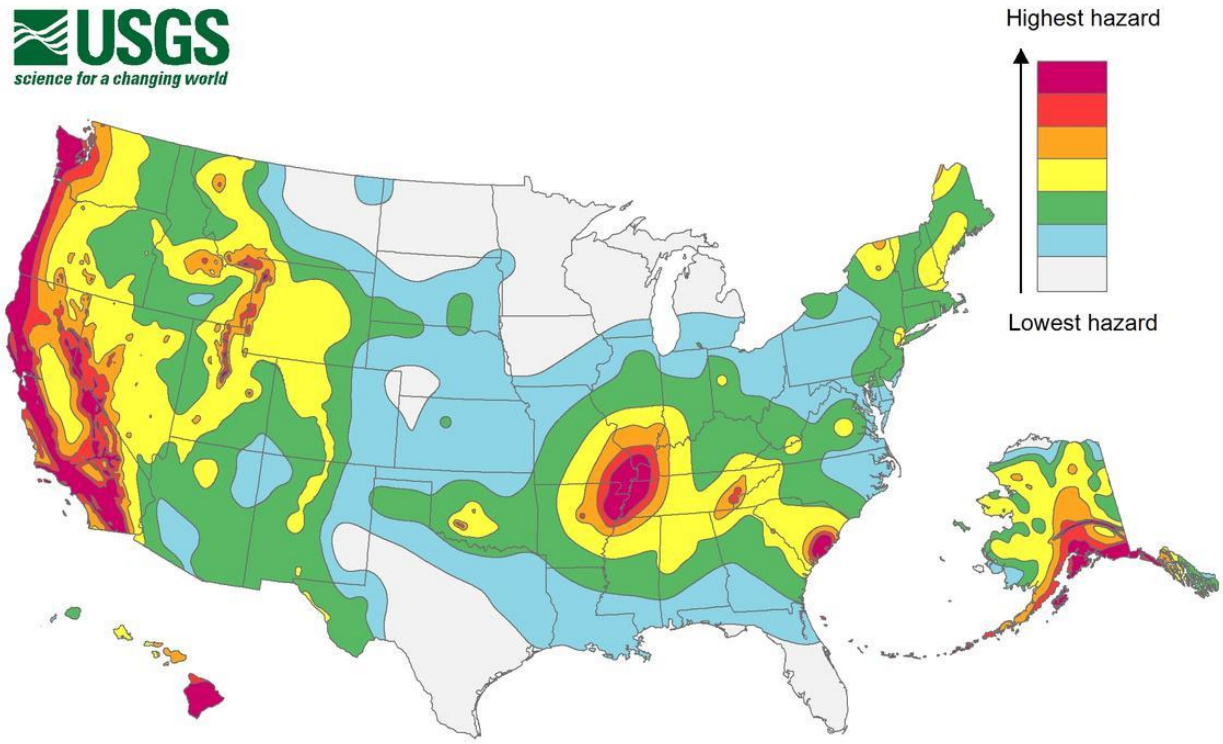


Figure 18: 2018 Long-term National Seismic Hazard Map[36]

For this purposes of this plan, the estimated probability of a damaging earthquake affecting Erie County in any given year is estimated at less than 1% (0.01). Within the past 243 years, there has not been an epicenter recorded in Erie County.

As with the previous Erie County Natural Hazards Mitigation Plan, it was decided that utilizing Hazus-MH would benefit Erie County and the other jurisdictions involved to determine loss estimates for this regional hazard. These loss estimates are utilized primarily to plan and stimulate efforts to reduce risks from natural hazards and to prepare for emergency response and recovery. Since an earthquake is a widespread hazard, HAZUS-MH was utilized in order to generate more accurate loss estimations for the planning effort. Because no historic earthquakes have severely impacted Erie County, five scenarios were run, in order to have a better understanding of the various risks different earthquakes in varying areas would have. Table 13 summarizes the Hazus-MH scenarios that were modeled. For ease of simplicity, the scenario number will be referred to for the rest of the plan.

[36] (United States Geological Survey, 2018)

Table 13: Hazus-MH Earthquake Scenarios

Scenario	Type	Magnitude	Location
1	Historic	5.4	Shelby County, OH
2	Historic	5.2	Astabula County, PA
3	Historic	5.4	Astabula County, PA
4	100 year Probabilistic	5.0	Erie County, OH
5	500 year Probabilistic	5.0	Erie County, OH

7.3.6 Vulnerability

All structures and infrastructure in Erie County are equally at risk of experiencing an earthquake. It would be expected to be on the order of a Magnitude 3.0-3.9 earthquake, or lower. Very minimal structural damage is anticipated. In most cases, damages are expected to be limited and examples of anticipated damages are broken dishes and windows and cracked plaster. The level of damage expected from an earthquake in Erie County is very low.

A very large earthquake affecting Erie County might cause structural damage in dilapidated structures or structures that do not meet current building codes. Roads and bridges might be damaged, and trees and power lines might fall. Communication, power, gas, water and sewer infrastructure also have the potential to crack, rupture, or otherwise fail.

Thus, the impact of an earthquake might range from negligible to minor damage. Based on over 200 years of experience in Erie County, there will most likely be no damage or very slight damage. Hazus-MH estimates that there are 35,000 buildings in the region which have an aggregate total replacement value of $10,731,000,000.

For each of the scenarios modeled, only Scenario 5 resulted in any building damage; therefore this scenario represents the worst-case scenario. For this simulated earthquake 165 buildings would be at least moderately damaged, and 514 buildings would have slight damage. Most damage will be to residential buildings. Only one building is expected to be completely destroyed.

Table 14 details the impacts from Scenario 5 with an estimated total damage for each occupancy type within Erie County if a 500-year earthquake were to be centered within the County.

Table 14: Expected Building Damage by Occupancy for Scenario 5

Occupancy	Expected Buildings Damaged				
	None	Slight	Moderate	Extensive	Complete
Single Family	28,327	356	99	12	1
Other Residential	3,038	81	24	1	0
Commercial	1,978	49	15	2	0
Industrial	560	14	5	1	0
Agricultural	178	5	2	0	0
Religion	187	5	1	0	0

Occupancy	Expected Buildings Damaged				
	None	Slight	Moderate	Extensive	Complete
Government	90	2	1	0	0
Education	67	2	1	0	0
Total:	34,425	514	148	16	1

The total economic losses for Scenario 5, which includes buildings and lifeline related losses are $12,650,000. For capital stock losses only, losses are $7,053,700; 64.9% of which was residential and 35.1% are non-residential. No critical facilities are expected to sustain moderate or greater damage in this scenario. However, functionality of these buildings may be marginally limited. Before the earthquake, the region had 424 hospital beds available for use. On the day of the earthquake, Hazus-MH estimates 401 hospital beds are available for use by patients already in the hospital and those injured by the earthquake. Within one week of the earthquake, 98% of the beds will be available, and all beds will be available within 30 days. Of the 16 police stations, 16 fire stations, 1 Emergency Operations Center, and 36 schools, none will have at least minimum damage, and all will have greater than 50% functionality on the day of the earthquake.

In Scenario 5, no transportation systems, including highways, railways, buses, ferries, ports and airports are expected to incur at least moderate damage, and all will have greater than 50% functionality the day of the earthquake. Of the utility system pipelines in Erie County, there are nine leaks and two breaks expected within the potable water system, and five leaks and one break in the waste water system. However, no utility system facilities are not expected to sustain at least moderate damage. All houses are expected to have electricity and drinking water service on the day of the earthquake.

The Hazus-MH Global Summary Reports for Scenarios 1-5 are found in Appendix G.

7.4 Flooding

7.4.1 Hazard Profile

Flooding is an important issue for the residents and local business owners of Erie County. Riverine flooding and flash flooding events have occurred with regularity in the past with significant impacts on the community.

Erie County has special flood hazard zones identified within the county. The best way to combat disaster losses within these special flood hazard zone areas is through public awareness. Except for Kelleys Island, all of Erie County follows state floodplain management standards and participates in the National Flood Insurance Program (NFIP). Unincorporated Erie County has been involved since September 1981, with most incorporated municipalities joining in the 1970s. Since the last Erie County Hazard Mitigation Plan, the Village of Berlin Heights now fully participates in the National Flood Insurance Program. Table 15 shows the details about each jurisdiction within Erie County and their participation in the National Flood Insurance Program and the effective date of the current Flood Insurance Rate Maps (FIRM), and Table 16 shows the jurisdictions that were formerly a participant in the National Flood Insurance Program but have since withdrawn. Since the last Hazard Mitigation Plan update, Berlin Heights, portions of unincorporated Erie County, Huron, Milan, and Sandusky have received updated FIRMs.

Table 15: Jurisdictions Participating in the National Flood Insurance Program

CID	Community	Initial FHBM Identified	Initial FIRM Identified	Current Effective FIRM	Reg-Emer Date
390595#	Bay View	03/22/1974	09/15/1977	08/28/2008	09/15/1977
390487#	Bellevue	03/15/1974	10/17/1978	01/19/2011	10/17/1978
390650#	Berlin Heights	04/05/1974	08/28/2008	11/19/2014(M)	01/17/2013
390653#	Castalia	03/29/1974	No data	(NSFHA)	05/25/1978
390153#	Erie County (unincorporated)	01/31/1975	01/16/1981	11/19/2014	01/16/1981
390154#	Huron	02/01/1974	04/03/1978	11/19/2014	04/03/1978
390155#	Milan	04/12/1974	09/01/1978	11/19/2014(M)	09/01/1978
390156#	Sandusky	06/21/1974	07/05/1977	11/19/2014	07/05/1977
395374#	Vermilion	05/05/1970	12/31/1970	08/19/2008	12/31/1970
390738#	Kelleys Island	04/18/1975	08/17/1981	08/28/2008	01/29/1986 (W)

FHBM - Flood Hazard Boundary Map
Reg-Emer Date - Date a community joins the National Flood Insurance Program
NSFHA - No Special Flood Hazard Areas - All Zone C
(M) - No Base Flood Elevation Established - All Zone A, C and X

Table 16: Jurisdictions Withdrawn from the National Flood Insurance Program

CID	Community	Initial FHBM Identified	Initial FIRM Identified	Current Effective FIRM	Reg-Emer Date
390738#	Kelleys Island	04/18/1975	08/17/1981	08/28/2008	01/29/1986 (W)

(W) - Withdrawn from program

Lake level rise is also a significant area of concern in the Great Lakes region, but even more so in Lake Erie, due to its shallow depth. The average depth of Lake Erie is 62 feet, with a maximum depth of 210 feet. In the shallower areas, the water depth is 25-30 feet, which allows strong winds to produce significant wave activity. Since the start of recordkeeping, the water levels in Lake Erie have showed natural cycles of higher or lower water levels, usually changing slowly over the course of a few decades. Lake levels also show with seasonal variability, with lake levels increasing in the spring when rain combines with snow melt, with the peak occurring in the summer. Between 1999-2014, the Great Lakes experienced an extended duration of historically low water levels. However, since 2014, water levels have exceeded the average level, reaching historically high monthly values in 2018, 2019 and 2020. In June 2019, Lake Erie experienced the highest average monthly water level at 574.61 feet. June 2020 fell just short of that mark at 574.47 feet. This increasingly rapid cycling between low and high-water levels is driven by climate change. Figure 19 below, shows the historical time series of the monthly average water level for Lake Erie since 1918, as well as the long-term average as indicated by the red line.

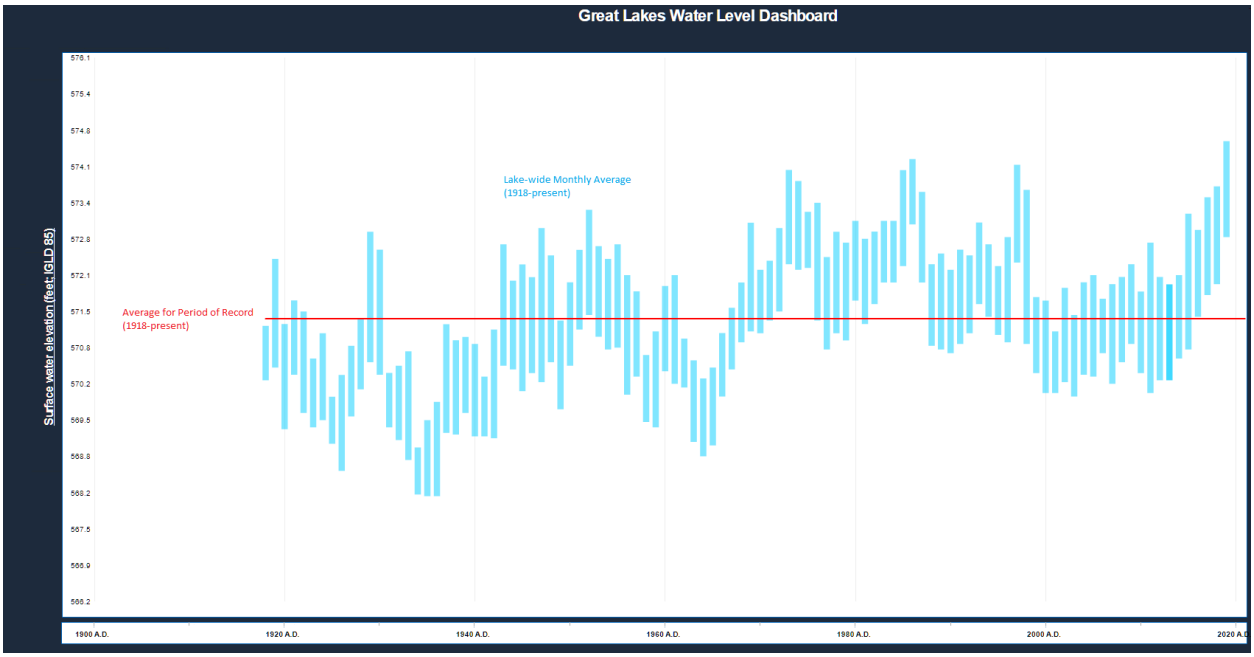


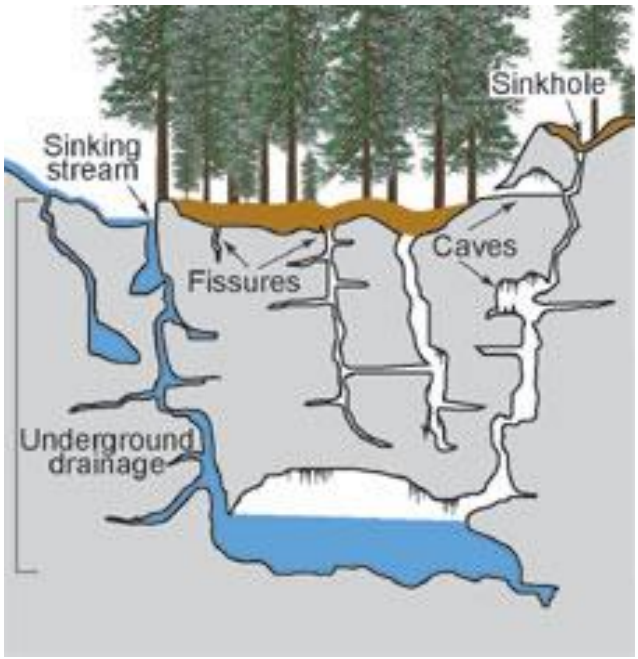
Figure 19: Monthly Average Water Levels in Lake Erie 1918-present[37]

Lake Erie is used for a variety of purposes, including supplying drinking water, recreation, commercial fishery, commercial shipping, and hydropower. For many of these industries, higher lake levels have been welcome after the most recent low water level period. However, the historically high lake levels have had many severe, negative impacts as well. High lake levels in Lake Erie have cause significant flooding issues along the shoreline, in the estuaries near the shore, and even further up the rivers and creeks that drain into Lake Erie. This flooding in turn can cause road closures, damage to

[37] (Gronewold, Clites, Smith, & Hunter, 2013)

infrastructure including roadways and utility systems, damage to private property, critical facilities and more. The effects are also seen inland from the shoreline due to flooding along the river and creeks. The City of Sandusky Engineering Department had not been able to inspect roads for damage sustained from flooding during the spring and summer of 2020, by late fall of that year because the water levels remained too high.

Climate change notwithstanding, addressing high lake levels directly is difficult due to the complexity of the problem. The catchment areas for Lake Superior, Lake Michigan, Lake Huron and Lake Erie is a combined 176,792 square miles, which means any precipitation that falls within that area will drain out through Lake Erie unless it evaporates or is otherwise diverted. Rates of precipitation and evaporation can also play a role in how much water is in Lake Erie or the other Great Lakes at any given time. As all of these causes are much greater than any single community can address individually, mitigation needs to focus on the impacts of the high lake levels, such as flooding. Mitigation for lake shore flooding due to lake level rise can involve regulations prohibiting development on the shoreline, buyout programs for private property that is threatened by the flooding, structural projects such as retaining walls and levees and more.



In Erie County, flooding can also be exacerbated by karst landscape. Karstic landscape are areas that are underlain by dolomite, limestone or gypsum that has eroded by dissolution by groundwater. As a result, subsurface drainage systems can develop. Also, unlike typical flooding associated with flooding, it is very challenging to try and predict when or how severe future karst related flooding will be. According to ODNR, "the engineering means to prevent or mitigate the effects of karst related flooding is technically very difficult and cost-prohibitive. Wise land-use planning is encouraged for areas that are most likely to be flooded upon the return of this pattern of climatic and hydrologic conditions." Figure 19 shows the different features that can be present in karst landscape. Figure 20 shows the bedrock geology of Erie County. In the eastern portion of the County, is primarily underlain by clastic sedimentary rocks such as sandstones and shales. The western part of the County is primarily underlain by limestones and dolomites, that form karstic landscapes.

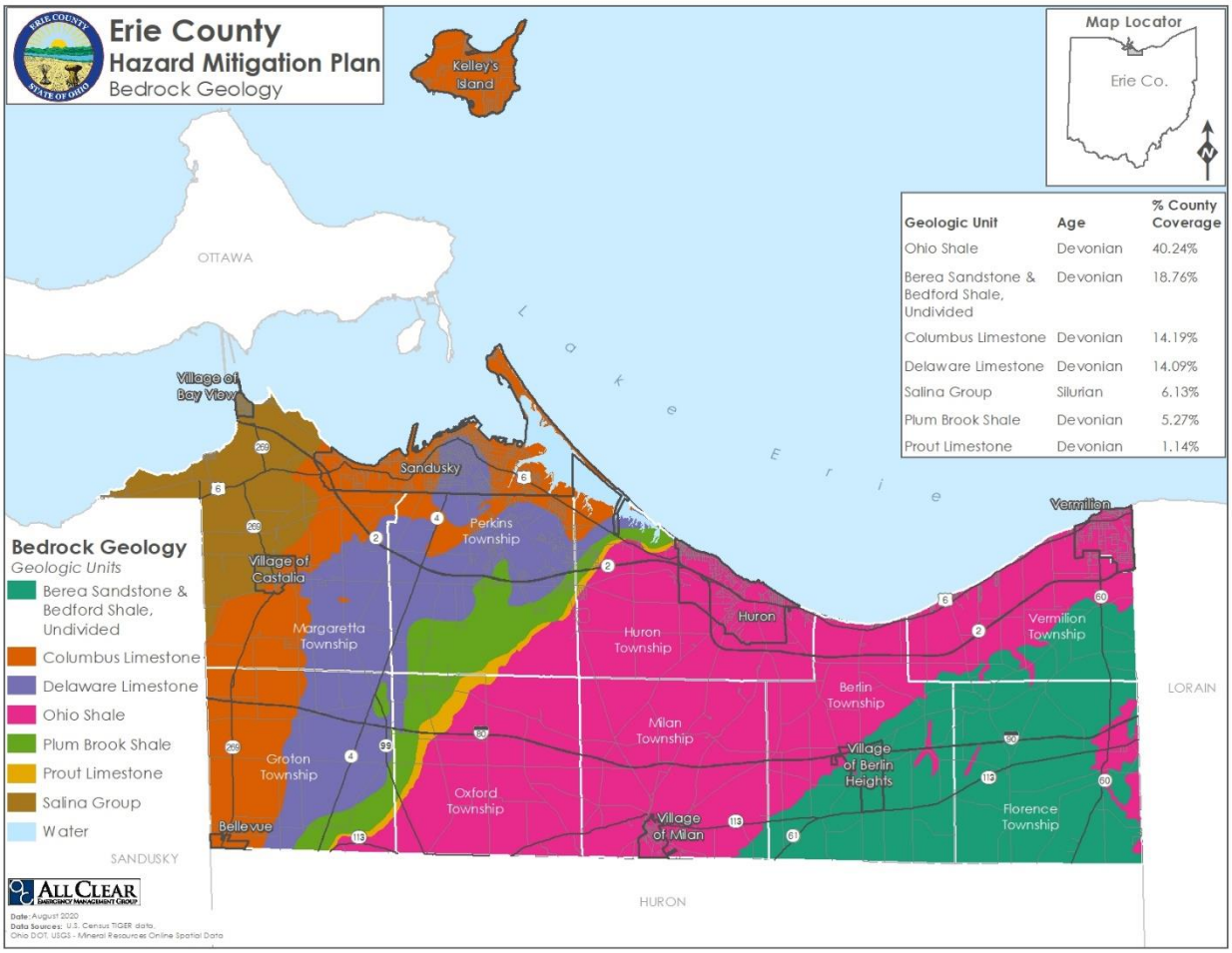


Figure 20: Bedrock Geology Map for Erie County

7.4.2 Location

Erie County lies in the Central Lowland Province. Lying in an area of lake plain and till plain physiography, the County has a relatively uniform, level topography. Erie County drains northward into Lake Erie. There are 17 distinct watersheds in the County. Primary watersheds include Mills Creek and Pipe Creek to the west, the Huron River in the central part of the County, Old Woman Creek in the east-central part of the County and the Vermilion River on the eastern edge of the County. Small creeks drain the other watersheds.

In addition, a portion of the western part of the county is considered to be karstic. The Bellevue-Castalia Karst Plain includes parts of western Erie County and contains more sinkholes than any other karst region in Ohio. Surface drainage in this region often flows into sinkholes and continues underground. Figures 21 - 31 show the karst hazard maps and the point locations of karstic features for Erie County and the jurisdictions that face this hazard. As it can be seen, karst is a flooding hazard for the western portion of Erie County including the Village of Bay View, the City of Bellevue, the Village of Castalia, the Village of Kelleys Island, and the City of Sandusky. Karst hazard maps and karst point locations for affected townships can be found in Appendix F for reference only.

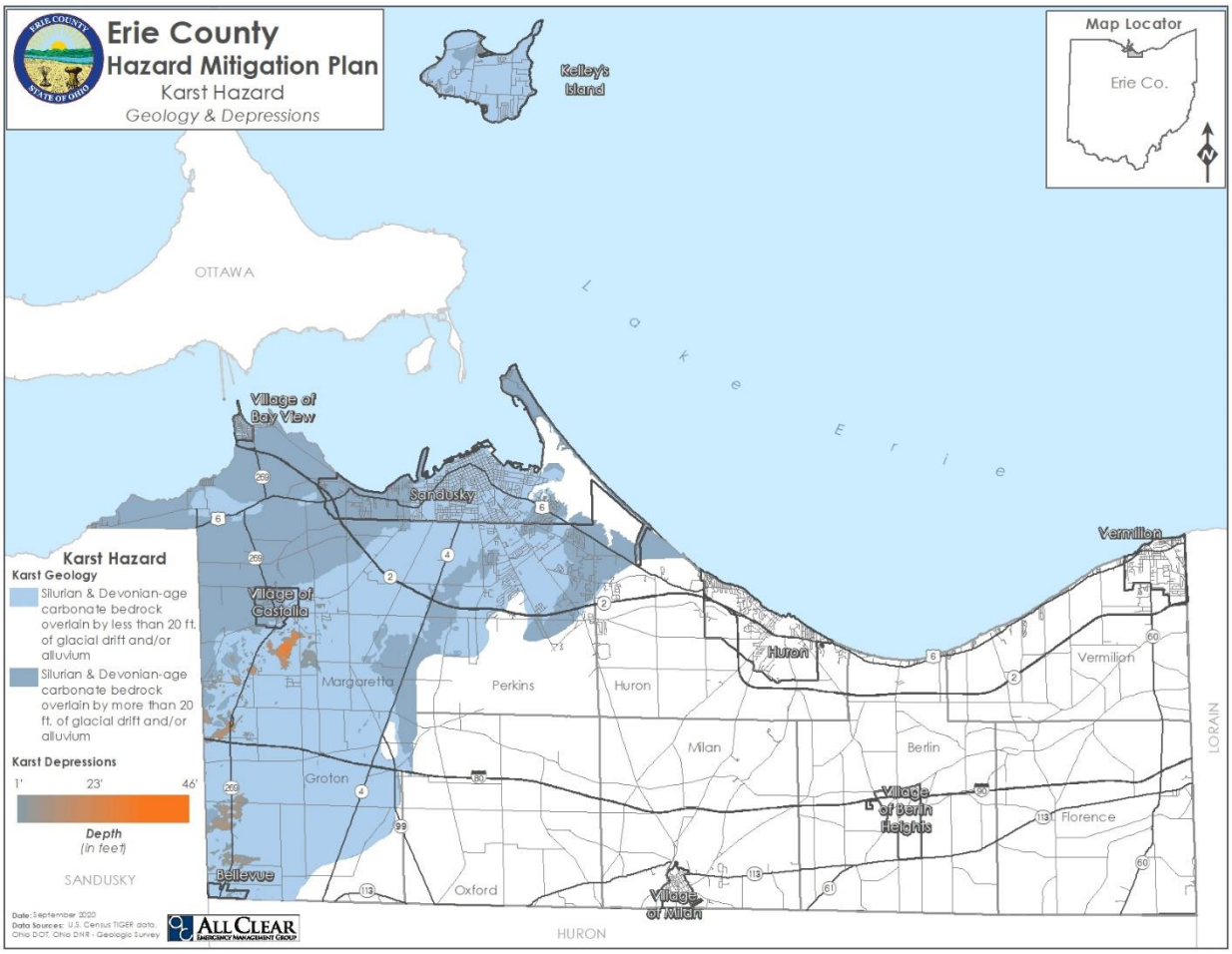


Figure 21: Karst Hazard Map for Erie County

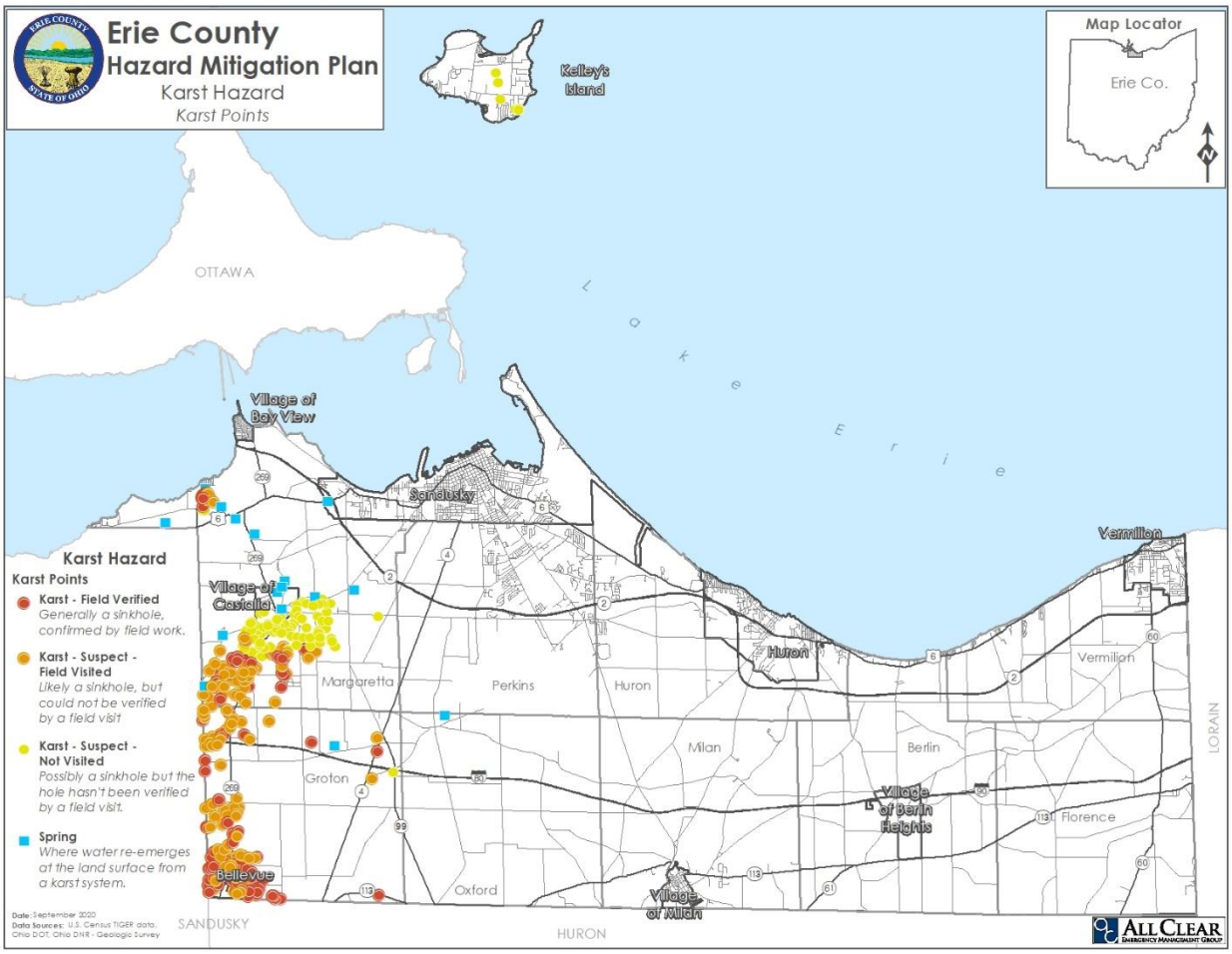


Figure 22: Karst Point Locations for Erie County

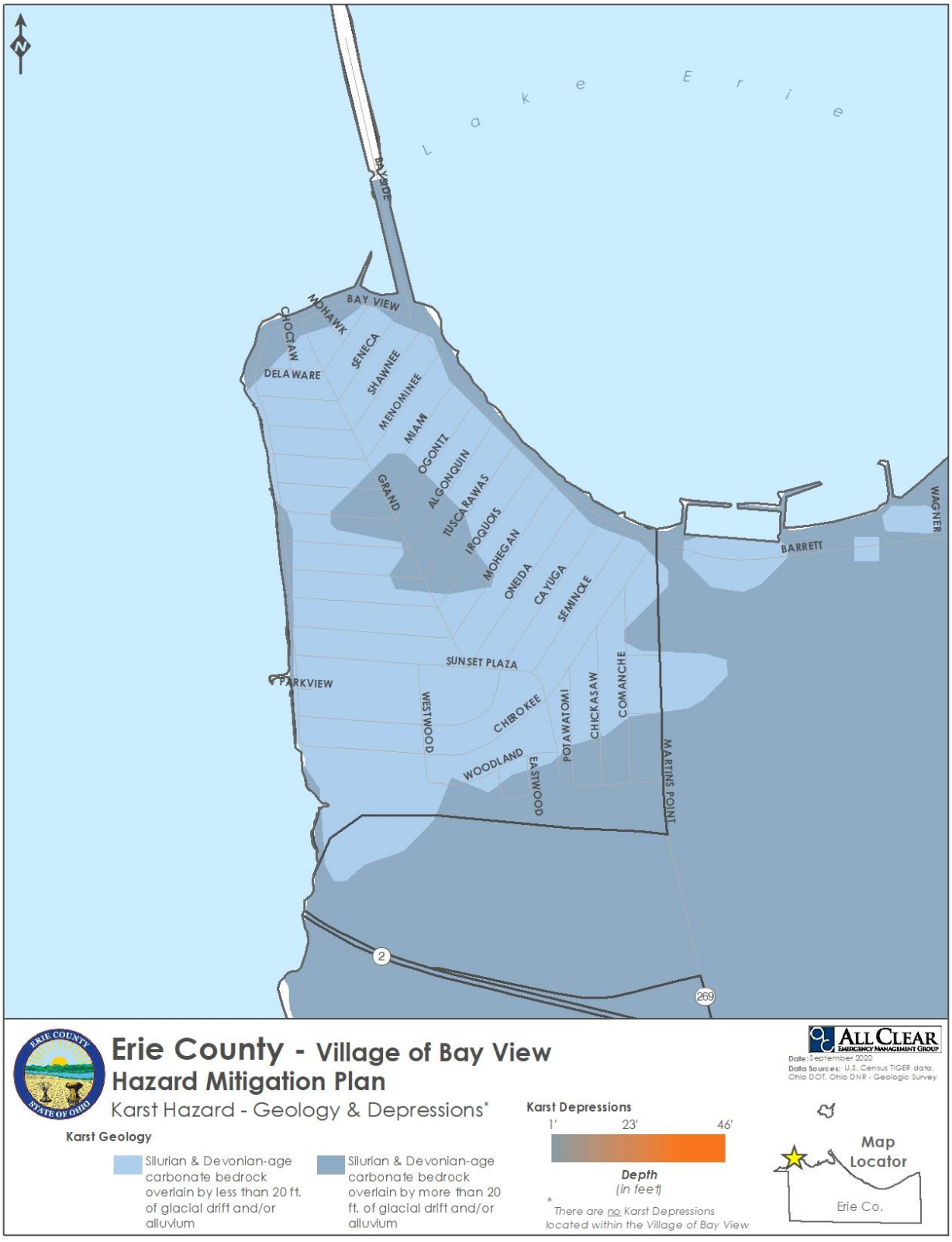


Figure 23: Karst Hazard Map for the Village of Bay View

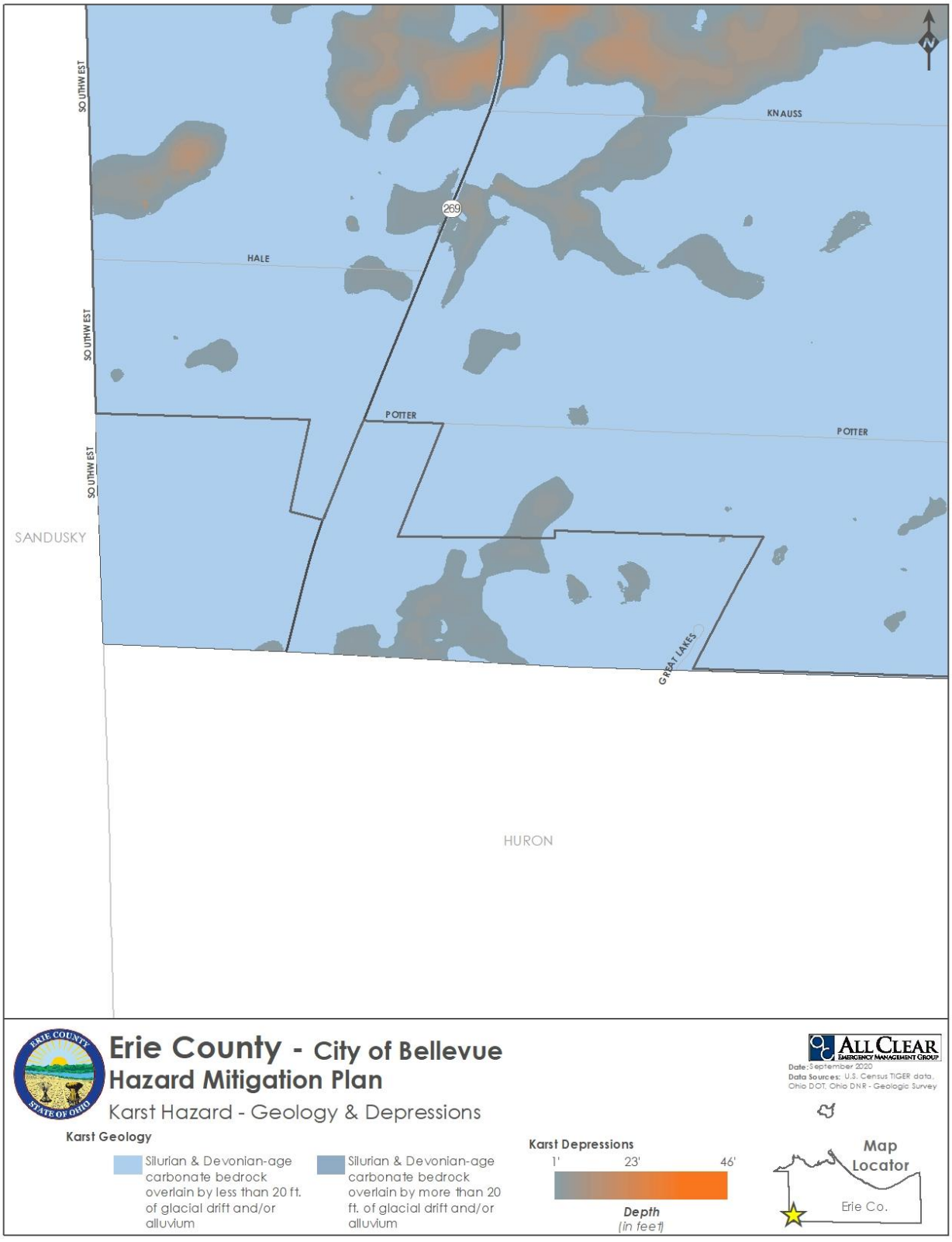


Figure 24: Karst Hazard Map for the City of Bellevue (Erie County Portion Only)

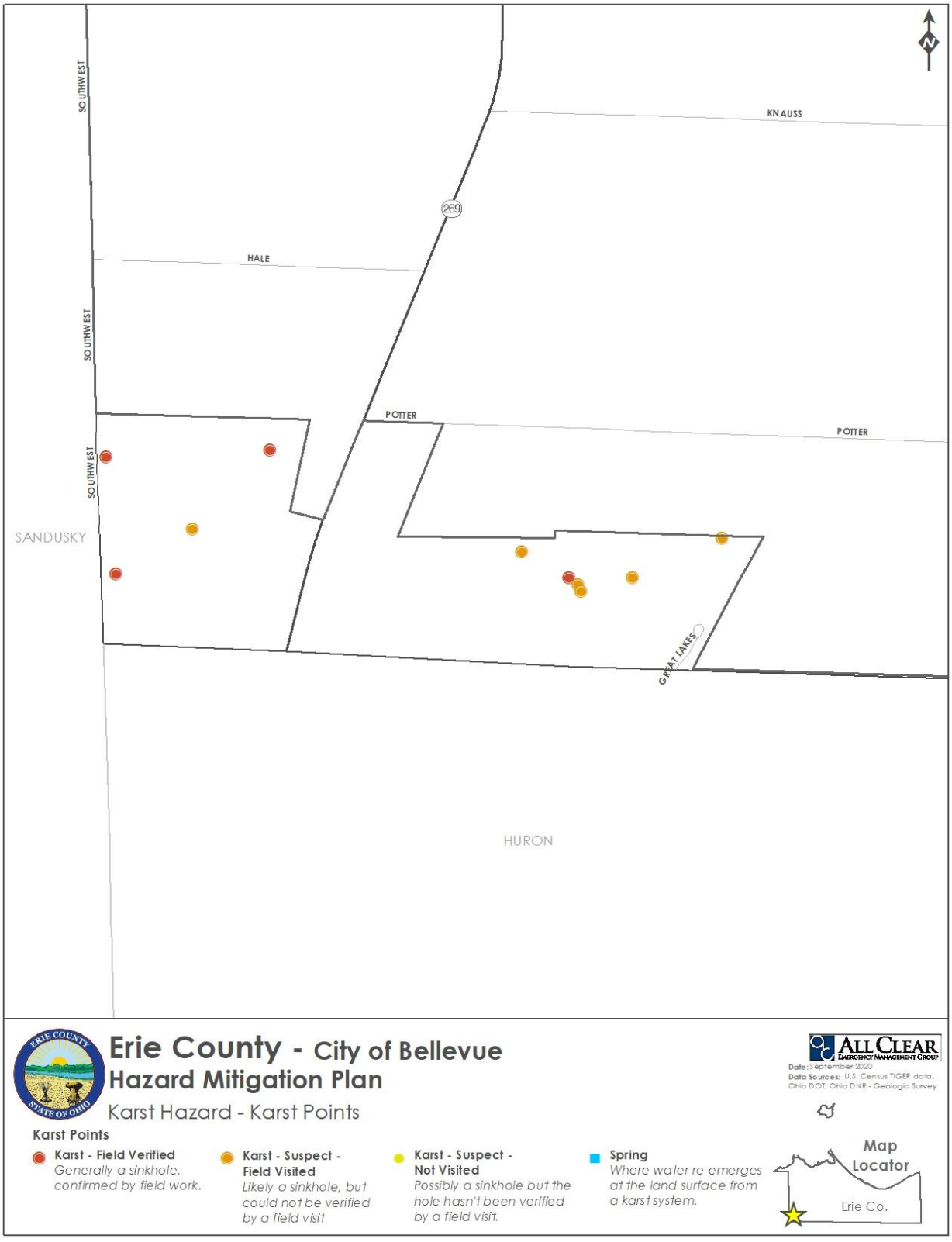


Figure 25: Karst Point Locations for the City of Bellevue

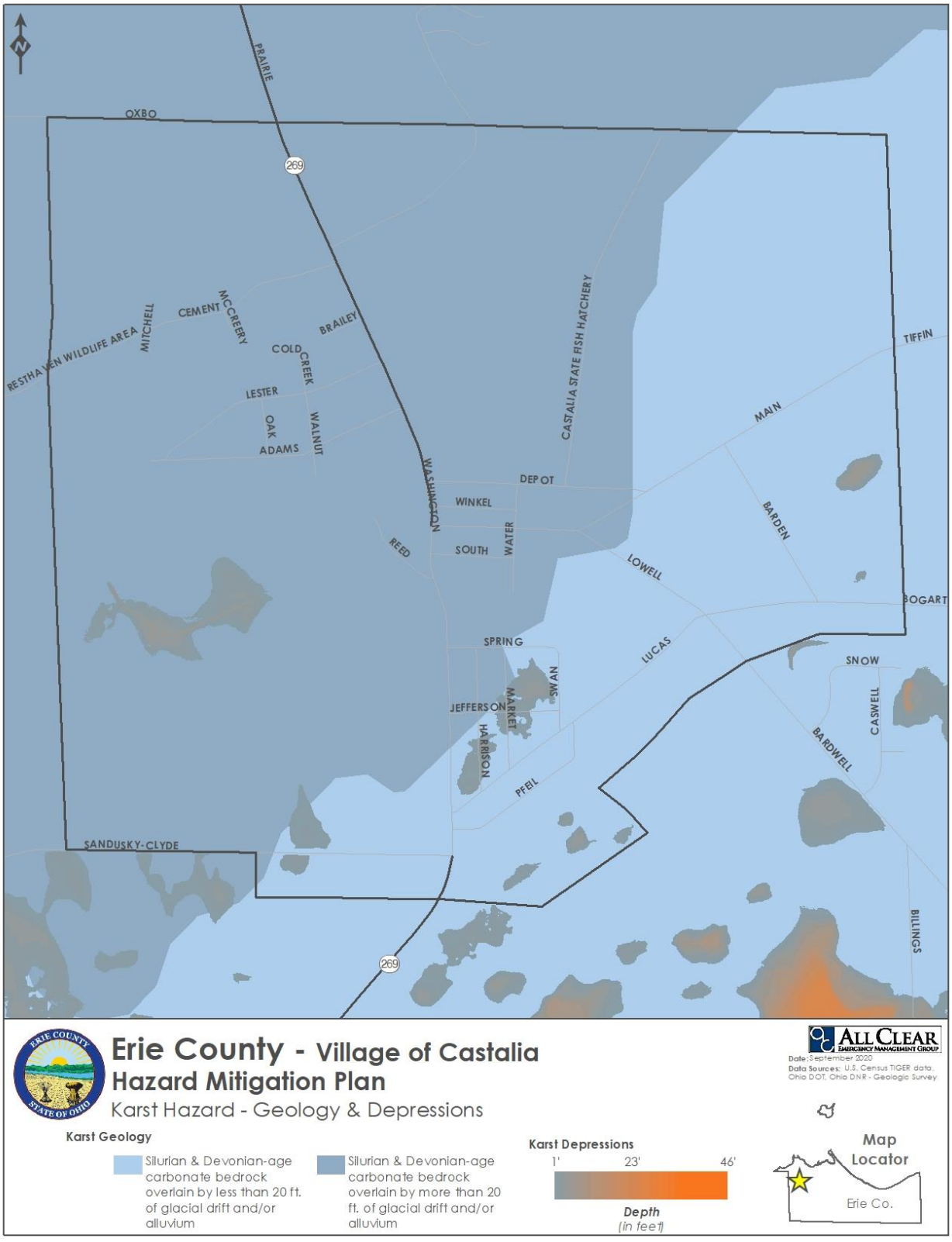


Figure 26: Karst Hazard Map for the Village of Castalia

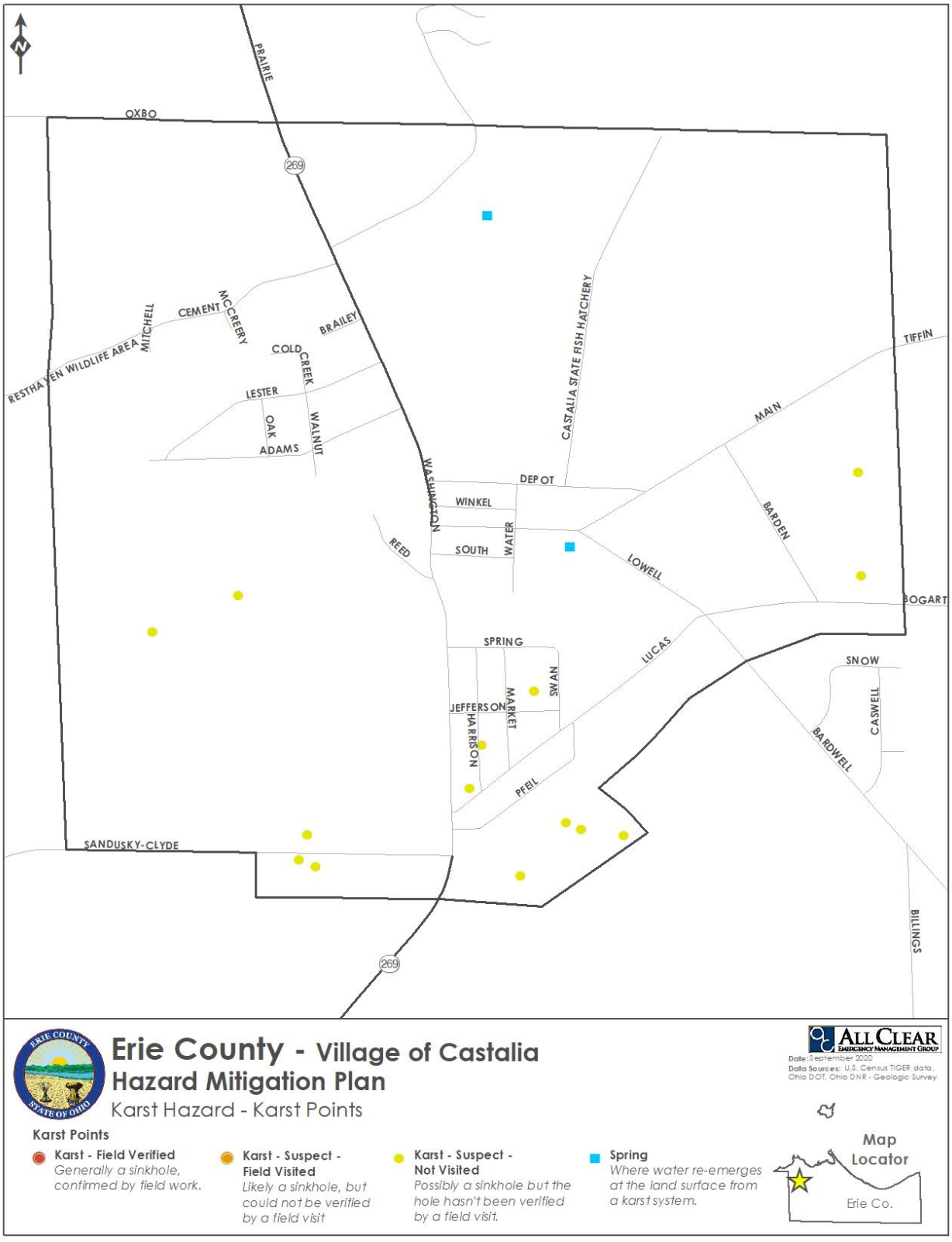


Figure 27: Karst Point Locations for the Village of Castalia

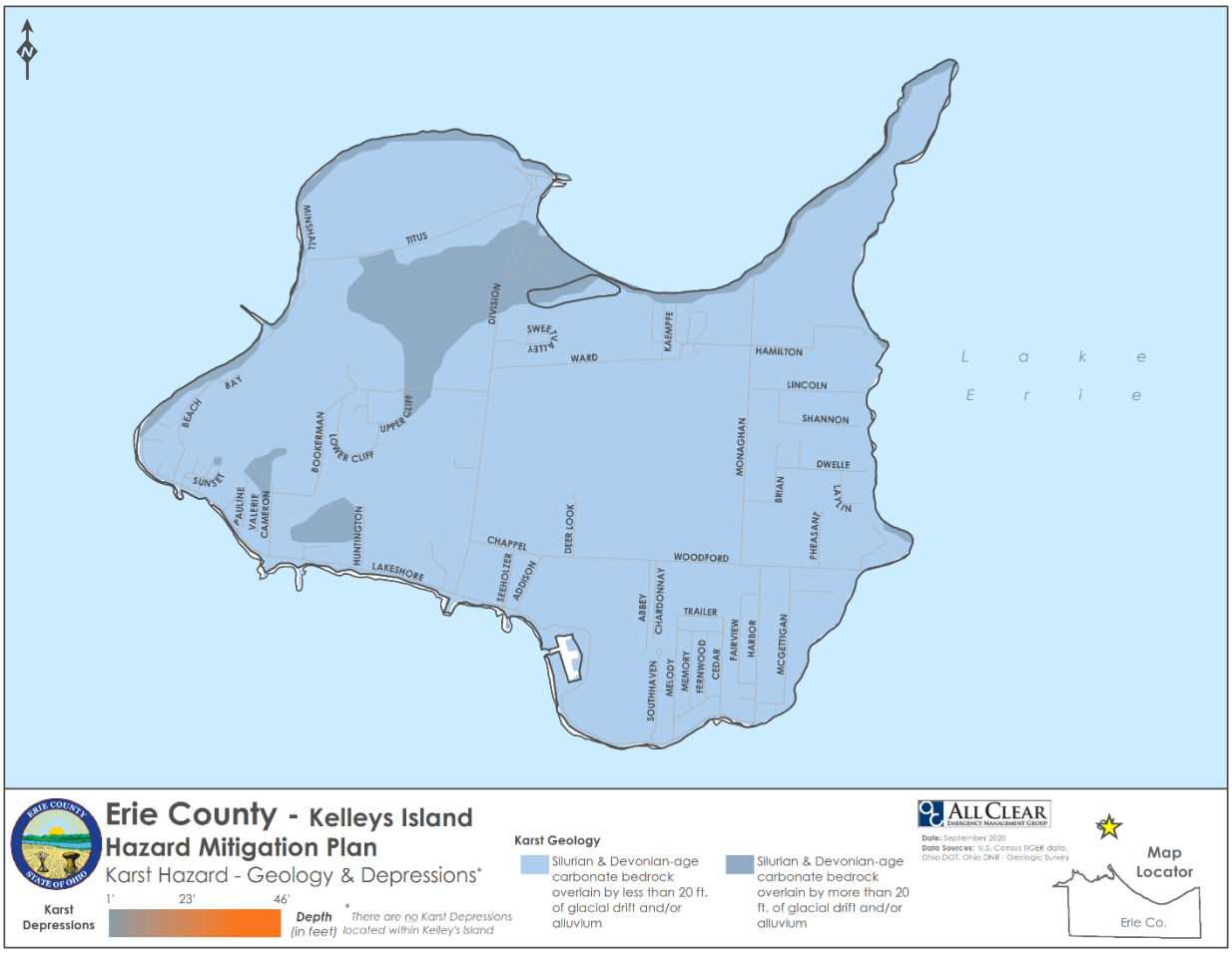


Figure 28: Karst Hazard Map for the Village of Kelleys Island

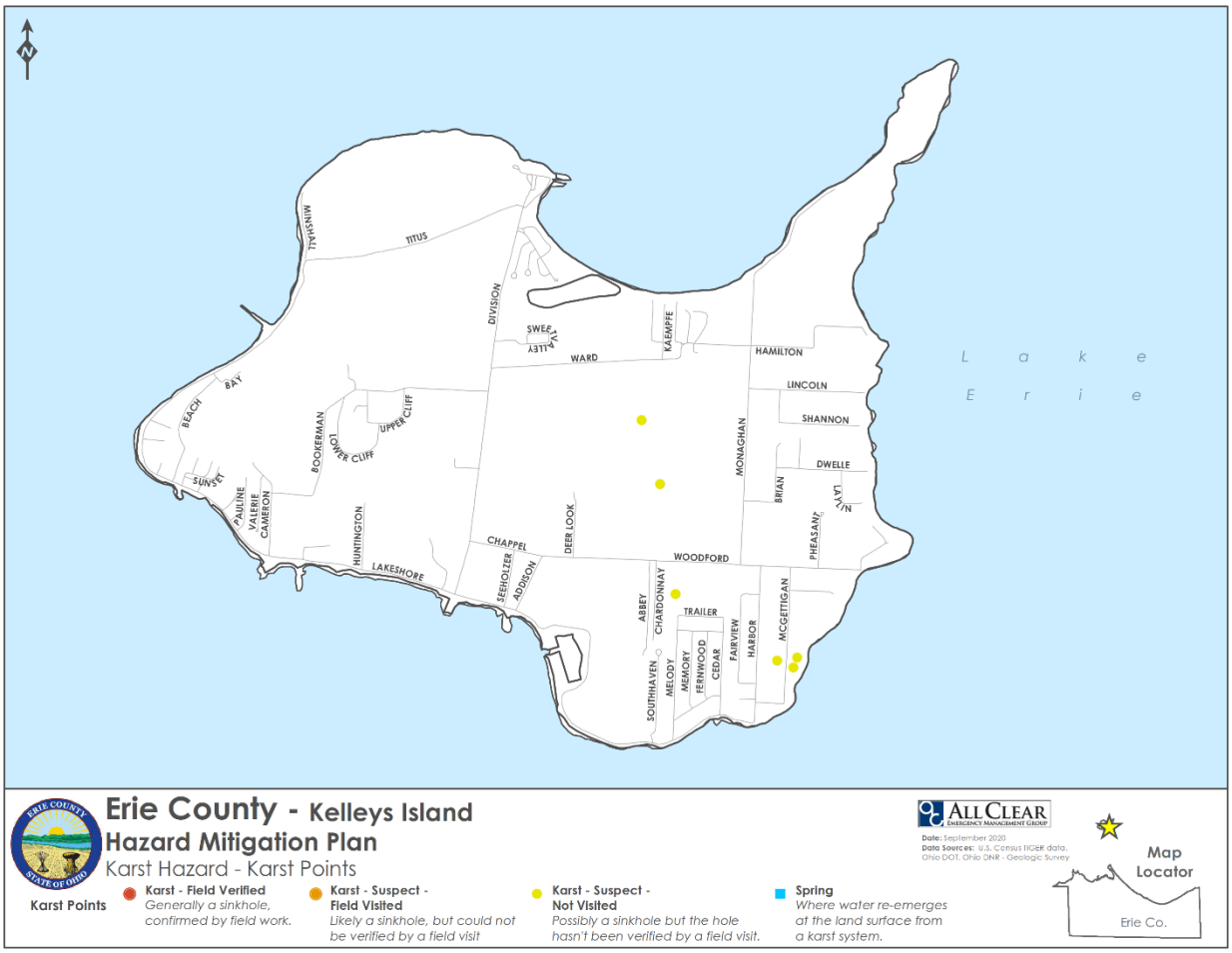


Figure 29: Karst Point Locations for the Village of Kelleys Island

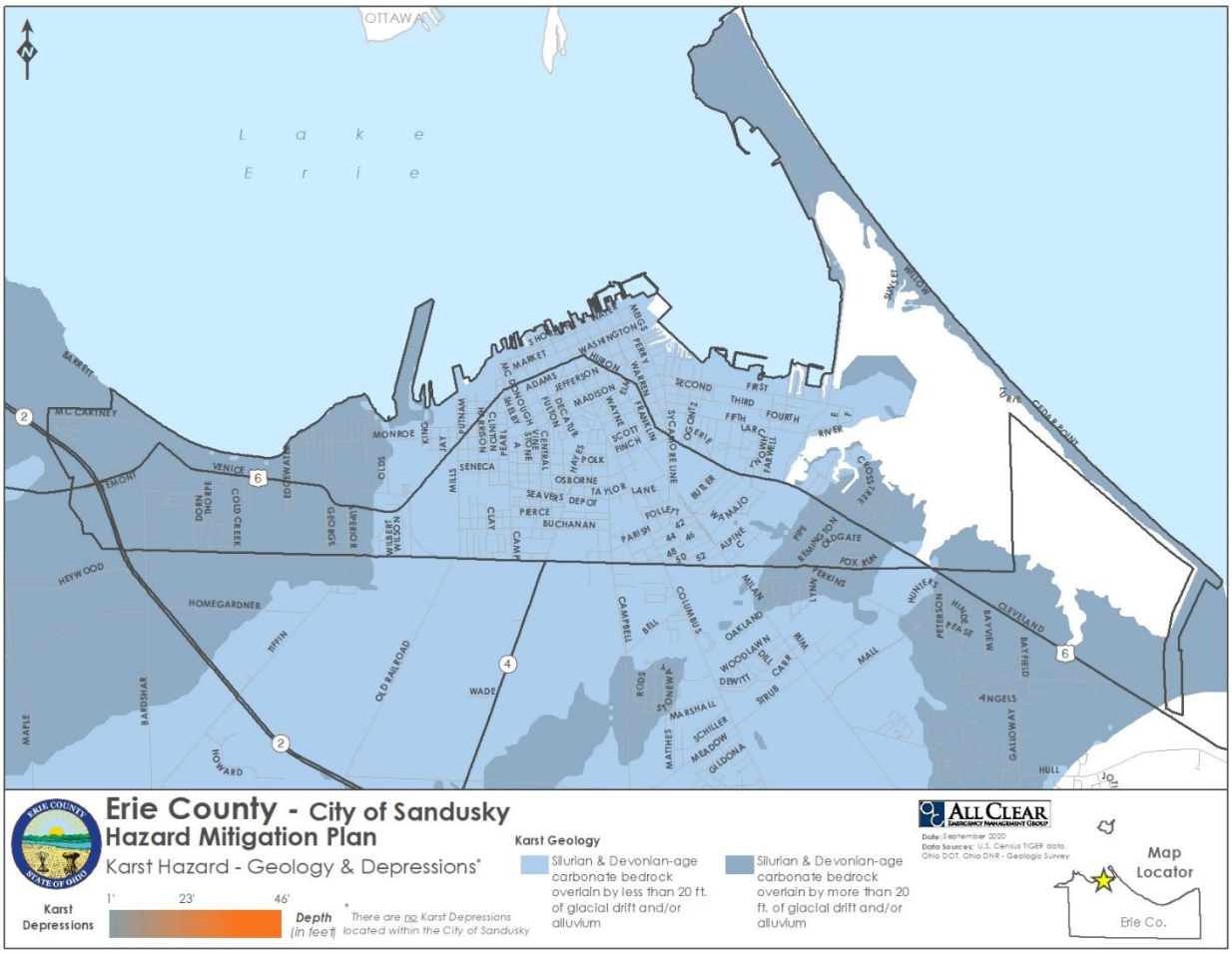


Figure 30: Karst Hazard Map for the City of Sandusky

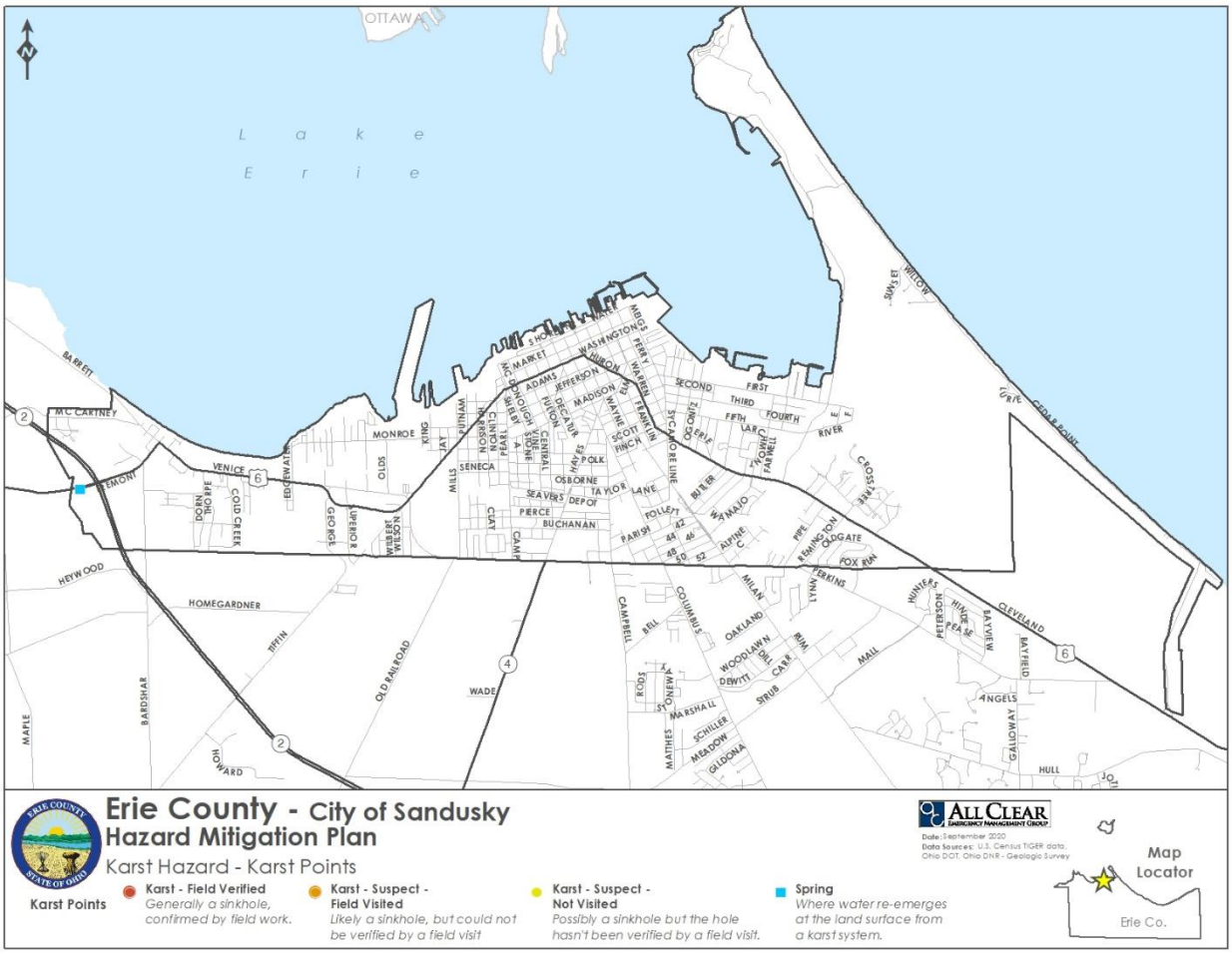


Figure 31: Karst Point Locations for the City of Sandusky

7.4.3 Extent

Flooding is a site-specific hazard. Therefore, floodplains are an important planning consideration. A floodplain is any land area susceptible to inundation by floodwaters from any source. Floodplains are measured in terms of the amount of stormwater that it takes to cover a given area of land. These storm events are measured in frequency of occurrence, such as 5-year, 100-year and 500-year, with the standard measurement being the 100-year storm or floodplain. In Erie County flooding can happen almost anytime however this number one hazard can be exacerbated when heavy rains occur in late winter and accelerate the melting of snow. Flooding in Erie County can also be intensified if the flow of water is obstructed in some way such as by ice jams. Ice jams occur when large chunks of ice flow downstream and become trapped at a point in a creek or stream. This creates a sort of natural dam. Ice jams can cause infrastructure damage to bridges and culverts, but typically their main concern is flooding upstream from the jam. Ice Jams can typically be easily controlled and broken up, so flooding is not always an issue.

Flooding can also be exacerbated locally by the presence of impermeable surfaces due to buildings and pavement or lack of appropriately sized flood water detention basins.

Any development within floodplains can impact the direction, flow and level of the watercourse during periods of high water or flooding. In other words, if fill material is placed or a house constructed in a floodplain, it will alter the boundaries of the floodplain upstream and downstream of that area. This alteration happens because structures or fill utilize valuable space that would otherwise act as a natural retaining area for floodwaters to spread and slow. Not only does development in the floodplain increase dangers downstream, developments within the floodplain are at higher risk of damage due to flooding. This damage includes fill material and debris from destroyed structures upstream colliding with structures in the floodplain downstream of an affected area. Many bridges are washed out in floods because debris clogs their free-flow area.

According to the National Weather Service (NWS), there are three stream gages in Erie County. One is located in Bellevue and records the height of groundwater. This stream gage does not have information regarding historical height of the groundwater at Bellevue. Measures of concern for this gage are at seven feet of depth basements of homes in and around Bellevue would be threatened and some roads could be flooded. At ten feet, the groundwater would flood basements and agricultural fields. Another stream gage in Erie County is on Old Woman Creek at Berlin Road. There are no historic records associated with this stream gage, no flood stages established, and no impacts given.

The last stream gage is located on the Huron River at Milan. The deepest historical flood at this location occurred on July 5, 1969 when the river crested at 31.1 feet. This is the deepest flood recorded by a stream gage in Erie County. At this location, the flood action stage is 14 feet, the flood stage is 18 feet, the moderate flood stage is 19.5 feet and the major flood stage is 22.5 feet. This 1969 flood was 8.6 feet higher than the major flood stage. According to the NWS, at 18 feet, flooding occurs in low lying areas along the Huron River from Milan to Franklin Flats. At 19.5 (moderate flood stage) feet, flood waters are over a foot deep in Franklin Flats. At 21 feet, businesses along the river in Milan, near US Route 50 are affected, and water in Franklin Flats is over two feet deep. Low lying secondary roads may be impassible. At 22.5 (major flood stage) feet, homes are flooded in Franklin Flats, and evacuation may be necessary; many local roads are impassible. The 100-year flood at this location is 23 feet deep. At 24 feet, major flooding occurs in Franklin Flats, and water begins to impact Mud Brook Road. The 500-year flood at this location is 25 feet deep. At 26 feet, the river gage is flooded, and there is major flooding along the Huron River. At 31 feet, record flooding occurs throughout the valley, and considerable backwater flooding occurs along the tributaries of the Huron River. [38]

The following figures show the flood hazard maps for Erie County and the jurisdictions. These flood hazard maps delineate the specific zones areas of the County lie in. Flood hazard maps for the Townships are provided for reference in Appendix F.

[38] (National Oceanic & Atmospheric Administration, 2020)

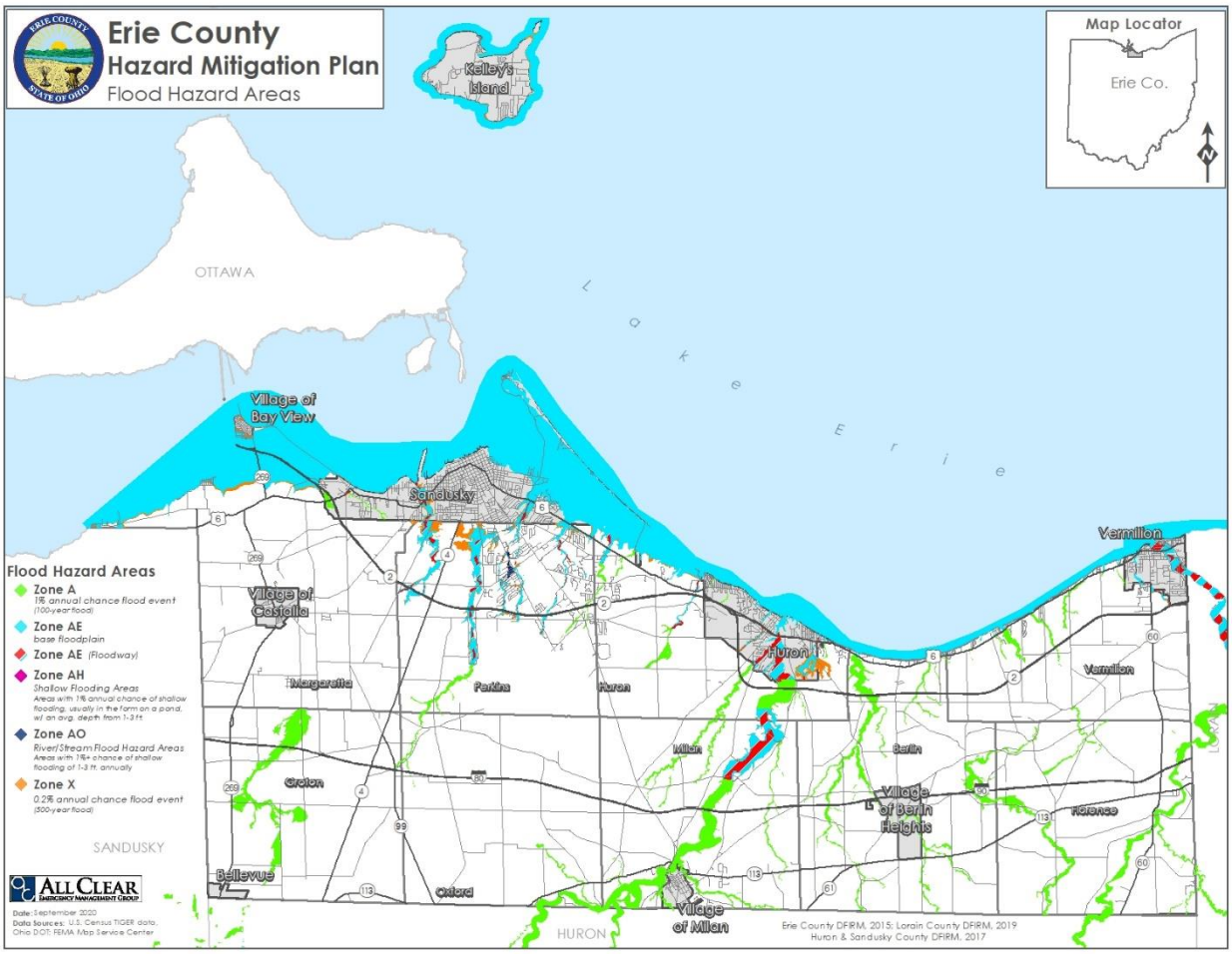


Figure 32: Flood Hazard Map for Erie County

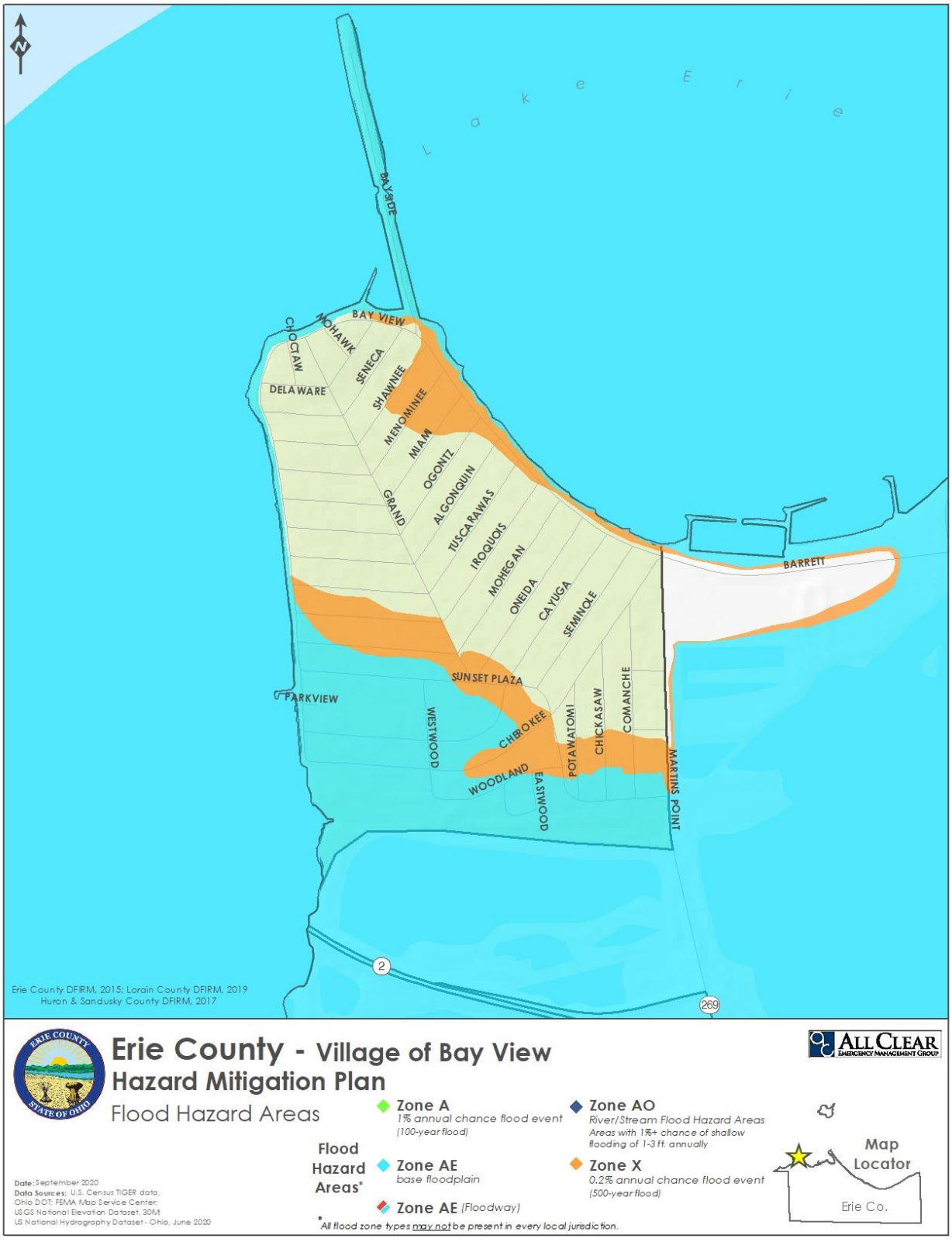


Figure 33: Flood Hazard Map for the Village of Bay View

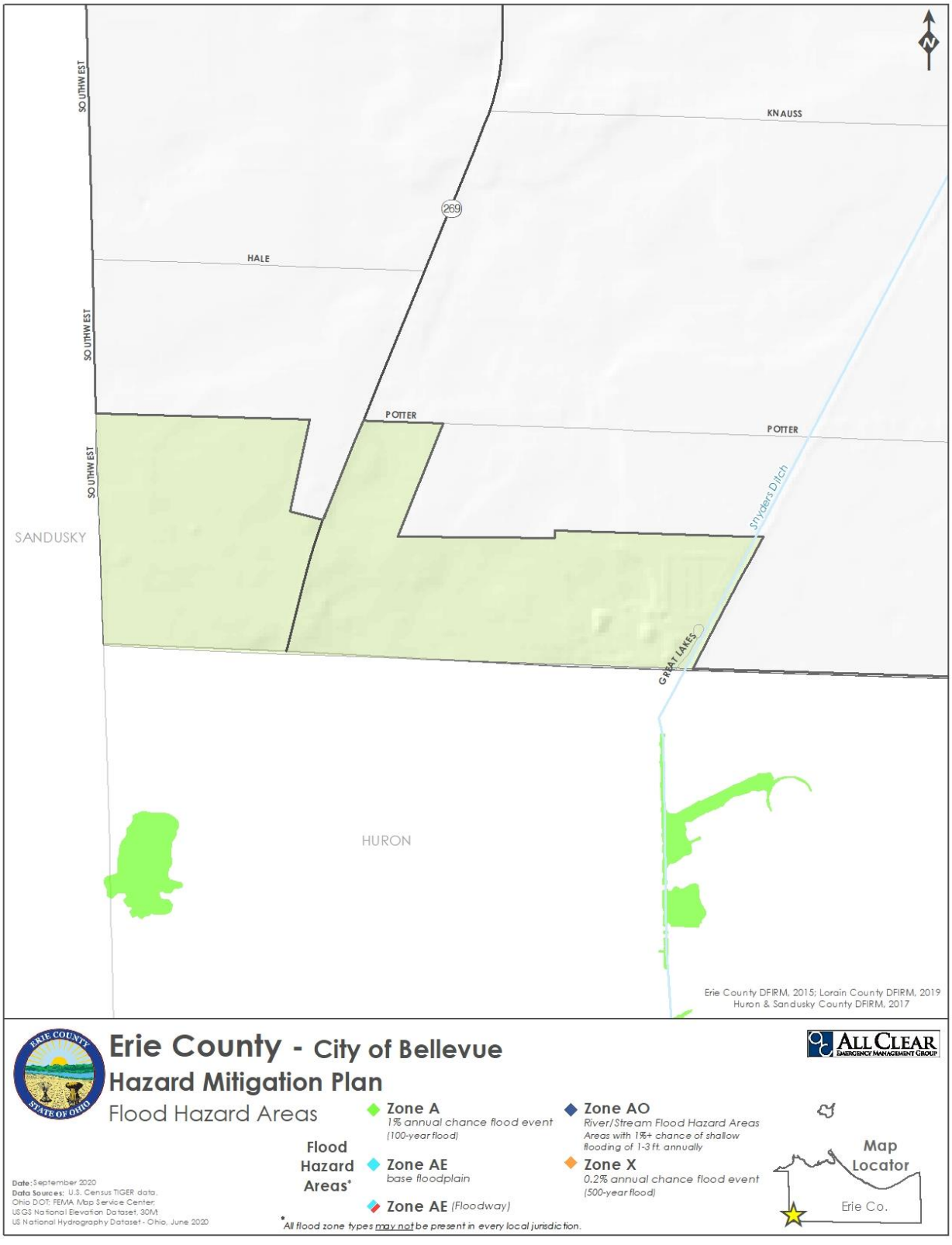


Figure 34: Flood Hazard Map for the City of Bellevue

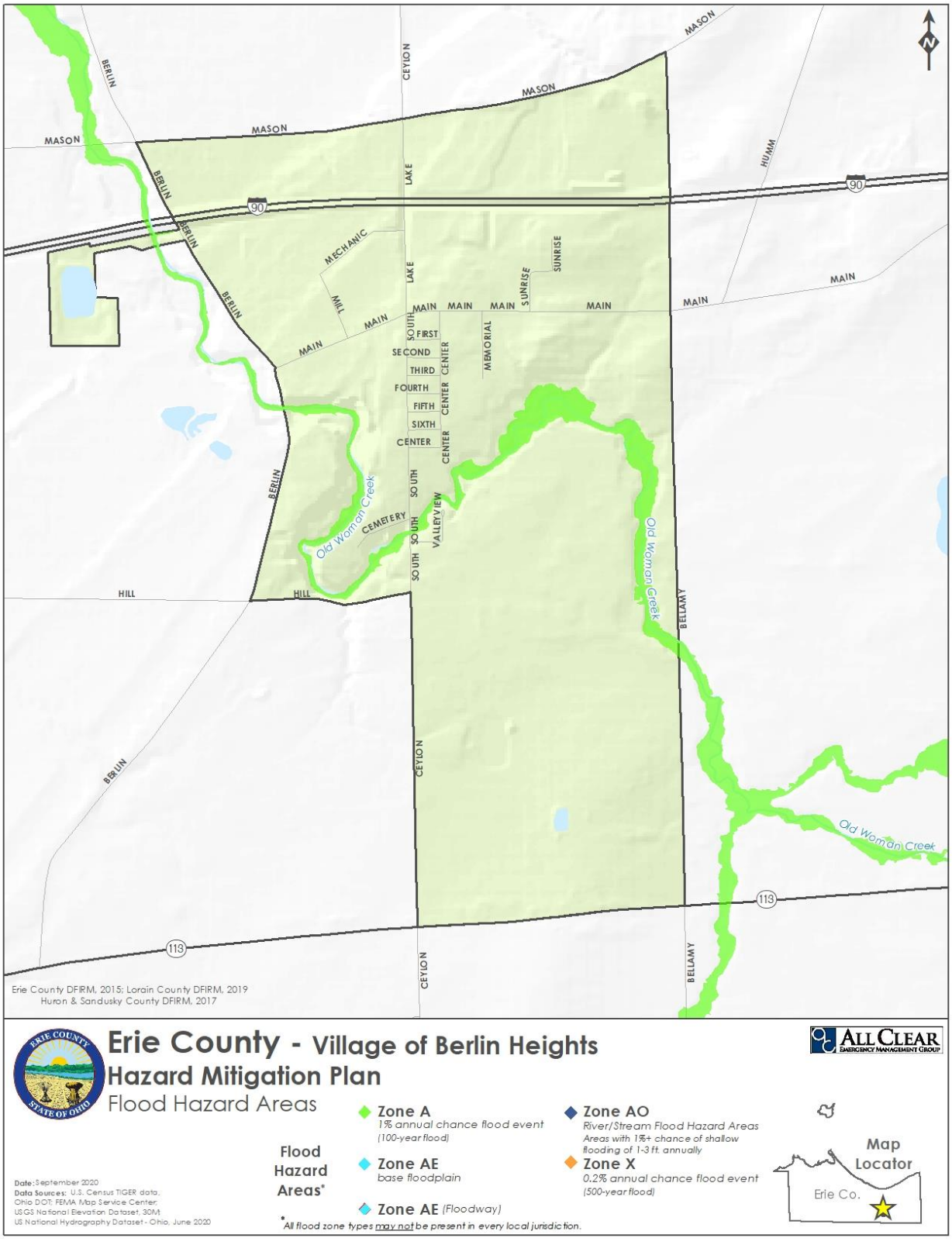


Figure 35: Flood Hazard Map for the Village of Berlin Heights

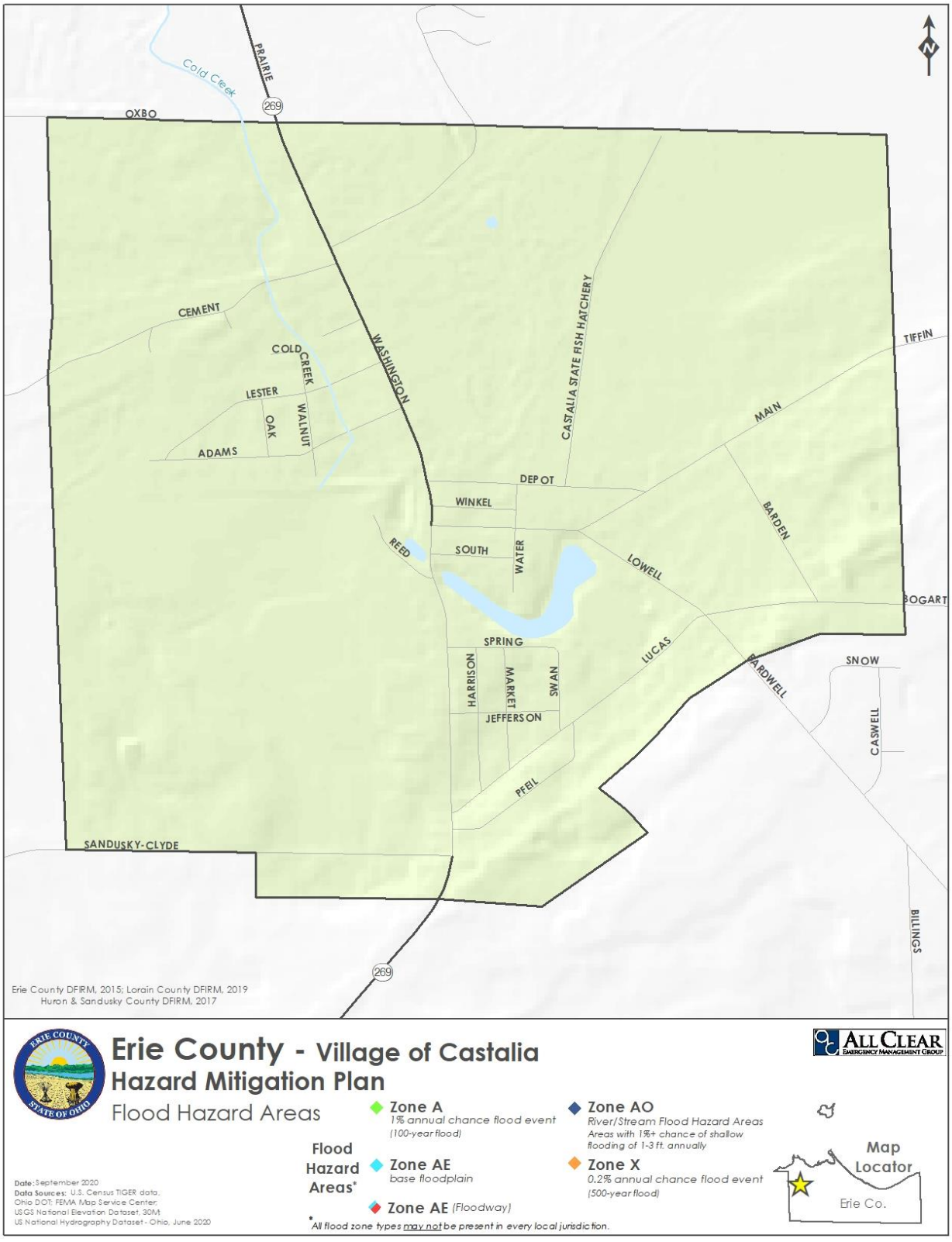


Figure 36: Flood Hazard Map for the Village of Castalia

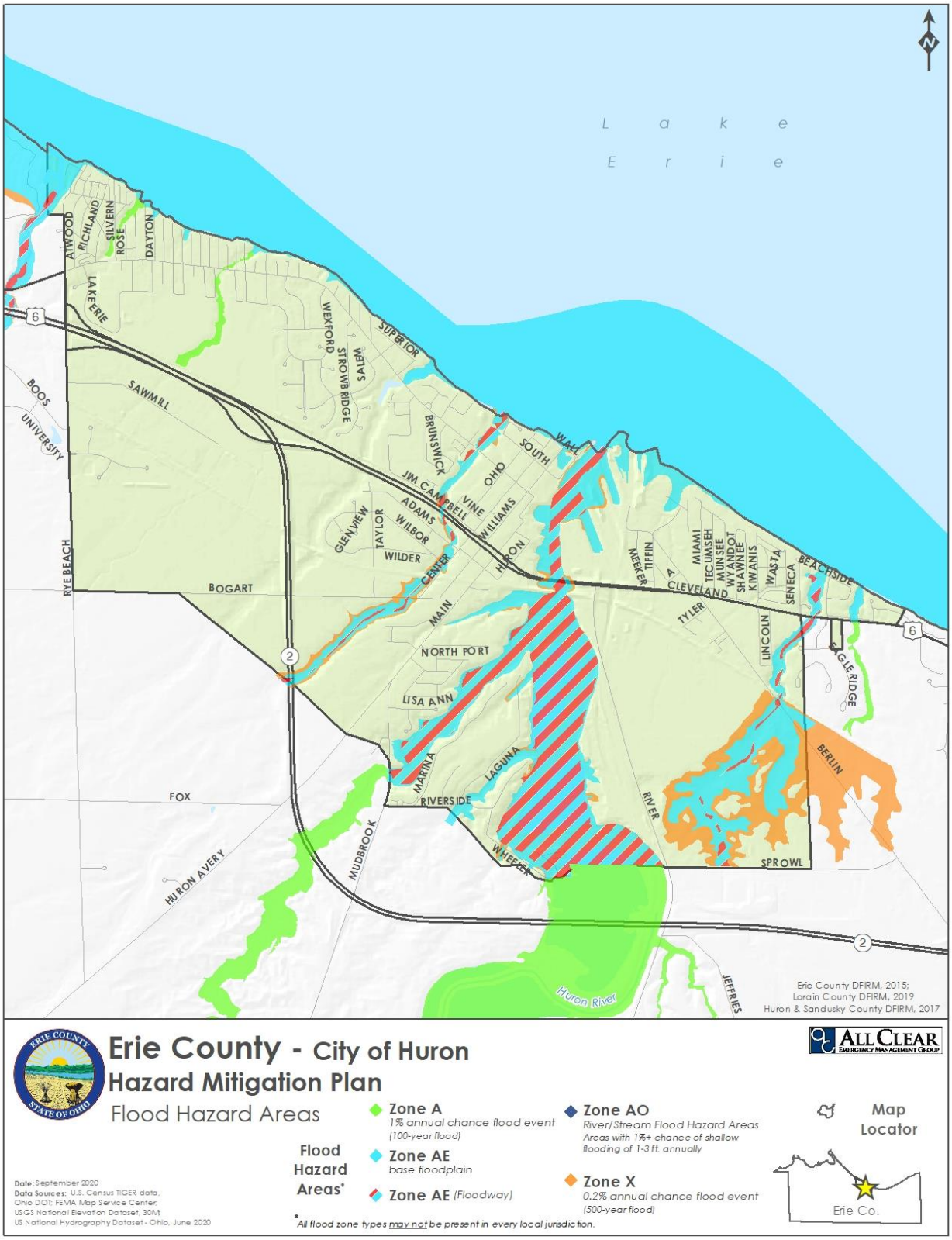


Figure 37: Flood Hazard Map for the City of Huron

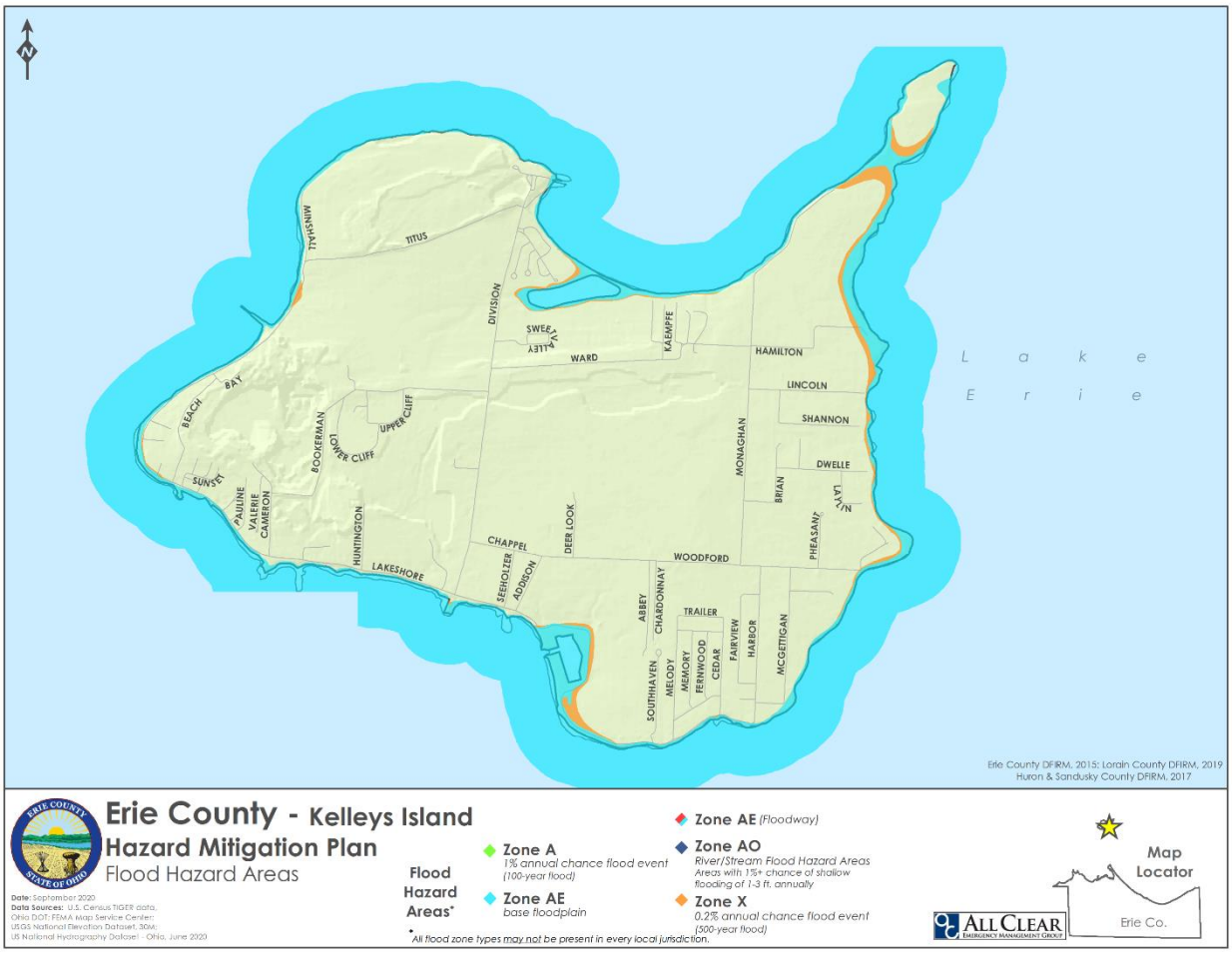


Figure 38: Flood Hazard Map for the Village of Kelleys Island

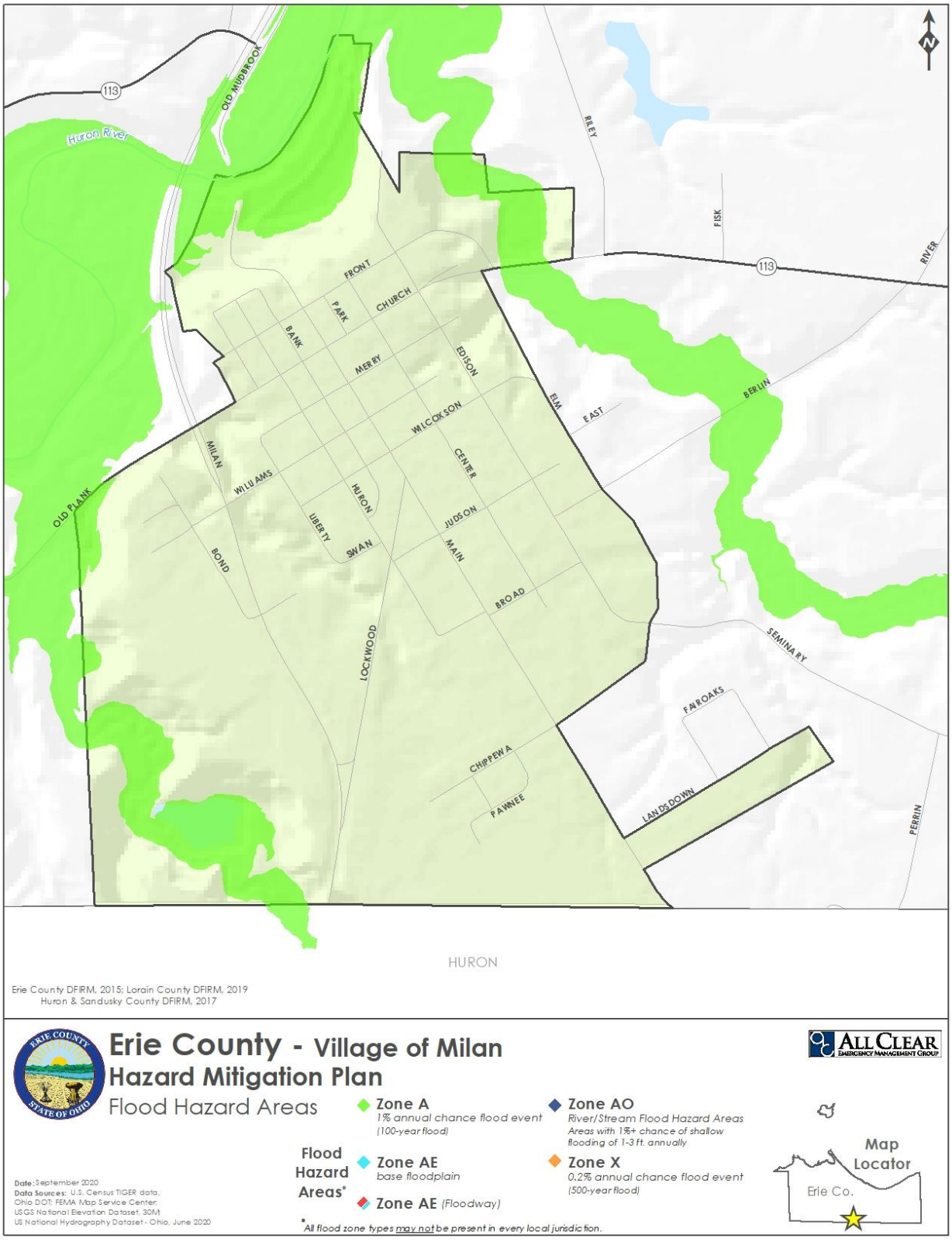


Figure 39: Flood Hazard Map for the Village of Milan

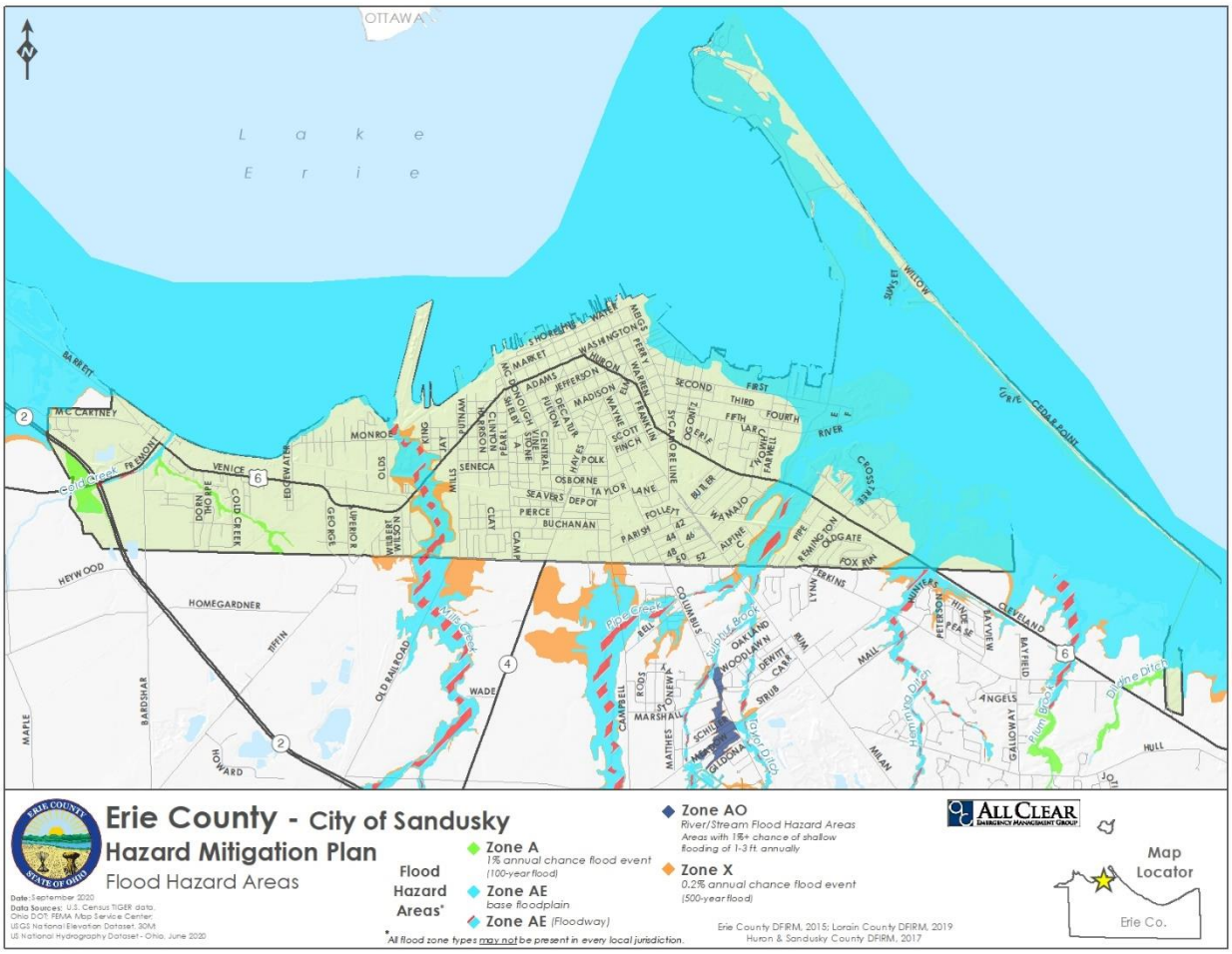


Figure 40: Flood Hazard Map for the City of Sandusky

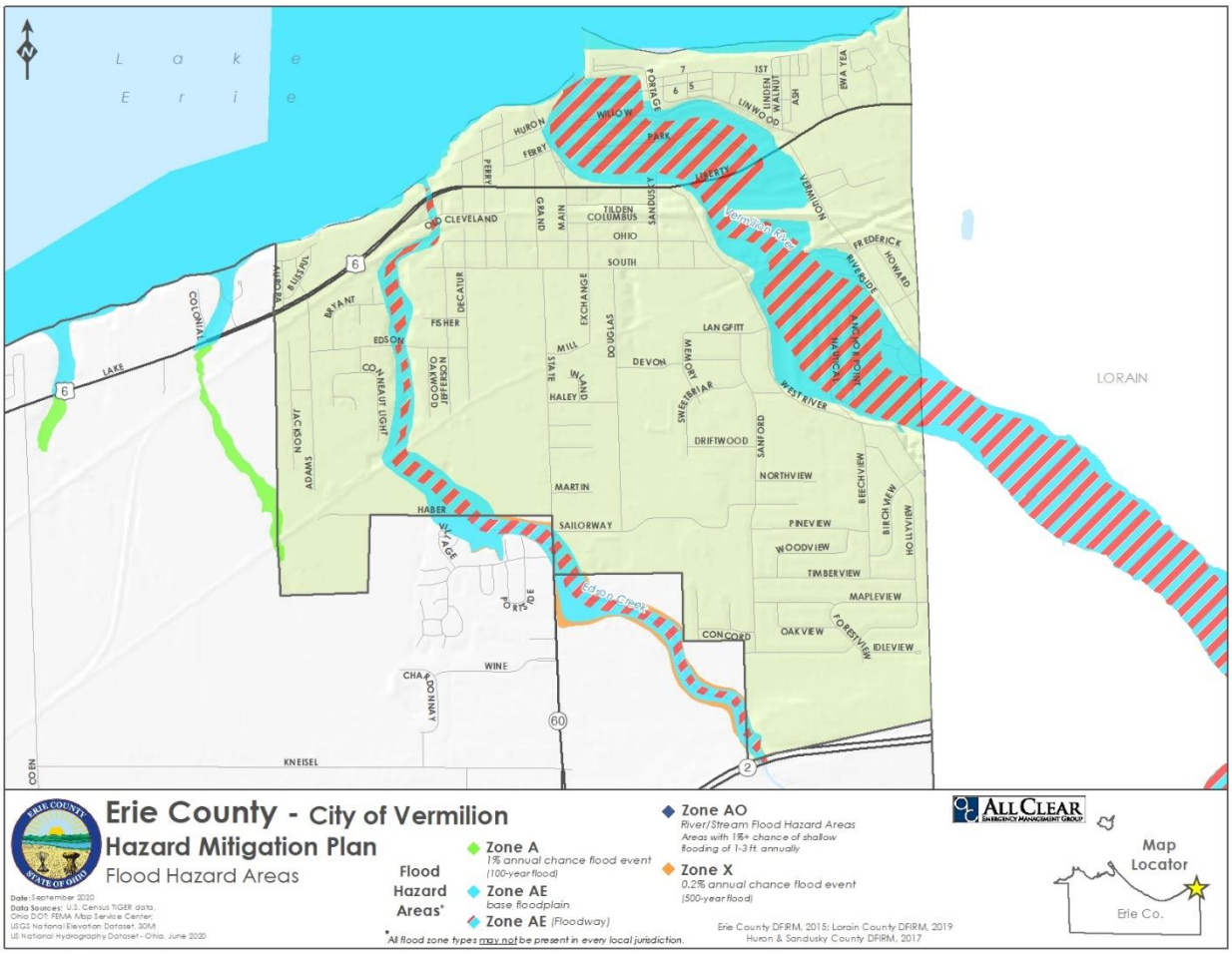


Figure 41: Flood Hazard Map for the City of Vermilion (Erie County Portion Only)

7.4.4 Previous Occurrences

The National Climatic Data Center (NCDC) has comprehensive information available on flood events back to 1996, as shown in Table 17. Additional historical flood information is provided in a narrative format. The county has suffered damage from numerous major floods and localized flash flooding. Flooding is the second most frequent disaster event: severe summer storms being the most common.

Flood of July 1969. The rain began at approximately 8:00 p.m., July 4, 1969 and ended between 1:00 and 3:00 p.m. July 5, 1969. Rain occurred about 20 miles on either side of a line running between Toledo, Ohio and Wheeling, West Virginia with centers of greater than 10 inches located around Wooster, Ohio and Norwalk, Ohio. Preliminary bucket surveys and reports from other unofficial rain gages indicated that up to 14 inches of rain occurred in certain localities.

This precipitation caused flooding which resulted in loss of life and considerable crop and property damages in a dozen Ohio counties. The hardest hit communities were Wooster, Ashland, Norwalk, Vermilion, Millersburg, Loudonville and Killbuck, Ohio. As of July 21, 1969, 46 fatalities were reported and five persons missing as a result of the 4th of July storm.

Total flood damages were estimated to be between 70 and 140 million dollars. Of these flood damages, agricultural damages were estimated between 40 and 80 million while property damage was between 30 to 60 million dollars.

Flood of August 1998. The Huron River at Milan exceeded its flood stage of 14 feet and crested at 23.4 feet at 0700 EST on 08/26/98. Flooding occurred in the lagoon communities from Milan to near Huron and small businesses near US Route 250. Basements and streets were also flooded. Seventy-five homes were evacuated in Franklin Flats, 10 to 12 homes on Mudbrook Road were evacuated as were 70 campers at Huron Valley Campground. This crest level was more than nine feet above flood stage and the second highest in 30 years.

Flood of January 2005. Heavy rain and runoff from snowmelt caused widespread lowland flooding in Erie County during the first half of January 2005. Some of the worst flooding occurred along the Huron River. At Milan, the river was already above the 14-foot flood stage at midnight on the 1st. The river continued in flood through the 14th with crests of 19.74 feet on the 1st and 19.66 feet on the 12th. The flooding on the 1st was caused by ice jamming on the river. Damage was reported to buildings in Franklin Flats on both the 1st and 12th. Businesses along U.S. Route 250 in Milan also sustained some damage from flooding. January 2005 was one of the wettest Januarys on record with 5.48 inches of rain measured by cooperative observers in Florence. In addition to this rain, extensive snowpack existed over Erie County at the beginning of the month. Temperatures in the 40s and 50s the first three days of the month caused a rapid snowmelt and brought area streams and creeks to full just in time for a significant winter storm on the 5th and 6th. Then, just as things began to return to normal, heavy rains fell on the area on the 11th, 12th and 13th causing conditions to once again worsen. Hundreds of homes in the county sustained damage from river, basement, or nuisance flooding. Many secondary roads had to be closed because of flooding.

Flood of June 2006. Thunderstorms caused torrential rains on Erie County during the evening of June 21st 2006. Rainfall rates with the stronger storms exceeded three inches per hour. As much as 7 to 9 inches of rain fell on Perkins Township with 4 to 6 inches over the remainder of the county. Most of this rainfall fell between 8 and 11 p.m. Devastating flash flooding occurred across the county as result of this rainfall. Perkins, Milan, Huron and Margaretta Townships were the hardest hit by the flooding. Rapid rises in water levels occurred in the county forcing the closure of dozens of roads and streets. Hundreds of people had to be evacuated from flood prone areas. The flooding was especially bad along Pike Creek in Perkins Township which quickly left its bank. Flooding also occurred along Mills Creek near Sandusky with several roads in the city flooded by two to three feet of water. The flooding worsened after daybreak on the 22nd as runoff from the heavy rains on the 21st made its way into the larger creeks and rivers. Local officials stated that this flood event was the worst in the county since the July 4th, 1969.

Three piers and several boats in this area were washed out into Lake Erie. A total of 20 homes were destroyed by flooding in Erie County with 25 homes suffering major damage and 79 more with minor damage. Several motorists had to be rescued from stranded vehicles. In addition, 64 mobile homes in Terrace Court and Franklin Flats were heavily damaged. Several hundred additional homes and businesses sustained damage from

either basement or nuisance flooding. A total of 573 people were evacuated in the county by emergency personnel. Damage to roads, culverts and bridges was significant. Crop losses in the county was substantial as standing water was reported over most of the county. Local officials stated that this flooding was the worst in the county since the storms of July 4th, 1969.

Flood of August 2007. A stationary boundary stretched from west to east through northern Ohio during the morning hours of the 20th and remained nearly stationary for the next several days. Heavy rain along this boundary moved across far northern Ohio during the day causing flooding and flash flooding across the region.

Heavy rain fell across the area during the morning hours of the 20th. Rainfall reports indicate that between 2.0 and 3.0 inches of rain fell that morning across the area. The heavy rain was able to quickly make its way to local streams and rivers, but those eventually filled up through the morning hours, and excess runoff began ponding in low lying locations and roads throughout the county. By midday of the 20th, roads northeast of Bellevue to Huron gradually flooded. Flooding continued through the overnight hours into the 21st. By the morning, water eventually flooded out the Franklin Flats area. Floodwaters receded throughout the county during the midday and afternoon hours of the 21st.

Flood of May 2010. A warm front lifted north across northern Ohio during the afternoon hours of May 31st. A cold front followed during the evening. Showers and thunderstorms developed in association with both fronts. Slow moving thunderstorms produced heavy rainfall which caused flash flooding in a few areas. Rainfall rates at times were between two and three inches per hour. A few locations received more than four inches of rainfall. The flooding was the worst in western Geauga County were the damage was extensive. A few storms also became severe with minor damage reported.

Slow moving thunderstorms dumped locally heavy rainfall on portions of Erie and Sandusky Counties. Rainfall rates at times were between two and three inches per hour. A storm total of 3.98 inches of rainfall was measured in Bellevue with 3.48 inches reported a mile north of Bellevue. A spotter in Bloomingville measured a total of 3.90 inches of rain. Widespread flooding occurred across southwestern Erie County, northwestern Huron County and eastern Sandusky County. The worst flooding was in the Bellevue area. To the north of Bellevue, State Route 269 along with Hale, Potter and Portland Roads had to be closed because of flooding. Over two feet of water was also reported on U.S Route 20 in Bellevue. Several cars became stranded in the flood waters. Many other secondary roads in the area also experienced flooding. Several dozen homes sustained damage, mainly from basement flooding.

Flood of March 2015. From mid-January through early March of 2015, frigid and much below normal temperatures set the stage for ice jam development along rivers and creeks in the Lake Erie drainage basin. Nearly every climate station in the Cleveland WFO region saw their coldest February on record in 2015. As a result, Lake Erie was 98% frozen by early March. The lake is the mouth for almost all northern Ohio and Pennsylvania rivers and creeks. When the lake is ice covered, it becomes a barrier to the natural outflow of the rivers. Going into March the area had a widespread and significant snowpack based

on regional climatology. The snowpack was heaviest across the snowbelt where the average depth was two to three feet. Elsewhere the snowpack had compacted to eight inches or less. A survey conducted by NWS Cleveland employees shortly before the thaw revealed the snow water equivalent in the snowpack to be one to two inches west and south of Cleveland, and three to five inches in the snowbelt to the east. By the middle of March temperatures began to warm. A result of the warming was that by the end of the second week of March the snowpack was mostly gone except in the snowbelt. The runoff from this snowmelt began to raise river levels and break up the ice sheets that had accumulated along most northern Ohio and Pennsylvania Rivers. Numerous ice jams formed during this time; however, no flooding impacts were reported. A rain event moved along the Ohio River on the 13th resulting in rapid runoff in the region. The rainfall was not substantial in the Lake Erie basins, with amounts near a trace in the Maumee River near Toledo, to three quarters of an inch in the Cuyahoga Basin near Cleveland. Though not significant, the rainfall was enough to raise river levels. For those rivers experiencing ice jams, the increased flow was forced to back-up and out of the riverbanks. The ice jams shifted and moved between the 13th through the 18th until the rivers were able to empty into Lake Erie. During that time numerous communities were impacted by the ice jams. Below is a summary of some of those communities.

On March 11th an ice jam developed on the Vermilion River in the Mill Hollow metro park located just south and upstream of the town of Vermilion. The ice jam was stationary for days as water continued to build behind it, flooding the metro park but no other properties or roads. Around 3:30 am on the morning of the 14th the combination of snowmelt and rainfall caused the ice jam to break. The water levels in the Riverside Drive community of Vermilion saw a rapid water rise. One person had to be rescued from waist deep water around 6 am that morning. Several people in the community had already evacuated due to the heightened awareness from the ice jam flood watch leading up to the ice jam break. A second ice jam developed around Riverside Drive which broke around 9:30 am. It went in cycles all day long, jamming up and then breaking loose because of all the bends in the river. About 20 homes sustained minor flooding damage mainly to garages and outer buildings.

In 2020, there were a series of Lakeshore flooding events in Erie County due to lake level rise, seiche events, and other severe weather. These flood events occurred on February 5, March 22, April 23, May 5, May 12, May 16, June 6 and June 14. In some areas of the county, the water had not yet receded enough to assess damaged by October 2020.

Table 17: Flooding in Erie County 1996-2019

Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Erie (Zone)	3/20/1996	Flood	0	0	$-	$-
Erie (Zone)	3/25/1996	Flood	0	0	$-	$-
Countywide	4/23/1996	Flash Flood	0	0	$-	$-
Erie (Zone)	4/23/1996	Flood	0	0	$-	$-
Erie (Zone)	4/30/1996	Flood	0	0	$-	$-
Huron	6/19/1996	Flash Flood	0	0	$10,000	$-
Sandusky	9/9/1996	Flash Flood	0	0	$-	$-
Sandusky	9/9/1996	Flash Flood	0	0	$50,000	$-
Erie (Zone)	12/11/1996	Flood	0	0	$-	$-

Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Erie (Zone)	12/17/1996	Flood	0	0	$-	$-
Erie (Zone)	12/24/1996	Flood	0	0	$-	$-
Erie (Zone)	1/22/1997	Flood	0	0	$-	$-
Erie (Zone)	2/4/1997	Flood	0	0	$75,000	$-
Erie Lakeshore	3/13/1997	Storm Surge/Tide	0	0	$-	$-
Erie (Zone)	5/25/1997	Flood	0	0	$50,000	$-
Countywide	6/1/1997	Flash Flood	0	0	$50,000	$15,000
Lake Erie Lakeshore	6/1/1997	Storm Surge/ Tide	0	0	$200,000	$-
Erie (Zone)	6/1/1997	Flood	0	0	$-	$-
Erie (Zone)	6/1/1997	Flood	0	0	$100,000	$-
Erie (Zone)	1/7/1998	Flood	0	0	$100,000	$-
Countywide	1/7/1998	Flash Flood	0	0	$-	$-
Countywide	1/9/1998	Flash Flood	0	0	$-	$-
Sandusky	2/4/1998	Storm Surge/ Tide	0	0	$75,000	$-
Sandusky	2/17/1998	Storm Surge/Tide	0	0	$500,000	$-
Erie (Zone)	2/17/1998	Flood	0	0	$-	$-
Sandusky	3/20/1998	Storm Surge/ Tide	0	0	$100,000	$-
Erie (Zone)	3/21/1998	Flood	0	0	$-	$-
Bay View	4/9/1998	Storm Surge/ Tide	0	0	$1,000,000	$-
Erie (Zone)	4/17/1998	Flood	0	0	$-	$-
South Portion	6/28/1998	Flash Flood	0	0	$5,000	$-
Erie (Zone)	6/30/1998	Flood	0	0	$-	$-
Countywide	6/30/1998	Flash Flood	0	0	$20,000	$-
Countywide	6/30/1998	Flash Flood	0	0	$-	$-
Countywide	6/30/1998	Flash Flood	0	0	$10,000	$-
Erie (Zone)	7/22/1998	Flood	0	0	$-	$-
Erie (Zone)	8/25/1998	Flood	0	0	$500,000	$-
Lakeshore	11/10/1998	Seiche	0	0	$-	$-
Erie (Zone)	1/22/1999	Flood	0	0	$100,000	$-
Erie (Zone)	1/23/1999	Flood	0	0	$100,000	$-
Erie (Zone)	4/9/1999	Flood	0	0	$-	$-
Milan	6/12/1999	Flash Flood	0	0	$-	$-
Erie (Zone)	4/8/2000	Flood	0	0	$-	$-
Erie (Zone)	6/18/2000	Flood	0	0	$-	$-
Castalia	7/29/2000	Flash Flood	0	0	$-	$-
Erie (Zone)	2/1/2001	Flood	0	0	$-	$-
Erie (Zone)	4/6/2001	Flood	0	0	$20,000	$-
Erie (Zone)	6/14/2004	Flood	0	0	$-	$-
Erie (Zone)	1/1/2005	Flood	0	0	$425,000	$-
Vermilion	8/20/2005	Flash Flood	0	0	$30,000	$-
Countywide	6/21/2006	Flash Flood	0	0	$2,000,000	$-
Countywide	6/22/2006	Flood	0	0	$24,500,000	$5,000,000
Vermilion	3/2/2007	Flash Flood	0	0	$100,000	$-
Kimball	8/20/2007	Flood	0	0	$150,000	$-
Milan	8/20/2007	Flood	0	0	$-	$-
Castalia	5/31/2010	Flash Flood	0	0	$200,000	$-
Berlin Heights	4/25/2011	Flash Flood	0	0	$50,000	$-
Florence	4/25/2011	Flash Flood	0	0	$80,000	$-
Sandusky	9/7/2011	Flood	0	0	$3,000	$-
Vermilion	10/30/2012	Flood	0	0	$40,000	$-
Milan	10/30/2012	Flood	0	0	$15,000	$-
Milan	7/10/2013	Flash Flood	0	0	$100,000	$-
Vermilion	3/14/2015	Flash Flood	0	0	$150,000	$-
Milan	1/12/2018	Flood	0	0	$-	$-

Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Vermilion	1/23/2019	Flash Flood	0	0	$50,000	$-
Erie (Zone)	5/12/2019	Coastal Flood	0	0	$5,000	$-
Erie (Zone))	6/5/2019	Lakeshore Flood	0	0	$300,000	
Total			**0**	**0**	**$31,263,000**	**$5,015,000**

7.4.5 Probability of Future Events

In this plan, special flood hazard area is used in conjunction with floodplain to clarify that the area under consideration is identified on the Flood Insurance Rate Maps (FIRM) as having at least a 1% chance of flooding in any given year. Historically, the area with a 1-percent chance of flooding in any given year has been called the "100-year floodplain" and the area with a .2% chance of flooding in any given year has been called the "500-year floodplain." As these terms can be misleading by suggesting that there will be a flood only every 100 or 500 years respectively. However, 100 year or 500 year floodplains do not predict the frequency or probability of a future flood. Therefore, the probability will be calculated using the historical number of events over the years on record.

The NCDC data indicates that there have been 66 events in the past 24 years. Therefore, the recurrence interval is 24/66 = 0.36 years, which means the probability is 100 percent chance annually.

Due to climate change, flooding can expect to get worse as the intensity of storms increases and lake levels continue to reach historically high levels.

7.4.6 Vulnerability

Flood vulnerability is described in terms of what community assets, structures, and infrastructure are found in locations where flooding is anticipated.

Table 18: Summary of Past Losses Due to Flooding

	Estimated Property Damages
Total Losses Due to Flooding (1996–2019)	$31,263,000
Average Annual Losses for 24 years	$1,302,625

According to NCDC and reflected above in Table 18, estimated significant property damage in Erie County attributable to flooding during the years 1996 through 2019 is $31,263,000. The average annual loss for these 24 years is $31,263,000/25 = $1,302,625.

Flooding can lead to property loss as well as loss of life. Flooding damages structures, including homes and businesses, vehicles, and infrastructure, including roadways. People who are surrounded by flood waters can require evacuation placing their lives as well as the lives of rescuers in danger. Flooding can disrupt the operation of businesses and schools and recovery from flood damages can be time consuming and costly.

Hazus-MH modeling was conducted for 100- and 500- year flood scenarios. Table 19 below summarizes the expected building damage by occupancy type for the 100-year flood scenario. Hazus-MH reports damage in damage levels. Level 1-10 represents minor

damage, Level 11-20 is moderate damage, etc. Level >50 is considered completely destroyed. It is predicted that in this scenario, about 155 buildings will sustain at least moderate damage and 5 buildings will be completely destroyed. These structures are all predicted to be residential structures.

Table 19: Expected Building Damage by Occupancy for 100 Year Flood Scenario

Occupancy	1-10	11-20	21-30	31-40	41-50	>50
Agriculture	0	0	0	0	0	0
Commercial	3	0	0	0	0	0
Education	0	0	0	0	0	0
Government	0	0	0	0	0	0
Industrial	1	0	0	0	0	0
Religion	0	0	0	0	0	0
Residential	136	118	24	6	2	5

The Hazus-MH flood model report for Erie County identified 72 critical facilities within the County. No critical facilities are expected to sustain moderate or more damage in either flood event. All hospital beds in the County are expected to be available for use.

Repetitive Loss Properties

Some structures in Erie County have been flooded repeatedly and have received more than one payment through the National Flood Insurance Program (NFIP) for flood damages. A repetitive loss structure is defined as an NFIP-insured structure that has had at least two paid NFIP claims of more than $1,000 each in any 10-year period since 1978. There are 99 structures in Erie County that have been classified as repetitive loss structures and 331 total losses.

Severe repetitive loss properties are properties that have at least four NFIP payments over $5,000 each and the cumulative amount of such claims exceeds $20,000, or at least two separate claims payments with the cumulative amount exceeding the market value of the building. There are 15 structures in Erie County that have been classified as severe repetitive loss structures and 80 total losses.

Table 20 lists the repetitive and severe repetitive loss properties by jurisdiction. There are no repetitive loss properties specified for Bay View, Berlin Heights, Castalia, Kelleys Island or Milan. Data from 2018 was used as more recent data had discrepancies that were unable to be verified. The blue highlights indicate that the property is a severe repetitive loss property.

Table 20: Repetitive Loss and Severe Repetitive Loss Structures (2018)

Location	Type	Zone	Total Building Payments	Total Contents Payments	Losses	Total Payments	Average Payment	SRL
Bellevue	Other-Nonres	C	$197,581.42	$4,090.71	2	$201,672.13	$100,836.07	
Bellevue	Single Family	X	$15,267.83	$335.48	2	$15,603.31	$7,801.66	

Location	Type	Zone	Total Building Payments	Total Contents Payments	Losses	Total Payments	Average Payment	SRL
Bellevue	Single Family	A	$16,836.71	$-	3	$16,836.71	$5,612.24	
Bellevue	Single Family	A	$23,611.91	$-	2	$23,611.91	$11,805.96	
Erie Co.	Other-Nonres	AE	$98,402.72	$16,372.41	3	$114,775.13	$38,258.38	
Erie Co.	Other-Nonres	C	$-	$12,025.00	3	$12,025.00	$4,008.33	
Erie Co.	Single Family	A02	$58,595.11	$15,487.16	4	$74,082.27	$18,520.57	MVU
Erie Co.	Single Family	A07	$21,471.00	$1,945.00	2	$23,416.00	$11,708.00	VU
Erie Co.	Single Family	A02	$4,353.23	$6,930.00	2	$11,283.23	$5,641.62	
Erie Co.	Single Family	A	$8,117.53	$4,076.68	2	$12,194.21	$6,097.11	
Erie Co.	Single Family	A	$9,796.31	$1,418.00	3	$11,214.31	$3,738.10	
Erie Co.	Single Family	X	$13,404.55	$1,368.75	2	$14,773.30	$7,386.65	
Erie Co.	Single Family	A02	$34,062.28	$1,000.00	3	$35,062.28	$11,687.43	
Erie Co.	Single Family	C	$16,140.00	$2,875.15	2	$19,015.15	$9,507.58	
Erie Co.	Single Family	A	$10,568.39	$-	3	$10,568.39	$3,522.80	
Erie Co.	Single Family	A	$3,586.00	$-	2	$3,586.00	$1,793.00	
Erie Co.	Single Family	AE	$10,843.27	$3,319.36	2	$14,162.63	$7,081.32	
Erie Co.	Single Family	AE	$17,968.48	$-	2	$17,968.48	$8,984.24	
Erie Co.	Single Family	AE	$38,444.21	$1,060.70	3	$39,504.91	$13,168.30	
Erie Co.	Single Family	A07	$12,531.24	$16,640.89	3	$29,172.13	$9,724.04	
Erie Co.	Single Family	AE	$7,360.44	$-	2	$7,360.44	$3,680.22	
Erie Co.	Single Family	A07	$7,048.51	$457.48	2	$7,505.99	$3,753.00	
Erie Co.	Single Family	A07	$81,131.14	$10,971.18	2	$92,102.32	$46,051.16	
Erie Co.	Single Family	A03	$14,627.71	$9,374.69	3	$24,002.40	$8,000.80	
Erie Co.	Single Family	AE	$49,050.77	$6,800.00	2	$55,850.77	$27,925.39	
Erie Co.	Single Family	A02	$45,610.45	$8,000.00	2	$53,610.45	$26,805.23	
Erie Co.	Single Family	C	$9,309.74	$8,617.00	5	$17,926.74	$3,585.35	
Erie Co.	Single Family	A	$12,494.07	$-	2	$12,494.07	$6,247.04	
Huron	2-4 Family	A06	$15,554.96	$7,362.06	3	$22,917.02	$7,639.01	
Huron	2-4 Family	A03	$3,801.60	$-	2	$3,801.60	$1,900.80	
Huron	Single Family	AE	$61,786.07	$33,844.73	6	$95,630.80	$15,938.47	V
Huron	Single Family	AE	$45,491.79	$3,765.65	5	$49,257.44	$9,851.49	V
Huron	Single Family	AE	$149,100.28	$19,576.32	10	$168,676.60	$16,867.66	V
Huron	Single Family	AE	$27,135.53	$19,724.31	3	$46,859.84	$15,619.95	
Huron	Single Family	A03	$63,399.01	$9,699.00	6	$73,098.01	$12,183.00	
Huron	Single Family	A	$16,572.18	$-	3	$16,572.18	$5,524.06	
Huron	Single Family	A	$3,759.26	$-	2	$3,759.26	$1,879.63	
Huron	Single Family	A	$37,638.33	$-	3	$37,638.33	$12,546.11	
Huron	Single Family	C	$2,282.00	$22.00	2	$2,304.00	$1,152.00	
Huron	Other-Nonres	A	$6,343.15	$4,799.24	3	$11,142.39	$3,714.13	
Sandusky	Assmd. Condo	C	$8,493.44	$16,212.69	4	$24,706.13	$6,176.53	

Location	Type	Zone	Total Building Payments	Total Contents Payments	Losses	Total Payments	Average Payment	SRL
Sandusky	Single Family	AE	$48,203.52	$997.00	5	$49,200.52	$9,840.10	V
Sandusky	Single Family	C	$6,110.12	$-	2	$6,110.12	$3,055.06	
Sandusky	Single Family	A03	$9,536.45	$11.00	3	$9,547.45	$3,182.48	
Sandusky	Single Family	A03	$9,757.92	$-	3	$9,757.92	$3,252.64	
Sandusky	Single Family	C	$3,193.26	$466.43	2	$3,659.69	$1,829.85	
Sandusky	Single Family	C	$16,572.39	$7,953.46	2	$24,525.85	$12,262.93	
Sandusky	Single Family	A03	$11,728.56	$2,041.39	4	$13,769.95	$3,442.49	
Sandusky	Single Family	A03	$7,133.39	$1,676.66	2	$8,810.05	$4,405.03	
Sandusky	Single Family	A03	$15,303.44	$-	2	$15,303.44	$7,651.72	
Sandusky	Single Family	A03	$7,213.65	$2,965.50	2	$10,179.15	$5,089.58	
Sandusky	Single Family	AE	$17,918.46	$2,457.50	4	$20,375.96	$5,093.99	
Sandusky	Single Family	A03	$9,553.07	$2,129.67	3	$11,682.74	$3,894.25	
Sandusky	Single Family	A03	$5,891.26	$6,169.86	2	$12,061.12	$6,030.56	
Sandusky	Single Family	A03	$15,540.96	$5,425.00	2	$20,965.96	$10,482.98	
Sandusky	Single Family	AE	$38,799.23	$7,705.00	4	$46,504.23	$11,626.06	
Sandusky	Single Family	A03	$-	$2,458.00	2	$2,458.00	$1,229.00	
Sandusky	Single Family	A03	$5,603.38	$1,081.15	3	$6,684.53	$2,228.18	
Sandusky	Single Family	A03	$11,868.79	$6,479.90	3	$18,348.69	$6,116.23	
Sandusky	Single Family	A03	$4,388.98	$2,980.00	2	$7,368.98	$3,684.49	
Sandusky	Single Family	A03	$8,100.00	$395.00	4	$8,495.00	$2,123.75	
Sandusky	Single Family	A03	$3,142.61	$4,163.10	2	$7,305.71	$3,652.86	
Sandusky	Single Family	C	$8,835.18	$984.16	2	$9,819.34	$4,909.67	
Sandusky	Single Family	A03	$26,552.21	$9,996.24	2	$36,548.45	$18,274.23	
Sandusky	Other-Res	A03	$12,635.79	$1,782.37	2	$14,418.16	$7,209.08	
Vermilion	Assmd. Condo	A10	$62,869.14	$52,651.71	5	$115,520.85	$23,104.17	
Vermilion	Assmd. Condo	A14	$28,409.39	$15,881.16	4	$44,290.55	$11,072.64	
Vermilion	Assmd. Condo	AE	$12,195.75	$17,785.22	4	$29,980.97	$7,495.24	
Vermilion	Single Family	AE	$35,357.08	$7,248.18	3	$42,605.26	$14,201.75	PU
Vermilion	Single Family	AE	$39,083.71	$8,719.85	6	$47,803.56	$7,967.26	PU
Vermilion	Single Family	A14	$42,206.83	$22,194.00	5	$64,400.83	$12,880.17	V
Vermilion	Single Family	A08	$28,059.80	$11,538.85	6	$39,598.65	$6,599.78	V
Vermilion	Single Family	A08	$47,934.92	$19,754.67	10	$67,689.59	$6,768.96	VU
Vermilion	Single Family	A08	$11,742.27	$5,418.29	3	$17,160.56	$5,720.19	
Vermilion	Single Family	AE	$32,705.29	$2,908.07	7	$35,613.36	$5,087.62	
Vermilion	Single Family	A11	$58,788.58	$9,310.87	4	$68,099.45	$17,024.86	
Vermilion	Single Family	AE	$35,826.22	$11,434.10	10	$47,260.32	$4,726.03	
Vermilion	Single Family	A10	$11,610.57	$924.28	3	$12,534.85	$4,178.28	
Vermilion	Single Family	A	$43,054.30	$10,100.97	3	$53,155.27	$17,718.42	
Vermilion	Single Family	A10	$6,884.72	$6,564.53	3	$13,449.25	$4,483.08	

Location	Type	Zone	Total Building Payments	Total Contents Payments	Losses	Total Payments	Average Payment	SRL
Vermilion	Single Family	A10	$16,496.94	$3,884.78	6	$20,381.72	$3,396.95	
Vermilion	Single Family	A10	$7,654.10	$6,746.84	2	$14,400.94	$7,200.47	
Vermilion	Single Family	A10	$6,663.88	$4,258.72	4	$10,922.60	$2,730.65	
Vermilion	Single Family	A	$5,238.49	$646.56	3	$5,885.05	$1,961.68	
Vermilion	Single Family	A10	$26,946.65	$7,968.87	7	$34,915.52	$4,987.93	
Vermilion	Single Family	A14	$2,931.01	$-	2	$2,931.01	$1,465.51	
Vermilion	Single Family	AE	$25,544.31	$4,068.33	5	$29,612.64	$5,922.53	
Vermilion	Single Family	A14	$2,729.64	$1,903.46	2	$4,633.10	$2,316.55	
Vermilion	Single Family	A14	$18,478.73	$8,278.06	3	$26,756.79	$8,918.93	
Vermilion	Single Family	AE	$12,974.95	$3,739.75	3	$16,714.70	$5,571.57	
Vermilion	Single Family	A10	$21,248.15	$2,004.08	4	$23,252.23	$5,813.06	
Vermilion	Single Family	B	$5,468.12	$-	2	$5,468.12	$2,734.06	
Vermilion	Other-Nonres	A	$48,370.17	$13,902.51	5	$62,272.68	$12,454.54	PNU
Vermilion	Other-Nonres	A14	$75,203.96	$11,397.52	3	$86,601.48	$28,867.16	PNU
Vermilion	Other-Nonres		$186,543.90	$110,536.28	6	$297,080.18	$49,513.36	VN
Vermilion	Other-Nonres	A14	$62,954.79	$37,039.23	4	$99,994.02	$24,998.51	VN
Vermilion	Other-Nonres	X	$142,316.36	$12,513.33	2	$154,829.69	$77,414.85	
Vermilion	Other-Nonres	A14	$10,380.00	$10,109.74	3	$20,489.74	$6,829.91	
Vermilion	Other-Nonres	B	$3,663.43	$11,731.09	3	$15,394.52	$5,131.51	

MVU – Mitigated Validated Uninsured
PNU – Pending Non Residential Uninsured
PU – Pending Uninsured
V - Validated
VN – Validated Non Residential
VU – Validated Uninsured

The current development within Erie County has been primarily concentrated in the western part of the county. This development is centered in Huron Township, which is a metropolitan area to the city of Sandusky. Huron Township has floodplain ordinances that should serve as a guide in keeping new development from being constructed in high hazard areas with respect to flooding.

In 2008, the Erie County Flood Damage Prevention and Floodplain Regulations were adopted. This resolution applies to any areas of special flood hazard, which are defined in the resolution as "the land in the floodplain subject to a one percent or greater chance of flooding in any given year. Areas of special flood hazard are designated by the Federal Emergency Management Agency as Zone A, AE, AH, AO, A1-30, and A-99." The areas of special flood hazard have been identified by FEMA.

Under this resolution, any proposed development must be reviewed, and a permit must be obtained from the Floodplain Administrator before construction or development can occur within any area of special flood hazard.

The 2005 plan had a method for estimating potential losses due to flooding using historical data from the NCDC. The method utilized in this update is based upon the same historical data updated through 2019, provided by NCDC.

7.5 Lake/Stream Bank Erosion

7.5.1 Hazard Profile

Erosion is defined as the removal and transport of earth materials by natural agents. Some of these agents include glaciers, wind, water, earthquakes, volcanoes, tornadoes, hurricanes, mud flows, and avalanches.

Stream bank erosion is the direct removal of banks and beds by flowing water. Typically, it occurs during periods of high stream flow. It is sometimes confused with gully erosion because it has similarities with seasonal or ephemeral streams.

Erosion of stream or riverbanks through lateral (side) erosion and collapse often causes high sediment loads in creeks and rivers. The problem is often initiated by heavy rainfalls in catchments with poor vegetation cover, causing excess runoff. The resultant high volume and velocity runoff concentrates in the lower drainage lines or streams within catchments. When the stress applied by these stream flows exceeds the resistance of the local soil material, stream bank erosion occurs. As the sediment load increases, fast-flowing streams grind and excavate their banks lower in the landscape. Later, the stream becomes overloaded or velocity is reduced, and deposition of sediment takes place further downstream or finally in dams and reservoirs. Stream bank erosion is exacerbated by the lack of riparian zone vegetation.

Lake erosion, also known as coastal erosion, is the gradual wearing and carrying away of land or beach materials by wave action, water, wind, general weather conditions and tidal currents. It is a process which affects the landmass of an area as a consequence of the sea or lake acting upon it. It is usually caused by a relative rise in water level and the fact that the amount of sediment removed by wave energy exceeds that supplied to the beach by longshore currents. Lake erosion is of particular concern in Erie County due to Lake Erie's water levels rising to record high levels. The higher the lake's water levels, the greater chance for erosion of the lake shore, resulting in property losses. High lake levels can also cause additional erosion further inland, as waterways are flooded from the lake. The combination of high lake level rise, seiche events or other wave action can cause devastating erosion along Lake Erie.

7.5.2 Location

In Erie County lake shore erosion is primarily a concern for jurisdictions that border Lake Erie. These include Bay View, Sandusky, Huron, Vermilion, Kelleys Island and portions of unincorporated Erie County. In Ohio, a Coastal Erosion Area (CEA) is a designated land area along Lake Erie's shore that is anticipated to be lost due to Lake Erie related erosion if preventative measures are not taken. More specifically, a CEA begins at the top of a bluff, bank or beach ridge and includes all land predicted to erode within a 30-year period if that distance totals 14 or more feet. In June 1998, the ODNR finalized its first official designation of CEAs, including those portions of property along Ohio's 262-mile Lake Erie coast which appear most threatened by erosion. They totaled 2,234 parcels, which represents about 37% of Ohio's Lake Erie coastline. In 2018, ODNR published updated CEAs, including five in Erie County. Vermilion has two CEAs, but they are

located within the Lorain County portion of the City. The following chart describes the CEAs located in Erie County, by jurisdiction.

Table 21: Costal Erosion Areas in Erie County and Its Jurisdictions

Jurisdiction	Location	Predicted Erosion
Huron	Behind Huron Filtration Plant	14.5-20.3 feet
Margaretta Township	West of Willow Point Wildlife Area	22.6-138.5 feet
Sandusky	North of Lions Park	18.5-37.8 feet
Sandusky	Tip of small peninsula southeast of Cedar Point parking lot in Sandusky Bay	17.5-29.3 feet
Sandusky	East of Crosstree Lane, in the Back Bay area	22.5-25.8 feet
Vermilion (Lorain County)	Behind Menlo Park Lane at Cinema Court	17.7-21 feet
Vermilion (Lorain County)	Near Edison Estates Park	14.3-14.8 feet

Additionally, much of the areas along Erie County's waterways are at risk for stream bank erosion. Figures 42-51 shows these areas of Erie County and the participating jurisdictions. Water erosion hazard maps are provided for the townships for reference in Appendix F.

Many areas within Erie County and the Jurisdictions are at risk for water erosion. Erosion becomes a hazard when the slope of the soil is greater than two percent and increases as the slope increases. Erosion is a concern because it reduces the natural soil fertility and productivity as the original topsoil is removed and the more acid subsoil is incorporated into the surface layer through tillage. If the amount of annual soil loss exceeds the rate at which new soil is formed, long-term productivity and natural fertility are affected. Erosion is also a problem because it increases the cost of crop production, results in poor soil structure in the surface layer, increases the need for tillage to incorporate organic matter into the surface layer and reduces the available water capacity of the surface layer. Sediment removal is the costliest item in ditch maintenance. Controlling erosion protects the soil resource base, maintains long-term productivity, reduces drainage maintenance costs and improves water quality. Wind erosion is primarily a concern on sandy soils. Sod strips and windbreaks can reduce the effects of wind velocity. Windbreaks protect livestock, buildings, and yards from wind and snow. Erosion can be controlled through crop rotations, cover crops, crop residue management, water-and sediment-control basins, grassed waterways and conservation tillage, as well as plowing in the spring rather than in the fall.

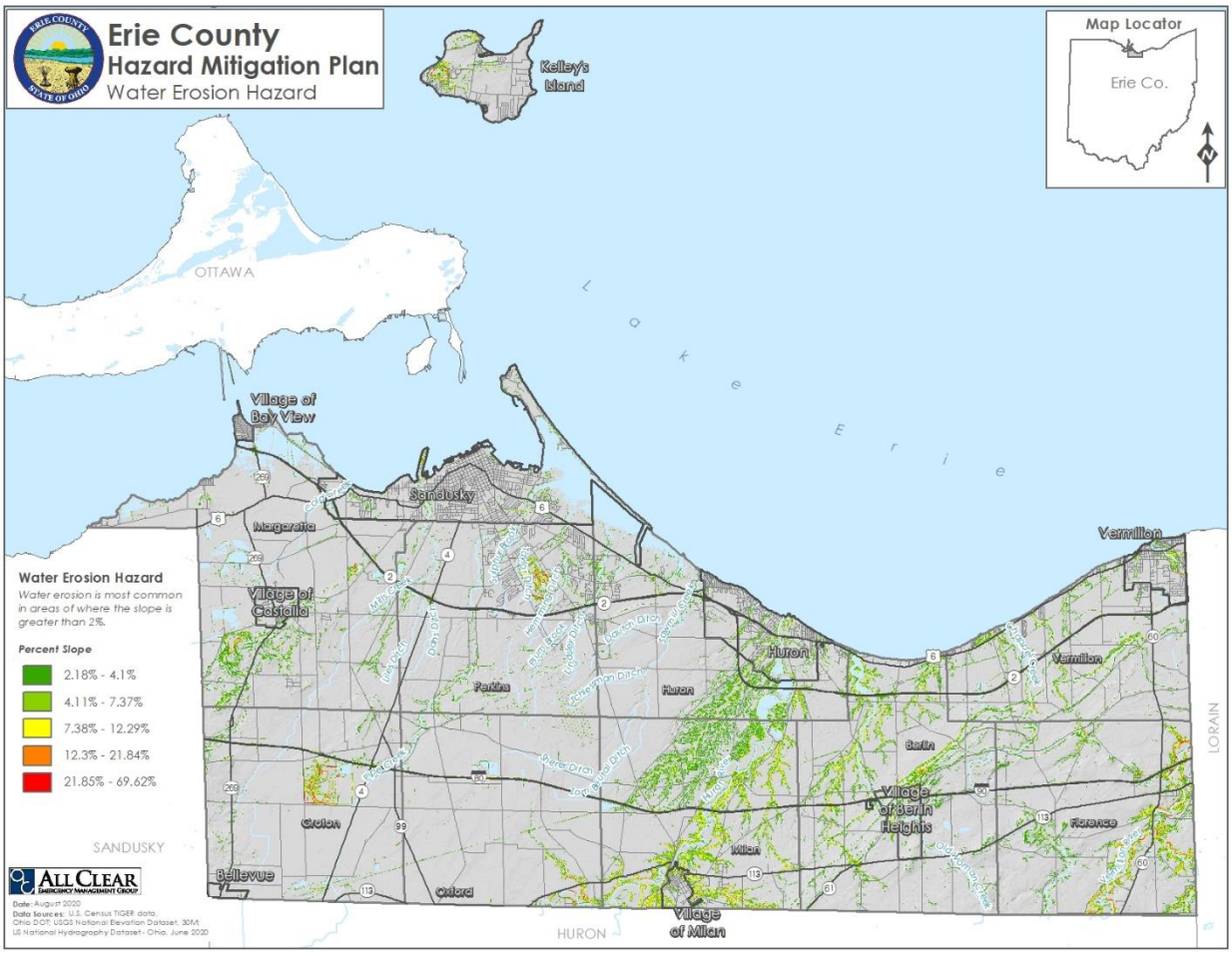


Figure 42: Water Erosion Hazard Map for Erie County

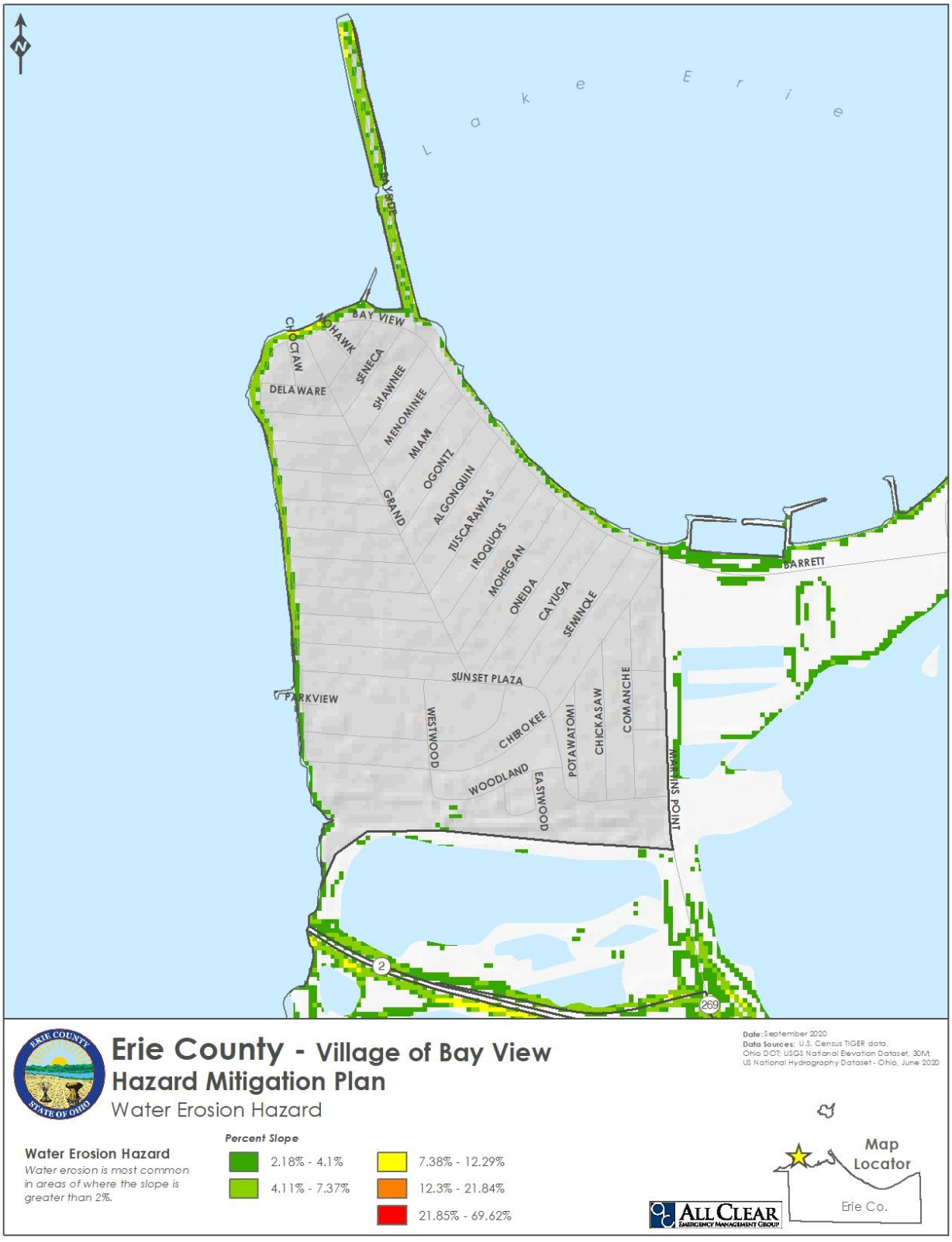


Figure 43: Water Erosion Hazard Map for the Village of Bay View

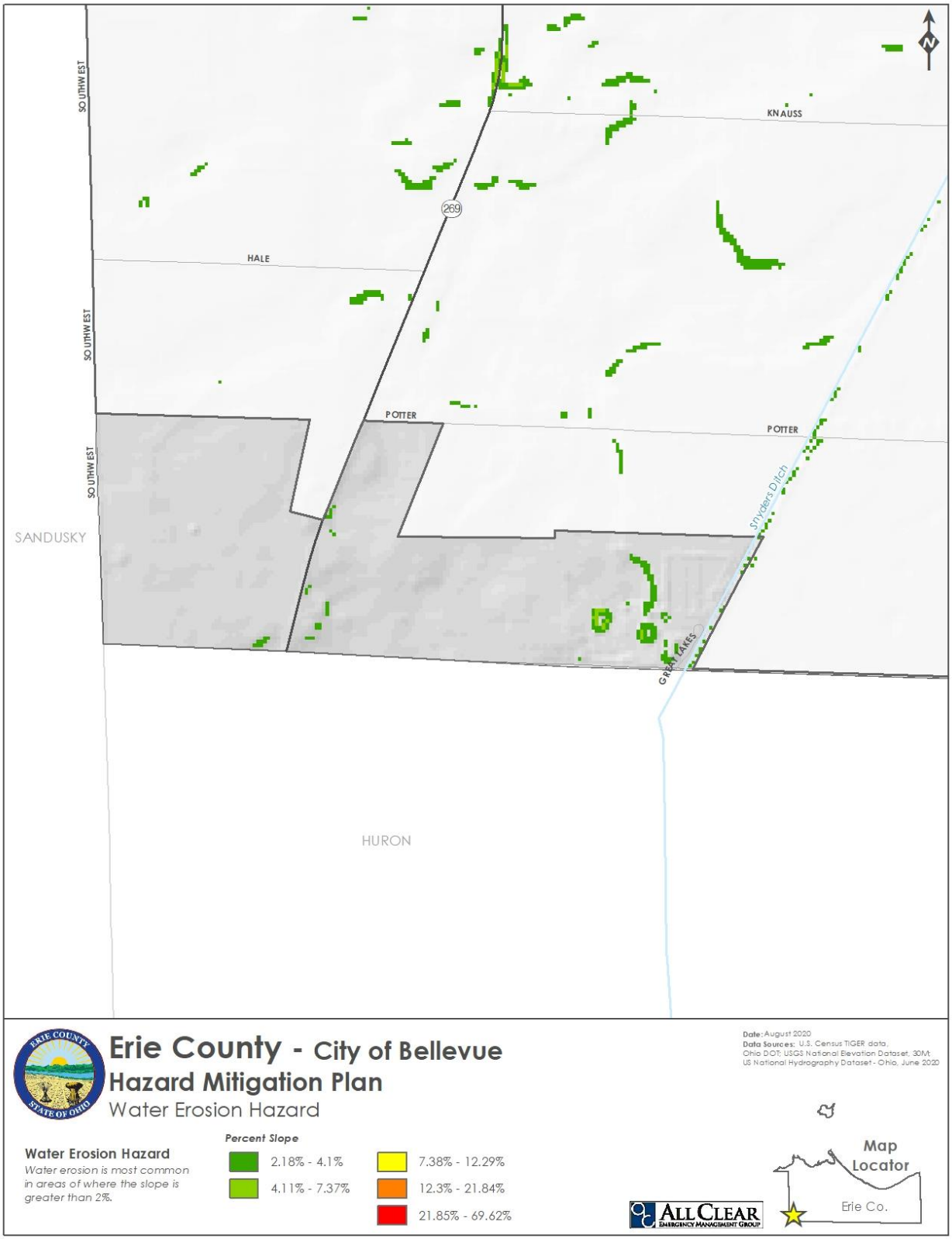


Figure 44: Water Erosion Hazard Map for the City of Bellevue (Erie County Portion Only)

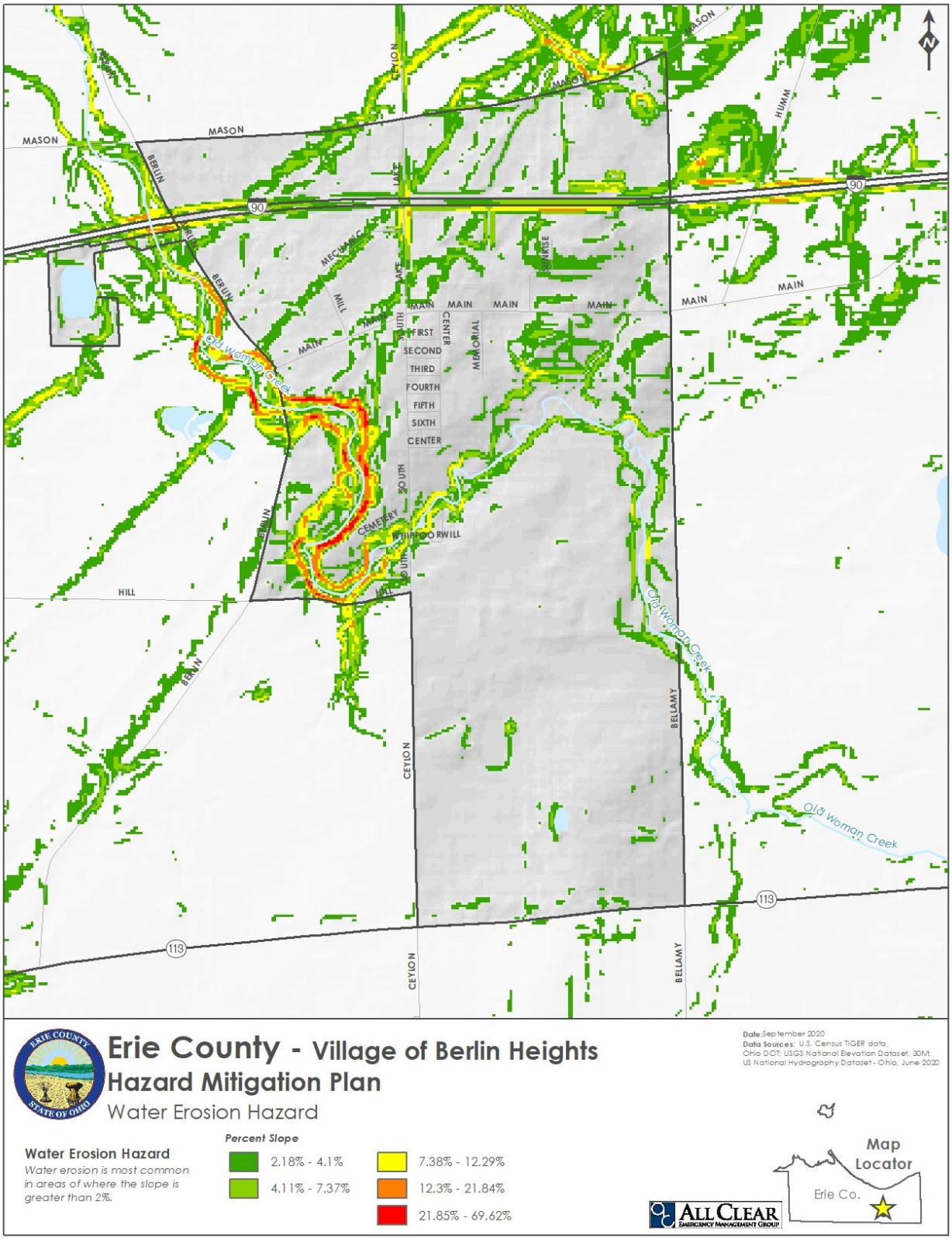


Figure 45: Water Erosion Hazard Map for the Village of Berlin Heights

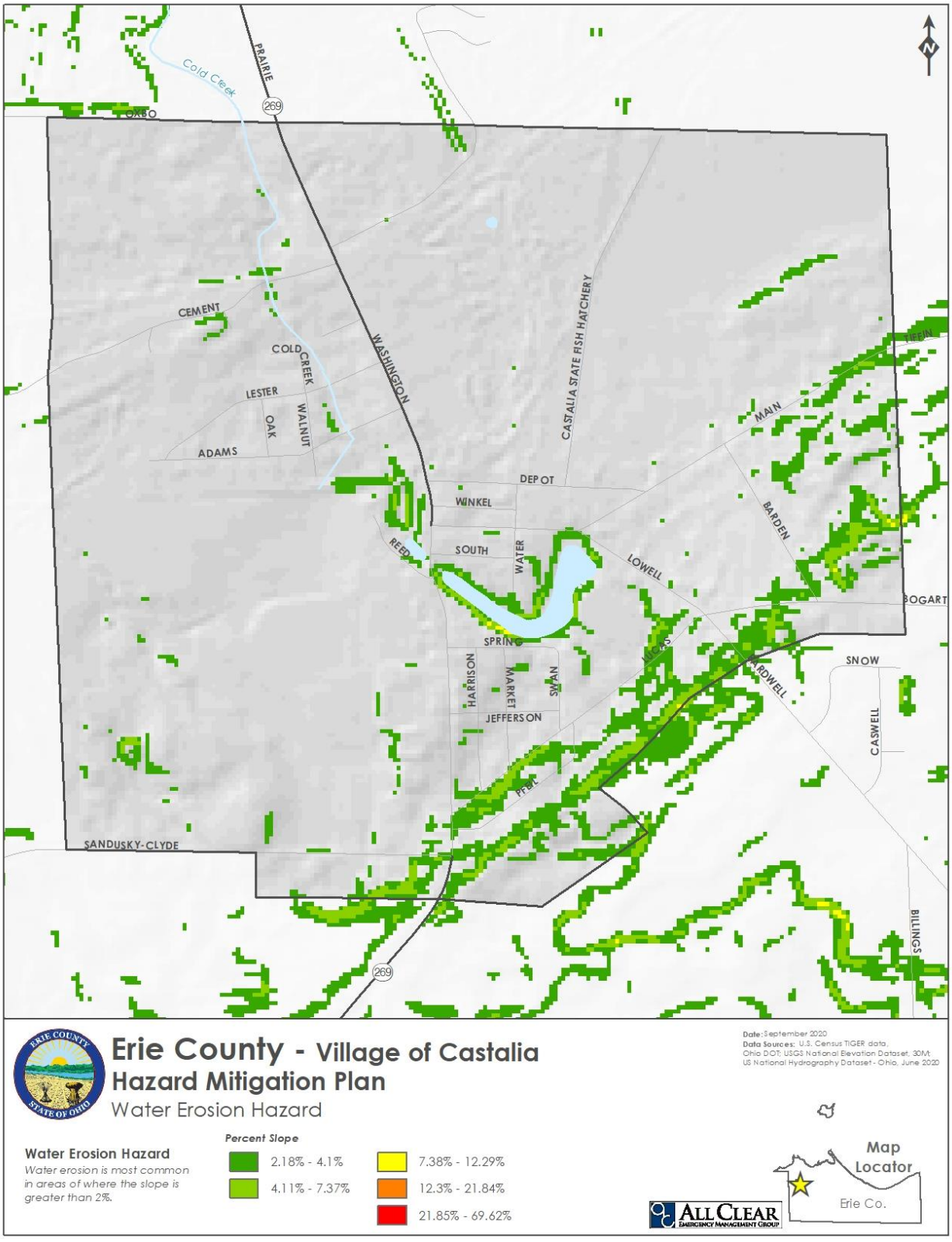


Figure 46: Water Erosion Hazard Map for the Village of Castalia

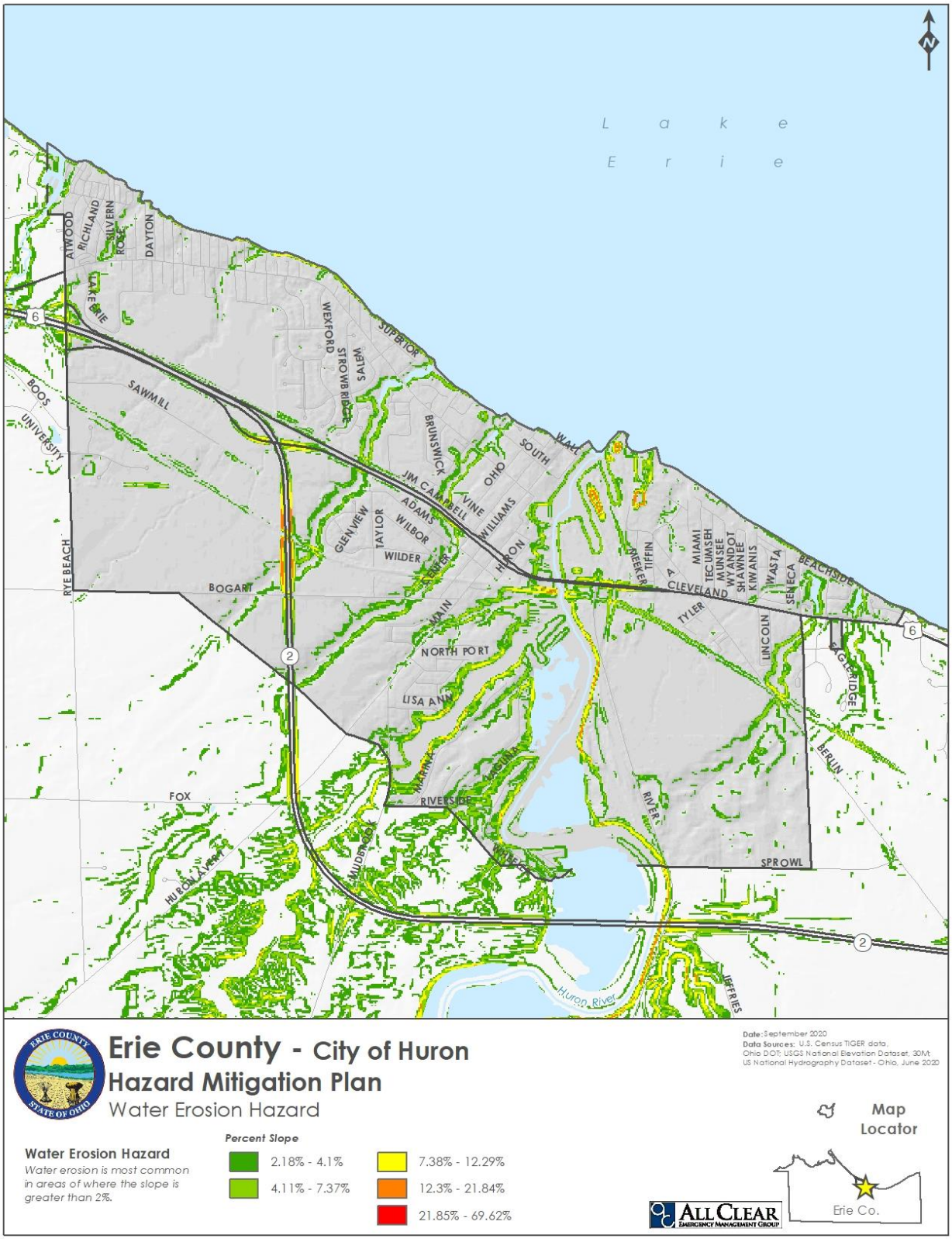


Figure 47: Water Erosion Hazard Map for the City of Huron

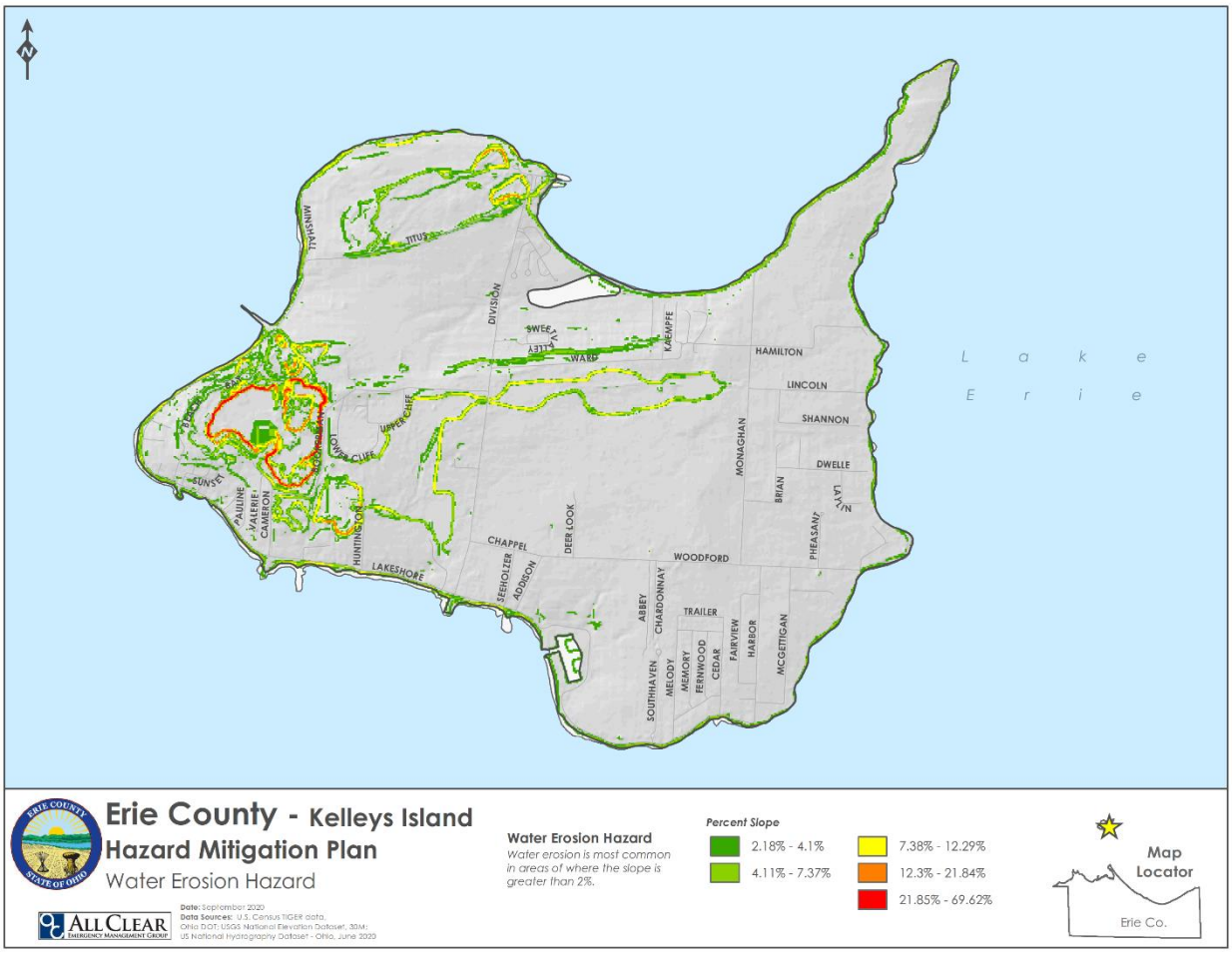


Figure 48: Water Erosion Hazard Map for the Village of Kelleys Island

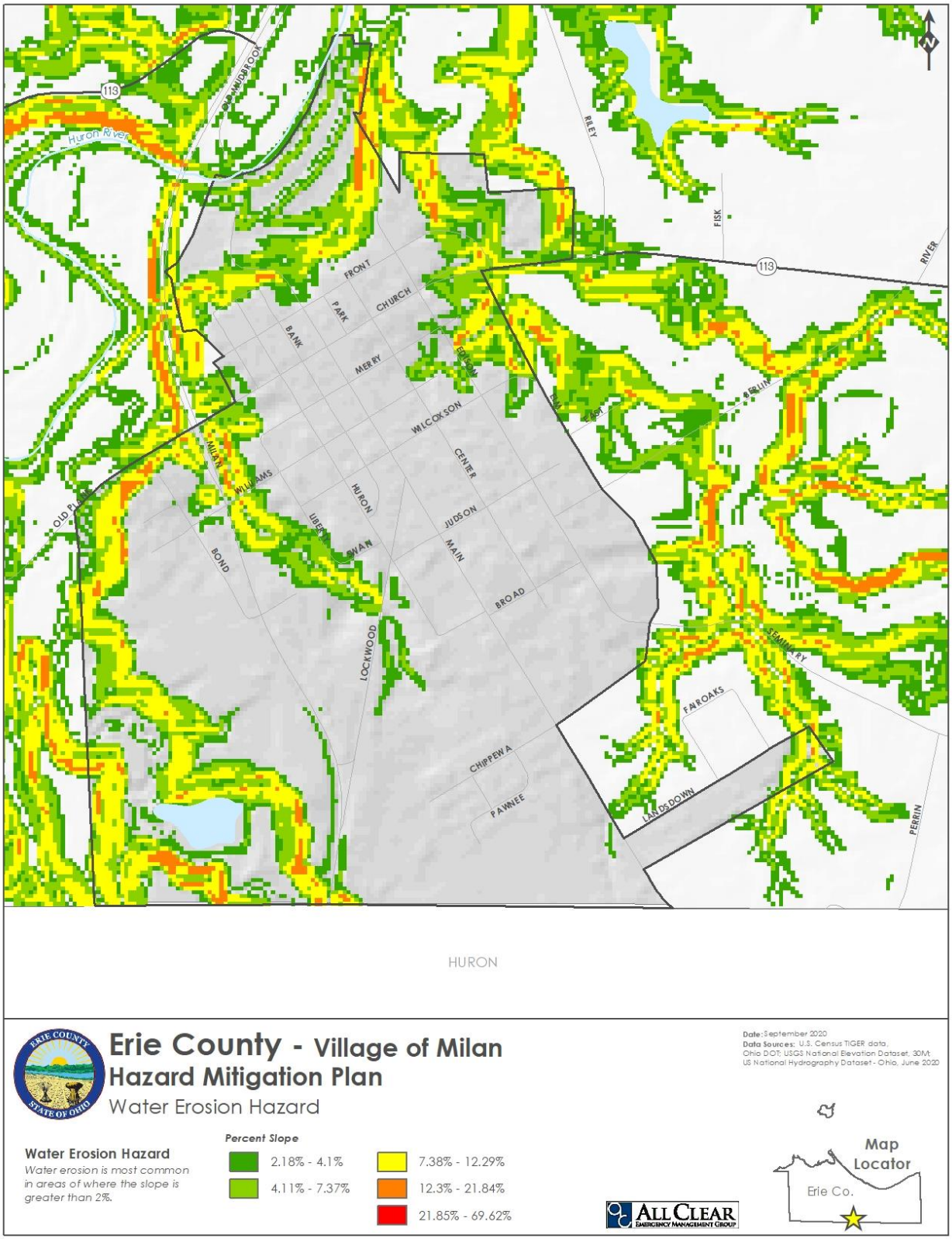


Figure 49: Water Erosion Hazard Map for the Village of Milan (Erie County Portion Only)

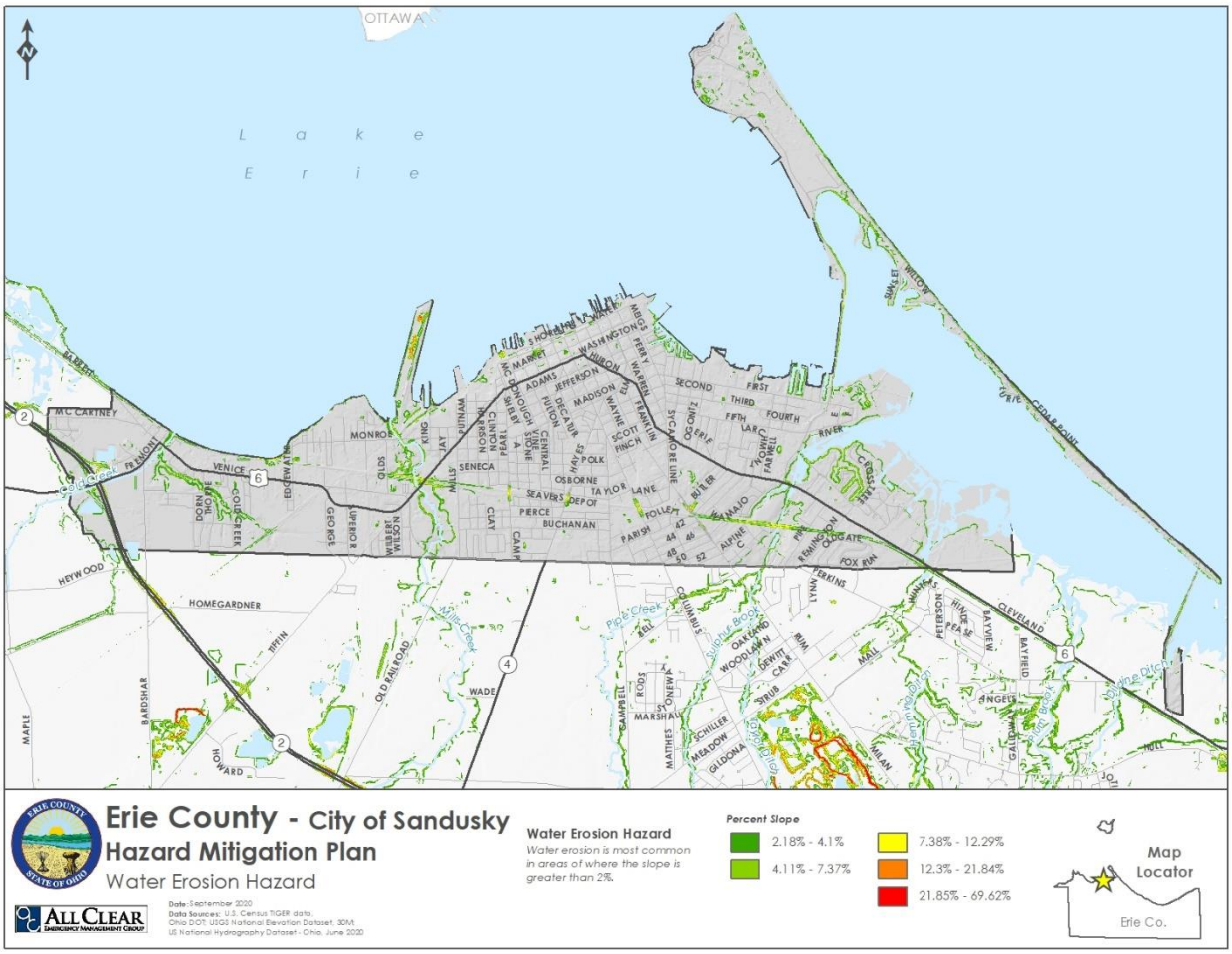


Figure 50: Water Erosion Hazard Map for the City of Sandusky

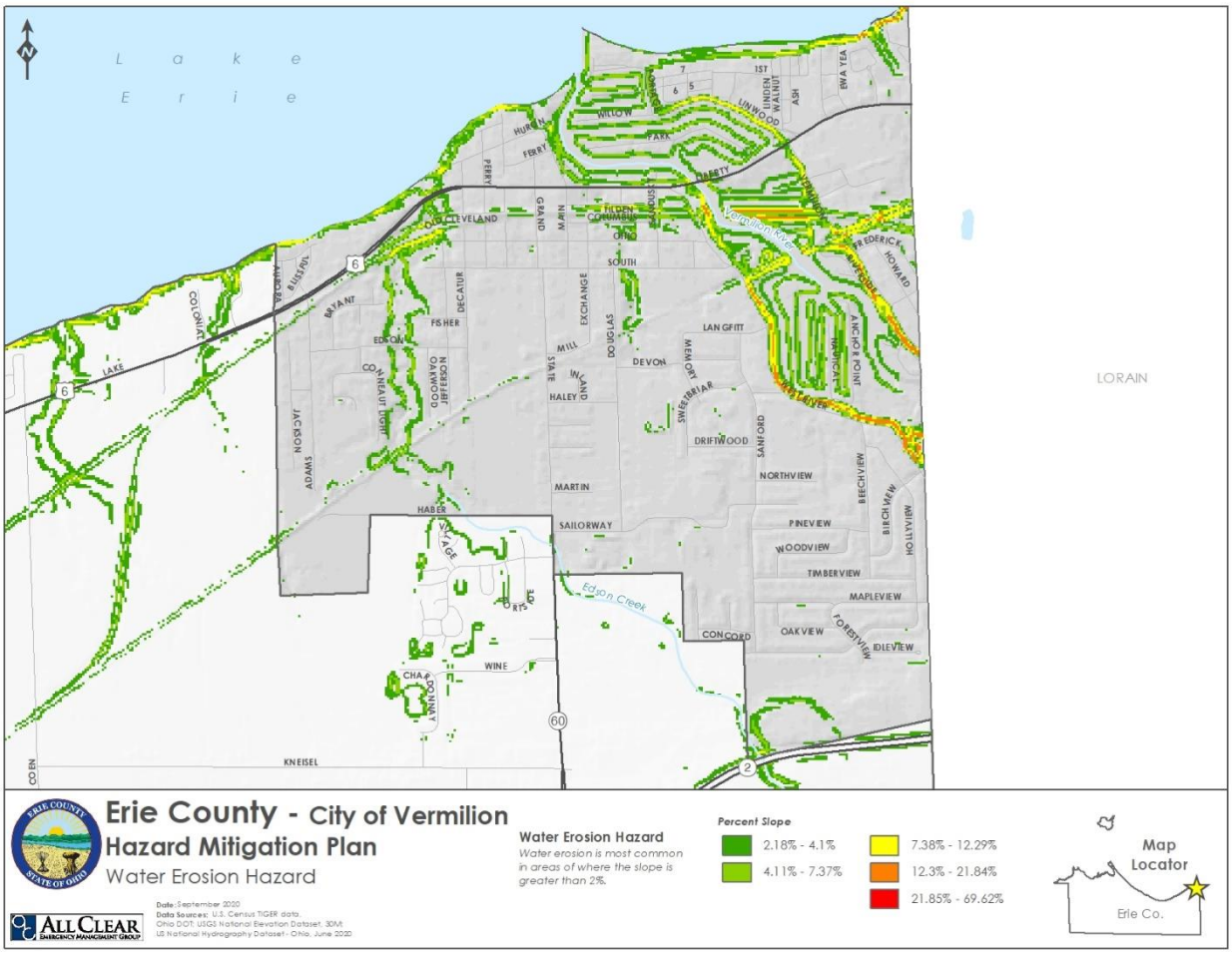


Figure 51: Water Erosion Hazard Map for the City of Vermilion

7.5.3 Extent

In addition to loss of productive land due to bank erosion, dramatic changes in the course of a river or creek often restrict access to property along the waterway. Subsequent deposition of soil causes problems on productive land downstream and sedimentation in reservoirs. Other problems include reduction in water quality due to high sediment loads, loss of native aquatic habitats, damage to public utilities (roads, bridges and dams) and maintenance costs associated with trying to prevent or control erosion sites.

Soil that has eroded and washed into the water is the chief cause of pollution in the waters of Ohio, according to the ODNR. This soil is carried along with the water. When the water's velocity decreases, the soil settles out of the water. The sediment reduces the capacity of creeks, rivers, ponds, and streams, which leads to loss of habitat for insects and fish in that waterway.

Property erosion results in accumulation of sediment and debris within and along the channel of streams and along the shores of Lake Erie. In streams, this accumulation occurs as sediment and debris settles in the channel simultaneously lowering the elevation of the stream banks and raising the elevation of the streambed. The

subsequent result is a reduction in the carrying capacity of the streams, which causes higher water elevations during future floods.

Factors that cause shoreline erosion include bluff recession, high lake levels, high winds and human activities. These cause many problems to the coastal communities of Bay View, Sandusky, Huron, Vermilion and Kelleys Island. Manmade shoreline structures that lie within a designated CEA along Lake Erie's coastline are susceptible to property damage over a 30-year period. Because of the large number of residential properties located within a CEA along the shoreline, property damages are expected to be high. There is no record of stream bank or lakeshore erosion directly causing injuries or death in Erie County, however, indirect injuries or deaths may be caused by motorists being unaware of damaged pavement and possibly driving off the road. However, damaged roads that may cause traffic accidents are typically closed for repairs to minimize the number of motorists traveling through that area.

Based on the property damage expected from stream bank and lake erosion, the impact on the local economy and local government is high. Manmade shoreline structures built along the Lake Erie shoreline are costly. They also trap sand supply, causing a beachless shoreline. Lack of beaches may have an adverse effect upon tourism in Erie County. County roadways have been impacted by rising lake levels and associated roadway erosion. These repairs have been delayed due to access issues as the roadways have been underwater for an extended period of time. These repairs are also quite costly.

7.5.4 Previous Occurrences

Various studies conducted by ODNR have measured lake shore erosion along Lake Erie. The largest measured rate of erosion was in Margaretta Township, and the shoreline eroded 90.4 feet between 2004 and 2015, for a rate of 8.2 feet per year. Erosion has also consistently occurred along stream banks, but no quantifiable data is available.[39]

7.5.5 Probability of Future Events

Since erosion is a gradual process that occurs over time, there is not an easy way to calculate the number of erosion events each year. However, according to Table 22 erosion is occurring in Erie County somewhere between one and three feet per year.

[39] (Ohio Department of Natural Resources, n.d.)

Table 22: Lake Erie Erosion Rates by Ohio County

County	Long-term Distance in Feet	Long-term Rate in Feet per Year (1877-1973)	Short-term Distance in Feet	Short-term Rate in Feet per Year (1973-1990)
Ashtabula	82	0.9	28	1.6
Lake	160	1.7	32	1.9
Cuyahoga	60	0.6	8	0.4
Lorain	80	0.8	12	0.7
Erie (Lake)	**103**	**1.6**	**42**	**2.5**
Ottawa (Lake)	208	2.0	27	1.6
Lucas	520	5.4	46	2.7
Erie (Bay)	241	2.8	32	1.9
Ottawa (Bay)	61	2.0	21	1.2

7.5.6 Vulnerability

As seen in the hazard profiles and as determined by the Core Group, Erie County has a countywide risk of incurring damage from lake erosion and stream bank erosion. The coastal area of Erie County extends inland on average from 1/8 mile to 1/4 mile on average, but continues to incorporate lake-influenced tributaries, embayments, wetlands and estuarine areas. In urban areas, the coastal boundary is generally less than 1/2 mile from the shore. Stream bank erosion occurs along the Vermilion River, Huron River, Mills Creek and their tributaries and is accelerated during flooding due to higher than normal water velocities within the streams. If property protection measures are not taken to avoid lake erosion along Lake Erie, the risk of damage to or loss of property, possessions, infrastructure and life are greatly increased.

In 1994, according to a study conducted by the H. John Henuz III Center for Science, Economics and the Environment, it is estimated that coastal erosion will destroy 87,000 buildings within 500 feet of the U.S. shoreline over the next 60 years, including the Great Lakes. Factors contributing to this erosion include rising sea levels, large storms, flooding, and powerful ocean waves. Other study findings indicate that those who live along the coast face as large a risk of damage from erosion as they do from flooding. Roughly 1,500 homes and the land on which they were built will be lost to erosion each year, with losses averaging $530 million per year.

As floodwaters overflow their banks, they carry sediment and debris from residential lawns, agricultural land and other sources further downstream and eventually into the channels of the creeks and their tributaries. This sediment and debris deposition has an adverse effect on aquatic and riparian habitats in Erie County and its watersheds. The bridges in Erie County act as collection sites for this debris, causing blockages of the floodway that raise flood elevations further downstream and also threaten evacuation routes during extreme flood emergencies. In addition, erosion left untreated may cause damage to roadways along stream banks, public piers, and marinas along Lake Erie. Undermining of pavement may cause roadways to crumble and slip down the bank, creating hazards for motorists. Public piers and marinas that are affected by erosion could be potentially dangerous, especially near recreational areas or public parks.

The areas within the County that are experiencing a higher rate of development will be more at risk for the occurrence of a landslide. Future structures on or near steep slopes may be a risk of damage due to landslide. If development on steep slopes were to disturb the land and vegetation to an unprecedented degree, the potential for damage due to landslide may increase.

Attempts were made to obtain more detailed information on the history of lake and stream bank erosion occurrences within Erie County in order to better predict both future occurrences and dollars lost associated with those occurrences. However, these events are not recorded by the NCDC so an estimate cannot be calculated.

Due to the lack of information regarding dollars lost associated with lake and stream bank erosion occurrences, the value for the maximum potential dollar losses is not able to be accurately calculated.

7.6 Natural Biohazards

7.6.1 Hazard Profile

Natural biohazards is a term to refer to any hazard that is caused by an organism. For the Erie County Natural Hazard Mitigation Plan, two types of natural biohazards are considered: Invasive Species and Harmful Algae Blooms.

Invasive species are any organism that are not native to an ecosystem that cause harm to that ecosystem. They are not just limited to plants and animals, but can include insects, fish, fungus, and even bacteria. In Ohio, more than 3,000 different species of plants are known to grow. Approximately 25% of these plants are non-native, and were not present before about 1750 when European settlers began expanding into the region in significant numbers. Sometimes, non-native species are introduced on purpose, for agriculture, medicinal use, erosion control or more, but other times, the species are introduced by accident. The Great Lakes, and Lake Erie especially, are extremely vulnerable to aquatic invasive species. To date, more than 185 different non-native species have been identified in the Great Lakes, and due to Lake Erie's characteristics (shallower, warmer, more biologically active), Lake Erie is very susceptible. Invasive species threaten water quality, native fish, wildlife, plants, fisheries, recreation and tourism, all of which are important to Erie County.

Harmful Algae Blooms (HAB) also have effects on the plant and aquatic life in Lake Erie. Algae blooms form in waters that are rich in nutrients, such as iron, nitrogen and phosphorus. Warmer waters also help algae blooms to grow more quickly. In freshwater, HABs most commonly form from cyanobacteria. Algae blooms can block sunlight at the surface of the water and not allow native plants to get a necessary amount to live. In addition, as algae die and sink to the bottom of the lake, bacteria decompose the dead algae and consume oxygen in the water in the process. As a result, there is a dead zone in central Lake Erie that has covered up to a third of the lake bottom in recent years, according to the New York Times. HABs can also produce toxins that can poison humans and animals that come into contact with them. This poisoning can carry up the food chain and sicken an animal or human that consumes fish that was contaminated by the toxins.

7.6.2 Location

All parts of Erie County and its jurisdictions are at risk of invasive species; however, the habitat of the invasive species dictates the precise locations that is affected. For example, the emerald ash borer only affects ash trees and aquatic invasive species affect Lake Erie as well as inland waterways and bodies of water.

Harmful Algae Blooms can occur in fresh water, marine water and brackish water. In Erie County, while HABs can occur in smaller bodies of water, those that occur in Lake Erie are of primary concern. In Lake Erie, HABs typically form first in Maumee Bay at the mouth of the Maumee River and in Sandusky Bay at the mouth of the Sandusky River because blue-green algae prefer warm water and high concentrations of phosphorus. Both bays are very warm and shallow, and the watersheds of both rivers have very high percentages of farmland (the Maumee is the largest tributary to the Great Lakes and

drains 4.2 million acres of agricultural land). As a result, both streams contain very high concentrations of phosphorus that eventually feeds into Lake Erie.[40]

7.6.3 Extent

Without natural predators or controls, invasive, non-native plants can spread quickly and force out native plants. In Ohio, several non-native plants are invading woodlands and displacing native spring wildflowers. Other non-native plants are impacting our wetlands by creating monocultures. Native plant diversity is important for wildlife habitat, as many animals depend on a variety of native plants for food and cover.

There are more than 185 non-native species in the Great Lakes, and by some estimates, cause $5.4 billion in damages. In Lake Erie particularly, invasive species threaten drinking water supplies and commercial fisheries. According to a report by the Ohio Department of Natural Resources, the top aquatic invasive species are:

1. Asian Carp
2. Curlyleaf Pondweed
3. Hydrilla
4. Round Goby
5. Ruffe
6. Red Swamp Crayfish
7. Sea Lamprey
8. White Perch
9. Zebra Mussel

According to the ODNR, Division of Forestry one of the most invasive insect species in Ohio is the Emerald Ash Borer. This Asian pest is part of a group of insects known as metallic wood-boring beetles. Emerald Ash Borer affects all species of native ash found in Ohio. Because North American ash trees did not coexist in association with this pest, they have little or no resistance to its attack. This ash tree-killing insect from Asia was unintentionally introduced to southeastern Michigan several years ago. In February of 2003, it was first found feeding on ash trees in northwest Ohio.

Emerald Ash Borer larvae feed on the living portion of the tree, directly beneath the bark. This eating habit restricts the tree's ability to move essential water and nutrients throughout the plant. In three to five years, even the healthiest tree is unable to survive an attack.

Another concern for Erie County is the eutrophication occurring in Lake Erie, especially due to the growing presence of blue/green algae. Algae blooms are caused by excess nitrogen and phosphorous in Lake Erie due incoming sources of polluted runoff, especially the Maumee and Detroit Rivers. The New York Times reported about the algae bloom issue in Lake Erie "It is perhaps the greatest peril the lake has faced since the 1960s, when relentless and unregulated dumping of sewage and industrial pollutants spawned similar algae blooms and earned it the nickname "North America's Dead Sea."' The

[40] (Ohio Emergency Management Agency, 2019)

recovery during the 1970's and 1980's was an $8 billion project to clean up Lake Erie. Recently the cause of the blooms is not unregulated dumping, but the phosphorus pollution mainly due to farming techniques. Nutrients that fuel cyanobacteria blooms usually come from the nitrogen in agricultural runoff; the runoff makes its way into streams and rivers, eventually flowing into large waterbodies such as lakes.

The zebra mussel, a dominant invasive species, are assisting the growth of toxic algae blooms. Zebra mussels consume nontoxic green algae and also produce phosphorus, therefore eliminating the toxic algae's competitor while also providing food for the toxic green/blue algae. They also can cause considerable damage to boats, water intake equipment, beaches, and even other aquatic animals.

7.6.4 Previous Occurrences

Invasive species of plants, fish and insects have been arriving in Ohio since the establishment of European settlers in the 1750s. With each improvement in the scale and speed of human transportation, the potential for unintended introduction of invasive species has increased. Organisms which could not survive the month-long journey from Europe or Africa to America can make the journey in a matter of hours today. Several examples of species introduction pathways follow:

The Round Goby species was introduced from Eurasia into the St. Clair River and vicinity on the Michigan-Ontario border where several collections were made in 1990 on both the U.S. and the Canadian side. Speculation exists the Goby was transported from its native Caspian Sea by way of ballast tanks on ocean going vessels. Today the Goby is found in all the Great Lakes and is making inroads in all contiguous state watersheds.

The Multiflora Rose was introduced to the U.S. from Japan in 1886 as an under-stock for ornamental roses. Birds are responsible for spreading the seeds, which remain viable for a number of years. In the 1930s, the Soil Conservation Services advocated the use of Multiflora Rose for erosion projects and as a way to confine livestock. Hedges of Multiflora Rose have also been used as a crash barrier and to reduce headlight glare in highway medians.

The Emerald Ash Borer was introduced into North America sometime in the 1990's. The insect is believed to have been introduced into the U.S. in wood packing material from China. It was first reported killing ash trees in the Detroit and Windsor areas in 2002. Only species of ash are hosts for the beetle, which usually kill infested trees within a couple of years. Since then, infestations have been found throughout Lower Michigan, Ohio, northern Indiana, the Chicago area, Maryland, Pennsylvania, West Virginia, and parts of New England.

In August 2014, for example, high microcystin concentrations caused by blue-green algae blooms were detected in drinking water from Lake Erie. As a result, the water supply to 400,000 people in Toledo, Ohio, was shut down.[41]

7.6.5 Probability of Future Events

Since the beginning of European colonization non-native species have been arriving in Ohio. With the increase in global trade and travel the probability of new and unexpected species arriving in Ohio will continue to grow. Legislation is in place around the world in an attempt to control the migration of unwanted species between ecosystems. The ODNR is currently battling the entrance of wild boars from Kentucky and West Virginia. In addition, there are several species of carp currently migrating up the Mississippi watershed from the Gulf Coast. Although not currently reported in any Ohio waterways, the probability of future infestations is near certain. It is certain that new species will arrive in Ohio. The importance of controlling the integrity of existing ecosystems will require ongoing state, national, and international efforts to avoid unwanted infestations.

Climate change will bring more rain and snow, higher average temperatures, and flooding to the Great Lakes region. More rain and snowfall increase runoff of the nutrients that fuel harmful algal blooms into the lake. The cyanobacteria that cause HABs also prefer the warmer water that comes with the higher air temperature caused by climate change. When combined, these changing conditions can increase the severity of harmful algal blooms. Global climate change may have an impact on the probability of future events; however, it is unclear the extent of this impact.

In Lake Erie, more than 65% of the phosphorus that causes HABs comes from agricultural fertilizer and manure runoff. Some phosphorus also comes from sewage treatment plants, combined sewer overflows, water treatment plants, cleaning products, faulty septic tanks and residential lawn fertilizers. The largest phosphorus load, about 80-90%, happens during heavy rain storms when fertilizer and other phosphorus sources are quickly washed into rivers and streams that flow into Lake Erie. [42]

NOAA and its research partners predicted that western Lake Erie will experience a harmful algal bloom (HAB) of cyanobacteria in 2020 that was larger than the mild bloom in 2018. Scientists expect the 2020 bloom to measure greater than a 7 on the severity index. The severity index is based on a bloom's biomass – the amount of its harmful algae – over a sustained period. The largest blooms, 2011 and 2015, were 10 and 10.5, on that index, respectively. The bloom in 2018 had a severity of 3.6 considered a mild bloom. However, the size of a bloom is not necessarily an indication of its toxicity.[43]

[41] (National Science Foundation, 2019)
[42] (Ohio Emergency Management Agency, 2019)
[43] (National Oceanic and Atmospheric Administration, 2020)

7.6.6 Vulnerability Assessment

Because Erie county is located on Lake Erie, there is a high risk of introducing aquatic invasive species from Welland and Erie barge canals as well as ballast water from incoming ships.

Invasive species can cause infiltration into crop lands, damage to drinking water processing facilities and utilities, impacts to in-water structures, and financial impacts to loggers and marinas and boaters.

Invasive Species and HABs can have a wide range of impacts on structures and critical facilities, ranging from negligible to devastating. The most prominent impact to facilities relates to the maintenance of marinas in Zebra Mussel impacted areas as well as protecting drinking water sources in areas where HABs and other natural biohazards occur.

Invasive species and HABs are not expected to have a significant impact on future buildings.

The effect of invasive species is hard to estimate for Erie County because of the lack of information isolating Erie County. Every invasive species is unique and therefore mitigation costs vary widely. Impacts of invasive species tend to have a greater impact on the operations of organizations than the structural impacts most of the other hazards have. Due to this unique situation, rather than a matrix of counties and losses the loss estimates will be presented using historical response costs to predict future losses in unadjusted dollars. These costs are for the State of Ohio and not specifically for Erie County but they give an idea of how costly invasive species can be.

From the perspective of invasive plant species, the Multiflora Rose is one of most expensive to combat in Ohio. Each individual plant's ability to produce 500,000 seeds a year allows this invasive species to spread over large area with incredible speed. Agricultural groups are facing the highest exposure and expense in the form of infiltration of crop lands and eradication programs. According to agricultural experts associated with The Ohio State University, Ohioans are estimated to spend millions of dollars combating the Multiflora Rose. Precise dollar figures are not available due to most response activities largely privately funded.

Four known methods of responding to invasive plant species exist. First, the removal of the plant, including the roots, can be cost effective in small applications. Second, repeated defoliation or mowing down the plants will eventually kill almost any plant. Third, the use of herbicides can be effective if applied at specific stages of the plant's growth. All of the above management techniques can be expensive and labor intensive. The last method is the use of Rose Rosette Disease, a mite-vectored virus, which is giving rise to a hope for a lower cost control agent.

The Zebra Mussel is one of the most expensive to control and can be very damaging. The mussels naturally collect on any solid surface and create significant problems for drinking water processing facilities and utilities. All in-water structures are impacted including, but

not limited to, piers, breakwalls, vessel hulls, and vessel engines cooled with external water. Estimates for controlling infestations cost between $2 and $10 million per year depending on how many sources are aggregated. If the Zebra Mussel effectively invade the river systems of Ohio, it is suggested the annual control costs could rise 10-fold.

Invasive insect species are both the direct source of damage to trees and a vector for other parasites. In the last century, the North American population of Elm trees was decimated by a fungus which arrived on infected trees shipped to an Ohio furniture company. One of the primary transport methods is through beetles which the fungus uses as a host to move from tree to tree. The beetle's ability to fly exponentially increased the number of trees impacted. Trees located in non-urban areas posed financial impact only to loggers; however, the Elm was a popular urban tree and the cost to remove them has risen into the millions over the years.

The Emerald Ash Borer, which is currently impacting the North American Ash tree, has already cost millions of dollars in attempts to identify and isolate infected trees. In Ohio alone there are an estimated 5 billion Ash trees at risk. Although many research centers are searching for an effective means of combating the insect, the only method currently available is the use of insecticides which must be applied annually. The un-captured cost to treat Ash trees in Ohio will likely reach into the millions, as urban areas combat the insect.

HABs can produce toxins that are capable of causing illness and sometimes even death. Microcystin is the most concerning toxin as it causes skin rashes, GI problems and varying degrees of nervous system, liver and kidney damage. While most healthy adults recover from contact with the toxin, it can be more problematic to children, the elderly and people with pre-existing conditions that weaken their systems. Exposure has also killed people in other parts of the world. The toxin can also be fatal to pets that drink or come in contact with contaminated water.[44]

The effect of HABs is difficult to estimate for Erie County because of the lack of information isolating Erie County. Every Harmful Algae Bloom is unique and therefore mitigation costs vary widely. Due to the lack of information regarding dollars lost associated with Harmful Algae Bloom (HABs) occurrences, the value for the maximum potential dollar losses is not able to be accurately calculated.

Of the Great Lakes, Lake Erie has particularly high vulnerability to HABs. As the southernmost, shallowest and warmest of the Great Lakes. Its watershed has the least forest, the most agricultural land and the second-most urban/suburban land. Therefore, Lake Erie gets more sediment and nutrients (fertilizer runoff, sewage, etc.) than the other lakes, while also having environmental conditions that favor algal blooms.

[44] (Ohio Emergency Management Agency, 2019)

7.7 Severe Summer Weather

7.7.1 Hazard Profile

In order to better address specific risks and vulnerabilities, severe summer weather and severe winter weather were separated into two separate hazards for this plan update. Severe summer weather includes hail, lightning, thunderstorms and extreme heat. Often thunderstorms can also cause damaging winds. For this Natural Hazards Mitigation Plan, damaging winds not associated with thunderstorms are included as a separate hazard due to their frequency of occurrence and their impact.

Hail is frozen precipitation that is formed when columns of air within a thunderstorm carry rain drops to high altitudes and very cold temperatures. Hail can cause damage to buildings and crops, and cause injuries to people.

Lightning is an electrical current between the ground and a cloud. A single bolt of lightning can reach over 5 miles in length, contain 100 million volts, and reach temperatures of about 50,000 degrees. Every year, about 54 people in the US die from being struck by lightning. Lightning can also cause fires or damage power lines.

Thunderstorms are storms that produce lightning, and occasionally damaging winds, or hail. They can even spawn tornadoes under the right circumstances. Most tornadoes are caused by a supercell thunderstorm, which can last several hours. Tornadoes are discussed as a separate hazard.

Extreme heat is defined as an extended period of time with high temperatures and humidity. Typically, it will be considered an extreme heat event if the temperatures reach 90 degrees for at least 2-3 days in a row. However, this definition can vary by location. For an area where heat at or above 90 degrees is not unusual, it is likely not going to be classified as a hazard event unless the temperatures and humidity exceed what is normal for that area. Extreme heat can occur without warning and young children and the elderly are most vulnerable, as well as individuals who work outdoors. Extreme heat can lead to dehydration, heat exhaustion, heat stroke, or even death.

7.7.2 Location

Erie County is in the north central portion of the state and is susceptible to severe summer weather, which may be experienced at any location in Erie County. Because severe summer weather is random in nature, the entire county population is susceptible and should be prepared. Populations located in mobile home parks and campgrounds are particularly at risk due to the lack of appropriate shelter.

7.7.3 Extent

Severe summer storms occur regularly throughout the State of Ohio. All of Erie County is exposed to the hazards associated with severe summer weather. Hail, lightning, and thunderstorms can occur throughout the year, but are most common during warmer months, which is why they are classified as summer weather. Extreme heat is most likely to occur during the summer. The largest diameter of hail recorded in Erie County since

1955 was two inches, which occurred three times, May 7, 2010, May 25, 2011, and August 8, 2012. The highest wind, associated with a thunderstorm, was 98 miles per hour, which occurred on November 10, 1998 along the shore of Lake Erie.

7.7.4 Previous Occurrences

Erie County is highly susceptible to severe summer weather, which encompasses thunderstorms, lightning, and hail. According to the NCDC, there have been 103 hail events since 1955, seven lightning events since 1996, and 197 thunderstorm-wind events since 1955 and two heat events since 1996. Together, these four types of severe summer weather phenomena have caused over $9 million in property damage in Erie County over the time periods specified. A complete list of these storms is provided below in Tables 23-26.

Table 23: Hail Events in Erie County 1955-2019

Location	Date	Type	Magnitude (Inch Hail)	Deaths	Injuries	Property Damage	Crop Damage
Erie Co.	4/14/1974	Hail	0.75	0	0	$-	$-
Erie Co.	6/15/1974	Hail	1	0	0	$-	$-
Erie Co.	7/10/1975	Hail	0.75	0	0	$-	$-
Erie Co.	8/21/1980	Hail	1.75	0	0	$-	$-
Erie Co.	5/22/1982	Hail	1.75	0	0	$-	$-
Erie Co.	6/22/1982	Hail	1	0	0	$-	$-
Erie Co.	6/22/1982	Hail	1	0	0	$-	$-
Erie Co.	6/22/1982	Hail	1.75	0	0	$-	$-
Erie Co.	7/21/1983	Hail	1	0	0	$-	$-
Erie Co.	3/28/1985	Hail	1	0	0	$-	$-
Erie Co.	3/28/1985	Hail	1.75	0	0	$-	$-
Erie Co.	3/28/1985	Hail	1	0	0	$-	$-
Erie Co.	3/27/1991	Hail	1.75	0	0	$-	$-
Erie Co.	8/19/1991	Hail	1	0	0	$-	$-
Erie Co.	8/30/1992	Hail	0.75	0	0	$-	$-
Erie Co.	9/9/1992	Hail	1.75	0	0	$-	$-
Sandusky	5/25/1994	Hail	0.75	0	0	$-	$-
Erie Co.	7/6/1994	Hail	0.75	0	0	$-	$-
Castalia	6/29/1997	Hail	0.88	0	0	$-	$-
Sandusky	4/8/1998	Hail	1	0	0	$-	$-
Sandusky	4/8/1998	Hail	0.75	0	0	$-	$-
Sandusky	5/31/1998	Hail	1	0	0	$-	$-
Castalia	5/31/1998	Hail	0.75	0	0	$-	$-
Countywide	6/12/1998	Hail	0.75	0	0	$-	$-
Crystal Rock	6/24/1998	Hail	0.75	0	0	$-	$-
Castalia	6/28/1998	Hail	1	0	0	$-	$-
Sandusky	7/21/1998	Hail	0.75	0	0	$-	$-
Countywide	10/13/1999	Hail	0.75	0	0	$-	$-
Kelleys Island	8/2/2000	Hail	0.88	0	0	$-	$-
Milan	7/1/2001	Hail	0.75	0	0	$-	$-
Milan	7/1/2001	Hail	0.75	0	0	$-	$-
Berlin Heights	5/30/2002	Hail	0.88	0	0	$10,000	$-
Vermilion	6/14/2002	Hail	0.75	0	0	$5,000	$-
Sandusky	6/21/2002	Hail	0.75	0	0	$-	$-
Sandusky	9/26/2003	Hail	0.75	0	0	$-	$-
Milan	4/17/2004	Hail	0.75	0	0	$-	$-
Castalia	4/17/2004	Hail	1	0	0	$2,000	$-

Location	Date	Type	Magnitude (Inch Hail)	Deaths	Injuries	Property Damage	Crop Damage
Castalia	5/17/2004	Hail	0.75	0	0	$-	$-
Sandusky	4/20/2005	Hail	0.75	0	0	$-	$-
Castalia	4/20/2005	Hail	0.75	0	0	$-	$-
Huron	4/20/2005	Hail	0.75	0	0	$-	$-
Huron	5/13/2005	Hail	0.75	0	0	$-	$-
Kimball	4/7/2006	Hail	0.88	0	0	$-	$-
Milan	4/7/2006	Hail	0.75	0	0	$-	$-
Florence	4/7/2006	Hail	0.75	0	0	$-	$-
Milan	4/21/2006	Hail	0.75	0	0	$-	$-
Birmingham	4/23/2006	Hail	0.75	0	0	$-	$-
Sandusky	6/19/2006	Hail	0.75	0	0	$-	$-
Sandusky	6/19/2006	Hail	0.88	0	0	$-	$-
Sandusky	6/19/2006	Hail	0.75	0	0	$-	$-
Kimball	6/19/2006	Hail	0.75	0	0	$-	$-
Sandusky	6/22/2006	Hail	0.88	0	0	$-	$-
Sandusky	6/22/2006	Hail	0.75	0	0	$-	$-
Weyers	5/30/2007	Hail	0.75	0	0	$-	$-
Berlin Heights	5/3/2008	Hail	0.88	0	0	$-	$-
Berlin Heights	6/22/2008	Hail	0.75	0	0	$-	$-
Berlin Heights	6/22/2008	Hail	1	0	0	$-	$-
Vermilion	6/22/2008	Hail	0.75	0	0	$-	$-
Kelleys Is	6/22/2008	Hail	0.75	0	0	$-	$-
Columbus Park	7/23/2008	Hail	0.88	0	0	$-	$-
Sandusky	7/23/2008	Hail	0.75	0	0	$-	$-
Sandusky	6/19/2009	Hail	0.75	0	0	$-	$-
Sandusky	6/25/2009	Hail	1	0	0	$20,000	$-
Sandusky	8/11/2009	Hail	0.75	0	0	$-	$-
Huron	4/25/2010	Hail	0.75	0	0	$-	$-
Sandusky	5/7/2010	Hail	2	0	0	$250,000	$-
Huron	5/7/2010	Hail	1.25	0	0	$15,000	$-
Sandusky	5/7/2010	Hail	1	0	0	$-	$-
Vermilion	5/7/2010	Hail	1	0	0	$-	$-
Milan	5/14/2010	Hail	0.88	0	0	$-	$-
Sandusky	6/23/2010	Hail	1	0	0	$-	$-
Sandusky	6/23/2010	Hail	1	0	0	$-	$-
Sandusky	6/27/2010	Hail	0.75	0	0	$-	$-
Huron	5/12/2011	Hail	0.75	0	0	$-	$-
Avery	5/12/2011	Hail	1	0	0	$5,000	$-
Vermilion	5/23/2011	Hail	0.88	0	0	$-	$-
Castalia	5/25/2011	Hail	1.5	0	0	$20,000	$-
Sandusky	5/25/2011	Hail	2	0	0	$400,000	$-
Sandusky	5/25/2011	Hail	1.75	0	0	$300,000	$-
Huron	5/25/2011	Hail	1	0	0	$10,000	$-
Milan	5/25/2011	Hail	1.75	0	0	$125,000	$-
Huron	5/29/2011	Hail	1	0	0	$-	$-
Vermilion	8/1/2011	Hail	1	0	0	$-	$-
Sandusky	7/1/2012	Hail	0.75	0	0	$-	$-
Venice	7/1/2012	Hail	1.25	0	0	$-	$-
Sandusky	7/1/2012	Hail	1	0	0	$-	$-
Columbus Park	8/9/2012	Hail	2	0	0	$15,000	$-
Sandusky	9/7/2012	Hail	0.75	0	0	$-	$-
Milan	9/7/2012	Hail	0.75	0	0	$-	$-
Milan	4/8/2013	Hail	1	0	0	$1,000	$-
Sand Hill	7/10/2013	Hail	1.25	0	0	$25,000	$-

Location	Date	Type	Magnitude (Inch Hail)	Deaths	Injuries	Property Damage	Crop Damage
Avery	7/10/2013	Hail	0.75	0	0	$-	$-
Milan	7/10/2013	Hail	1	0	0	$-	$-
Vermilion	4/29/2014	Hail	0.75	0	0	$-	$-
Pakertown	5/21/2014	Hail	1.5	0	0	$10,000	$-
Weyers	5/21/2014	Hail	1	0	0	$2,000	$-
Sandusky	7/30/2014	Hail	1	0	0	$-	$-
Huron Airport	6/22/2015	Hail	1	0	0	$2,000	$-
Huron	7/7/2017	Hail	0.75	0	0	$-	$-
Bay View	7/16/2017	Hail	1	0	0	$-	$-
Sandusky	7/16/2017	Hail	0.75	0	0	$-	$-
Sandusky	7/16/2017	Hail	1	0	0	$-	$-
Huron	8/21/2017	Hail	1	0	0	$-	$-
Totals				**0**	**0**	**$1,217,000**	**$ -**

Table 24: Lightning Events in Erie County 1996-2019

Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Huron	4/22/1996	Lightning	0	0	$-	$-
Huron	4/22/1996	Lightning	0	0	$-	$-
Huron	6/11/1996	Lightning	0	0	$350,000	$-
Groton Township	7/30/1996	Lightning	0	0	$75,000	$-
Berlin Heights	4/9/1998	Lightning	0	1	$-	$-
Milan	6/26/1998	Lightning	0	0	$10,000	$-
Sandusky	8/9/1998	Lightning	0	0	$12,000	$-
Total			**0**	**1**	**$447,000**	**$-**

Table 25: Thunderstorm Wind Events in Erie County 1955 - 2019

Location	Date	Type	Magnitude (MPH)	Deaths	Injuries	Property Damage	Crop Damage
Erie Co.	5/15/1968	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	8/8/1968	Thunderstorm Wind	60	0	0	$-	$-
Erie Co.	8/7/1972	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	7/3/1973	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	4/14/1974	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	7/16/1976	Thunderstorm Wind	70	0	0	$-	$-
Erie Co.	7/16/1976	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/30/1977	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	10/5/1978	Thunderstorm Wind	52	0	0	$-	$-
Erie Co.	5/13/1980	Thunderstorm Wind	52	0	0	$-	$-
Erie Co.	6/7/1980	Thunderstorm Wind	52	0	0	$-	$-
Erie Co.	8/2/1980	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	9/13/1980	Thunderstorm Wind	52	0	0	$-	$-
Erie Co.	1/4/1982	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/15/1982	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/15/1982	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/15/1982	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	5/2/1983	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	7/4/1983	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	7/4/1983	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	9/6/1983	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	9/6/1983	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	9/6/1983	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	8/8/1984	Thunderstorm Wind	0	0	0	$-	$-

Location	Date	Type	Magnitude (MPH)	Deaths	Injuries	Property Damage	Crop Damage
Erie Co.	5/6/1986	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/16/1986	Thunderstorm Wind	52	0	0	$-	$-
Erie Co.	8/26/1986	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	9/26/1986	Thunderstorm Wind	52	0	0	$-	$-
Erie Co.	9/26/1986	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/8/1987	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/29/1987	Thunderstorm Wind	52	0	0	$-	$-
Erie Co.	8/2/1987	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	8/2/1987	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	8/2/1987	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	5/9/1988	Thunderstorm Wind	50	0	0	$-	$-
Erie Co.	8/5/1988	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	5/31/1989	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	11/27/1989	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/2/1990	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/3/1990	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	3/27/1991	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	5/31/1991	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/15/1991	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	5/17/1992	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	6/17/1992	Thunderstorm Wind	51	0	0	$-	$-
Erie Co.	6/17/1992	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	8/10/1992	Thunderstorm Wind	0	0	0	$-	$-
Berlin Heights	6/20/1994	Thunderstorm Wind	0	0	0	$5,000	$-
Milan	4/11/1995	Thunderstorm Wind	0	0	0	$-	$-
Erie Co.	5/28/1995	Thunderstorm Wind	0	0	0	$5,000	$-
Sandusky	6/28/1995	Thunderstorm Wind	0	0	0	$10,000	$-
Countywide	7/13/1995	Thunderstorm Wind	0	0	0	$100,000	$-
Castalia	7/15/1995	Thunderstorm Wind	0	0	0	$3	$-
Countywide	8/11/1995	Thunderstorm Wind	0	0	0	$2,000	$-
Kimball	8/15/1995	Thunderstorm Wind	0	0	0	$2	$-
Countywide	4/12/1996	Thunderstorm Wind	52	0	0	$50,000	$-
Huron	6/19/1996	Thunderstorm Wind	60	0	0	$2,000	$-
Sandusky	7/7/1996	Thunderstorm Wind	50	0	0	$-	$-
Sandusky	7/14/1996	Thunderstorm Wind		0	0	$20,000	$-
Countywide	10/30/1996	Thunderstorm Wind	50	0	0	$-	$-
Huron	12/1/1996	Thunderstorm Wind	50	0	0	$2,000	$-
Countywide	5/18/1997	Thunderstorm Wind	56	0	0	$2,000	$-
Berlin Heights	5/19/1997	Thunderstorm Wind	50	0	0	$-	$-
Castalia	5/19/1997	Thunderstorm Wind		0	0	$2,000	$-
Sandusky	7/26/1997	Thunderstorm Wind		0	0	$5,000	$-
Milan	7/26/1997	Thunderstorm Wind		0	0	$3,000	$-
Countywide	8/16/1997	Thunderstorm Wind		0	0	$5,000	$-
Countywide	8/16/1997	Thunderstorm Wind		0	0	$10,000	$-
Castalia	3/28/1998	Thunderstorm Wind		0	0	$20,000	$-
Sandusky	6/30/1998	Thunderstorm Wind	55	0	0	$-	$-
Vermillion	7/21/1998	Thunderstorm Wind		0	0	$15,000	$-
Castalia	7/21/1998	Thunderstorm Wind	52	0	0	$20,000	$-
Milan	7/21/1998	Thunderstorm Wind	61	0	0	$750,000	$-
Sandusky	7/21/1998	Thunderstorm Wind		0	0	$10,000	$-
Countywide	7/21/1998	Thunderstorm Wind		0	0	$10,000	$-
Countywide	8/25/1998	Thunderstorm Wind		0	0	$10,000	$-
Countywide	11/10/1998	Thunderstorm Wind		0	0	$10,000	$-
Lakeshore	11/10/1998	Thunderstorm Wind	98	0	0	$-	$-

Location	Date	Type	Magnitude (MPH)	Deaths	Injuries	Property Damage	Crop Damage
Vermillion	7/6/1999	Thunderstorm Wind	51	0	0	$15,000	$-
Countywide	7/9/1999	Thunderstorm Wind		0	0	$20,000	$-
Berlin Heights	7/30/1999	Thunderstorm Wind		0	0	$5,000	$-
Countywide	7/31/1999	Thunderstorm Wind		0	0	$300,000	$-
Crystal Rock	7/31/1999	Thunderstorm Wind		0	0	$25,000	$-
Countywide	10/13/1999	Thunderstorm Wind	62	0	0	$30,000	$-
Sandusky	7/14/2000	Thunderstorm Wind	59	0	0	$35,000	$-
Sandusky	8/2/2000	Thunderstorm Wind		0	0	$35,000	$-
Sandusky	8/2/2000	Thunderstorm Wind		0	0	$50,000	$-
Sandusky	8/6/2000	Thunderstorm Wind		0	0	$15,000	$-
Milan	8/9/2000	Thunderstorm Wind		0	0	$40,000	$-
Castalia	10/4/2000	Thunderstorm Wind		0	0	$5,000	$-
Milan	4/28/2002	Thunderstorm Wind		0	0	$35,000	$-
Berlin Heights	5/30/2002	Thunderstorm Wind		0	0	$10,000	$-
Sandusky	6/21/2002	Thunderstorm Wind		0	0	$10,000	$-
Vermilion	6/21/2002	Thunderstorm Wind	53	0	0	$-	$-
Milan	7/22/2002	Thunderstorm Wind		0	0	$10,000	$-
Sandusky	7/27/2002	Thunderstorm Wind		0	0	$2,000	$-
Sandusky	7/28/2002	Thunderstorm Wind		0	0	$10,000	$-
Countywide	7/29/2002	Thunderstorm Wind		0	0	$15,000	$-
Castalia	8/4/2002	Thunderstorm Wind		0	0	$10,000	$-
Vermilion	9/20/2002	Thunderstorm Wind		0	0	$5,000	$-
Milan	11/10/2002	Thunderstorm Wind		0	0	$25,000	$-
Vermilion	11/10/2002	Thunderstorm Wind		0	0	$600,000	$-
Castalia	4/4/2003	Thunderstorm Wind	50	0	0	$3,000	$-
Huron	4/4/2003	Thunderstorm Wind	50	0	0	$2,000	$-
Castalia	4/20/2003	Thunderstorm Wind	50	0	0	$75,000	$-
Milan	6/26/2003	Thunderstorm Wind	50	0	0	$5,000	$-
Sandusky	7/4/2003	Thunderstorm Wind	50	0	0	$50,000	$-
Countywide	7/7/2003	Thunderstorm Wind	50	0	0	$20,000	$-
Countywide	7/7/2003	Thunderstorm Wind	50	0	0	$15,000	$-
Countywide	7/8/2003	Thunderstorm Wind	56	0	0	$400,000	$-
Vermilion	9/26/2003	Thunderstorm Wind	50	0	0	$5,000	$-
Milan	11/12/2003	Thunderstorm Wind	50	0	0	$5,000	$-
Countywide	5/21/2004	Thunderstorm Wind	52	0	0	$50,000	$-
Sandusky	6/9/2004	Thunderstorm Wind	50	0	0	$15,000	$-
Vermilion	6/13/2004	Thunderstorm Wind	50	0	0	$8,000	$-
Castalia	6/14/2004	Thunderstorm Wind	50	0	0	$3,000	$-
Bay View	6/5/2005	Thunderstorm Wind	50	0	0	$2,000	$-
Avery	6/30/2005	Thunderstorm Wind	54	0	0	$10,000	$-
Kelleys Island	7/18/2005	Thunderstorm Wind	50	0	0	$5,000	$-
Kelleys Island	7/26/2005	Thunderstorm Wind	50	0	0	$4,000	$-
Kelleys Island	7/26/2005	Thunderstorm Wind	50	0	0	$2,000	$-
Sandusky	9/22/2005	Thunderstorm Wind	61	0	0	$750,000	$-
Castalia	11/6/2005	Thunderstorm Wind	50	0	0	$1,000	$-
Castalia	5/25/2006	Thunderstorm Wind	50	0	0	$6,000	$-
Sandusky	6/19/2006	Thunderstorm Wind	50	0	0	$5,000	$-
Sandusky	6/21/2006	Thunderstorm Wind	50	0	0	$1,000	$-
Sandusky	7/4/2006	Thunderstorm Wind	50	0	0	$10,000	$-
Vermilion	7/30/2006	Thunderstorm Wind	50	0	0	$6,000	$-
Sandusky	6/2/2007	Thunderstorm Wind	50	0	0	$5,000	$-
Kelleys Is	6/8/2007	Thunderstorm Wind	50	0	0	$1,000	$-
Sandusky	6/8/2007	Thunderstorm Wind	50	0	0	$30,000	$-
Castalia	6/21/2007	Thunderstorm Wind	50	0	0	$3,000	$-

Location	Date	Type	Magnitude (MPH)	Deaths	Injuries	Property Damage	Crop Damage
Sandusky	9/8/2007	Thunderstorm Wind	50	0	0	$25,000	$-
Berlin Heights	1/9/2008	Thunderstorm Wind	70	0	0	$30,000	$-
Bay View	1/29/2008	Thunderstorm Wind	60	0	0	$25,000	$-
Bogart	6/9/2008	Thunderstorm Wind	50	0	0	$2,000	$-
Milan	6/10/2008	Thunderstorm Wind	50	0	0	$2,000	$-
Castalia	6/15/2008	Thunderstorm Wind	50	0	0	$2,000	$-
Sandusky	6/15/2008	Thunderstorm Wind	50	0	0	$1,000	$-
Sandusky	7/8/2008	Thunderstorm Wind	50	0	0	$7,000	$-
Sandusky	8/1/2008	Thunderstorm Wind	50	0	0	$1,000	$-
Sandusky	6/25/2009	Thunderstorm Wind	59	0	0	$-	$-
Sandusky	6/25/2009	Thunderstorm Wind	50	0	0	$2,000	$-
Vermilion	8/28/2009	Thunderstorm Wind	50	0	0	$3,000	$-
Huron	4/25/2010	Thunderstorm Wind	50	0	0	$5,000	$-
Venice	5/7/2010	Thunderstorm Wind	70	0	0	$500,000	$-
Huron	5/7/2010	Thunderstorm Wind	50	0	0	$50,000	$-
Sandusky	6/6/2010	Thunderstorm Wind	50	0	0	$5,000	$-
Sandusky	6/6/2010	Thunderstorm Wind	50	0	0	$12,000	$-
Soldiers Home	6/27/2010	Thunderstorm Wind	50	0	0	$25,000	$-
Bogart	6/27/2010	Thunderstorm Wind	50	0	0	$10,000	$-
Sand Hill	6/27/2010	Thunderstorm Wind	50	0	0	$1,000	$-
Vermilion	7/2/2011	Thunderstorm Wind	50	0	0	$10,000	$-
Sandusky	7/22/2011	Thunderstorm Wind	50	0	0	$15,000	$-
Pakertown	7/22/2011	Thunderstorm Wind	50	0	0	$10,000	$-
Castalia	6/18/2012	Thunderstorm Wind	50	0	0	$1,000	$-
Sandusky	6/18/2012	Thunderstorm Wind	50	0	0	$50,000	$-
Huron	6/18/2012	Thunderstorm Wind	50	0	0	$1,000	$-
Berlin Heights	6/18/2012	Thunderstorm Wind	52	0	0	$15,000	$-
Vermilion	6/18/2012	Thunderstorm Wind	50	0	0	$2,000	$-
Berlin Heights	7/1/2012	Thunderstorm Wind	70	0	0	$10,000	$-
Sandusky	7/1/2012	Thunderstorm Wind	50	0	1	$15,000	$-
Sandusky	7/1/2012	Thunderstorm Wind	50	0	0	$2,000	$-
Vermilion	7/5/2012	Thunderstorm Wind	55	0	0	$-	$-
Berlin Heights	5/31/2013	Thunderstorm Wind	50	0	0	$2,000	$-
Castalia	6/13/2013	Thunderstorm Wind	50	0	0	$15,000	$-
Milan	6/13/2013	Thunderstorm Wind	50	0	0	$25,000	$-
Huron	6/13/2013	Thunderstorm Wind	50	0	0	$20,000	$-
North Monroeville	7/10/2013	Thunderstorm Wind	50	0	0	$50,000	$-
Florence	11/17/2013	Thunderstorm Wind	50	0	0	$15,000	$-
Milan	6/18/2014	Thunderstorm Wind	50	0	0	$1,000	$-
Castalia	11/24/2014	Thunderstorm Wind	50	0	0	$2,000	$-
Sandusky	5/27/2015	Thunderstorm Wind	50	0	0	$25,000	$-
Vermilion	5/27/2015	Thunderstorm Wind	50	0	0	$-	$-
Castalia	6/18/2015	Thunderstorm Wind	50	0	0	$12,000	$-
Sandusky	6/5/2016	Thunderstorm Wind	74	0	0	2,000,000	$-
Vermilion	7/18/2016	Thunderstorm Wind	50	0	0	$1,000	$-
Berlin Heights	8/28/2016	Thunderstorm Wind	50	0	0	$100,000	$-
Huron	8/28/2016	Thunderstorm Wind	51	0	0	$-	$-
Vermilion	8/28/2016	Thunderstorm Wind	50	0	0	$1,000	$-
Bay View	7/16/2017	Thunderstorm Wind	50	0	0	$1,000	$-
Lakeshore	11/5/2017	Thunderstorm Wind	50	0	0	$35,000	$-
Sandusky	7/26/2018	Thunderstorm Wind	60	0	0	$150,000	$-
Castalia	8/6/2018	Thunderstorm Wind	50	0	0	$125,000	$-
Crystal Rock	5/23/2019	Thunderstorm Wind	56	0	0	$20,000	$-

Location	Date	Type	Magnitude (MPH)	Deaths	Injuries	Property Damage	Crop Damage
Sandusky	5/23/2019	Thunderstorm Wind	52	0	0	$-	$-
Avery	5/23/2019	Thunderstorm Wind	52	0	0	$-	$-
Milan	7/2/2019	Thunderstorm Wind	65	0	0	$100,000	$-
Milan	7/2/2019	Thunderstorm Wind	65	0	0	$10,000	$-
Milan	7/2/2019	Thunderstorm Wind	52	0	0	$-	$-
Ogontz	7/2/2019	Thunderstorm Wind	61	0	0	$-	$-
Bogart	8/6/2019	Thunderstorm Wind	52	0	0	$-	$-
Sandusky	8/6/2019	Thunderstorm Wind	52	0	0	$2,000	$-
Venice	8/18/2019	Thunderstorm Wind	52	0	0	$-	$-
Vermilion	9/13/2019	Thunderstorm Wind	52	0	0	$2,000	$-
Vermilion	9/13/2019	Thunderstorm Wind	52	0	0	$10,000	$-
Vermilion	9/13/2019	Thunderstorm Wind	52	0	0	$10,000	$-
				0	**1**	**$7,445,005**	$-

Table 26: Heat Events in Erie County 1996 - 2019

Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Erie County	6/6/1999	Heat	0	0	$-	$-
Erie County	7/1/1999	Heat	0	0	$-	$-
Total			**0**	**0**	**$ -**	**$-**

7.7.5 Probability of Future Events

Severe summer weather typically occurs every year in Erie County. The NCDC data supports this showing that there was a total of 103 hail events, 7 lightning events, 197 thunderstorm wind events, and 2 heat events in the years included in the NCDC.

The recurrence interval for hail events is 65 years/103 events = 0.63, so the probability of Erie County experiencing a hail event is 100% in any given year.

The recurrence interval for lightning events is 24 years/7 events = 3.43, which indicates a lightning event can be expected about every 3.4 years. The probability of a lightning event in any given year is 29%.

The recurrence interval for a thunderstorm wind event is 65 years/197 events = 0.33, so the probability of Erie County experiencing a thunderstorm wind event in any given year is 100%.

The recurrence interval for heat events is 24 years/2 events = 12, which indicates a heat event would occur every 12 years. However, this may be misleading due to how well records have been kept and added to the NCDC database. Only two heat events were reported, and these occurred within a month of each other. It is possible other heat events have occurred but have not been recorded.

7.7.6 Vulnerability

The most vulnerable structures are those that were poorly built or are dilapidated. The wind loads from thunderstorms may lead to structural collapse or to minor damage. Some shed roofs that protect township and borough road maintenance or firefighting equipment have large span roofs that may collapse during especially severe summer

storms although none have collapsed due to recent severe summer storms. Thunderstorms can rip roofs off of any dilapidated structures and overturn mobile homes.

Vulnerability to the effects of severe summer weather on buildings is somewhat dependent on the age of a building because as building codes become more stringent, buildings are capable of enduring greater wind forces due to thunderstorms. As buildings age, various factors may deteriorate their structural integrity. Vulnerability also depends upon the type of construction and the degree to which a structure has been maintained.

The most common detrimental effects of severe storms are not collapsed structures but traffic accidents, interruptions in power supply and communications services, and roadway blockages due to downed trees. In addition, lightning strikes can interrupt communication networks and cause structure or wild land fires. Hail also has the potential to cause significant damage to building roofs, glass windows and skylights, and vehicles. Extreme heat events can cause heat exhaustion, heat stroke or even death.

Because severe summer weather impacts the entire county, all structures within the county are at some risk. The total number and value of structures can be found in Table 8.

For this mitigation plan, structures identified as potentially vulnerable to damage from severe summer weather are structures older than 50 years that may have deteriorated over time. Data on the age of structures was not available when the previous version of this plan was prepared, so an analysis of vulnerability was not completed. Data is only available for housing units. Therefore, only housing unit structures will be evaluated.

There are 9,188 housing units standing in Erie County that were built before 1939 and approximately 58 percent of the structures in the county are more than 50 years old, according to the 2019 American Community Survey. Nevertheless, for this review, because the National Trust for Historic Preservation identifies structures greater than 50 years old as being eligible for designation as historic, the assumption is made that structures built before 1970 are at some risk of at least minor damage due to severe storms. There are 21,648 structures in the county that were built before 1970, thus the percent of structures considered to be particularly vulnerable to damage due to severe storms is 57 percent. Figure 52 shows the number of structures built in Erie County and illustrates the fact that many structures in the county are older than 50 years.

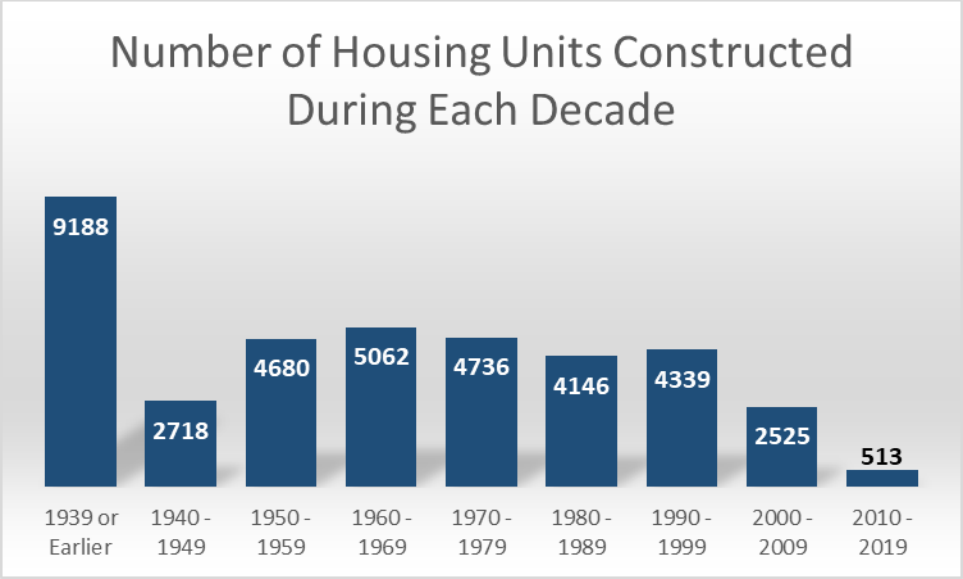


Figure 52: Number of Housing Units Constructed During Each Decade in Erie County

All structures and infrastructure in Erie County will be exposed to severe summer weather. Currently Erie County has not adopted any building codes; however, the cities, villages and townships within Erie County have adopted and enforced the Ohio building codes.

Due to the non-site-specific nature of this hazard, current development trends have no effect. Current development within Erie County has been primarily concentrated in the western part of the county largely in Huron Township.

Table 27: Summary of Past Losses Due to Different Components of Severe Summer Weather

	Estimated Property Damages
Total Losses Due to Hail (1955–2019)	$1,217,000
Average Annual Losses for 65 years	$18,723
Total Losses Due to Lightning (1996–2019)	$447,000
Average Annual Losses for 24 years	$18,625
Total Losses Due to Thunderstorm Wind (1955–2019)	$7,445,005
Average Annual Losses for 65 years	$114,539
Total Losses Due to Heat (1996-2019)	$0
Average Annual Losses for 24 years	$0

Because severe summer weather is random in nature, the Core Group has chosen to look at historic events to determine Erie County's susceptibility. According to the National Climatic Data Center (NCDC), there have been 103 hail events (since 1955), 7 lightning events (since 1996), 197 thunderstorm-wind events (since 1955), and 2 heat events (since 1996) in Erie County resulting in over $9 million in damages, and 2 injuries. Wind events not associated with thunderstorms are in the damaging winds section.

Since the total loss due to hail over the previous 65 years is $1,217,000, the average annual loss is $1,217,000 / 66 = $18,723. The total loss due to lightning over the previous 24 years is $447,000, so the average annual loss is $18,625. For thunderstorm wind events, the total loss was $7,445,005 and the average annual loss is $114,539. The cost due to thunderstorm

wind events is clearly much higher than due to hail or lightning events. There are no annualized losses due to high heat.

Climate change may also impact how severe summer weather affects Erie County and its jurisdictions. Climate changes tends to cause storms to be more severe, which would increase the vulnerability of Erie County to the impacts of severe summer weather.

7.8 Severe Winter Weather

7.8.1 Hazard Profile

Severe winter weather includes freezing temperatures, blizzards, ice storms, and snowstorms. These hazards have the potential to disrupt traffic, cause outages to power and communication networks, and even cause damage to structures. The health impacts from extreme cold (frostbite and hypothermia) as well motor vehicle accidents present a risk to the health of the community and can even cause loss of life. Heavy snow may cause buildings to collapse or suffer damage. Ice storms can cause dangerous build-up of ice on utility wires or trees causing them to fall. Ice and snow can also cause traffic to become extremely hazardous and roads can become impassible. Depending on when the severe winter weather occurs, crops can even be destroyed if there is an early or late freeze.

7.8.2 Location

Erie County is in the north central portion of the state and is susceptible to severe winter weather, which may be experienced at any location in Erie County. Because severe winter weather is random in nature, the entire county population is susceptible. Severe winter weather tends to be even more widespread than severe summer weather, and large portions of the county are likely to be impacted during any storm, if not the entire county and all of the municipalities.

7.8.3 Extent

Severe winter weather occurs throughout the State of Ohio. All of Erie County is exposed to the hazards associated with severe winter weather. Severe winter weather typically occurs between the months of September through May but may be experienced outside of that timeframe. Severe winter weather events may contain extreme cold, heavy snow, blizzards or ice storms. Because the area receives a moderate amount of snowfall and can be stricken by ice storms, all the structures erected in the county and the municipalities are susceptible to damage if not designed to the proper snow loading parameters. The most significant winter weather event in Erie County, in terms of losses, occurred on December 22, 2004, and cost $3,800,000 in property losses alone. In terms of injuries, the most severe winter weather event occurred on January 13, 1998, when 8 injuries occurred. There have been no reported deaths due to severe winter weather in Erie County since 1996.

7.8.4 Previous Occurrences

Erie County is highly susceptible to severe winter weather, which encompasses freezing temperatures, blizzards, ice storms and snowstorms.

According to the NCDC, there have been 43 severe winter weather events in Erie County reported since 1996, with total property losses of $8,197,000 and no reported crop losses. Since 1996 the average annual losses reported for the county have been approximately $341,512.

Erie County has experienced several severe storms causing significant damage. Some of the most notable and costly are described below. Table 28 list each of the winter

weather events in Erie County and information regarding the number of injuries and damage caused by each.

Table 28: Winter Weather Events in Erie County 1996 - 2019

Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Erie (Zone)	2/2/1996	Cold/Wind Chill	0	0	$50,000	$-
Erie (Zone)	3/19/1996	Heavy Snow	0	0	$15,000	$-
Erie (Zone)	1/10/1997	Cold/Wind Chill	0	0	$5,000	$-
Erie (Zone)	1/16/1997	Winter Weather	0	0	$15,000	$-
Erie Co.	1/13/1998	Winter Weather	0	8	$-	$-
Erie (Zone)	1/2/1999	Winter Storm	0	2	$15,000	$-
Erie (Zone)	1/8/1999	Winter Storm	0	0	$2,000	$-
Erie (Zone)	3/5/1999	Heavy Snow	0	0	$10,000	$-
Erie (Zone)	3/11/2000	Winter Storm	0	0	$15,000	$-
Erie (Zone)	12/13/2000	Winter Storm	0	0	$75,000	$-
Erie (Zone)	3/24/2002	Winter Storm	0	0	$50,000	$-
Erie (Zone)	3/26/2002	Winter Storm	0	0	$100,000	$-
Erie (Zone)	12/24/2002	Heavy Snow	0	0	$75,000	$-
Erie (Zone)	2/22/2003	Heavy Snow	0	0	$500,000	$-
Erie (Zone)	1/4/2004	Winter Storm	0	0	$100,000	$-
Erie (Zone)	12/22/2004	Winter Storm	0	0	$3,800,000	$-
Erie (Zone)	1/5/2005	Ice Storm	0	0	$600,000	$-
Erie (Zone)	1/22/2005	Winter Storm	0	0	$200,000	$-
Erie (Zone)	2/4/2006	Winter Storm	0	0	$50,000	$-
Erie (Zone)	2/13/2007	Winter Storm	0	0	$25,000	$-
Erie (Zone)	12/15/2007	Winter Storm	0	0	$120,000	$-
Erie (Zone)	2/25/2008	Winter Storm	0	0	$75,000	$-
Erie (Zone)	3/4/2008	Winter Storm	0	0	$200,000	$-
Erie (Zone)	3/7/2008	Winter Storm	0	0	$400,000	$-
Erie (Zone)	3/21/2008	Heavy Snow	0	0	$50,000	$-
Erie (Zone)	12/19/2008	Winter Storm	0	0	$30,000	$-
Erie (Zone)	1/9/2009	Winter Storm	0	0	$120,000	$-
Erie (Zone)	1/15/2009	Extreme Cold/Wind Chill	0	0	$-	$-
Erie (Zone)	1/27/2009	Winter Storm	0	0	$150,000	$-
Erie (Zone)	2/1/2011	Winter Storm	0	0	$250,000	$-
Erie (Zone)	3/27/2012	Extreme Cold/Wind Chill	0	0	$-	$-
Erie (Zone)	4/29/2012	Extreme Cold/Wind Chill	0	0	$200,000	$-
Erie (Zone)	1/6/2014	Extreme Cold/Wind Chill	0	0	$-	$-
Erie (Zone)	1/28/2014	Extreme Cold/Wind Chill	0	0	$-	$-
Erie (Zone)	2/4/2014	Winter Storm	0	0	$125,000	$-
Erie (Zone)	3/12/2014	Winter Storm	0	0	$200,000	$-
Erie (Zone)	2/1/2015	Winter Storm	0	0	$250,000	$-
Erie (Zone)	2/15/2015	Extreme Cold/Wind Chill	0	0	$-	$-
Erie (Zone)	2/20/2015	Extreme Cold/Wind Chill	0	0	$-	$-
Erie (Zone)	4/8/2016	Winter Storm	0	0	$150,000	$-
Erie (Zone)	12/17/2016	Winter Storm	0	0	$100,000	$-
Erie (Zone)	1/19/2019	Winter Storm	0	0	$75,000	$-
Erie (Zone)	1/30/2019	Extreme Cold/Wind Chill	0	0	$-	$-
Total			**0**	**10**	**$8,197,000**	**$-**

7.8.5 Probability of Future Events

Severe winter weather typically occurs every year in Erie County. The NCDC data supports this showing that there was a total of 43 winter weather events over the period

between 1996 and 2019. Thus, the recurrence interval for severe winter weather in Erie County is 24 years/ 43 events = 0.56. The probability of the occurrence of a winter weather event in Erie County in any given year is 100 percent.

7.8.6 Vulnerability

The most vulnerable structures to severe winter weather are those that were poorly built or are dilapidated. The weight of snow and ice on structures can lead to structural collapse or to minor damage. Some shed roofs that protect township and borough road maintenance or firefighting equipment have large span roofs that may collapse under the weight of especially heavy snows, although none have collapsed due to recent winter storms.

Vulnerability to the effects of severe storms on buildings is somewhat dependent on the age of a building because as building codes become more stringent, buildings can support heavier loads. As buildings age, various factors may deteriorate their structural integrity. Vulnerability also depends upon the type of construction and the degree to which a structure has been maintained.

The most common detrimental effects of winter weather events are not collapsed structures but traffic accidents, interruptions in power supply and communications services, and roadway blockages due to downed trees and impassible roads. Because severe storms affect the entire county, all structures within the county are at some risk. The total number and value of structures can be found in Table 8.

Due to the non-site-specific nature of this hazard, current development trends have no effect, other than to increase the number of buildings exposed. Current development within Erie County has been primarily concentrated in the western part of the county. This development is centered in Huron Township. Developers in these areas should consider the importance of road design to maximize accessibility during a severe storm event. In this township especially, more effort should be placed on maintenance of trees in utility areas to reduce the number of power outages due to fallen trees and/or branches due to the accumulation of ice or snow.

Because severe storms are random in nature, the Core Group has chosen to look at historic events to determine Erie County's susceptibility. According to the National Climatic Data Center (NCDC), there have been 43 winter storm events in Erie County since 1996, totaling $8,197,000 in property losses. Past losses provided in NCDC are used to estimate the potential for annual losses due to severe storms. Since the total loss over 24 years is $8,197,000 the average annual loss is $8,197,000 / 24 = $341,542.

Table 29: Summary of Past Losses Due to Severe Winter Weather 1996 - 2019

	Estimated Property Damages
Total Losses Due to Winter Weather (1996–2019)	$8,197,000
Average Annual Losses for 66 years	$341,542

Climate change has the potential to cause more severe and more costly storms, therefore, the likelihood that winter weather events negatively impact Erie County and its jurisdictions will increase, potentially with more damage and more losses.

7.9 Tornado and Waterspouts

7.9.1 Hazard Profile

Tornadoes are violently rotating columns of air extending from the base of thunderstorms to the ground. Most often tornadoes are funnel shaped, but it is possible to have a tornado without seeing a visible funnel, and the powerful winds can extend beyond the visible funnel as well. Most tornadoes that occur in the US are classified as weak, but some can have wind speeds of 200-300 miles per hour and last for more than an hour. [45]

Since 2007, tornadoes have been measured by the Enhanced Fujita scale, which is based on estimated three second gust wind speeds and observed damage based on a 28-item damage indicator scale[46]. Figure 54 shows the older Fujita scale as compared to the Enhanced Fujita scale. In Erie County, there has only been one tornado on record since the Enhanced Fujita scale was enacted, so most are still listed using the older Fujita scale.

Fujita Scale		Enhanced Fujita Scale* * In use since 2007	
F–0	40–72 mph winds	EF–0	65–85 mph winds
F–1	73–112 mph	EF–1	86–110 mph
F–2	113–157 mph	EF–2	111–135 mph
F–3	158–206 mph	EF–3	136–165 mph
F–4	207–260 mph	EF–4	166–200 mph
F–5	261–318 mph	EF–5	>200 mph

Figure 53: Fujita Scale and Enhanced Fujita Scale[47]

Tornadoes cause damage from the high winds they contain and from flying debris the strong winds carry as they traverse the ground. In the most violent tornadoes, automobiles can become airborne, homes and buildings can be completely destroyed. Mobile homes are especially vulnerable to tornadoes, even weak ones due to sitting on top of the ground without being anchored to it. Tornadoes can also cause widespread utility and communication failures and often result in injuries and loss of life to humans and animals.[48]

Waterspouts are spouts of rotating air and water mist. There are two types of waterspouts: fair weather and tornadic. Tornadic waterspouts are tornadoes that form over water or move from land to water. They have the same features as regular tornadoes and are

[45] (National Oceanic & Atmospheric Administration, 2016)
[46] (National Oceanic & Atmospheric Administration, n.d.)
[47] (Young, 2020)
[48] (National Oceanic & Atmospheric Administration, n.d.)

formed from thunderstorms. Fair weather waterspouts are not usually associated with thunderstorms, and typically form from the surface of the water, and move upwards. Tornadic waterspouts form at the cloud and move to the ground surface. Fair weather waterspouts rarely move much from where they form, but if they do move over land, they can cause the same types of damage as a tornado.[49]

7.9.2 Location

Tornadoes can pose a threat to life and property in all parts of Erie County with the potential to destroy property and cause injury of death. Tornadoes are a risk for people anywhere in the path, however those outdoors without adequate shelter are particularly vulnerable. Erie County has many outdoor recreation venues which when populated would be high risk if a tornado were to hit the area. Also those in mobile home parks and campgrounds are also at greater risk.

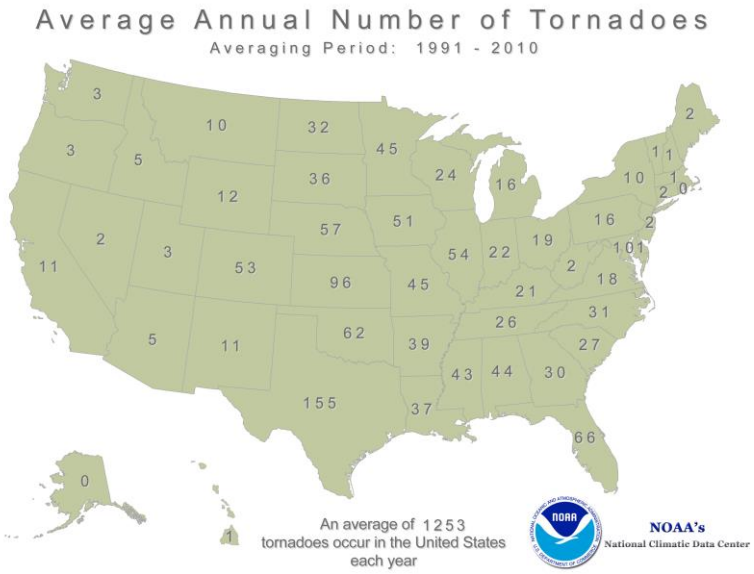


Figure 54: Average Annual Number of Tornadoes

Tornadoes are finite in their reach. The paths of tornadoes range widely with the largest tornado paths exceeding one mile, while the smallest widths can be less than 10 yards. Widths can even vary considerably during a single tornado, since its size can change during its lifetime. Path lengths can range from a few yards to more than 100 miles. A key point to remember is that the size of a tornado is not necessarily an indication of its intensity. Due to the nature of these paths, it is unlikely an entire community would sustain significant damage, especially for the size of tornadoes that typically form in Erie County.

Waterspouts can be tornadoes that move over water from land, or can form over water in fair weather. While this can happen on smaller, inland waters, in Erie County, it is most likely to occur over or near Lake Erie.

7.9.3 Extent

Tornadoes are considered the most violent atmospheric phenomenon on the face of the earth, having winds estimated at 300 mph in large tornadoes. Although the number of tornadoes in Ohio does not rank high compared to other states in the United States, the State does average around 19 tornadoes a year as shown in Figure 55. Ohio's peak tornado season runs from April through July, with most tornadoes occurring between 2-

[49] (National Oceanic & Atmostpheric Administration, 2018)

10 p.m. Even though June has been the month with the most tornado occurrences, many of the State's major tornado outbreaks have taken place in April and May. However, history has shown that tornadoes can occur during any month of the year and at any time of the day or night. Many of these tornadoes are weak (EF0 or EF1 on the Enhanced Fujita Scale), but Ohio has been struck by some of the most destructive (F5) tornadoes ever, including the April 3, 1974 tornado which devastated Xenia, killing over 30 people and destroying 2,000 buildings. The deadliest tornado to occur in Ohio affected Lorain and Sandusky on June 28, 1924 when 85 people were killed. The Lorain-Sandusky tornado remains the 24th most deadly tornado in US history.

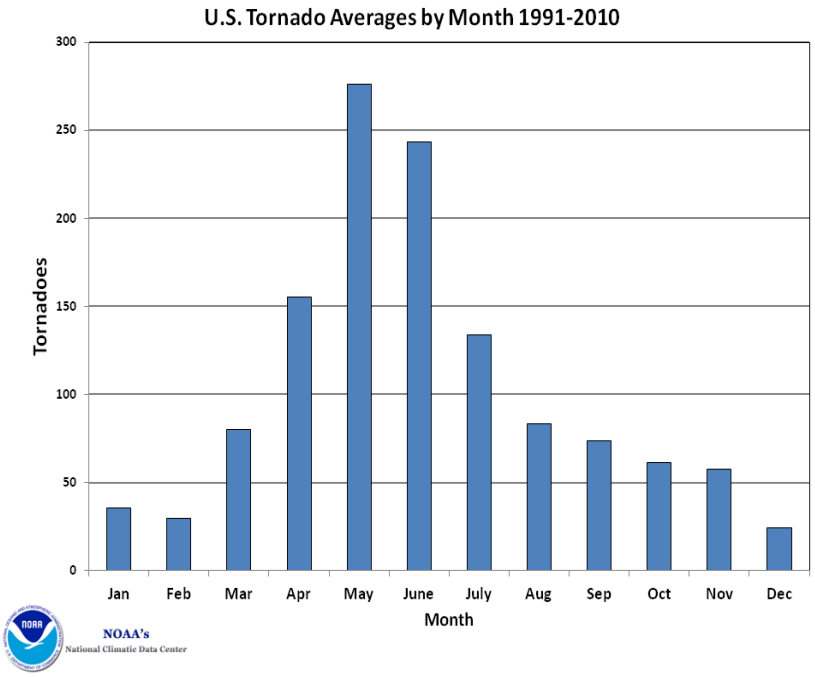


Figure 55: U.S. Tornado Average by Month 1991-2010

Tornadoes can occur anywhere in the State of Ohio. All of Erie County is exposed to the hazards associated with tornadoes. Tornadoes can theoretically occur any time of the year, however the greatest chances of an occurrence are in the spring and summer months.

In Erie County, the highest magnitude tornado recorded occurred on June 8, 1953 and was an F4 tornado. It caused 2 deaths and 23 injuries. Crop and property losses were not recorded. Most recently, there was an EF1 tornado in the Prout are of Sandusky on November 5, 2017 that caused $125,000 in property losses. Of the recorded waterspouts, none have caused any deaths, injuries or losses.

7.9.4 Previous Occurrences

According to the NCDC, there have been 14 damaging tornado events in Erie County reported since 1950, with total property and crop losses of $3,620,000, 2 deaths, and 26 injuries. The paths of these tornadoes can be found in Figure 57 below with a list of all tornadoes since 1950 in Table 30. There have been seven waterspouts reported since 1996, but no deaths, injuries or property losses were recorded. Table 31 lists the waterspouts since 1996.

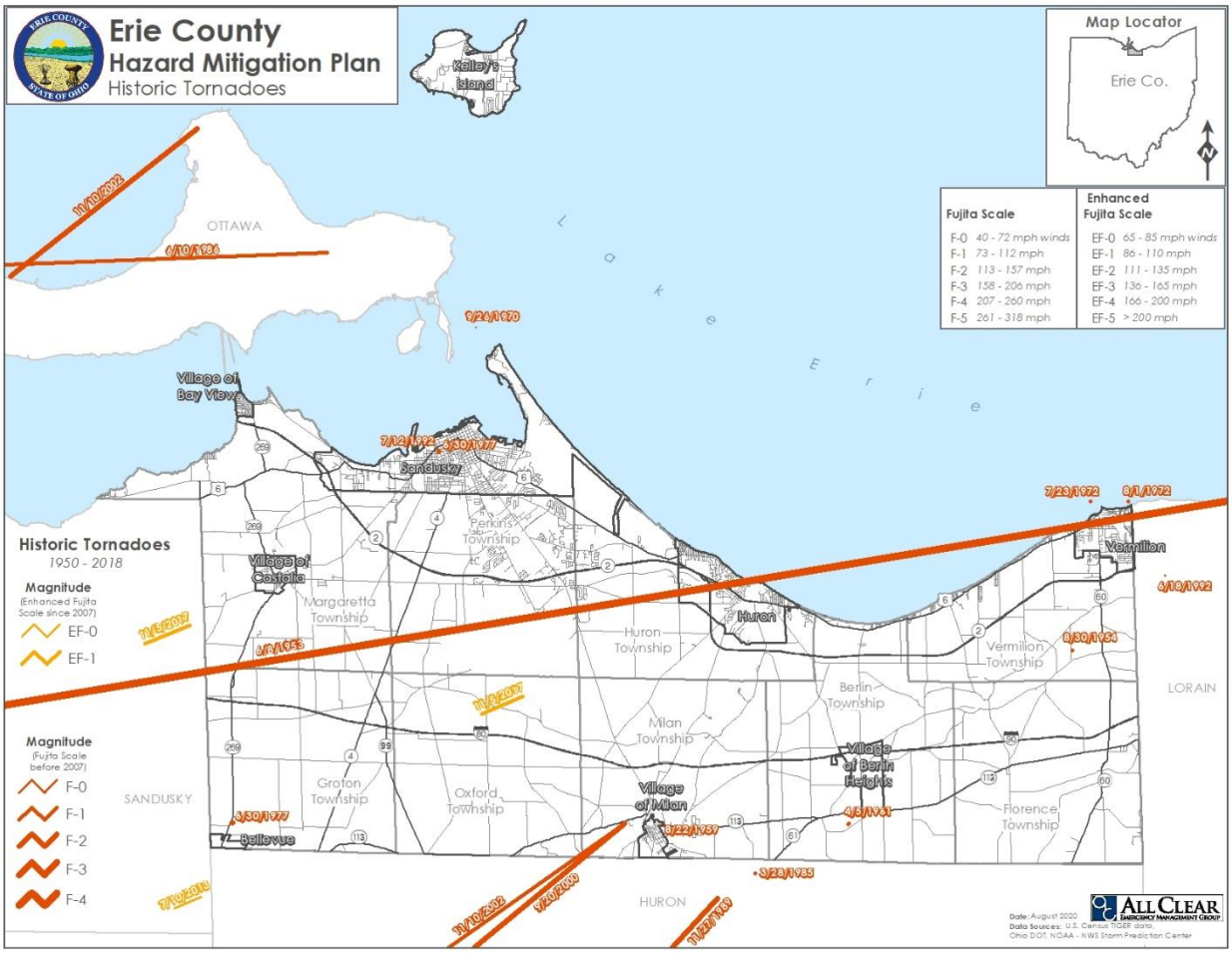


Figure 56: Historic Tornado Tracks 1950-2018 in Erie County

Tornado on June 25, 1924. The deadliest tornado in Ohio history formed over Sandusky Bay during the late afternoon of June 28, 1924 and first touched down in Sandusky. It heavily damaged a nine-block area of Sandusky, destroying over 100 homes and 25 businesses, and killing eight people in Erie County. The tornado continued eastward, over Lake Erie, and came ashore near the Lorain Municipal Bath House in Lakeview Park. Damage in Lorain was significantly worse than in Sandusky. The tornado left a 35-block path of damage along Broadway, and more than 200 automobiles were buried under rubble from collapsed buildings. More than 1,000 homes were damaged and 500 were completely destroyed. A total of 72 people were killed in Lorain County, with 15 deaths occurring in the State Theater alone. Three additional tornadoes formed in the area of Sandusky, Erie, and Lorain Counties that day, but none were as destructive or as deadly.[50]

[50] (Ohio Historical Society, 2008)

Figure 57: Destruction Along the Waterfront in Sandusky caused by the 1924 Tornado[51]

Tornado on September 20, 2000. A tornado touched down north of Monroeville in Huron County and traveled east along State Route 113 into southern Erie County. The tornado dissipated near the corner of Higbee and Livengood Roads after destroying a farm house. The home was ripped from its foundation, moved 40 feet and knocked over. A second house and a small barn were also slightly damaged. The tornado traveled approximately one mile in Erie County and had a damage path about 100 yards wide. Debris was thrown well outside the damage path and was clearly visible through corn fields outside the tornado's path. Ears of corn were shucked, apparently by the tornado and some ears had many kernels removed. Several dozen trees were downed along the damage path. Although there were no deaths or injuries, the tornado caused $175,000 in property damage and $10,000 in crop damage.

Tornado on November 10, 2002. A tornado moved into Erie County from Huron County to the southeast of Kimball near the intersection of Section Line Road and State Route 113. The tornado continued east northeast in the county for around five miles and dissipated north of Milan near the intersection of U.S. Highway 250 and State Route 13. Several high voltage transmission poles were toppled by the tornado in Milan Township. A few homes sustained minor damage and several barns were destroyed. Many trees were downed along the damage path which was generally 25 to 50 yards in width. Although there were no deaths or injuries, the tornado caused $500,000 in property damage.

[51] (Museum, 1924)

Tornado on November 5, 2017. A cold front moved across the Ohio Valley and southern Great Lakes on the afternoon of Sunday, November 5th, 2017. Unseasonably warm and humid air was in place across the region ahead of the front. The cold front gradually progressed across the Ohio Valley and thunderstorms initiated and swept east ahead of the front. The storms formed in a very strong wind field and allowed the storms to move very rapidly east at speeds of 60 to 80 mph. A large macroburst formed and swept east just south of Cleveland and produced winds in excess of 100 mph. The most concentrated damage stretched from southern Lorain County across Cuyahoga County and into northern Summit, northern Portage and southern Geauga Counties. A 105-mph thunderstorm wind gust was measured at Aurora in Portage County. In addition to the damaging winds, at least 13 tornadoes were reported. Three of the tornadoes reached EF2 intensity with eight EF1 tornadoes and two EF0 tornadoes. Tens of thousands of trees were downed by these storms and widespread power outages occurred. In the Cleveland area alone, over 100,000 electric customers lost power. It took several days for power to be completely restored. Dozens of homes, buildings and barns were damaged or destroyed by the tornadoes.

An EF1 tornado touched down in open farmland in rural Oxford Township just west of Ransom Road and about halfway between Mason Road and the Ohio Turnpike. The tornado continued northeast on the ground for about a mile and a quarter before weakening to EF0 intensity and lifting just as it entered NASA's Plum Brook Station. A home near the initial touchdown was damaged by several trees blown over by the tornado. A small barn was leveled, and a trailer flipped at a second property nearby. The tornado ripped a large section of roof including trusses off a house on Mason Road. The roof was found on the NASA facility nearby. Trees were downed along the entire damage path including on the southwestern end of the NASA property. The damage path was up to 50 yards in width. No injuries were reported.

Table 30: Tornado Events in Erie County 1950-2019

Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Erie Co.	6/8/1953	Tornado	F4	2	23	$-	$-
Erie Co.	8/12/1954	Tornado	F0	0	0	$2,500	$-
Erie Co.	8/30/1954	Tornado	F1	0	0	$25,000	$-
Erie Co.	8/22/1959	Tornado	F0	0	0	$2,500	$-
Erie Co.	4/5/1961	Tornado	N/A	0	0	$2,500	$-
Erie Co.	9/26/1970	Tornado	F0	0	0	$2,500	$-
Erie Co.	6/30/1977	Tornado	F1	0	3	$25,000	$-
Erie Co.	3/28/1985	Tornado	F1	0	0	$250,000	$-
Erie Co.	7/12/1992	Tornado	F2	0	0	$2,500,000	$-
Bellevue	4/12/1996	Tornado	F0	0	0	$-	$-
Sandusky	6/30/1998	Tornado	F0	0	0	$-	$-
Milan	9/20/2000	Tornado	F2	0	0	$175,000	$10,000
Kimball	11/10/2002	Tornado	F1	0	0	$500,000	$-
Prout (Sandusky)	11/5/2017	Tornado	EF1	0	0	$125,000	$-
Totals				**2**	**26**	**$3,610,000**	**$10,000**

Table 31: Waterspout Events in Erie County 1996-2019

Location	Date	Type	Deaths	Injuries	Property Damage	Crop Damage
Lake Erie	9/17/1996	Waterspout	0	0	$-	$-
Vermillion	8/4/1997	Waterspout	0	0	$-	$-
Vermillion	8/21/1997	Waterspout	0	0	$-	$-
Sandusky	6/30/1998	Waterspout	0	0	$-	$-
Huron	6/30/1998	Waterspout	0	0	$-	$-
Huron	7/21/2000	Waterspout	0	0	$-	$-
Vermilion	8/13/2001	Waterspout	0	0	$-	$-
Totals			**0**	**0**	**$ -**	**$ -**

7.9.5 Probability of Future Events

The NCDC data lists 14 damaging tornadoes for Erie County between 1950 and 2019. The recurrence interval for tornadoes is 70 years / 14 events = 5 years. This means, Erie County can expect a tornado every five years. Thus, the probability of a tornado occurring anywhere within the County in any given year is 20%.

The NCDC data lists seven waterspouts between 1996 and 2019. The recurrence interval for waterspouts is 24 years / 7 events = 3.4 years. This means that Erie County can expect a waterspout about every 3.4 years. The probability of a waterspout occurring anywhere within the County in any given year is 29%. From these calculations, it is clear that a waterspout is slightly more likely to occur than a tornado. However, tornadoes have caused more deaths, injuries, property losses, and crop losses than waterspouts.

7.9.6 Vulnerability Assessment

For tornadoes, any structure is vulnerable to the strong winds associated with these events. Aged and dilapidated structures or structures not built to modern building codes are more susceptible to damage, even from weaker tornadoes. Mobile homes and campgrounds are especially susceptible to damage due to tornadoes. Strong winds can rip roofs off of any dilapidated structures and overturn mobile homes. Past experience with tornadoes in Erie County and adjacent counties shows that death and injury are indeed a possibility. Depending on the magnitude of the tornado, a variety of damage can be expected. Table 32 summarizes different types of expected damage for tornadoes of varying strength.

Table 32: Expected Tornado Damage(s)

F or EF Scale	Examples of Possible Damage(s)
0	Light damage. Some damage to chimneys; broken tree branches; shallow-rooted trees pushed over; damage to sign boards.
1	Moderate damage. Surface peeled off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads.
2	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
3	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.

F or EF Scale	Examples of Possible Damage(s)
4	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
5	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 100 yards; trees debarked.

Tornadoes are also usually accompanied by other hazards when they affect a community. In fact, when tornadoes hit a community, they are typically coupled with other natural events such as high winds, thunderstorms, lighting and possibly flash floods. Vulnerability to the effects of tornadoes is somewhat dependent upon the age of a structure because as building codes become more stringent, buildings are capable of enduring greater wind forces. However, all parts of the County have the same probability of tornado touching down in the area. Unlike waterspouts, which are most likely to affect areas near the shoreline of Lake Erie.

In a worst-case scenario, Erie County could be hit with an EF5 tornado that would travel through the largest city in the county. To predict the structural cost associated with a worst-case scenario for a tornado; an analysis was run with an EF5 tornado traveling on a straight path through the most densely populated and developed area within the county. This analysis assumes that the tornado was to completely encompass the city of Sandusky, destroying nearly all structures in its path. Even with the current building codes, most buildings cannot withstand the force of an EF5. To perform this analysis the average property values for the county were used as a generalization where date for Sandusky specifically was not available. The number of structures in Sandusky were estimated using a ratio of the population of the city from the 2019 American Community Survey Five Year Estimate to the population of the County from the Survey. Since 33.1% of Erie County's population lives in Sandusky, it was assumed that 33.1% of each type of structure is also located in Sandusky.

In Table 33, an assessment shows the total value loss that is expected per type of structure. It also shows the value of damage that is expected for this worst-case scenario. Apart from the devastation within the path of the tornado, large regions of the county can also be expected to be without power and potentially have lesser degrees of damage.

Table 33: Damage Assessment by Land Use and Appraised Value

Type	Count	Average Value	Total
Residential	10,572	$249,280	$2,635,388,160
Non-Residential	1,047	$875,158	$916,290,426
Total	11,619		$3,551,678,586

Any future structures might be exposed to tornadoes as this hazard does not occur in specific locations. However, future buildings will be somewhat better protected from the effects of tornadoes as they will meet the most current state building code requirements for bracing and roof design.

As in the previous plan update, NCDC data is used to estimate potential loss. According to NCDC the estimated property damage in Erie County attributable to tornadoes accounts for $3,610,000 in damage. This amount is attributed to 14 occurrences and was observed from 1950 to 2019. There was no estimated property damage due to waterspouts between 1996 and 2019.

The total costs due to tornadoes over 70 years is $3,610,000 therefore the average annual losses due to tornadoes is $3,610,000 / 70 = $51,571. There are no estimated average annual losses due to waterspouts in Erie County.

8 Summary of Risk Assessment Findings

The purpose of completing a rigorous assessment of risk is to inform decision-making about mitigation actions which are most appropriate for the county. Table 34 details the probabilities of occurrence and estimated annual dollar losses discussed in each hazard section found in this plan. The results of this analysis show that Erie County can expect the greatest losses from flooding. Annualized anticipated losses due to flooding are more than three times the losses anticipated due to all hazards combined. Thus, the highest priority actions proposed in this mitigation plan address potential damage due to flooding.

Table 34: Risk Assessment Findings

Hazard	Vulnerable Locations	Annual Probability of Occurrence	Estimated Annual Dollar Loss
Flood	Special Flood Hazard Areas, Karst Areas, Lakeshore, Localized	100%	$1,290,125
Severe Winter Weather	Entire County	100%	$341,542
Damaging Winds	Entire County	100%	$278,083
Severe Summer Weather	Entire County	100%	$151,887
Tornado	Entire County	20%	$51,571
Waterspout	Lake Erie	29%	$0
Earthquake	Localized	<1%	$0
Drought	Entire County	25%	$7,000,000*
Lake and Stream Bank Erosion	Localized	100%	Not Available
Natural Biohazards	Entire County	100%	Not Available

*One drought instance

The conclusion of the risk assessment is that the greatest damages attributable to a single hazard occurring in Erie County can be expected to be caused by flooding.

For each hazard, aside from flooding, tornadoes and earthquakes, all critical facilities are assumed to withstand normal forces and events based on the hazards affecting Erie County. This is assumed because these facilities are typically designed to meet building code and they are usually maintained by the personnel occupying the building. Therefore, no damages are assumed for these types of facilities

9 Mitigation Goals

9.1 Mitigation Goals Update

Goals express aspirations about long-term conditions rather than specific measures. The goals expressed in this plan regarding natural hazards have evolved from the goals that were established when the plan was initially developed for adoption in 2005, with some of the original goals being rewritten in 2014. In 2020, the Core Group reviewed the existing goals and determined that some of the goals needed to be reworded for additional clarity. In addition, as the goals in the previous versions of Erie County's Natural Hazard Mitigation Plan were hazard specific, a new goal needed to be developed for the new hazard of Damaging Winds. Existing goals were also modified in order to correspond to the hazards identified and updated as part of the 2020 plan update. Severe Storms was divided into Severe Summer Weather and Severe Winter Weather, so the goals addressing Severe Storms were revised to accommodate that division. Also, the Invasive Species hazard in the 2014 plan was renamed Natural Biohazards, so the goals developed for that hazard were also appropriately renamed.

During the September 4, 2020 planning meeting, the Mitigation Core Group agreed to revised goals. These goals are listed in section 9.3 and are ranked according to the 2020 Risk Assessment.

9.2 Goals

Table 35: Mitigation Goals for Erie County

#	Hazard	Goal
1.	Flooding	Increase awareness of and preparedness for flooding and lake level rise to save lives and reduce property damage and their impacts on the community.
2.	Flooding	Identify, monitor, and evaluate high risk areas of ice jam concern.
3.	Severe Summer Weather	Increase awareness of and preparedness for severe summer weather to reduce loss of life and property damage, examining current means of response to identify gaps in planning and response.
4.	Severe Summer Weather	Evaluate and implement measures to prepare the community for severe summer weather.
5.	Lake and Stream Bank Erosion	Evaluate and implement measures to protect lives, property and the environment impacted by lake and stream bank erosion.
6.	Damaging Winds	Educate residents and businesses on the dangers of damaging winds as well as techniques to mitigate their impacts.
7.	Natural Biohazards	Proactively evaluate and enact measures to reduce the effects of Harmful Algae Blooms.
8.	Natural Biohazards	Increase awareness of invasive species to reduce harm to infrastructure, crops and the native ecology.

#	Hazard	Goal
9.	Severe Winter Weather	Increase awareness of and preparedness for severe winter weather to reduce loss of life and property damage, examining current means of response to identify gaps in planning and response.
10.	Severe Winter Weather	Evaluate and implement measures to prepare the community for severe winter weather.
11.	Tornado/ Waterspouts	Evaluate and implement measures designed to warn residents and provide safe shelter during tornadoes and waterspouts.
12.	Drought	Identify, monitor, and evaluate high risk areas of concern.
13.	Drought	Increase awareness and fire prevention strategies.
14.	Earthquake	Increase awareness of and implement measures to decrease loss of life and property damage from earthquake events.

10 Mitigation Actions

10.1 Mitigation Action Updates

Actions that were included in the previous mitigation plan were reviewed by Erie County staff, members of the Mitigation Core Group and representatives of the participating jurisdictions and townships to determine the status of the actions. These actions are recorded in this updated plan as having been completed, deleted, deferred, in progress or ongoing. These actions were part of the review of a range of actions suggested for inclusion in this updated plan. Representatives from the County and the participating jurisdictions were also encouraged to review these mitigation actions, and modify them if necessary, to better serve the needs of their communities. Actions that existed in the previous mitigation plan, but have been modified, are included as existing mitigation actions. Mitigation actions that were completed prior to the 2014 Erie County Natural Hazard Mitigation Plan were removed from that plan, and thus, are unable to be included in this update.

10.2 Cost Benefit Review of Mitigation Alternatives

During the third Core Group meeting, the Cost-Benefit analysis method used during the previous Natural Hazard Mitigation Plan update process was discussed, and the Core Group agreed that it was appropriate to use for the 2020 Plan with slight modifications based on the results of the updated risk analysis.

This cost benefit analysis was conducted for each new mitigation action that was developed during this planning process. In the same way as in the previous version, the Core Group used a modified version of the FEMA recommended process called STAPLEE. STAPLEE is an acronym that stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. The modified version used in the previous Plan update process, and continued with this update considered Administrative, Legal, Economic, and Environmental factors for each mitigation action developed.

The template given to Core Group members to develop new mitigation actions included the following explanations for each of the ALEE categories.

A – Administrative: Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
L – Legal: It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – Economic: Budget constraints can significantly deter the implementation of mitigations actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost-benefit review, and possible to fund.
E – Environmental: Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with Federal, State, and local environmental regulations, and that are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

For each criterion, the prioritization methodology assigned a 1 if there would be a benefit, a -1 if there would be a cost, and a 0 if no cost or benefit could be associated with the suggested action. For example, if an action might have a positive effect on the natural environment, the score for environmental impact would be 1; and if a proposed action would require significant staff time, the score for administrative burden would be -1.

As was done in the previous update of the plan, because the risk assessment showed that estimated annual dollar losses due to flooding, severe winter weather, damaging winds, and severe summer weather would be substantial, the economic benefits of suggested actions for mitigating the effects of these hazards was assigned a weight. A weight of three (3) was given to economic impacts for flood mitigation actions because annualized flood damages are substantially higher than all hazards; a weight of two (2) was given to economic impacts of severe winter weather, severe summer weather and damaging winds because annualized repair costs due to this hazard is the second most costly; a weight of one (1) was given to economic impacts of the remaining hazards mitigation actions because repairs due to these hazards have low to no annualized losses associated with them, or annualized losses could not be calculated from available data.

10.3 Prioritization Methodology

In a change from the previous mitigation plan update processes, mitigation actions were prioritized based on the hazard identification and risk assessment that the Core Group did via electronic survey following the March 6, 2020 planning meeting. During this meeting, the Consultant presented information regarding the hazards of Erie County and asked that each Core Group member assess the hazards based on their Vulnerability, Consequence and Frequency using a high, medium, and low ranking. These rankings were then totaled for each hazard, using a scoring system that equated high with 3, medium with 2 and low with 1. The sums of the Vulnerability, Consequence, and Frequency scores for each hazard were then ranked from highest to lowest. Once the hazards were ranked by the sum of their scores, hazards with a score above 200 were classified as high priority, hazards with a score between 175 and 200 were classified as medium priority and hazards with a score below 175 were classified as low priority. Mitigation goals that addressed high priority hazards, were given high priority, and so on.

Table 36: Hazard Identification and Risk Assessment Results

Hazard	Vulnerability Score	Consequence Score	Frequency Score	Total	Priority
Flooding	83	64	77	224	High
Severe Summer Weather	87	64	62	213	High
Lake/Stream Bank Erosion	79	60	73	212	High
Damaging Winds	81	57	59	197	Medium
Natural Biohazards	73	52	58	183	Medium
Severe Winter Weather	75	54	51	180	Medium
Tornadoes/Waterspouts	67	65	44	176	Medium
Drought	65	42	46	153	Low
Earthquakes	42	38	32	112	Low

10.4 Selected Actions

10.4.1 Mitigation Actions for Erie County

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Provide maintenance for ditches and waterways to avoid overflow due to sediment and debris build up.	EMA/ Incorporated Jurisdictions	Erie Soil and Water Conservation District	Engineers Office	Erie County	4	1	Long Term	Ongoing	
High	Flooding/ Lake & Stream Bank Erosion	Update flood insurance rate maps (FIRMs).	EMA/ Planning Commission	FEMA	State or Federal Sources	Erie County	4	1, 5	Medium Term	Ongoing	Riverine FIRMS updated; Great Lakes Coastal Study will establish new coastal Zone V. Preliminary maps are complete, expected updated regulations Spring 2021
High	Flooding/ Severe Summer Weather/ Severe Winter Weather/ Tornadoes	Provide back-up generators (both temporary and permanent) for pumping and lift stations in sanitary sewer systems.	EMA/ Engineers Office		State or Federal Sources	Erie County	3	1, 4, 10, 11	Medium Term	Ongoing	Not FEMA fundable

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Eliminate cross contamination of storm and sanitary sewers by eliminating CSO and SSO systems.	EMA/ Engineers Office		State or Federal Sources	Erie County	4	1	Long Term	Deferred	Not FEMA fundable
High	Flooding	Increase capacity of sanitary sewer lift stations to avoid overflow.	EMA/ Water and Sewer Department		State or Federal Sources	Erie County	4	1	Long Term	Deferred	Not FEMA fundable
High	Flooding	Assess and inventory problems with undersized culverts within Erie County	EMA/Engineers Office	Erie Soil and Water Conservation District	Existing Budget	Erie County	4	1	Long Term	Ongoing	
High	Flooding/ Lake & Stream Bank Erosion	Assess and inventory problems with roadways susceptible to flooding within Erie County	EMA/Engineers Office		Existing Budget	Erie County	4	1, 5	Long Term	Not Started	
High	Flooding	Identify and assess Pipe Creek Watershed to identify actual hazard	EMA/ Engineers Office	Erie Soil and Water Conservation District	State or Federal Sources	Erie County	4	1	Long Term	Not Started	Seek funding by 2025
High	Flooding	Identify and assess culverts and undersized drainage pipe property and drainage affected on Kelley's Island	EMA/ Engineers Office	Erie Soil and Water Conservation District/ Kelleys Island, ERPC	State or Federal Sources	Kelleys Island	4	1	Long Term	Not Started	Seek additional funding
High	Flooding	Identify and asses Chapel Creek	EMA/ Engineers Office	Erie Soil and Water	State or Federal Sources	Erie County	4	1	Long Term	Not Started	Seek funding by 2025

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		watershed to benefit Berlin Heights-Florence Twp.		Conservation District, ERPC							
High	Flooding	Re-evaluate Franklin Flats neighborhood for a buyout program.	EMA	Planning Commission	State or Federal Sources	Erie County	4	1	Long Term	In Progress	Seek funding by 2025, ERPC and EMA have had discussions regarding buyout program
High	Flooding	Identify and assess other localized flooding areas and direct tributaries to the Bay and Lake	EMA	Planning Commission	State or Federal Sources	Erie County	4	1	Long Term	In Progress	FEMA map update for coastal zone flooding occurring now
High	Flooding	Identify a flood notification system and a river gauge system	EMA		State or Federal Sources	Erie County	4	1	Long Term	Not Started	Seek funding by 2025
High	Flooding	Foster inter-agency coordination of floodplain management (Round Table)	Planning Commission	EMA/Erie Soil and Water Conservation District	Existing Budget	Erie County	4	1	Long Term	Ongoing	Meet on a case by case basis
High	Flooding	Provide public education of floodplain regulations for new construction through brochures distributed county-wide.	Planning Commission	EMA/Erie Soil and Water Conservation District	Existing Budget	Erie County	4	1	Long Term	Completed	Regulations will be updated once new coastal maps approved (2021)

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding (Ice Jams)	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA	Planning Commission	State and Federal Sources	Erie County	5	2	Long Term	Ongoing	ERPC staff has attended US Army Corp ice jam awareness seminar; worked with USGS to find grant to pay for camera to capture real time footage (Vermilion River), USGS was interested in installing a real time camera on top of their river gauge in the Vermilion River. Forwarded grant information
High	Karst Flooding	Identify high risk areas and evaluate land-use planning techniques to mitigate future events	EMA	Erie Soil and Water Conservation District/ Regional Planning	State and Federal Sources	Erie County	5	1	Long Term	Ongoing	2025 Estimated Time of Completion; ERPC will lend assistance if requested
High	Severe Summer Weather/ Severe Winter Weather/ Tornadoes	Provide more NOAA radios in critical facilities to move toward achieving a	EMA/ Incorporated Jurisdictions		State or Federal Sources	Erie County	2	3, 4, 6, 9, 10, 11	Long Term	Ongoing	Several hundred provided

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	and Waterspouts/ Damaging Winds	"Storm Ready" community status. Provide additional NOAA radios for other facilities such as private businesses									
High	Severe Summer Weather/ Severe Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	Evaluate the potential to develop a Countywide Program for pre-wiring structures to accept generators	EMA/ Incorporated Jurisdictions		State or Federal Sources	Erie County	2	3, 4, 6, 9, 10, 11	Long Term	Not Started	Seek funding by 2025
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Provide additional interoperable sirens to provide early warnings to citizens of approaching severe weather.	EMA/ Incorporated Jurisdictions		State or Federal Sources	Erie County	2	3, 4, 6, 9, 10, 11	Long Term	Not Started	Seek funding by 2025
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Develop and provide outreach program for County residents and those in the sensitive / special needs population covering the dangers associated with severe storms.	EMA/ County Commissioners		Existing budget	Erie County	3	3, 6, 9, 11	Long Term	Ongoing	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Severe Summer Weather/ Severe Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	Construct designated safe shelters that would provide protection from severe weather throughout the County.	EMA/ County Commissioners/ Incorporated Jurisdictions		State or Federal Sources	Erie County	2	4, 6, 9, 11	Long Term	Deferred	Seek funding by 2025
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Develop a tree maintenance program to prune or remove those trees recognized to be hazards.	EMA/ City of Sandusky	Erie Soil and Water Conservation District	Existing budget	Erie County	2	3, 4, 6, 9, 10, 11	Long Term	Ongoing	Seek additional funding by 2025
High	Severe Summer Weather/ Severe Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	Evaluate the need for shelters for marinas and for tourist areas within the County	EMA/ City of Sandusky		State or Federal Sources	Erie County	3	3, 4, 6, 9, 10, 11	Long Term	Ongoing	Seek additional funding by 2025
High	Severe Summer Weather/ Severe Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	Develop and provide outreach on the unique weather patterns in Erie County	EMA/ City of Sandusky		Existing budget	Erie County	3	3, 6, 9, 11	Long Term	Ongoing	
Medium	Tornadoes and Waterspouts/ Damaging Winds	Evaluate the need for multi-use shelters for marinas and for high tourist	EMA/ Incorporated Jurisdictions		State or Federal Sources	Erie County	2	6, 11	Long Term	Ongoing	Seek additional funding by 2025

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		areas within the County									
High	Lake & Stream Bank Erosion	Provide additional monitoring of water levels in streams and rivers with stream gauges	EMA/ USGS	Erie Soil and Water Conservation District	State or Federal Sources	Erie County	2	5	Long Term	Ongoing	Assisted with providing grant information to USGS regarding installation of camera on top of stream gauges to capture real time video (see ice jams above)
High	Lake & Stream Bank Erosion	Identify and evaluate areas and tributaries impacted by stormwater	EMA/ Engineers Office	Planning Commission/ Erie Soil and Water Conservation District	State or Federal Sources	Erie County	2	5	Short Term	Ongoing	ERPC will lend assistance if requested, seek additional funding by 2020
High	Lake & Stream Bank Erosion	Identify and evaluate Best Management Practices for stormwater and localized stream and lake bank erosion	EMA/ Engineers Office	Erie Soil and Water Conservation District	State or Federal Sources	Erie County	2	5	Long Term	Ongoing	ERPC will lend assistance if requested, seek additional funding
High	Lake & Stream Bank Erosion	Develop and provide educational information and promotion of urban and agricultural	EMA/ Engineers Office	Erie Soil and Water Conservation District	State or Federal Sources	Erie County	3	5	Medium Term	Ongoing	ERPC will lend assistance if requested, seek additional funding

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		impacts of stormwater									
Low	Drought	Develop a public education program for restrictions on water usage during drought conditions.	EMA		Existing Budget	Erie County	2	12	Long Term	Ongoing	
Low	Drought/ Severe Summer Weather	Develop a public education program on the hazards associated with droughts and extreme heat.	EMA		Existing Budget	Erie County	2	3, 12	Long Term	Ongoing	
Low	Drought	Develop educational program for restrictions on water usage during fire events	EMA		Existing Budget	Erie County	2	13	Long Term	Ongoing	
Low	Earthquakes	Develop a public education program on the dangers of earthquakes	EMA		Existing Budget	Erie County	2	14	Long Term	Ongoing	
Low	Earthquakes	Develop and enforce appropriate building codes for structures to be constructed in seismic areas.	EMA		Existing Budget	Erie County	2	14	Long Term	Ongoing	
Low	Earthquakes	Evaluate the potential association of injection wells	EMA		State or Federal Sources	Erie County	2	14	Long Term	Ongoing	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		and how that is affected by earthquakes									
Medium	Natural Biohazards	Evaluate the types and effects of Invasive Species on Erie County and its residents	EMA	Erie Soil and Water Conservation District/ OSU Extension	State or Federal Sources	Erie County	2	8	Long Term	Ongoing	Expected Completion 2025
High	Flooding/ Severe Summer Weather/ Lake and Stream Bank Erosion/ Damaging Winds/ Natural Biohazards/ Severe Winter Weather/ Tornadoes and Waterspouts/ Drought/ Earthquake	Utilize Erie County's Facebook Page and Twitter Account to conduct a social media campaign to increase education and awareness of hazards	Erie County Regional Planning Commission	EMA	Existing Budget	Erie County	1	1, 3, 6, 8, 9, 11, 13, 14	Short Term	New	
High	Flooding/ Severe Summer Weather/ Lake and Stream Bank Erosion/ Damaging Winds/ Natural	Increase awareness and education on hazards by sharing information at established public meetings	EMA/ Erie County Regional Planning Commission	Jurisdictions	Existing Budget	Erie County	1	1, 3, 6, 8, 9, 11, 13, 14	Short Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	Biohazards/ Severe Winter Weather/ Tornadoes and Waterspouts/ Drought/ Earthquake										
High	Flooding	Revise County Regulations after the FEMA Coastal Maps become official	Erie County Regional Planning Commission	Impacted jurisdictions	Existing Budget	Erie County	5	1	Long Term	New	
Medium	Natural Biohazards	Create a public education campaign targeted at landowners to encourage ECO-Farming techniques aimed at reducing nutrient loads in Lake Erie	EMA	Erie Soil and Water Conservation District, OSU Extension	Existing Budget	Erie County	4	7	Long Term	New	
Medium	Tornadoes and Waterspouts/ Damaging Winds	Create a public education campaign encouraging home owners and private businesses to install safe rooms, and provide information about Ohio's Safe Room Rebate Program	EMA	Erie County Regional Planning Commission	Existing Budget	Erie Count	2	6, 7	Medium Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Establish program to acquire and demolish or retrofit existing flood prone properties within the County and Incorporated Jurisdictions	Erie County EMA/ Incorporated Jurisdictions	Jurisdictions	State or Federal Sources	Erie County and Incorporated Jurisdictions	-1	1	Long-Term	New	

10.4.2 Mitigation Actions for the Village of Bay View

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA/ Village of Bay View	Erie County Engineering Department, Erie County Planning Commission	State and Federal Sources	Village of Bay View	5	2	Long Term	Deferred	Seeking Funding
High	All Hazards	Identify high risk areas and evaluate land- use planning techniques to mitigate future events	EMA/ Village of Bay View	Erie Soil and Water Conservation District/ Regional Planning	State and Federal Sources	Village of Bay View	5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	50% Completed	2025 Estimated time of completion
High	Flooding	Assess and inventory problems with undersized culverts within Erie County	EMA/ Village of Bay View		Existing Budget	Village of Bay View	N/A	N/A	N/A	Deleted	Not an area of concern for Village
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Develop and provide outreach program for County residents and those in the sensitive/ special needs population covering the dangers associated with severe storms.	EMA/ County Commissioners	Village of Bay View	Existing Budget	Village of Bay View	3	3, 6, 9, 11	Long Term	Ongoing	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Severe Summer Weather/ Severe Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	Construct designated safe shelters that would provide protection from severe weather throughout the County.	EMA/ County Commissioners/ Incorporated Jurisdictions		State or Federal Sources	Village of Bay View	2	4, 6, 9, 11	Long Term	Deferred	Seeking funding by 2025
High	Flooding/, Lake & Stream Bank Erosion	Develop and provide educational information and promotion of urban and agricultural impacts of stormwater	EMA/ Engineers Office	Village of Bay View/ Erie Soil and Water Conservation District	State or Federal Sources	Village of Bay View	3	5	Medium Term	Ongoing	Seeking additional funding by 2021
Medium	Tornadoes and Waterspouts/ Damaging Winds	Create a public education campaign encouraging home owners and private businesses to install safe rooms, and provide information about Ohio's Safe Room Rebate Program	EMA/ Village of Bay View	Erie County Regional Planning Commission	Existing Budget	Village of Bay View	2	6, 7	Medium Term	New	
Medium	Natural Biohazards	Create a public education campaign targeted at landowners	EMA/ Village of Bay View	Erie Soil and Water Conservation District, OSU Extension	Existing Budget	Village of Bay View	4	7	Long Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		to encourage ECO-Farming techniques aimed at reducing nutrient loads in Lake Erie									
Medium	Damaging Winds/ Tornadoes and Waterspouts	Cut down and remove dead/rotted trees that have the potential to cause property damage, injury, and power outages	Village of Bay View Council		Potentially a tax levy	Village of Bay View	1	6, 11	Short Term	New	
High	Flooding	Construct a lift station or pumping station on the Bayfront to prevent lake water from entering the storm water system, which causes flooding	Erie County Engineering Department	Village of Bay View Council		Village of Bay View	-2	1	Long Term	New	

10.4.3 Mitigation Actions for the City of Bellevue

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA	Erie County Engineering Department, Erie County Planning Commission	State and Federal Sources	City of Bellevue	5	2	Long Term	Ongoing	2025 Estimated Time of Completion
High	All hazards	Identify high risk areas and evaluate land use planning techniques to mitigate future events	EMA	Erie Soil and Water Conservation District/ Regional Planning	State and Federal Sources	City of Bellevue	5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	Ongoing	2025 Estimated Time of Completion
High	Flooding	Assess and inventory problems with undersized culverts within Erie County	EMA		Existing Budget	City of Bellevue	4	1	N/A	Completed	Erie County portion only
High	Severe Summer Weather	Develop and provide outreach program for County residents and those in the sensitive/special needs population covering the dangers associated with severe storms.	EMA/ County Commissioners		Existing Budget	City of Bellevue	3	3, 6, 9, 11	Long Term	Ongoing	
High	Severe Summer Weather, Tornadoes	Construct designated safe shelters that would	EMA/ County Commissioners/ Incorporated Jurisdictions		State or Federal Sources	City of Bellevue	2	4, 6, 9, 11	Long Term	Deferred	Seek Funding

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		provide protection from severe weather throughout the County.									
High	Flooding	Develop and provide educational information and promotion of urban and agricultural impacts of stormwater	EMA/ Engineers Office		State or Federal Sources	City of Bellevue	3	5	Medium Term	Ongoing	Seek Funding

10.4.4 Mitigation Actions for the Village of Berlin Heights

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA/ Village of Berlin Heights	Erie County Engineering Department/ Erie County Planning Commission	State and Federal Sources	Village of Berlin Heights	5	2		Deleted	
High	All Hazards	Identify high risk areas and evaluate land-use planning techniques to mitigate future events	EMA/ Village of Berlin Heights	Erie Soil and Water Conservation District/ Regional Planning	State and Federal Sources	Village of Berlin Heights	5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	In Progress	2025 Estimated Time of Completion
High	Flooding	Assess and inventory problems with undersized culverts within Erie County	EMA/ Village of Berlin Heights		Existing Budget	Village of Berlin Heights	4	1	Medium Term	In Progress	
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Develop and provide outreach program for County residents and those in the sensitive/special needs population covering the dangers associated with severe storms.	EMA/ County Commissioners	Village of Berlin Heights	Existing Budget	Village of Berlin Heights	3	3, 6, 9, 11	Medium Term	In Progress	
High	Severe Summer Weather/ Severe	Construct designated safe shelters that would	EMA/ County Commissioners/ Incorporated Jurisdictions		State or Federal Sources	Village of Berlin Heights	2	4, 6, 9, 11	Long Term	In Progress	Seek funding by 2025

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	provide protection from severe weather throughout the County.									
High	Flooding/ Lake & Stream Bank Erosion	Develop and provide educational information and promotion of urban and agricultural impacts of stormwater	EMA/ Engineers Office	Village of Berlin Heights/ Erie Soil and Water Conservation District	State or Federal Sources	Village of Berlin Heights	3	5	Medium Term	In Progress	Seek additional funding
Medium	Tornadoes and Waterspouts/ Damaging Winds	Create a public education campaign encouraging home owners and private businesses to install safe rooms, and provide information about Ohio's Safe Room Rebate Program	EMA/ Village of Berlin Heights	Erie County Regional Planning Commission	Existing Budget	Village of Berlin Heights	2	6, 7	Medium Term	New	
Medium	Natural Biohazards	Create a public education campaign targeted at landowners to encourage ECO-Farming techniques aimed at reducing nutrient loads in Lake Erie	EMA/ Village of Berlin Heights	Erie Soil and Water Conservation District, OSU Extension	Existing Budget	Village of Berlin Heights	4	7	Long Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
Medium	Damaging Winds/ Tornadoes and Waterspouts	Inspect trees in road ROW and remove as necessary	Village of Berlin Heights Road Department		Existing Budget	Village of Berlin Heights	-3	6, 11	Short Term	New	

10.4.6 Mitigation Actions for the Village of Castalia

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA/ Village of Castalia	Erie County Engineering Department, Erie County Planning Commission	State and Federal Sources	Village of Castalia	5	2	Long Term	Deleted	
High	All Hazards	Identify high risk areas and evaluate land-use planning techniques to mitigate future events	EMA/ Village of Castalia	Erie Soil and Water Conservation District/ Regional Planning	State and Federal Sources	Village of Castalia	5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	Ongoing	
High	Flooding	Assess and inventory problems with undersized culverts within Erie County	EMA/Village of Castalia		Existing Budget	Village of Castalia	4	1	Medium Term	Ongoing	
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Develop and provide outreach program for County residents and those in the sensitive/special needs population covering the dangers associated with severe storms.	EMA/ County Commissioners	Village of Castalia	Existing Budget	Village of Castalia	3	3, 6, 9, 11	Long Term	Ongoing	
High	Severe Summer Weather/ Severe	Construct designated safe shelters that would	EMA/ County Commissioners/ Incorporated Jurisdictions	Village of Castalia	State or Federal Sources	Village of Castalia	2	4, 6, 9, 11	Long Term	Ongoing	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	provide protection from severe weather throughout the County.									
High	Flooding/, Lake & Stream Bank Erosion	Develop and provide educational information and promotion of urban and agricultural impacts of stormwater	EMA/ Engineers Office	Village of Castalia/ Erie Soil and Water Conservation District	State or Federal Sources	Village of Castalia	3	5	Medium Term	Ongoing	
Medium	Tornadoes and Waterspouts/ Damaging Winds	Create a public education campaign encouraging home owners and private businesses to install safe rooms, and provide information about Ohio's Safe Room Rebate Program	EMA/ Village of Castalia	Erie County Regional Planning Commission	Existing Budget	Village of Castalia	2	6, 7	Medium Term	New	
Medium	Natural Biohazards	Create a public education campaign targeted at landowners to encourage ECO-Farming techniques aimed at reducing nutrient loads in Lake Erie	EMA/ Village of Castalia	Erie Soil and Water Conservation District, OSU Extension	Existing Budget	Village of Castalia	4	7	Long Term	New	

10.4.7 Mitigation Actions for the City of Huron

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA/ City of Huron	Erie County Engineering Department, Erie County Planning Commission	State and Federal Sources	City of Huron	5	2	Long Term	Deleted	Ice jams are not a concern; river is wide.
High	All Hazards	Identify high risk areas and evaluate land-use planning techniques to mitigate future events	EMA/ City of Huron	Erie Soil and Water Conservation District/ Regional Planning	State and Federal Sources	City of Huron	5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	Ongoing	Expected completion 2025
High	Flooding	Assess and inventory problems with undersized culverts within Erie County	City of Huron Street Department/City of Huron Engineering Department		Existing Budget	City of Huron	4	1	Long Term	Ongoing	Maintain and improve as necessary existing culverts
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Develop and provide outreach program for County residents and those in the sensitive/special needs population covering the dangers associated with severe storms.	City of Huron Parks Department	Police Department	Existing Budget	City of Huron	3	3, 6, 9, 11	N/A	Completed	Automatic monitoring system
High	Severe Summer Weather/ Severe	Construct designated safe shelters that would	City of Huron Parks Department		State or Federal Sources	City of Huron	2	4, 6, 9, 11	Long Term	Ongoing	All parks have shelter buildings

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	provide protection from severe weather throughout the County.									for storms, but not tornadoes
High	Flooding/, Lake & Stream Bank Erosion	Develop and provide educational information and promotion of urban and agricultural impacts of stormwater	EMA/ Engineers Office	City of Huron/ Erie Soil and Water Conservation District	State or Federal Sources	City of Huron	3	5	Medium Term	Ongoing	Rain barrel programs, etc.
Medium	Tornadoes and Waterspouts/ Damaging Winds	Create a public education campaign encouraging home owners and private businesses to install safe rooms, and provide information about Ohio's Safe Room Rebate Program	EMA/ City of Huron	Erie County Regional Planning Commission	Existing Budget	City of Huron	2	6, 7	Medium Term	New	
Medium	Natural Biohazards	Create a public education campaign targeted at landowners to encourage ECO-Farming techniques aimed at reducing nutrient loads in Lake Erie	EMA/ City of Huron	Erie Soil and Water Conservation District	Existing Budget	City of Huron	4	7	Long Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Create educational materials for presentation and distribution at existing public meetings regarding flood zone development	City of Huron Engineering Department	ODNR, Huron Public Library	Existing Budget	City of Huron	-1	1	Medium-Term	New	
High	Lake and Stream Bank Erosion	Develop and maintain a list of funding sources for private property owners to undertake erosion control projects along Lake Erie	City of Huron Engineering Department		Existing Budget	City of Huron	-1	5	Long-Term	New	

10.4.8 Mitigation Actions for the Village of Kelleys Island

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need for multi-use shelters for marinas and for high tourist areas within the County	EMA/ Kelleys Island	Erie County Engineering Department, Erie County Planning Commission	State or Federal Sources	Kelleys Island		2	Long Term	Deferred	Seek Funding
High	All Hazards	Develop and provide outreach program for County residents and those in the sensitive/special needs population covering the dangers	EMA/ Kelleys Island	Erie Soil and Water Conservation District/ Regional Planning	Existing budget	Kelleys Island		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	Ongoing	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		associated with severe storms.									
High	Flooding	Identity and assess culverts and undersized drainage pipe property and drainage affected on Kelley's Island	EMA/ Kelleys Island		State or Federal Sources	Kelleys Island		1	N/A	Deleted	
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Assess and inventory problems with roadways susceptible to flooding within Erie County	EMA/ County Commissioners	Kelleys Island	Existing budget	Kelleys Island		3, 6, 9, 11	Long Term	Ongoing	
High	Severe Summer Weather/ Severe Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	Provide NOAA radios in critical facilities to move forward on the "Storm Ready" Community status.	EMA/ County Commissioners/ Incorporated Jurisdictions		State or Federal Sources	Kelleys Island		4, 6, 9, 11	Long Term	Ongoing	
High	Flooding/, Lake & Stream Bank Erosion	Develop and provide educational information and promotion of urban and agricultural impacts of stormwater	EMA/ Engineers Office	Kelleys Island/ Erie Soil and Water Conservation District	State or Federal Sources	Kelleys Island		5	Medium Term	Ongoing	
Medium	Tornadoes and Waterspouts/	Create a public education campaign encouraging	EMA/ Kelleys Island	Erie County Regional Planning Commission	Existing Budget	Kelleys Island	2	6, 7	Medium Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	Damaging Winds	home owners and private businesses to install safe rooms, and provide information about Ohio's Safe Room Rebate Program									
Medium	Natural Biohazards	Create a public education campaign targeted at landowners to encourage ECO-Farming techniques aimed at reducing nutrient loads in Lake Erie	EMA/ Kelleys Island	Erie Soil and Water Conservation District, OSU Extension	Existing Budget	Kelleys Island	4	7	Long Term	New	
High	Flooding, Lake/Stream Bank Erosion	Repair shoreline and Lakeshore Drive sustainably, to resist future damage from erosion and flooding associated with high lake levels	Village of Kelleys Island	United States Army Corps of Engineers, Ohio EMA, FEMA	BRIC or other funding sources	Kelleys Island	-1	1, 5	Long Term	New	
High	Flooding	Encourage the Village of Kelleys Island to participate in the National Flood Insurance Program	Village of Kelleys Island	Erie County EMA, Erie County Regional Planning Commission	Existing Budget	Kelleys Island	1	1	Medium Term	New	

10.4.9 Mitigation Actions for the Village of Milan

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA/ Milan Township Fire Department	Erie County Engineering Department, Erie County Planning Commission	State and Federal Sources	Village of Milan	5	2	Long Term	Ongoing	
High	All Hazards	Identify high risk areas and evaluate land-use planning techniques to mitigate future events	EMA/ Village of Milan	Erie Soil and Water Conservation District/ Regional Planning	State and Federal Sources	Village of Milan	5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	Ongoing	
High	Flooding	Assess and inventory problems with undersized culverts within Erie County	EMA/ Village of Milan		Existing Budget	Village of Milan	4	1	Long Term	Ongoing	
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Develop and provide outreach program for County residents and those in the sensitive/ special needs population covering the dangers associated with severe storms.	EMA/ County Commissioners	Village of Milan Utilities/Street Department Milan Township Fire Department	Existing Budget	Village of Milan	3	3, 6, 9, 11	Long Term	Ongoing	
High	Severe Summer Weather/ Severe	Construct designated safe shelters that would	EMA/ County Commissioners/ Incorporated Jurisdictions	Village of Milan Utilities/Street Department	State or Federal Sources	Village of Milan	2	4, 6, 9, 11	Long Term	Deferred	Need Funding

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	provide protection from severe weather throughout the County.		Milan Township Fire Department							
High	Flooding/, Lake & Stream Bank Erosion	Develop and provide educational information and promotion of urban and agricultural impacts of stormwater	EMA/ Engineers Office	Village of Milan/ Erie Soil and Water Conservation District	State or Federal Sources	Village of Milan	3	5	Medium Term	Deferred	Need Funding
Medium	Tornadoes and Waterspouts/ Damaging Winds	Create a public education campaign utilizing the Village's social media accounts, to notify home owners and private businesses to install safe rooms, and provide information about Ohio's Safe Room Rebate Program and encourage the removal of diseased and damaged trees	Village of Milan	Erie County Regional Planning Commission	Existing Budget	Village of Milan	3	6, 7	Short Term	New	
Medium	Natural Biohazards	Create a public education campaign targeted at	EMA/ Village of Milan	Erie Soil and Water Conservation District, OSU Extension	Existing Budget	Village of Milan	4	7	Long Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		landowners to encourage ECO-Farming techniques aimed at reducing nutrient loads in Lake Erie									

10.4.10 Mitigation Actions for the City of Sandusky

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA/ County/ Commissioners		State and Federal Sources	City of Sandusky	5	2	Long Term	Deleted	Action item is deleted because ice jams are not a hazard in the City of Sandusky.
High	All Hazards	Identify high risk areas and evaluate land-use planning techniques to mitigate future events	EMA/ County Commissioners		State and Federal Sources	City of Sandusky	5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	Ongoing	
High	Flooding	Assess and inventory problems with existing culverts within Erie County	EMA/ Engineering Office	Sandusky Engineering Department	Existing Budget	City of Sandusky	4	1	Medium Term	Ongoing	
High	Severe Summer Weather	Develop and provide outreach program for County residents and those in the sensitive/special needs population covering the dangers associated with severe storms.	EMA/ County Commissioners		Existing Budget	City of Sandusky	3	3, 6, 9, 11	Long Term	Ongoing	Annual Weather Spotter Training
High	Severe Summer Weather, Tornadoes	Create a public education campaign encouraging	EMA/ City of Sandusky	Erie County Regional Planning Commission	State or Federal Sources	City of Sandusky	2	4, 6, 9, 11	Long Term	Ongoing	Areas of large crowds such as Cedar Point

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	and Waterspouts/ Damaging Winds	home owners and private businesses to install safe rooms, and provide information about Ohio's Safe Room Rebate Program									and Sports Force.
High	Flooding	Develop and conduct a social media educational campaign informing residents and businesses of the impacts of stormwater	EMA/ Planning Commission/ Engineers Office		State or Federal Sources	City of Sandusky	3	5	Long Term	Ongoing	See Stormwater Management Plan
Medium	Severe Winter Weather	Provide education for vulnerable populations regarding city operated warming centers during events of extreme cold	City of Sandusky Commissioners, New Jerusalem, Sandusky Planning Department		Existing Budget/ Volunteer	City of Sandusky	4	9, 10	Immediate	New	
High	Lake and Stream Bank Erosion	Develop erosion control plans	City of Sandusky Engineering Department		Existing Budget	City of Sandusky	4	5	Short Term	New	
Medium	Natural Biohazards	Create a public education campaign targeted at landowners to encourage ECO-Farming techniques aimed at reducing	EMA/ City of Sandusky	Erie Soil and Water Conservation District, OSU Extension	Existing Budget	City of Sandusky	4	7	Long Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		nutrient loads in Lake Erie									

10.4.11 Mitigation Actions for the City of Vermilion

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
High	Flooding	Evaluate the need to consider Ice Jams as concern for those communities that are affected directly from these winter flooding hazard	EMA/ City of Vermilion	Erie County Engineering Department, Erie County Planning Commission	State and Federal Sources	City of Vermilion	5	2	Long Term	Ongoing	
High	All Hazards	Identify high risk areas and evaluate land-use planning techniques to mitigate future events	EMA/ City of Vermilion	Erie Soil and Water Conservation District/ Regional Planning	State and Federal Sources	City of Vermilion	5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Long Term	Ongoing	
High	Flooding	Assess and inventory problems with undersized culverts within Erie County	EMA/ City of Vermilion		Existing Budget	City of Vermilion	N/A	N/A	N/A	Deleted	
High	Severe Summer Weather/ Severe Winter Weather / Tornadoes and Waterspouts/ Damaging Winds	Develop and provide outreach program for County residents and those in the sensitive/ special needs population covering the dangers associated with severe storms.	EMA/ County Commissioners	City of Vermilion	Existing Budget	City of Vermilion	3	3, 6, 9, 11	Long Term	Ongoing	
High	Severe Summer Weather/ Severe	Construct designated safe shelters that would	EMA/ County Commissioners/ Incorporated Jurisdictions		State or Federal Sources	City of Vermilion	2	4, 6, 9, 11	Long Term	Ongoing	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
	Winter Weather/ Tornadoes and Waterspouts/ Damaging Winds	provide protection from severe weather throughout the County.									
High	Flooding/, Lake & Stream Bank Erosion	Develop and provide educational information and promotion of urban and agricultural impacts of stormwater	EMA/ Engineers Office	City of Vermilion/ Erie Soil and Water Conservation District	State or Federal Sources	City of Vermilion	3	5	Medium Term	Ongoing	
High	Flooding	Communicate with current and new residents the possibility of water rising and entering their basement, or lower level limiting or eliminating access to their home.	Vermilion Police and Fire		Existing Budget	City of Vermilion	0	1	Short Term	New	
Medium	Tornadoes and Waterspouts/ Damaging Winds	Create a public education campaign utilizing the Village's social media accounts, to notify home owners and private businesses to install safe rooms, and provide information about Ohio's	City of Vermilion	Erie County Regional Planning Commission	Existing Budget	City of Vermilion	3	6, 7	Short Term	New	

Priority	Hazard Type	Mitigation Action	Lead Agency	Supporting Agencies	Funding Source	Benefiting Community	Benefit/ Cost	Goal Addressed	Time Frame	Current Status	Other Information
		Safe Room Rebate Program and encourage the removal of diseased and damaged trees									
Medium	Natural Biohazards	Create a public education campaign targeted at landowners to encourage ECO-Farming techniques aimed at reducing nutrient loads in Lake Erie	EMA/ City of Vermilion	Erie Soil and Water Conservation District, OSU Extension	Existing Budget	City of Vermilion	4	7	Long Term	New	

10.5 Implementation Strategies

For each proposed alternative, the associated strategy identifies the agency that will be responsible for initiating the work and potential sources of funding for the work. Each action also indicates when the action will happen and identifies all of the parties responsible for implementation of each action.

The county intends to use the Erie County Natural Hazards Mitigation Plan to help in updating and developing other plans in the county as well as for applying for grants. These other plans would include:

- The Erie County Emergency Operations Plan (EOP)
- Various Emergency Action Plans (EAP) for festivals and community functions
- Various grants as they become available
- Emergency Action Plans for other potential emergency situations within individual jurisdictions
- Comprehensive plans
- Capital Improvement Plans
- Watershed Management Plans
- Other

Erie County Emergency Management will encourage the 2020 Natural Hazard Mitigation Plan update be incorporated into other planning opportunities by actively participating in the development of those plans and grant applications and educating other planning participants about the importance and goals of the Natural Hazard Mitigation Plan update. Each jurisdiction will also help to ensure the goals of the 2020 Erie County Natural Hazard Mitigation Plan are incorporated into any of the planning processes they are a part of as well.

To implement mitigation strategies into local government plans, the Core Group will be responsible for identifying how and when to include the mitigation plan into other efforts. With a wide range of government representatives within the Core Group, the Core Group members are best suited to identify local plans that align with the mitigation action items, such as comprehensive or capital improvement plans. It will be the Core Group member's responsibility to align these efforts to maximize the potential for action item completion.

11 Plan Maintenance

11.1 Plan Maintenance Update

An annual review of mitigation actions will be conducted. The process for evaluating the plan has been modified slightly from that presented in the previous version of the plan. The protocols for updating the plan and continued public involvement have been elaborated upon in this version of the plan.

Currently, the Erie County EMA office has ownership of the plan and will governor the document for the foreseeable future. With sole proprietorship of the plan, the EMA office with be able to organize the proper meeting and document any changes for proper plan maintenance.

11.2 Monitoring Mitigation Actions

The Erie County EMA Director will monitor the progress made on the implementation of the identified action items annually at about the anniversary date of plan adoption. Monitoring will be accomplished by calling or e-mailing each county or municipal agency that, through adoption of the plan, has assumed the responsibility of implementing one or more mitigation actions.

By monitoring mitigation actions, when the plan is next updated, information about the status of proposed mitigation actions will be readily available. The updated plan will include a section explaining if previously proposed mitigation actions have been implemented, completed, deleted, or deferred. The updated plan will identify actions that are no longer appropriate for the community and should be deleted. The updated plan will identify obstacles to implementation that caused proposed actions to be deferred and will recommend strategies for overcoming those obstacles.

The Mitigation Core Group will not only monitor the implementation of mitigation actions proposed in this plan, but will also monitor actions of participating jurisdictions and surrounding communities that may affect the ability of Erie County to withstand the effects of natural hazards or to recover from a disaster in the future. The method for gathering information about actions beyond those proposed in this plan will be informal; as active members of the Erie County community, Mitigation Core Group members will bring their own knowledge of the area to monitoring meetings to provide information about actions of participating jurisdictions as well as of nearby communities.

11.3 Evaluating the Plan

One month after conducting the annual monitoring of mitigation actions, the Erie County EMA Director will schedule an annual meeting of the Mitigation Core Group to evaluate the mitigation planning process, implementation of the plan, and conditions in Erie County that suggest the need to modify either planning data or planning actions.

Participating incorporated jurisdictions' and townships will be invited to attend the evaluation meetings. The evaluation meeting will include a presentation of the results of the monitoring of mitigation actions and will answer the following questions:

- Do mitigation goals and objectives reflect current community concerns as well as the finding of the risk assessment?
- Have conditions in the county changed so that findings of the risk assessment should be updated?
- What hazards have caused damage in the county since the plan was written? Were these anticipated and evaluated in the plan or should these hazards be added to the plan?
- Have conditions in the county changed so that the magnitude of risk as expressed in this plan has changed?
- Are new sources of data available that will improve the risk assessment?
- Are current resources sufficient for implementing mitigation actions?
- For each mitigation action that has not been completed, what are the obstacles to implementation? What are potential solutions for overcoming these obstacles?
- Is each completed mitigation action effective in reducing risk? What action is required to further reduce the risk addressed by the completed action?
- What mitigation actions should be added to the plan and proposed for implementation?
- Should any proposed mitigation actions be deleted from the plan? What is the rationale for deleting previously proposed actions from the plan?
- Based upon the evaluation, should the plan be updated as soon as possible, or should the plan be updated as scheduled 5 years after it was adopted?

The Erie County EMA Director will document the results of the annual evaluation meeting and submit the findings to each incorporated jurisdiction and townships in the county for review within 2 weeks. If the Mitigation Core Group determined that the plan should be updated as soon as possible, the Erie County EMA Director will take action to initiate the plan update.

11.4 Updating the Plan

This plan must be updated within 5 years and again adopted by the county and participating jurisdictions in order to maintain compliance with the regulations stated in 44 CFR Part 201.6 and ensure eligibility for applying for and receiving certain Federal mitigation grant funds.

Monitoring and evaluation will identify necessary modifications to the plan including changes in mitigation strategies and actions that should be incorporated in the next update. The update will have more current information about previous occurrences of hazards and improved information about wind speed for high wind events will be sought.

The Erie County EMA Director will initiate the process of updating the plan no more than 3 years after the plan was adopted, or immediately upon a determination by the Mitigation Core Group that the plan should be updated sooner. This will allow approximately 1 year for securing funding and/or staff for updating the plan and 1 year for conducting research and writing the updated plan.

11.5 Continued Public Involvement

The Erie County EMA Director will provide printed copies of the plan to key Erie County offices including the public library in the county so that the public has access to printed copies of the plan. A copy of the adopted plan will be posted on the county website for 5 years so that the public has electronic access to the plan. The website will include contact information for anyone to provide comment so that residents, business owners, and others who read the plan will be able to provide a comment about the plan or about the mitigation strategies. The Erie County EMA will maintain these comments and will provide them to the Mitigation Core Group for consideration at the annual plan evaluation meetings.

The Erie County EMA Director will post notices of annual mitigation plan evaluation meetings using the usual methods for posting meeting announcements in the county to invite the public to participate. In addition to posting announcements on the county web site, at least one newspaper press release will be published at the onset of the process of updating the plan inviting public participation.

The Erie County EMA Director will document the number of people who participate in the annual meetings and the results of the meeting for inclusion in the plan when it is next updated. In this way, the public will have an opportunity to become involved in the planning process and to influence mitigation planning decisions.

The Erie County EMA Director will provide a written report and/or make a presentation to the Erie County Commissioners to advise them of the status of the plan and of proposed mitigation actions. In this way, the public will have another opportunity to become aware of local mitigation efforts.

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13 List of Acronyms

CDBG	Community Development Block Grant
CEA	Coastal Erosion Area
CRA	Community Reinvestment Act
CRF	Code of Federal Regulations
CRS	Community Rating System
DMA2K	Disaster Mitigation Act of 2000
EAP	Emergency Action Plan
EMA	Emergency Management Agency
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance Program
GIS	Geographic Information System
HAB	Harmful Algae Bloom
HMGP	Hazard Mitigation Grants Program
HUD	Housing and Urban Development
MCPP	Mitsubishi Chemical Performance Polymers
MORPC	Mid-Ohio Regional Planning Commission
MPH	Miles per Hour
NCDC	National Climate Data Center
NFIP	National Flood Insurance Rate Program
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
ODNR	Ohio Department of Natural Resources
OEMA	Ohio Emergency Management Agency
OSU	Ohio State University
PDM	Pre-Disaster Mitigation Assistance Program
PDSI	Palmer Drought Severity Index
RFC	Repetitive Flood Claims Program

SLR	Severe Repetitive Loss Program
STORMS	State of Ohio Rain Snow Monitoring System
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WSS	Web Soil Survey