

Antrim County, Michigan Natural Hazard Mitigation Plan

2023

FEMA LETTER OF APPROVAL

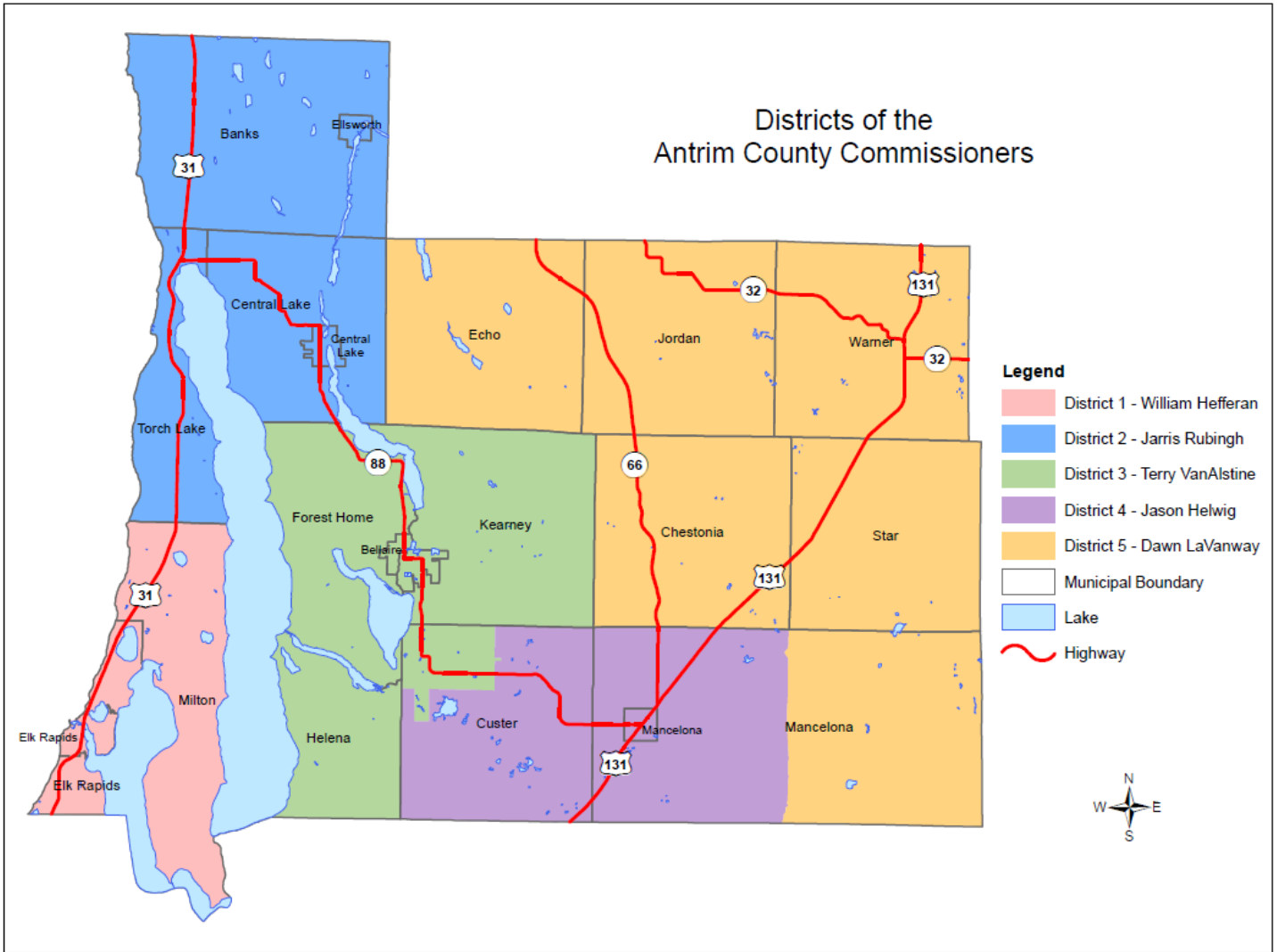
ACKNOWLEDGEMENTS

The Antrim County Natural Hazard Mitigation Plan is prepared for Antrim County, Michigan and all the jurisdictions within it. This plan is the culmination of an interdisciplinary and interagency planning effort that required the participation, technical assistance and expertise of individuals within the agencies and organizations listed below. Refer to Appendix E for a complete table of how and when the representatives of each participating entity contributed to the development of the plan. Each jurisdiction is invited to be a continuing participant in future regular review and updates of the Plan.

Participating Entity	Representative	Title
Antrim County Board of Commissioners	Bill Hefferan	District 1 (Milton Township, Elk Rapids Township, Village of Elk Rapids)
	Terry VanAlstine	Board Chair, District 3 (Village of Bellaire; Forest Home, Helena and Kearney Townships; part of Custer Township)
	Jason Helwig	Vice Chair, District 4 Commissioner representing the Village of Mancelona, the west half of Mancelona Township, and part of Custer Township
	Dawn LaVanway	District 5 Commissioner representing the Townships of Warner, Echo, Jordan, Chestonia, Star and the east half of Mancelona Township
	Ed Boettcher	Former Commissioner representing Elk Rapids Township & Village of Elk Rapids
Antrim County Planning Commission	Richard Friske, Jr.	Planning Commissioner
	Bill Hefferan	Planning Commissioner
	James Gurr	Planning Commissioner
	Ron Tschudy	Planning Commissioner
	Leslie Elrod	Planning Commissioner
Antrim County	Jeremy Scott	County Administrator/ former Deputy County Administrator
	Peter Garwood	County Administrator (former)
	Matthew Adamek	Emergency Operations Director
	Leslie Meyers	Emergency Operations Director (former)/Operator of Dams
	Mike Gank	911 Administrative Sergeant
	Mark Stone	Operator of Dams (former)
	Scott Kleinhuizen	Assistant Operator of Dams
	Julie Weston	GIS Technician
	Alan Shumaker	Meadow Brook County Health Care Facility – Director of Maintenance
	Kevin Hoch	County Sheriff's Office
	Daniel Bean	Sheriff
Village of Bellaire	Nicole Essad	Clerk/Zoning Administrator
	Dave Gadja	Treasurer/ Bellaire DDA member
Village of Central Lake	Andrew Smith	Treasurer/Clerk (former)
Village of Elk Rapids	David Centala	Chief of Police
	Kevin Lane	DPW Supervintendent
	Kerri Esterly	Treasurer/Planning/Zoning/Community Development
	Laura Schumate	Trustee
	Bill Hefferan	County Commissioner, District 1
Village of Ellsworth	Lynn Aldrich Spearing	Village of Ellsworth President Pro Tem
	Ross Maxwell	Resident
Village of Mancelona	Jason Helwig	County Commissioner, District 4
	Michael Allison	Village President

Participating Entity	Representative	Title
Banks Township	Richard Friske Jr.	County Planning Commissioner
	Donna Heeres	Clerk
Central Lake Township	Judith Kosloski	Clerk
Chestonia Township	Dawn LaVanway	County Commissioner, District 5
Custer Township	Roxann Flake	Supervisor
	Terry VanAlstine	Board Chair, District 3
	Jason Helwig	Vice Chair, District 4
Echo Township	Ron Tschudy	County Planning Commissioner
	William Derenzy	Supervisor
Elk Rapids Township	Bill Hefferan	County Commissioner, District 1
Forest Home Township	Terry Smith	Supervisor
	Bonnie Robbins	Trustee
	Stephen C. Barnard	Zoning Administrator
	Paul Trumbler	Planning Commission Chair
Helena Township	Bonnie Robbins	Trustee
	Mike Robinson	Twp. Planning Commissioner & S. Torch Lake Fire Dept.
	Clark "Butch" Peeples	Supervisor
Jordan Township	Dawn LaVanway	County Commissioner, District 5
Kearney Township	Ed Niepoth	Supervisor
	Dick Jacques	Township Planning Commissioner
Mancelona Township	Jason Helwig	County Commissioner, District 4
	Dawn LaVanway	County Commissioner, District 5
Milton Township	Bill Hefferan	Township Planning Commission Chair
	Jeremy Ball	Milton Township Fire Chief
	Joe Renis	Twp. Planning Commissioner
	Brett Pharo	Trustee
Star Township	Dawn LaVanway	County Commissioner, District 5
	Robert Marsh	Supervisor
Torch Lake Township	Ted Schroeder	Assistant Fire Chief
	Jerry Kulka	Planning Commissioner (former)
	Mike Robinson	S. Torch Lake F.D.
	Virginia Hawkins	Deputy Clerk
	Sara Kopriva	Zoning Administrator
Warner Township	Dawn LaVanway	County Commissioner, District 5
Antrim County Road Commission	Peter Stumm	Superintendent
	Burt Thompson	Engineer/Manager
Antrim Commission on Aging	Judy Parliament	Director
	Amy Tate	Clerk I, Office Manager
Antrim Conservation District	Melissa Zelenak	Executive Director
	Kyle Williams	Soil Erosion Officer
	Mike Meriwether	Forester
	Heidi Shafer	Soil Erosion Officer (former)
	Wendy Warren	Executive Director (former)
Charlevoix, Antrim, Kalkaska, & Emmet – Cooperative Invasive Species Management Area (CAKE CISMA)	Lindsey Bona-Eggeman	Program Coordinator

Participating Entity	Representative	Title
Three Lakes Association	Fred Sittel	President
Six Mile Lake Association	Linda VanAndel	Board Member
The Watershed Center Grand Traverse Bay	Heather Smith	Grand Traverse Baykeeper
Bellaire Chamber of Commerce	Sue Palmisano	Executive Director
American Red Cross	Darlene Windish	Disaster Assistant Volunteer
Health Department of Northwest Michigan	Chloe Capaldi	Emergency Preparedness Coordinator
Bellaire Family Health Center	Christine Wilhelm	HR Director
Michigan Department of Health and Human Services	Bob Bush	Assistant Payments Specialist
Michigan State Police – Emergency Management & Homeland Security Division	Lt. Mike deCastro	District 7 Coordinator
Michigan Department of Environment, Great Lakes and Energy (EGLE) -Remediation and Redevelopment Division	Brian Flickinger	Project Manager
Michigan State University Extension	Stan Moore	Farm Business Management Educator



Prepared for: Antrim County Board of Commissioners

Prepared by: Antrim County Office of Emergency Management and the Antrim County Local Emergency Planning Committee with assistance from:



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I. INTRODUCTION

Hazard mitigation is defined as any action taken before, during, or after a disaster or emergency to permanently eliminate or reduce the long-term risk to human life and property from natural, technological and human-related hazards. Mitigation is an essential element of emergency management, along with preparedness, response and recovery.

Mitigation allows repairs and reconstruction to be completed after an incident occurs in such a way that does not just restore the damaged property as quickly as possible to pre-disaster conditions. It also ensures that such cycles are broken, that post-disaster repairs and reconstruction take place after damages are analyzed, and that sounder, less vulnerable conditions are produced. Through a combination of regulatory, administrative, and engineering approaches, losses can be limited by reducing susceptibility to damage. When successful, hazard mitigation will lessen the impact of a disaster on people, property, the environment and economy, and continuity of services through the coordination of available resources, programs, initiatives, and authorities.

A *hazard*, in the context of this plan, is an event or physical condition that has potential to cause fatalities; injuries; damage to personal property, infrastructure, or the environment; agricultural product loss; or interruption of business or civic life. The Antrim County Natural Hazard Mitigation Plan focuses on *natural* hazards such as extreme heat/cold, drought, wildfires, tornadoes, thunderstorm with wind, high winds, hail, extreme winter weather, flooding, shoreline erosion and flooding, dangerous shoreline currents, and invasive species. An exception is that it will also consider these technological and human-related hazards: dam failure and public illness outbreak. The following natural hazards were not included in the analysis for this Hazard Mitigation Plan: earthquakes, space weather, and subsidence. According to information presented about these hazards in Michigan State Police's 2019 Michigan Hazard Analysis, there is very little risk of these events occurring in Northwest Michigan.

The main objective of the Antrim County Natural Hazard Mitigation Plan is to permanently eliminate or reduce long-term risks to people and property from natural hazards so that county assets such as transportation, infrastructure, commerce, and tourism can be sustained and strengthened. This can be accomplished through collaborative efforts and activities amongst agencies within the county to protect the health, safety, and economic interests of the residents and businesses through planning, awareness, and implementation.

Through the development of this Plan, a broad perspective was taken in examining multiple hazard mitigation activities and opportunities in Antrim County. Each hazard was analyzed from a historical perspective, evaluated for potential risk, and considered for possible mitigation.

Since the 2016 plan's adoption period, the county and municipalities have made progress on the following key endeavors to address their previously identified mitigation strategies:

- FLOODING &/OR EROSION
 - In 2022, the United State Army Corps of Engineers (USACE) finished a 2-year long hydrology study of the Antrim County Chain of Lakes. The data that the USACE hydrologists gathered was studied and used to develop a computer model of the Elk River Chain of Lakes Watershed. The model will be used to study behavior patterns of the water flow and to predict lake water levels under different storm scenarios, including flood events. The findings of the study were presented to the public in June 2022.
 - Partnerships with other local municipalities and non-profits to conserve parkland/undeveloped land (ongoing).
 - Commissioning the creation of a new county-wide Soil Erosion and Sedimentation Control ordinance (currently in development).
 - Increased standards for County construction permit approval completed in 2016 - elevation certificates and compliance with NFIP are now required.
 - Collaboration with The Watershed Center Grand Traverse Bay, Antrim Conservation District and the Tip of the Mitt Watershed Council resulted in an inventory of shoreline erosion sites and culverts for road/stream crossings throughout the County. (This project is ongoing – it started in 2014).
- OTHER
 - Implemented the "Rave" brand mass alert notification software that enables information sharing across multiple channels, whether through mobile in the form of SMS alert (Short Message Service), email, desktop or social media, or audibly through voice calls, sirens or long-range acoustic devices (LRADs).

- All fire departments in the county are equipped to be used as secondary emergency shelters if needed.
- In September 2022, Antrim County Emergency Management received a mobile trailer to be used by a variety of groups, including the County's 911 Department, county law enforcement and CERT (Community Emergency Response Team), to aid in providing emergency assistance as needed and at large special events.

Appendix C provides a list of mitigation strategies included in the Antrim County 2016 Natural Hazards Mitigation Plan, along with their current status and how they may have been integrated into other local planning mechanisms.

Section VII of this plan, "Mitigation Strategies and Priorities", provides a current list of hazard mitigation strategies for each natural hazard identified. Mitigation strategies were developed based on discussions with local officials and a review of FEMA/MSP best practices for hazard mitigation. (Refer to Appendix D for a list of Alternative Strategies that were considered.) Strategies are grouped according to their purpose: Awareness and Preparation; Shelters; Buildings, Roads & Dams; Utilities & Technology; and Environment & Natural Resources. The strategies table also includes: a description of each strategy; what hazards it addresses; where the strategy applies; who is responsible for implementing the strategy; how the strategy will be implemented (what resources are available to apply the strategy); the estimated timeframe for completion; the level of priority; and what type of strategy it is. Most strategies are intended to be action items completed during the 5-year timeframe in which the plan is active. Some long-term strategies may extend beyond the 5-year timeframe due to feasibility or level of difficulty.

Recognizing the importance of reducing community vulnerability to natural hazards, Antrim County is actively addressing the issue through the development and implementation of this plan. This process will help ensure that Antrim County remains a vibrant, safe, enjoyable place in which to live, raise a family, continue to conduct business, and maintain a tourist base. The Plan serves as the foundation for natural hazard mitigation activities and actions within Antrim County, and will be a resource for building coordination and cooperation within the community for local control of future mitigation and community preparedness around the following goals and objectives:

Goal 1: Increase local awareness and participation in natural hazards mitigation strategies

- Encourage cooperation and communication between planning and emergency management officials
 - Develop partnerships and procedures with adjoining county Emergency Managers to coordinate resources in the event of an emergency; for example, identifying long-term and short-term shelter sites for a large amount of displaced people (i.e., campgrounds, hotels, community centers, special event spaces).
- Encourage additional local governmental agencies to participate in the natural hazards mitigation process
- Encourage public and private organizations to participate, including organizations who advocate for individuals with functional or access needs (vulnerable populations)

Goal 2: Integrate natural hazards mitigation considerations into the county's comprehensive planning process

- Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures; and into the county's comprehensive master plan
- Update zoning ordinances to reflect building codes, shoreline protection rules, etc.
- Incorporate natural hazards mitigation into basic land use regulation mechanisms
- Improve hazard preparedness and mitigation through increased community education and promotion of public warning systems
- Strengthen the role of the Local Emergency Planning Committee in the land development process
- Integrate natural hazards mitigation into the capital improvement planning process so that public infrastructure does not lead to development in natural hazards areas
- Encourage county agencies to assess local roads, bridges, dams, and related transportation infrastructure for natural hazards vulnerability

Goal 3: Utilize available resources and apply for additional funding for natural hazards mitigation

- Provide a list of desired community mitigation measures to the State for possible future funding
- Encourage the application for project funding from diverse entities

Goal 4: Develop and complete natural hazards mitigation projects in a timely manner

- Encourage public and business involvement in natural hazards mitigation projects

II. PLANNING PROCESS

The Stafford Act, as amended by the Disaster Mitigation Act of 2000, shifted the Federal Emergency Management Agency's (FEMA) scope of work to promoting and supporting prevention, or what is referred to as hazard mitigation planning. FEMA requires government entities to have a natural hazards mitigation plan in place and updated on a 5-year cycle as a condition for applying for grant funding related to natural hazard mitigation and remediation. Antrim County has a history of mitigation planning and adopted past Natural Hazard Mitigation Plans in 2007 and 2016. The adoption of the 2023 plan will reaffirm the eligibility of the county, as well as those local municipalities who participated in the planning process and adopted the county's plan, for federal funding.

The update of the County's plan was led by the Natural Hazards Task Force composed of the County's Local Emergency Planning Committee (LEPC). LEPC members consist of first responders and local, regional, and state public entities that ensure the readiness of County entities by recommending equipment purchases, training and exercises, and public education on preparedness issues. Networks Northwest staff assisted with the creation of the updated plan by providing meeting facilitation, conducting an online survey, and writing the plan. The Task Force generally met on a quarterly basis virtually via Zoom, with one in-person field trip meeting. All meetings were open to the public.

Invitations to participate in the planning process - via email invitation, phone calls, meeting attendance/presentation, or mailed letters - were sent to the following stakeholders: local and regional agencies involved in hazard mitigation activities; agencies that have the authority to regulate development; neighboring communities; representatives of businesses, academia, or other private organizations; and representatives of nonprofit organizations, including community-based organizations that work directly with and/or provide support to underserved communities and socially vulnerable populations. Please refer to the Acknowledgements section in the beginning of this plan for a list of participants; Appendix E for a detailed table showing how and when representatives participated in the planning process; and Appendix F for meeting and public input documentation. All jurisdictions in Antrim County remain as continuing participants in the 2023 Hazard Mitigation Plan (since the 2016 plan was completed).

The following is an outline of the planning process for the development of the 2023 Antrim County Natural Hazard Mitigation Plan. Refer to Appendix E for meeting and public input documentation.

- An online public survey was made available from October 25, 2021 to January 28, 2022 to obtain input on community experience, concerns and priorities regarding natural hazard mitigation in Antrim County. Table 1 indicates who participated in the survey. A copy of the survey results are included in Appendix B.

Table 1: Community Survey Participation

Community/Organization	Representative and Title (if indicated in the survey)
Banks Township	Donna Heeres, Township Clerk
Central Lake Township	Judith Kosloski, Township Clerk; citizen; summer resident
Custer Township	Citizen
Forest Home Twp.	Stephen C. Barnard, Zoning Administrator
	Paul Trumbler, Planning Commission Chair
Helena Township	Mike Robinson, Planning Commissioner; S. Torch Lake Fire
Kearney Township	Dick Jacques, Planning Commissioner
	Elected Official
Mancelona Township	County Community Emergency Response Team member
	Citizens (2)
Milton Township	Joe Renis, Planning Commissioner
	Brett Pharo, Trustee
	Jeremy Ball, Fire Chief
	Planning Commission members (2)
Star Township	Robert Marsh, Supervisor
Torch Lake Township	Jerry Kulka, Planning Commissioner (former)
	Mike Robinson, S. Torch Lake F.D.
	Sara Kopriva, Zoning Administrator
Village of Bellaire	Nicole Essad, Clerk/Zoning Administrator
Village of Central Lake	Andrew Smith, Clerk/Treasurer (former)
	Citizen
Village of Elk Rapids	Laura Schumate, Village Council Trustee
	Kerri Esterley, Treasurer; Planning/Zoning/Community Dev.
	Elected Official
Village of Ellsworth	Lynn Aldrich Spearing, President Pro Tem
Village of Mancelona	Michael Allison, Village President
Antrim County Government	Leslie Meyers, Emergency Management Coordinator (former)
	Mike Gank, 911 Manager
	Deputy Assessor
	EDC Board Member
	Elected Officials (3)
	County Government Employees (2)
Antrim County Road Commission	Burt Thompson, Engineer/Manager

- LEPC meetings where the Natural Hazard Mitigation Plan update work was discussed:
 - August 10, 2021
 - September 1, 2021
 - November 9, 2021
 - February 8, 2022
 - August 30, 2022
 - January 10, 2023
- Community Input meetings were held with stakeholders via Zoom on March 16, 2022 and October 4th and 5th, 2022 to obtain input on hazard identification and draft plan content.
- June 14, 2022 – Field Trip to visit sites in the County that have been or could be impacted by natural hazards.
- The Antrim County Emergency Manager attended Antrim County Planning Commission meetings on September 6, 2022, October 4, 2022, and January 10, 2023 to explain the Hazard Mitigation Plan progress to date, feedback

on ideas for goals and strategies, and relay relevance of the Hazard Mitigation Plan content to the update of the Antrim County Master Plan.

- A letter was mailed, via certified mail, and emailed, from Networks Northwest to all local government offices in Benzie County on February 2, 2023. The letter provided notification of the public hearing on the draft plan, a website address to access the plan, and requested local government review and feedback.
- Public notices were published in the *Elk Rapids News* newspaper and in the *Antrim Review* newspaper on February 9 and 16, 2023, indicating that the County's draft Natural Hazard Mitigation Plan was available for review and comment, and that a public hearing would be held on March 7, 2023.
- On March 7, 2023, a public hearing was held regarding the draft Hazard Mitigation Plan at the Antrim County Planning Commission meeting. The Planning Commission members then recommended that the draft plan be submitted to Michigan State Police/FEMA for their review and approval.
- Leslie Myers (former Emergency Manager and current Operator of Dams for Antrim County) shared the hazard mitigation strategies from the plan at a Village Council meeting for the Village of Elk Rapids on April 18, 2023; and at a Township Board meeting for Elk Rapids Township on May 15, 2023.

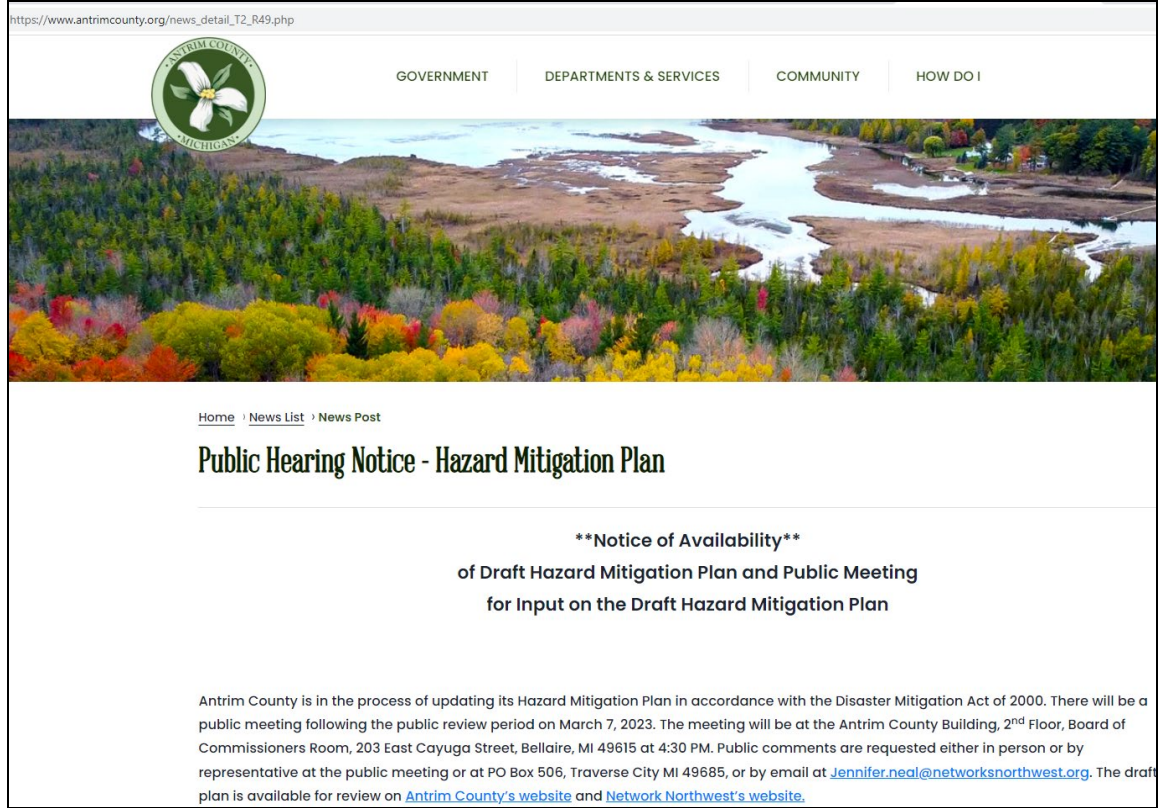
The draft plan was published openly on the Antrim County "news" webpage, as well as on the project page on Networks Northwest's website (Figures 1 and 2). The public was encouraged to review the draft plan and invited to submit suggestions, questions or comments. Written comments were received via email during the draft review period. Verbal comments were received from the public and county planning commissioners during the public hearing/County Planning Commission meeting on March 7, 2023. Appendix F provides relevant meeting documentation describing this.

During development of the plan, all Antrim County municipalities were provided the opportunity to participate in the online community survey, participate in scheduled meetings, and comment on draft plan materials. Additionally, representatives from county and regional agencies that encompass or share borders with Antrim County (listed below) were invited to participate in the planning meetings, and were able to view the draft and final plan materials on the hazard mitigation project page of Network Northwest's website.

- Gregg Bird, Emergency Management Coordinator, Grand Traverse County
- Mike Thompson, Emergency Management Coordinator, Kalkaska County
- Jon Deming, Emergency Management Director, Otsego County
- Sienna L. Wenz, Emergency Management Coordinator, Charlevoix County
- Doug Pratt, Emergency Manager, Crawford County
- Jolanda Murphy, Public Safety Department 2 Manager and Emergency Manager, Grand Traverse Band of Ottawa and Chippewa Indians
- Robert Carson, Regional Director of Community Development, Networks Northwest

All meetings where the plan was discussed were openly published for public and other jurisdiction/municipality participation. Additionally, County and Networks Northwest staff received feedback on the plan via other methods besides meetings, such phone calls or emails.

Figure 1. Antrim County Website Image



Source: Antrim County Emergency Services webpage 02/27/2023

Figure 2. Networks Northwest Image

mitigation/antrim-county.html

ANTRIM COUNTY

Notice of Availability of Draft Hazard Mitigation Plan and Public Meeting for Input on the Draft Hazard Mitigation Plan

A public hearing for the plan will be held on March 7, 2023 at 4:30 PM as part of the Antrim County Planning Commission Meeting. The meeting location is in the Antrim County Building, 2nd Floor, Board of Commissioners Room at 203 East Cayuga Street, Bellaire, MI. Upon review of the plan, Planning Commission shall recommend it be sent to Michigan State Police Homeland Security Division for review/preliminary approval and then on to FEMA for their review and approval. Once FEMA has approved the plan, it will be brought before all local government boards for adoption.

Public comments are requested either in person or by representative at the public meeting or at PO Box 506, Traverse City MI 49685, or by email at jennifer.neal@networksnorthwest.org.

2023 Antrim County Hazard Mitigation Plan Current Drafts for Review:

[2/3/2023 Draft Plan and Strategies Table](#)

Full Size Hazard Maps (Appx. A of the plan)

- [Hazard Areas](#)
- [Vulnerable Populations and Hazard Areas](#)
- [Environmental Features](#)
- [Infrastructure](#)

Meetings and Documentation

Natural Hazard work-related meeting dates, times, and presentation materials will be posted here as they become available. All meetings are open to the public and are held via Zoom, unless otherwise stated. Please contact the [Antrim County Emergency Operations Director](#) for a Zoom link if you would like to attend!

Antrim County LEPC/LPT Meetings, 10:00 AM
09/01/2021
11/09/2021
02/08/2022
03/16/22 *Public Input via Zoom to ID Natural Hazard Concern Areas for: <div style="text-align: center;"> Coastal Communities & Inland Communities 3/16/22 Notes and Hazard ID Map </div>
06/14/2022 Field Trip to Hazard Concern Sites
8/30/22 LEPC/LPT
10/4/22 and 10/5/22 Public Input Sessions on Draft Via Zoom
01/10/23 LEPC/LPT

Update Process

Phase I: Data collection and community survey

An online survey was available from 10/25/2021 to 1/28/2022 to obtain input on past projects, hazard events, and potential mitigation strategies. The survey results are summarized [here](#).

Phase II: Hazard identification and risk assessment

Phase III: Review and update hazard mitigation goals, priority areas, and implementation strategies.

Phase IV: Draft plan public comment period. Post the plan electronically and meet with the public for comments. Incorporate feedback from the public review period and make final edits to the plan.

Phase V: Plan Adoption. Facilitate the plan adoption process with the County Board of Commissioners and local officials.

Source: Networks Northwest webpage 2/27/2023

Figure 3. Images of Publications in the Elk Rapids Review and Antrim Review Newspapers

AFFIDAVIT OF PUBLICATION

Kathleen Weitschat
KATHLEEN WEITSCHAT

being duly sworn, says that she is the publisher of the Elk Rapids News, L.L.C., a newspaper printed, published and circulated in said county and otherwise qualified according to Supreme Court Rule; that annexed hereto is a printed copy of a notice which was published in said newspaper on the following date, or dates, to wit:

Feb 9, 2023
Feb 16, 2023
 _____, 20____
 _____, 20____
 _____, 20____

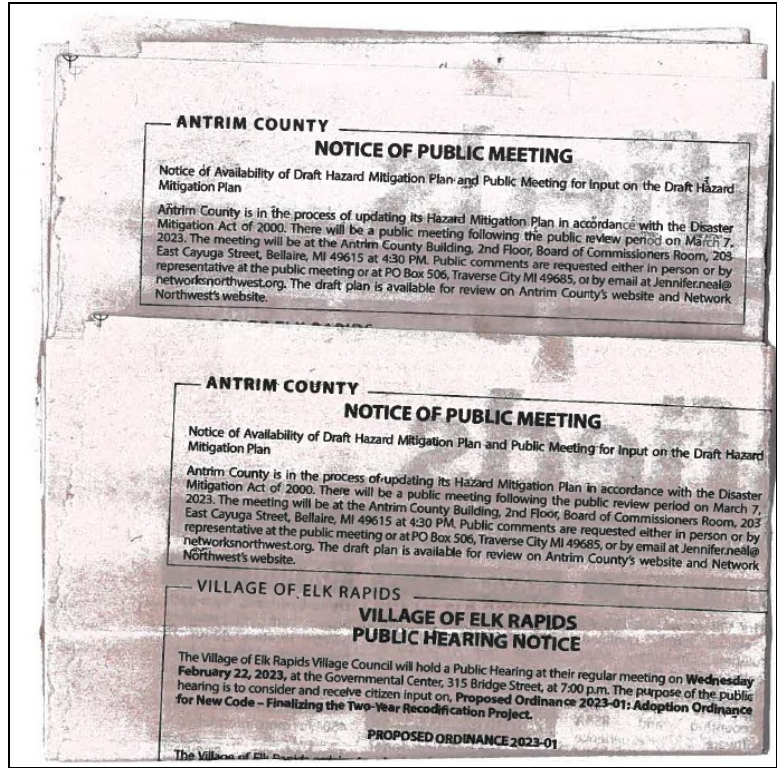
RECEIVED AND FILED
 ANTRIM COUNTY CLERK
MAR 02 2023
 BY _____

Subscribed and sworn to before me this 4th day of MARCH, A.D. 2023

Notary Public,
Kaitlyn Sczyzpa
 My commission expires: _____

KATHLYN SZCZYPA
 Notary Public - State of Michigan
 County of Antrim
 My Commission Expires Jan 25, 2028
 Acting in the County of ANTRIM

KATHLYN SZCZYPA
 Notary Public - State of Michigan
 County of Antrim
 My Commission Expires Jan 25, 2028
 Acting in the County of ANTRIM



AFFIDAVIT OF PUBLICATION

STATE OF MICHIGAN)
 COUNTY OF ANTRIM)

Jacqueline L. Tarrant, Partner/General Manager of the Antrim Review hereby acknowledges that the Public Notice for Antrim Co Planners was published in the above entitled newspaper for the weeks of February 9 and February 16, 2023.

Jacqueline L. Tarrant
 Jacqueline L. Tarrant

Subscribed and Sworn to on the 16th Day of February 2023

Mary Hansen
Mary Hansen
 Notary Public
 Kalkaska County, Michigan
 (Acting in Antrim County)
 My Commission Expires: February 18, 2029

NOTICE OF AVAILABILITY

Notice of Availability of Draft Hazard Mitigation Plan and Public Meeting for input on the Draft Hazard Mitigation Plan. Antrim County is in the process of updating its Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000. There will be a public meeting following the public review period on March 7, 2023. The meeting will be at the Antrim County Building, 2nd Floor, Board of Commissioners Room, 203 E. Cayuga St., Bellaire, MI 49615 at 4:30 p.m. Public comments are requested either in person or by representative at the public meeting or at PO Box 506, Traverse City, MI 49685 or by email at Jennifer.neal@networknorthwest.org. The draft plan is available for review on Antrim County's website and Network Northwest's website.

MARY HANSEN
 NOTARY PUBLIC - KALKASKA COUNTY
 MY COMMISSION EXPIRES: 02/18/29

III. COMMUNITY PROFILE

Land Use/ Land Cover

Antrim County is located in Northwest Lower Michigan, and is bordered by Charlevoix County to the north, Otsego County to the east, Crawford County to the southeast, Kalkaska and Grand Traverse Counties to the south, and Grand Traverse Bay/Lake Michigan to the west/northwest. Refer to the county maps in Appendix A for locations of main roads, water bodies, other natural features, and jurisdictions.

The county consists of 475.7 square miles of land area and is the 76th largest county in Michigan by total area.¹ 10% of the county area includes 47.5 square miles of water.

With the exception of the US-131 corridor, which has predominantly level topography, most of the county is covered with a rolling terrain with of forest (private and State-owned), lakes, rivers, agricultural fields, five villages and some hamlets. There are 76 inland lakes in Antrim County, 264 miles in length of streams, and with more than 25 miles of Great Lakes shoreline.

The 2018 Antrim County Master Plan indicates that based on an evaluation of land use changes from 1978 to 1998, the county gained 113 acres of water acreage and 130 acres of wetland acreage. Antrim County has more than 31,000 acres of inland water area (lakes, rivers and streams), and more than 6,500 acres of wetlands. Because of the relatively small size of these acre changes, it is suspected the gain in acreage may reflect a higher water table in 1998 compared to 1978.

A key natural resource in the western half of Antrim County is the Elk River Chain of Lakes (ERCOL). ERCOL covers over 500 square miles, including over 200 miles of shoreline and almost 60 square miles of water. This continual connection of inland waterbodies embraces 14 lakes and interconnecting rivers. The 14 lakes are listed in their order of hydraulic flow: Beals, Scotts, Six Mile, St. Clair, Ellsworth, Wilson, Benway, Hanley, Intermediate, Bellaire, Clam, Torch, Skegemog, and Elk. The Chain of Lakes is a designated water trail and flows through the Villages of Ellsworth, Central Lake, Bellaire, and Elk Rapids. The Chain of Lakes is the largest sub-watershed in the Grand Traverse Bay Watershed, which comprises 72% of the county.

The Cedar River, a “Blue Ribbon Trout Stream,” flows mostly westward through Antrim County into the Intermediate River in Bellaire. The Cedar River originates in southwest Chestonia Township, near the boundary with Mancelona Township.

The headwater for the Jordan River is in Chestonia Township and it flows to the north/northwest, all but two miles, in Antrim County. Over 30,000 acres of state forestlands border this river.

The mainstream of the Upper Manistee River watershed is approximately 78 miles long and originates in southeast Antrim County (approximately six miles from the hamlet of Alba), at an elevation of 1,250 feet.

According to the 2017 Census of Agriculture, the county had 55,565 acres of land in farms for a total of 333 farms. This represents a 20% and 13% drop in the number of farms and acreage of farms, respectively, since the 2012 USDA Census of Agriculture.

About 82% of the market value of agricultural products sold in the county is from crops. Fruits, tree nuts, and berries had the highest market value of agriculture products sold at \$16,071,000. Antrim County ranks 10th in the State of Michigan for the sale of fruits, tree nuts, and berries overall. The county also ranks 10th in the State for the sale of cultivated Christmas trees and short rotation woody crops (\$965,000 in sales). Livestock, poultry and other animal products composed about 18% of the market value of agricultural products sold.

The predominant land cover type is “Forested,” a combination of deciduous forest, evergreen forest, and mixed forest (Table 2). The second most prevalent land cover type is “Agriculture,” a combination of “cultivated crops and hay/pasture.” Developed land cover is found predominantly in and around the villages of Mancelona, Bellaire, Central Lake, Ellsworth, and Elk Rapids. The largest concentration of people and businesses is located in the Village of Mancelona, in the southeast corner of the county on US-131.

¹ <https://data.census.gov/cedsci/profile?q=0500000US26009>

Table 2: Land Cover by Type

Classification	Acres	Percent
Developed (High Intensity)	178.37	0.1%
Developed (Med. Intensity)	933.79	0.3%
Developed (Low Intensity)	6,936.23	2.2%
Developed (Open Space)	16,563.63	5.2%
Agriculture (Cultivated Crops, Hay/Pasture)	52,481.56	16.5%
Forested (Deciduous, Evergreen and Mixed Forest)	157,722.49	49.5%
Herbaceous & Shrub/Scrub	39,898.25	12.5%
Wetlands	28,201.74	8.9%
Barren Land	1,363.13	0.4%
Open Water	14,244.66	4.5%
TOTAL	318,523.85	

Source: Networks Northwest

The 2016 Hazard Mitigation Plan indicated that 180,821 acres, or 57%, of the county was composed of forested lands; compared to current data, there has been a 12% decrease in forested areas. While growth in the county has remained steady, it has been noted that the type of growth is changing. Office and industrial development has largely stopped, commercial development has slowed, but residential development is occurring as quickly as plans can be approved. Housing of all types and prices is in demand, but many communities desire smaller units and multiple family units. This type of housing is especially important for the senior and low to moderate income populations and will likely be in demand for many years. The Environmental Features Map in Appendix A shows the intensity of development in the county as well as natural features.

Additionally, all of the coastal communities in Antrim County (Banks Township, Torch Lake Township, Milton Township, Elk Rapids Township and the Village of Elk Rapids) contain High Risk Erosion Areas (HREAs) as designated and regulated by the State of Michigan’s Department of EGLE. HREAs are shorelines of the Great Lakes where the land is receding at a rate of one foot or more per year for a minimum of 15 years. Recession rates change over time as water levels fluctuate and coastal conditions change. Along these shorelines, new structures are required to meet setbacks for their protection from a changing shoreline. When structures are not in danger, the shoreline does not need to be altered to protect the structure.

Torch Lake Township also contains Critical Dune Areas (CDAs), which are a combination of coastal barrier dunes, land that has dune-like features, and unique plant communities. Regulatory authority goes to the water’s edge. The CDAs include public lands and private properties where developmental, silvicultural, and recreational activities are regulated and a permit is required under Part 353, Sand Dunes Protection and Management, of the Natural Resources and Environmental Protection Act for activities that significantly alter the CDA, such as the construction of a house or garage, building a road or driveway, installing a septic system, installing retaining walls, and sand removal. Maps of the HREAs and CDAs in Antrim County are included in Appendix A.

Population

Antrim County is the 6th most populated county in the ten county region of Northwest Lower Michigan (Table 3) and is ranked 61 out of 83 counties in the state for population.² The 2019 American Community Survey (ACS) estimated the county population to be 23,206 people. A comparison of the 2010 and 2019 ACS data indicates a downward county population growth trend with a 3.2% decrease from 2010, when the population was an estimated 23,975 persons (Table 3). The 2019 population per square mile is approximately 44.2 people.

Antrim County is composed of fifteen (15) townships and five (5) villages. All communities - with the exception of Chestonia, Echo, Helena, Milton and Star Townships, and the Villages of Bellaire and Mancelona - experienced population decline between 2010 and 2019 (shown in Table 4).

Figure 4 shows the difference in population levels for each community. The most populated community is Mancelona Township, which contains the Village of Mancelona and part of highway US-131, at an estimated 4,350 persons.

² https://www.michigan-demographics.com/counties_by_population

The second most populated community, at an estimated 2,575 persons is Elk Rapids Township, located in the southwest portion of the county. The township contains the Village of Elk Rapids and is bordered by the Grand Traverse Bay to the west, Elk Lake to the east and contains part of the US-31 highway corridor.

The third most populated community is Milton Township, at 2,545 persons, located in the southwest portion of the county. Milton Township is bordered by Torch Lake, Elk Lake, and Grand Traverse Bay and also contains part of the US-31 highway corridor. Milton Township grew by an estimated 23.1% between 2010 and 2019.

Table 3: 2019 Estimated Regional Population by County, State

Jurisdiction	Population
Missaukee County	15,028
Kalkaska County	17,585
Benzie County	17,615
Leelanau County	21,652
Antrim County	23,206
Manistee County	24,457
Charlevoix County	26,188
Emmet County	33,104
Wexford County	33,256
Grand Traverse County	92,181
State of Michigan	9,965,265

Source: US Census, 2019 ACS Estimates

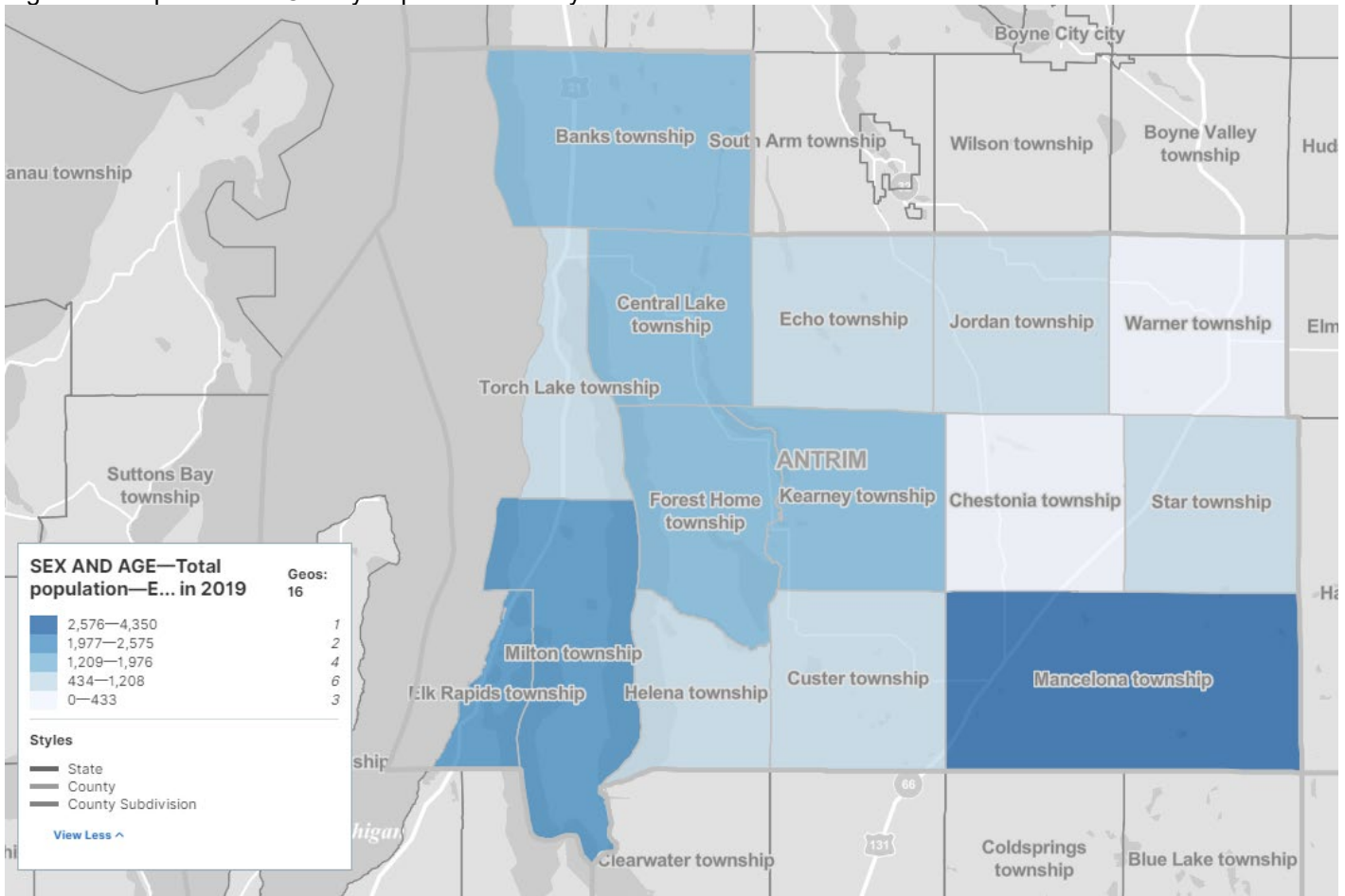
Table 4: Population by Municipality, 2010, 2019

Municipality	2010 Estimated Population	2019 Estimated Population	Numeric Change	Percent Change	Jurisdiction Status*
Antrim County	23,975	23,206	-769	-3.2%	P
Village of Bellaire	1,014	1,015	1	0%	P
Village of Central Lake	1,046	953	-93	-8.9%	P
Village of Elk Rapids	1,864	1,494	-370	-19.8%	P
Village of Ellsworth	412	339	-73	-17.7%	P
Village of Mancelona	1,478	1,574	96	6.5%	P
Banks Township	1,686	1,604	-82	-4.9%	P
Central Lake Township	2,447	1,976	-471	-19.2%	P
Chestonia Township	344	433	89	25.9%	P
Custer Township	1,103	949	-154	-14.0%	P
Echo Township	839	846	7	0.8%	P
Elk Rapids Township	2,703	2,575	-128	-4.7%	P
Forest Home Township	1,949	1,594	-355	-18.2%	P
Helena Township	964	1,024	60	6.2%	P
Jordan Township	953	929	-24	-2.5%	P
Kearney Township	1,918	1,882	-36	-1.9%	P
Mancelona Township	4,442	4,350	-92	-2.1%	P
Milton Township	2,068	2,545	477	23.1%	P
Star Township	842	929	87	10.3%	P
Torch Lake Township	1,331	1,208	-123	-9.2%	P
Warner Township	386	362	-24	-6.2%	P

Source: US Census, 2010 and 2019 ACS 5-Year Estimates

*2023 Hazard Mitigation Plan Participation Status: P = Participant or N = Non-participant

Figure 4: Map of Antrim County Population Density



Source: U.S. Census Bureau - 2019 ACS 5-Year Estimates Data Profile

Like many northwest Michigan communities, Antrim County experiences an influx of seasonal residents and tourists during the summer months. However, the decennial Census and the American Community Survey only consistently and comprehensively track the permanent population. The 2022 *Seasonal Population Study for Northwest Lower Michigan*, analyzed the 2020 seasonal population for ten counties in northwest Michigan. The study collected data for permanent and part-time residents and overnight visitors in accommodations and short-term rentals by County. Northwest Lower Michigan’s permanent base population is 310,802 and expands to its largest seasonal population of 676,052 in July, 118% increase. Antrim County’s combined population increases by as much as 92% from its minimum population in March (30,860) to July (59,352). On average, the population grows by 75% or 17,599 people throughout the year. All ten counties in the Networks Northwest service area were included in the study: Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Kalkaska, Leelanau, Manistee, Missaukee, and Wexford.

Table 5: Antrim County Seasonal Population by Month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.	Region
Permanent Population	23,431	23,431	23,431	23,431	23,431	23,431	23,431	23,431	23,431	23,431	23,431	23,431	23,431	310,802
Combined Population	30,991	31,104	30,860	31,701	42,680	57,446	59,352	59,237	43,462	38,615	33,397	33,519	41,030	676,052
Difference	7,560	7,673	7,429	8,270	19,249	34,015	35,921	35,806	20,031	15,184	9,966	10,088	17,599	365,250
Percent Change	32%	33%	32%	35%	82%	145%	153%	153%	85%	65%	43%	43%	75%	

Source: Networks Northwest 2022 Seasonal Population Study for Northwest Lower Michigan

Age, Race & Disability

Understanding the age distribution and median age of Antrim County can help identify social, economic, and public service needs in the community. The county's total 2019 population is broken into age cohorts (analyzing which proportions of a municipality's population are in which stages of life). This gives a nuanced view of the makeup of a community. Figure 5 indicates the cohort group with the largest population is the 45 to 64 year old group. As shown in Figure 6, the median age (the midpoint where half the population is younger and half the population is older) of Antrim County is older (51.3 years) than the State (39.7 years). The youngest community is Mancelona Village with a median age of 28.7 years; the oldest community in the county is Helena Township with a median age of 60.9 years (Figure 7).

Figure 5: Antrim County Population by Age Cohort, 2019

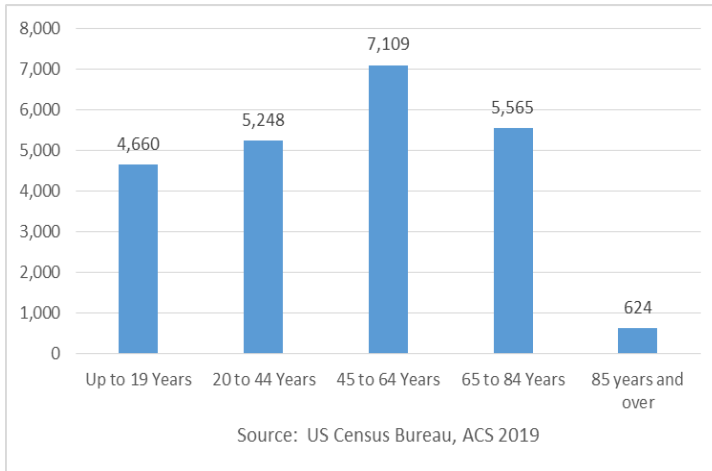


Figure 6: Median Age Trend, 2000, 2010, and 2019

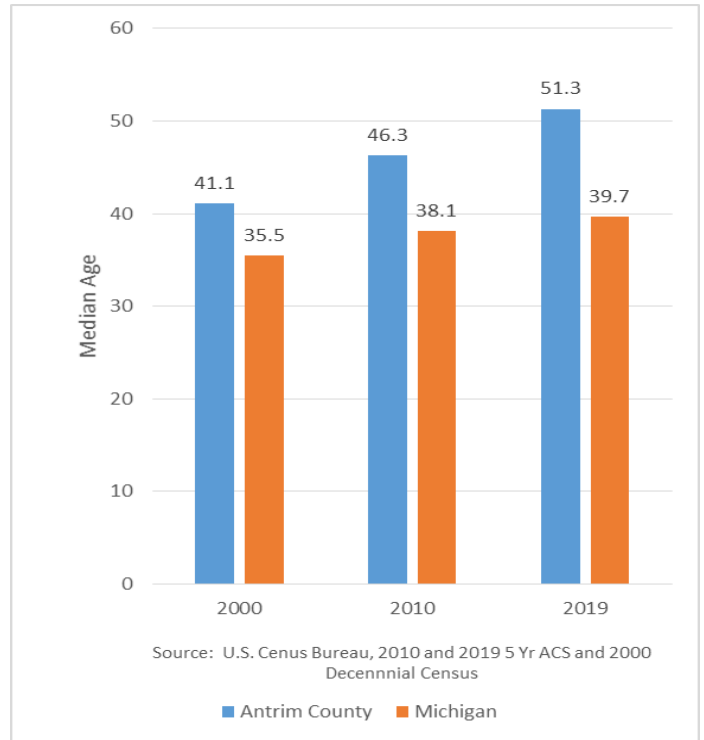
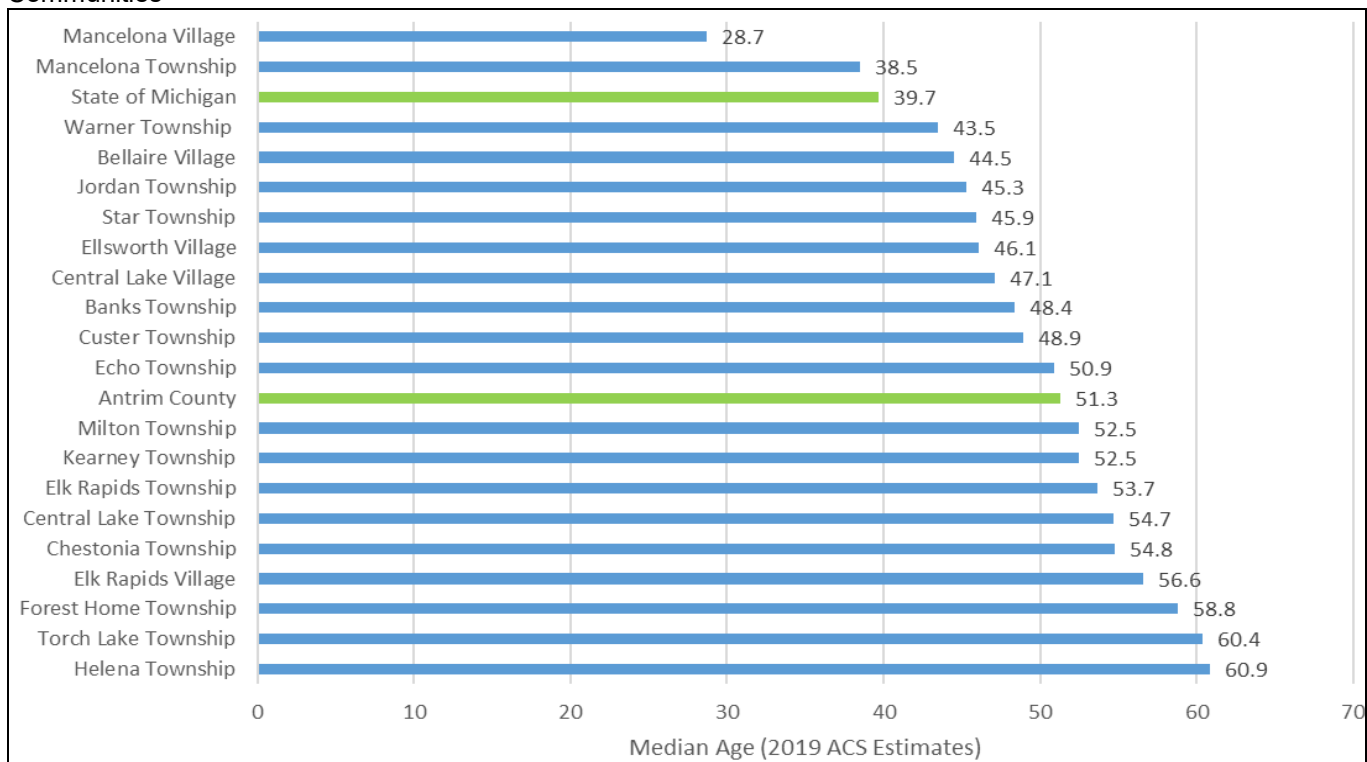


Figure 7: Median Age Comparison, Antrim County Communities

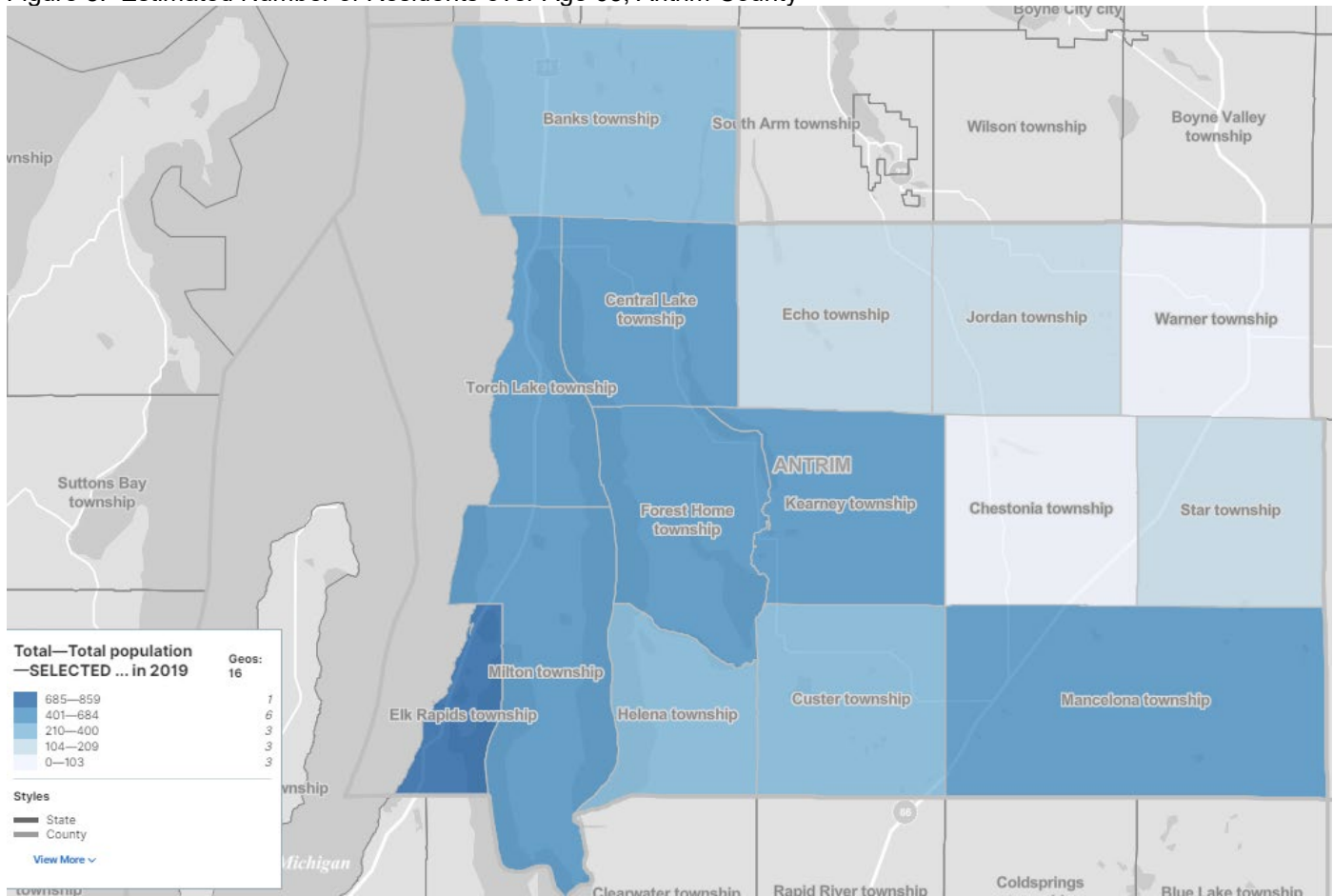


Source: U.S. Census, 2019 ACS Estimates

Persons over the age of 65 are considered a socially vulnerable population group. An estimated 30.3% of persons aged 65 years or older in Antrim County has one or more type of disability (Table 8).

Figure 8 and Table 6 indicate that the greatest concentrations of this cohort are located in Elk Rapids Township (which includes Elk Rapids Village), at 859 persons over Age 65. The community with the greatest percentage of its population over age 65 is Torch Lake Township (Table 6). The data presented indicate where a greater focus on services may be needed for senior citizens to endure the impacts from hazard events such as extreme temperatures, severe winter weather, high winds, flooding, tornado, or a public health emergency.

Figure 8. Estimated Number of Residents over Age 65, Antrim County



Source: US Census Bureau, 2019 ACS 5-Year Estimates

Table 6. Estimated Population Over Age 65 by Jurisdiction

Community	Est. Population Age 65 + years	
	Number	Percentage
Elk Rapids Township	859	33.4%
Milton Township	684	26.9%
Mancelona Township	659	15.1%
Forest Home Township	621	39.0%
Central Lake Township	586	29.7%
Kearney Township	530	28.2%
Torch Lake Township	494	40.9%
Helena Township	400	39.1%
Banks Township	348	21.7%
Custer Township	292	30.8%
Star Township	209	22.5%
Echo Township	192	22.7%
Jordan Township	167	18.0%
Chestonia Township	103	23.8%
Warner Township	45	12.4%
Elk Rapids Village	574	38.4%
Bellaire Village	235	23.2%
Central Lake Village	197	20.7%
Mancelona Village	140	8.9%
Ellsworth Village	50	14.7%

The racial makeup of Antrim County is predominantly white (97.7% of those that do not identify as being of Hispanic or Latino origin; 59.3% of those that do identify as being of Hispanic or Latino origin, Table 8). An estimated 2.3% of the county population identifies as being of Hispanic or Latino origin.³ The following lists the estimated percentages of minority races in the county, presented as “Not Hispanic or Latino Origin” / “Hispanic or Latino Origin”:

- Black or African American alone: 0.4% / 0.6%
- American Indian and Alaska Native alone: 0.7% / 4.2%
- Asian alone: 0.3% / 0.7%
- Some other race alone: 0.1% / 33%
- 2 or more races: 1.5% / 2.2%

Yellow highlighted entries in Table 7 indicate concentrations of minority populations by geography. Most notably, Milton Township has 246 persons (9.7 of the township population) that identify as being of Hispanic or Latino origin. Of those, an estimated 158 persons (64.2%) identify as “some other race alone”, and 23 persons (9.3%) identify as American Indian/Alaska Native alone. Mancelona Township has an estimated 77 persons (1.8%) and Kearney Township has an estimated 66 persons (3.5%) of their population identifying as being of Hispanic or Latino origin.

In Mancelona Township, those who did not identify as being of Hispanic or Latino origin had an estimated 121 persons (2.8%) that were of “two or more races”; 55 persons (1.3%) as American Indian and Alaska Native alone; 43 (1%) as Black or African American alone; and 22 (0.5%) as Asian alone. Mancelona Township is the most populated community in Antrim County, and contains the Village of Mancelona.

All Antrim County communities (excluding Forest Home Township) contain small estimates of minority populations, which are also considered socially vulnerable populations in a natural hazard event scenario. There may be an increased need for public assistance in these communities as these population groups may have limited social and financial resources to withstand or recover from a hazard event. Those identifying as being of Hispanic or Latino Origin may also not be fluent in the English language, which could be a communication challenge for receiving public notices/warnings prior to or during a hazard event, or during rescue and recovery efforts after a disaster.

³ Persons identifying as being of Hispanic or Latino origin may identify as any type of race in the U.S. Census.

Table 7: Racial Composition

	Antrim County	Banks Township	Central Lake Township	Chestonia Township	Custer Township	Echo Township	Elk Rapids Township	Forest Home Township
Total:	23,206	1,604	1,976	433	949	846	2,575	1,594
Not Hispanic or Latino:	22,663	1,597	1,975	424	933	837	2,554	1,594
	97.7%	99.6%	99.9%	97.9%	98.3%	98.9%	99.2%	100.0%
White alone	21,970	1,506	1,937	402	926	837	2,521	1,594
	96.9%	94.3%	98.1%	94.8%	99.2%	100.0%	98.7%	100.0%
Black or African American alone	100	24	1	9	0	0	0	0
	0.4%	1.5%	0.1%	2.1%	0.0%	0.0%	0.0%	0.0%
American Indian and Alaska Native alone	159	13	10	0	2	0	0	0
	0.7%	0.8%	0.5%	0.0%	0.2%	0.0%	0.0%	0.0%
Asian alone	78	10	7	4	0	0	0	0
	0.3%	0.6%	0.4%	0.9%	0.0%	0.0%	0.0%	0.0%
Native Hawaiian and Other Pacific Islander alone	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%
Some other race alone	14	0	0	0	0	0	0	0
	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Two or more races	342	44	20	9	5	0	33	0
	1.5%	2.8%	1.0%	2.1%	0.5%	0.0%	1.3%	0.0%
Hispanic or Latino:	543	7	1	9	16	9	21	0
	2.3%	0.4%	0.1%	2.1%	1.7%	1.1%	0.8%	0.0%
White alone	322	7	0	9	0	9	21	0
	59.3%	100.0%	0.0%	100.0%	0.0%	100.0%	100.0%	0.0%
Black or African American alone	3	0	0	0	0	0	0	0
	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
American Indian and Alaska Native alone	23	0	0	0	0	0	0	0
	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Asian alone	4	0	0	0	0	0	0	0
	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Native Hawaiian and Other Pacific Islander alone	0	0	0	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Some other race alone	179	0	1	0	16	0	0	0
	33.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%
Two or more races:	12	0	0	0	0	0	0	0
	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: US Census Bureau, 2019 ACS 5-Year Estimates

Table 7, continued: Racial Composition

	Helena Township	Jordan Township	Kearney Township	Mancelona Township	Milton Township	Star Township	Torch Lake Township	Warner Township
Total:	1,024	929	1,882	4,350	2,545	929	1,208	362
Not Hispanic or Latino:	1,024	904	1,816	4,273	2,299	903	1,168	362
	100.0%	97.3%	96.5%	98.2%	90.3%	97.2%	96.7%	100.0%
White alone	986	864	1,735	4,033	2,256	882	1,138	353
	96.3%	95.6%	95.5%	94.4%	98.1%	97.7%	97.4%	97.5%
Black or African American alone	0	0	16	42	2	6	0	0
	0.0%	0.0%	0.9%	1.0%	0.1%	0.7%	0.0%	0.0%
American Indian and Alaska Native alone	5	4	16	55	33	0	21	0
	0.5%	0.4%	0.9%	1.3%	1.4%	0.0%	1.8%	0.0%
Asian alone	4	9	16	22	0	6	0	0
	0.4%	1.0%	0.9%	0.5%	0.0%	0.7%	0.0%	0.0%
Native Hawaiian and Other Pacific Islander alone	0	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0%
Some other race alone	6	8	0	0	0	0	0	0
	0.6%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Two or more races	23	19	33	121	8	9	9	9
	2.2%	2.1%	1.8%	2.8%	0.3%	1.0%	0.8%	2.5%
Hispanic or Latino:	0	25	66	77	246	26	40	0
	0.0%	2.7%	3.5%	1.8%	9.7%	2.8%	3.3%	0.0%
White alone	0	21	66	73	62	23	31	0
	0.0%	84.0%	100.0%	94.8%	25.2%	88.5%	77.5%	0.0%
Black or African American alone	0	0	0	0	3	0	0	0
	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	0.0%
American Indian and Alaska Native alone	0	0	0	0	23	0	0	0
	0.0%	0.0%	0.0%	0.0%	9.3%	0.0%	0.0%	0.0%
Asian alone	0	4	0	0	0	0	0	0
	0.0%	16.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Native Hawaiian and Other Pacific Islander alone	0	0	0	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Some other race alone	0	0	0	4	158	0	0	0
	0.0%	0.0%	0.0%	5.2%	64.2%	0.0%	0.0%	0.0%
Two or more races:	0	0	0	0	0	3	9	0
	0.0%	0.0%	0.0%	0.0%	0.0%	11.5%	22.5%	0.0%

Source: US Census Bureau, 2019 ACS 5-Year Estimates

Table 8 represents the number of persons with a disability by age group. An estimated 3,733 (16.2%) of Antrim County residents have one or more type of disability. An estimated 30.3% of persons aged 65 years and over have a disability.

Table 8: Estimated Persons with a Disability, Antrim County

Total Civilian Noninstitutionalized Population	23,031 persons
With one or more disability, any age	3,733 (16.2%)
Age 0-17 with a disability	207 (4.9% of that age group)
18 to 64 years with a disability	1,686 (13.3% of that age group)
65 years and over with a disability	1,840 (30.3% of that age group)

Source: US Census, 2019 ACS Estimates

Housing Characteristics and Development Trends

The average household size for County residents is 2.32 persons, which is slightly lower than the State's average of 2.46. Antrim County has an estimated 9,899 total households (also referred to as housing units) as reported in the 2019 ACS 5-Year Estimates (Table 9). The Census defines a household as all the people who occupy a single housing unit, regardless of their relationship to one another. In 2019, an estimated 54.8% of those housing units were occupied (indicating physically occupied, principal residence housing units; Table 810). Mancelona Township has the largest percentage of housing units of all municipalities in the county (14.2%). The 2019 ACS also estimates that 88.1% (8,721) of the county's household units are 1-unit, detached structures, which are commonly referred to as single-family homes. Over 55% of residential units were built after 1980 (Table 8).

Table 9: Housing Units by Municipality, 2019

Municipality	Estimated Housing Units	Percent of Total
Antrim County	18,069	
Village of Elk Rapids	1,179	6.5%
Village of Mancelona	647	3.6%
Village of Central Lake	590	3.3%
Village of Bellaire	550	3.0%
Village of Ellsworth	166	0.9%
Mancelona Township	2,564	14.2%
Milton Township	1,934	10.7%
Elk Rapids Township	1,918	10.6%
Central Lake Township	1,637	9.1%
Forest Home Township	1,536	8.5%
Kearney Township	1,409	7.8%
Torch Lake Township	1,399	7.7%
Custer Township	1,161	6.4%
Banks Township	1,002	5.5%
Helena Township	962	5.3%
Star Township	848	4.7%
Echo Township	601	3.3%
Jordan Township	552	3.1%
Chestonia Township	349	1.9%
Warner Township	197	1.1%

Source: US Census, 2019 ACS Estimates

Note: The number of housing units for each village is incorporated into the totals for the respective township in which each village is located.

Table 10: Year Structure Built, 2019

Year Built	Estimated Housing Units	Percentage of Total
Built 2010 or later	343	1.9
Built 2000 to 2009	2,055	11.4
Built 1980 to 1999	5,733	31.7
Built 1960 to 1979	5,526	30.6
Built 1940 to 1959	2,332	12.9
Built 1939 or earlier	2,080	11.5
Total Housing Units	18,069	

Source: US Census, 2019 ACS Estimates

Housing Tenure, Table 11, summarizes the status of housing units, whether occupied or vacant, as well as the median housing value (\$160,500) and the median gross rent (\$752). Of the 18,069 total housing units, 9,899 (54.8%) are occupied (indicating physically occupied, principal residence housing units).

Table 11: Housing Tenure, 2019

Total housing units	18,069	%
Occupied housing units	9,899	54.8%
Owner-occupied	8,621	87.1%
Median Housing Value	\$160,500	
Renter-occupied	1,278	12.9%
Median Gross Rent	\$752	
Vacant housing units	8,170	45.2%

Source: US Census, 2019 ACS Estimates

Economic Profile

The *2021 Comprehensive Economic Development Strategy (CEDS)* prepared by Networks Northwest is the product of a locally-based, regionally-driven economic development planning process to identify strategies for economic prosperity. The plan was prepared for the ten county region of northwest Lower Michigan. Table 12 provides a comparison of annual average wage for each county in the CEDS planning area for 2018. Kalkaska County has the highest average annual wage with \$ 50,971 followed by Grand Traverse County at \$44,562. Antrim County has the lowest average annual wage at \$33,081. As their northern neighbor, it is not unexpected to have residents of Antrim County travel to Grand Traverse County or Kalkaska County for work.

Table 12: Average Annual Wage by County, 2018

County	Average Annual Wage
Antrim	\$33,081
Manistee	\$33,821
Benzie	\$33,908
Missaukee	\$35,917
Leelanau	\$36,833
Emmet	\$40,258
Wexford	\$40,586
Charlevoix	\$44,558
Grand Traverse	\$44,562
Kalkaska	\$50,971

Source: 2021 Comprehensive Economic Development Strategy (CEDS) prepared by Networks Northwest

The Economic Profile of Antrim County is further described in Table 13. The table provides the county's industry makeup divided into 20 different North American Industry Classification Sectors (NAICS) as well as industry's establishments, jobs, percent distribution, and annual average wage. The industry with the largest percent distribution is **"Other (includes private, management of business, and unallocated)"** at 19.0% of jobs, followed by **"Accommodation and Food Service"** at 17.4%, and **"Manufacturing"** at 17.1%. The annual average wage for "Other" is not available; for "Accommodation and Food Services" is \$18,169; and for "Manufacturing" is \$41,194. **"Retail Trade"** is the fourth largest industry with 11.3% of jobs in the county, at an annual average wage of \$24,557. The industry with the highest annual average wage is **"Wholesale Trade"** at \$50,125, followed by **"Transportation, Warehousing"** at \$49,224.

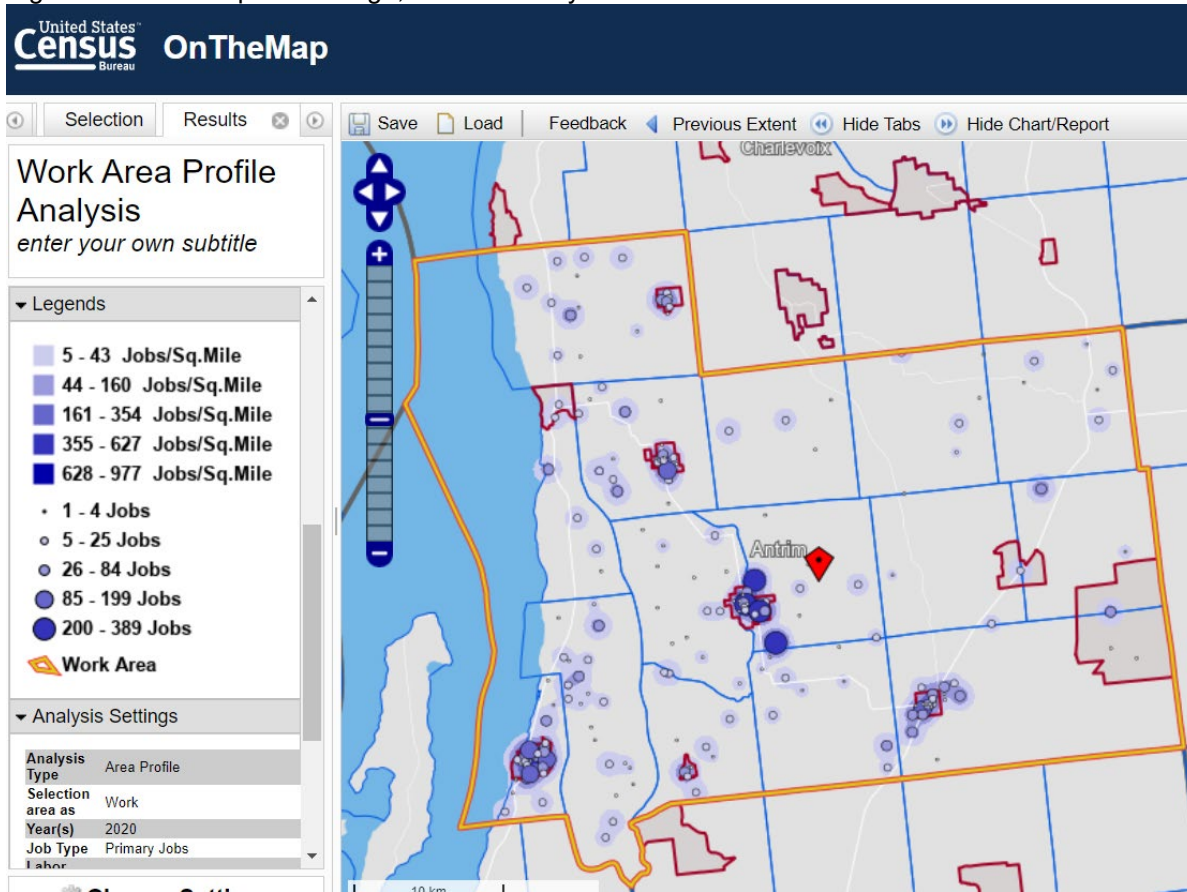
Table 13: Antrim County Economic Distribution by Industry, 2018

Industry Description	Establishments	Jobs	Percent Distribution	Annual Average Wage
Total Covered Employment	525	5,304	100.00%	\$33,081
Agriculture, forestry, hunting	19	D	D	D
Mining	1	D	D	D
Construction	83	447	8.30%	\$37,231
Manufacturing	38	918	17.10%	\$41,194
Wholesale trade	13	52	1.00%	\$50,125
Retail trade	68	604	11.30%	\$24,557
Transportation, warehousing	22	35	0.70%	\$49,224
Utilities	2	D	D	D
Information	10	84	1.60%	\$17,289
Finance and Insurance	19	92	1.70%	\$47,852
Real Estate, rental, leasing	24	86	1.60%	\$28,150
Professional, technical services	26	124	2.30%	\$29,719
Administrative, waste services	23	70	1.30%	\$39,194
Educational services	11	D	D	D
Health care, social assistance	36	218	4.10%	\$41,637
Arts, Entertainment, recreation	10	144	2.70%	\$27,163
Accommodation and food services	41	932	17.40%	\$18,169
Other services, exc. Public admin.	52	214	4.00%	\$29,489
Public administration	24	317	5.90%	\$33,958
Other (includes private, management of business, and unallocated)	3	967	19.00%	N/A

Source: 2021 Comprehensive Economic Development Strategy, Networks Northwest
 *D means limited industries of a sector that would disclose confidential information

Additionally, OnTheMap, an online interactive tool available from the US Census Bureau, allows for viewing of estimated job density within the county. This website is useful for emergency preparedness planning as related to response and potential impact to local economic activity areas. Below is a screenshot of the interactive map when completing an area profile analysis for all workers in primary jobs in the county in 2020 (Figure 9). It appears the greatest density of jobs are located within and around the Village of Bellaire, including Shanty Creek resort; followed by the Village of Elk Rapids, the Village of Mancelona and the Village of Central Lake.

Figure 9: OnTheMap Web Image, Antrim County



Source: US Census Bureau, OnTheMap

According to the 2016 Economic Profile for Antrim County by the Northern Lakes Economic Alliance (Table 14), major employers for Antrim County are primarily located in or near the Villages of Mancelona, Bellaire, Elk Rapids, Central Lake and Ellsworth. The largest employer is Shanty Creek Resort, with around 600 employees in Kearney Township, near the Village of Bellaire. Note that some of these employers may no longer be present in the county.

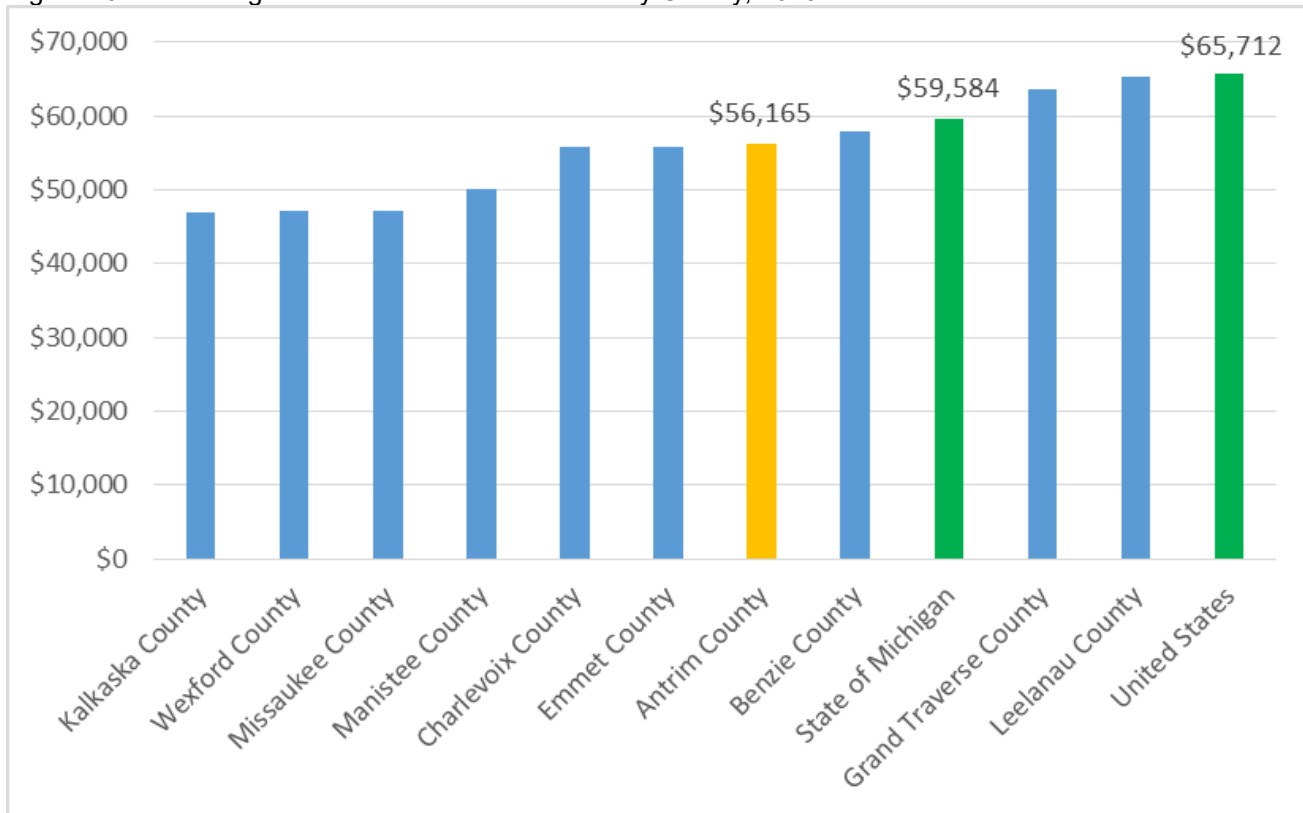
Table 14. Major Antrim County Employers (as of 2016)

Company Name	Location	# Emp	Industry/Product
Shanty Creek Resort	Bellaire	600	Traveler Accommodation
Great Lakes Packing	Kewadin	300	Frozen Food Processors
County of Antrim	Bellaire	200	All County Departments
Elk Rapids School District	Elk Rapids	180	Elementary/Secondary School
Central Lake Armor Express	Central Lake	165	Armored car services
Anchor Lamina	Bellaire	160	Plating (mfg); Electroplating, anodizing, and coloring
Cherry Ke, Inc.	Kewadin	150 Seasonal	Misc. Crop Farming
Meadowbrook Medical Care	Bellaire	150+	Nursing Care Facilities
Shorts Brewing	Bellaire/E.R.	74	Beverage Manufacturing
Burnette Foods Inc.	Elk Rapids	70	Canning; Fruit & Vegetable
Central Lake Public School	Central Lake	67	Public School
Bellaire Public School	Bellaire	55	Public School
Mancelona School District	Mancelona	50	Public School
Family Fare	Bellaire	50	Supermarket
Burt Moeke & Son Hardwoods/Fahl Forest Products	Mancelona	45	Logging
Ellsworth Farmers Exchange	Ellsworth	37	Feeds, LP Gas, Service
Traverse Bay Manufacturing	Elk Rapids	35	Sewing Contractors; Textile Products
Kitchen Farms	Elmira	35	Growing, Bagging and Shipping Potatoes
Wooden Hammer	Elk Rapids	35	Manufacturer Custom Wood Prod.
Elk Rapids Engineering	Elk Rapids	35	Engineering
Snyder Industries	Mancelona	29	Mnfg. Bulk Handling Containers
Specialty Silicone Fabricators	Elk Rapids	27	Mnfg. Custom Silicone Components
Antrim Machine Products	Mancelona	18	Machinery/Machine Tools
45th Parallel Furniture	Elk Rapids	13	Furniture Manufacturing
Echo Quality Grinding	Central Lake Twp.	12	Hardware Manufacturing

Figures 10 and 11 present a comparison of the median household income (MHI) across the ten county region, the State of Michigan, and local jurisdictions. Antrim County has the fourth highest median household income (\$56,165) in the region, just slightly ahead of Emmet County (\$55,829). Chestonia Township has the lowest MHI at \$34,088, and Torch Lake Township has the highest MHI at \$77,500. The economic profile can be further described by considering the cost of housing, transportation, and other goods and services. The budgeting rule of thumb has been that a household should spend no more than 30 percent of its income on housing costs. Considering the MHI of Antrim County over twelve months, a household is earning \$4,680 per month. The US Census 2016-2020 5-year ACS estimates that the median gross monthly rent is \$761 in Antrim County.

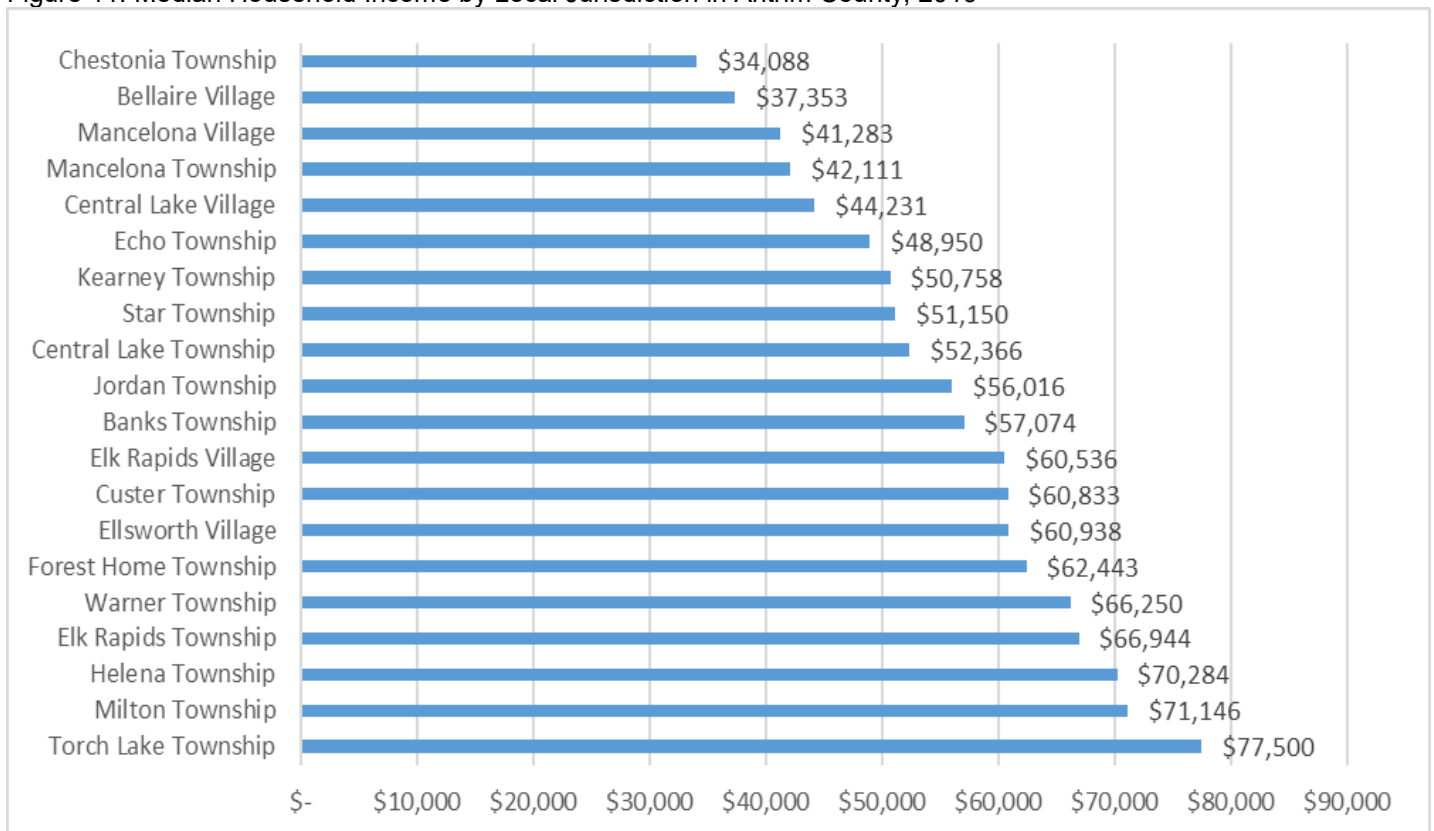
However, according to the 2019 Northwest Michigan Target Market Analysis (conducted by LandUseUSA on behalf of Housing North and Networks Northwest), rents are far higher in Antrim County than what many renters can afford. While the affordable rent for a renter earning the mean wage is \$700, the affordable rent for a full-time minimum wage worker is \$491. And anecdotally, the demand for housing is driving prices higher still. Home prices are also increasing where the cost to purchase a home is often as much as \$200/square foot or more.

Figure 10: NW Michigan Median Household Income by County, 2019



Source: US Census, 2019 ACS Estimates

Figure 11: Median Household Income by Local Jurisdiction in Antrim County, 2019



Source: US Census, 2019 ACS Estimates

The following tables describe the population with the lowest incomes. It is estimated, in 2019, that 11% of all persons in the county lived at or below the poverty level (Table 15). The Census describes poverty thresholds differently based on the size of the family and the number of related children living together, as illustrated in Table 16 below.

Table 15: 2019 Federal Poverty Level Guidelines

Persons in family/household	Poverty guideline
1	\$12,490
2	\$16,910
3	\$21,330
4	\$25,750
5	\$30,170
6	\$34,590
7	\$39,010
8*	\$43,430

*For families/households with more than 8 persons, add \$4,420 for each additional person.

Table 16: Antrim County Poverty Estimates, 2019

Poverty	Statistics
All families living below the poverty level	7.7% (534)
Families with related children under age 18, in poverty	13.1% (298)
All persons living below the poverty level	11% (2,527)

Source: US Census, 2019 ACS Estimates

Financial hardship is further described in the United Ways of Michigan report entitled *ALICE in Michigan: A Financial Hardship Study*. ALICE, which is an acronym for Asset Limited, Income Constrained, Employed, are those households with income above the Federal Poverty Level, but below the basic cost of modern living, such as housing, child care, food, health care, technology and transportation. The ALICE threshold is described as, “the average income that a household needs to afford the basic necessities... for each county in Michigan. Households earning below the ALICE Threshold include both ALICE and poverty-level households” (ALICE, 2019). Table 17 identifies the number and percentage of households that are estimated to be below ALICE and poverty thresholds for the each municipality and the County. These households likely would not have reserve savings to cover an emergency, such as impacts from a natural hazard event. Note that ALICE data is not available for villages in Antrim County.

Every community in Antrim County contains low-income households, which are considered to be socially vulnerable populations. These households may have more of a need for social/public services, such as assistance with transportation, food, water or shelter, during or after a hazard event. The estimated numbers of these households are shown in Table 17, with Mancelona Township containing the most and Warner Township containing the fewest.

Table 17: United Ways of Michigan ALICE Report Findings, 2019⁴

Jurisdiction	Total Households	% of all HH that are in Poverty and ALICE	# of Total HH that are in Poverty and ALICE
Antrim County	9,899	34.5% (State Avg. is 25%)	
Mancelona Township	1,637	47%	769
Central Lake Township	913	39%	356
Elk Rapids Township	1,142	29%	331
Kearney Township	754	40%	302
Milton Township	1,068	24%	256
Forest Home Township	765	28%	214
Banks Township	679	28%	190
Torch Lake Township	584	30%	175
Echo Township	349	41%	143
Star Township	397	32%	127
Custer Township	406	30%	122
Jordan Township	367	33%	121
Chestonia Township	201	59%	119
Helena Township	493	24%	118
Warner Township	144	34%	49

⁴ Michigan Association of United Ways. *ALICE in Michigan: A Financial Hardship Study*. 2021. <https://www.uwmich.org/alice-report>

IV. Hazard Identification and Assessments

Vulnerability Assessment

Natural hazard impact on the community can be understood by evaluating vulnerabilities for commonly agreed upon assets. A community's assets are defined broadly to include anything that is important to the character and function of a community and can be described very generally in the following categories:

- People
- Economy
- Built environment
- Natural environment

Vulnerable populations include the economically disadvantaged, elderly, homeless, and persons with a disability. Those that live unsheltered or in homeless encampments, assisted living facilities, mobile home parks, or isolated subdivisions are more susceptible to hazardous events. Vulnerable populations that consist of mobile homes and campgrounds/RV parks are represented on the *Vulnerable Populations and Hazard Areas Map* in Appendix A. (There may be other existing locations of vulnerable populations that are not indicated on the map.) Those locations included on the map were specifically discussed during public input sessions. The State Equalized Value (SEV) of the approximate area of these properties, based on the US Census Bureau's 2019 ACS 5-year estimates and Antrim County Equalization data, is as follows:

- Campgrounds: \$3,892,323.85
- Mobile homes: \$778,978.30

The natural environment is the primary reason residents choose to live and vacation northwest Michigan. Antrim County is home to plentiful forest lands, vast inland lakes and streams, Lake Michigan shoreline and all of the wildlife within them that are integral to the identity of the community. While natural resources are abundant, they are also vulnerable to all types of hazards. Northwest Lower Michigan is also home to many sensitive wildlife and plant populations that require specific climates and habitats to survive. Damaged, destroyed or changing natural environments may decrease the chances for certain species' survival. Christmas tree production is also a part of Antrim County's local economy; tree diseases or wildfires may impact properties in the county that operate tree farms. These areas are also indicated on the *Vulnerable Populations and Hazard Areas Map* in Appendix A. (There may be other existing locations of vulnerable populations that are not indicated on the map.) The State Equalized Value (SEV) of the approximate area of these properties, based on the US Census Bureau's 2019 ACS 5-year estimates and Antrim County Equalization data, is as follows:

- Tree farms: \$163,586.84

Additionally, countywide critical infrastructure is represented on the Critical Infrastructure Map, shown in Appendix A. Antrim County Office of Emergency Management and community stakeholders identified the critical facilities and infrastructure on the base map. Table 18 provides a summary critical infrastructure points in Antrim County.

Table 18: Critical Facilities and Infrastructure

No. of Facilities (total)	Facility Type
22	Healthcare Facilities <ul style="list-style-type: none"> • 10 Extended Health Care Facilities • 5 Public Health Care Facilities • 4 Health Practitioner Office or Clinic • 2 Health Supporting Facilities
24	Emergency Services Facilities <ul style="list-style-type: none"> • Antrim County Emergency Services – Bellaire • 3 EMS Services – Mancelona, Eastport, Bellaire • 14 Fire and Emergency Services • 6 Law Enforcement Offices
17	Communications Facilities <ul style="list-style-type: none"> • Antrim County 911 • 1 Satellite Communications • 5 Wired Communications • 10 Wireless Communications
14	Government Facilities <ul style="list-style-type: none"> • 7 Public Water Districts (18.6% public system or private company) • 5 Public Sewer Districts (18.6% public sewer) • 3 Dams – Elk Rapids Dam, Bellaire Dam and Cedar River Dam
8	Transportation Facilities <ul style="list-style-type: none"> • 4 Airports (Antrim County Airport in Kearney Twp; Torchport Airport in Torch Lake Twp.; Lakes of the North Airport and Mancelona Municipal Airport in Mancelona Twp.) • 3 Antrim County Road Commission Facilities (Kewadin, Central Lake, Mancelona) • Antrim County Public Transportation (Bellaire)
6	Commercial Facilities (Agricultural/Food Products) <ul style="list-style-type: none"> • King Orchards, Central Lake Township • Burnette Foods, Village of Elk Rapids • Friske Orchards, Banks Township • Ellsworth Farmers Exchange, Village of Ellsworth and Village of Mancelona • Kitchen Farms, Star Township
3	Industry <ul style="list-style-type: none"> • EJ Foundry (Elmira) • Anchor Lamina (Bellaire) • Jordan River Fish Hatchery (Star Twp./Elmira)

Source: Antrim County Emergency Services

Historical Analysis

The Historical Analysis of Antrim County weather-related hazards uses information on impacts and losses from previous hazard events to predict potential impacts and losses during a similar event. Because of the frequency of these events, communities are more likely to have experience with and data on impacts and losses. Additionally, there have been five federal-or state-declared disaster events that have involved Antrim County (Table 19). These events are included in the hazard analysis for individual event types.

Table 19: Presidential and Governor Declared Disasters or Emergencies for Antrim County

Date Declaration	Type of Incident	Affected Area	Type of Declaration/ Fed ID #
3/1/2020	COVID-19; Pandemic	Statewide & National	State of Emergency, National Emergency (3455), and Governor and Presidential Declared Major Disaster (4494)
1/29/2019	Extreme Cold	Statewide	Governor Declared Emergency
9/4/2005 and 9/7/2005	Hurricane (Katrina) Evacuation	Statewide (Declared due to the emergency conditions in the State of Michigan, resulting from the influx of evacuees from states impacted by Hurricane Katrina beginning on August 29, 2005.)	Governor Declared Disaster and Presidential Declared Emergency (3225)
1/26-27/1978	Blizzard, Snowstorm	Statewide	Presidential Declared Emergency (3057); Governor Declared Disaster
3/2/1977	Drought	Antrim and 43 other counties	Presidential Declared Emergency (3035)

Sources: FEMA <https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties> and Michigan State Police [2019 Michigan Hazard Analysis \(MHA\) pub. 103](#)

Hazard Descriptions

Antrim County is vulnerable to a wide range of natural hazards. Hazard events have the potential to impact local residents, economic drivers in the community, critical infrastructure and the built environment, and the natural environment. The Antrim County Emergency Services Department is challenged with managing these threats to protect life and property. This plan includes a profile for each natural hazard event the county is likely to face. Each profile includes the location, extent, previous occurrences, probability of future events, and vulnerability assessment.

Location is the geographic areas within the planning area that are affected by the hazard, such as a floodplain. The entire planning area may be uniformly affected by some hazards, such as drought or winter storm. Location may be described in narrative and/or through map illustrations.

Extent is the strength or magnitude of the hazard. Extent can be described in a combination of ways depending on the hazard.

Previous occurrences describe the history of previous hazard events within the county. This information helps estimate the likelihood of future events and predict potential impacts. The extent of historic events may be included when the data is available. Severe weather event data is primarily collected from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) Storm Events Database.

Probability of future events is the likelihood of the hazard occurring in the future and any trends that may appear. Probability may be defined using historical frequencies or statistical probabilities.

Vulnerability assessment accounts for the type, amount, and value of assets such as: existing and future buildings, infrastructure, critical facilities, populations, recreation areas and environmental features that may be impacted by a hazard.

Data for natural hazard events in Antrim County was compiled from several different sources. Weather event data was collected primarily from the National Centers for Environmental Information through the National Oceanic and Atmospheric Administration's (NOAA) website. All data sources include:

- FEMA's webpage on Disaster Declarations for States and Counties was referenced for the most up-to-date data on Presidential- and Governor-Declared emergencies and disasters pertaining to Antrim County (Table 18).
- Climate <https://www.weather.gov/wrh/Climate?wfo=apx> – Historical local observed weather data; Climate prediction and variability; local high impact event summaries

NOAA Storm Events Database <https://www.ncdc.noaa.gov/stormevents/> - Data available to search beginning in 1950 to within approximately 3 months prior to present day; however, information on record for various types of events is limited and non-contiguous. The database provides local storm reports, damage reports, and recorded event descriptions. The event types researched for Antrim County include the following (the event types in italics are as these types of events are listed in the Storm Events Database):

- Dangerous Currents (i.e., *Rip Current*)
 - Dense Fog (*Dense Fog*)
 - Drought (*Drought*)
 - Extreme Temperatures (*Cold/Wind Chill, Extreme Cold/Wind Chill, Heat, Excessive Heat*)
 - Extreme Winter Weather (*Blizzard, Freezing Fog, Frost/Freeze, Heavy Snow, Ice Storm, Lake-Effect Snow, Sleet, Winter Storm, Winter Weather*)
 - Flood (*Flash Flood, Flood*)
 - Hail (*Hail*)
 - Seiche (Seiche)
 - Shoreline Flood (*Lakeshore Flood*)
 - Thunderstorm and High Wind (*Heavy Rain, Lightning, High Wind, Strong Wind, Thunderstorm Wind*)
 - Tornado (*Tornado, Funnel Cloud, Waterspout*)
 - Wildfire (*Wildfire*)
- The [Michigan Hazard Analysis](#), completed by the Michigan Department of State Police in 2019, was referenced to collect data on wildfires that occurred on State of Michigan owned land between 1981 and 2018 (as reported by the MDNR).
 - The websites for the National Inventory of Dams and MI-EGLE's Michigan Dam Inventory were used to collect information on dams in the county.

- The Great Lakes Current Incident Database <https://www.michiganseagrant.org/dcd/dcdsearch.php> provided by the National Weather Service and Michigan Sea Grant provides a list of all types of dangerous current-related fatalities and rescues on the Great Lakes from 2002 to 2020.

The NOAA – NCEI Storm Events Database is updated on a rolling basis, and thus the database is always being added to. The most up to date information was added to Table 20, but as events occur the database will change. There were 303 events reported in Antrim County between 01/01/1950 and 12/31/2022 (26,662 days). There were a total of 253 days with an event, 3 days with event and death or injury, 44 days with event and property damage, and 3 days with event and crop damage. Those events, as well as any wildfires on MDNR land, and State and Federal emergency or disaster declarations, are included in the hazard analysis. The hazard analysis groups the events into the following types:

Table 20: Number of Hazard Events in Antrim County by Type

Type of Event	# of Events	Event Location	Years Event Recorded
Wildfire	256	MDNR lands	1981 - 2018
Extreme Winter Weather	165	Region, County or Statewide	1978*, 1996 – 2016, 2018-2022
Thunderstorm/Wind; High Wind; Strong Wind	83	Countywide	1965, 1973, 1982, 1983, 1985, 1987, 1991, 1992, 1995, 1996, 1998-2011, 2013-2016, 2018-2022
Hail	36	Countywide	1979, 1989, 1996, 1998, 2000, 2001, 2004-2008, 2011-2013, 2015, 2016, 2019, 2021, 2022
Tornado	11	Townships of Kearney, Jordan, Warner, Echo, Central Lake, Elk Rapids, Torch Lake, Mancelona, Milton, Helena and Star	1958, 1974, 1977, 1985, 1990, 1995, 1998, 2007, 2017, 2018, 2022
Flash Flood	3	Elk Rapids; Helena/Custer Townships; Custer Township	1999, 2021
Extreme Cold / Wind Chill	2	Region or Statewide	2007, 2019*
Drought	2	Region	1977*, 2001
Heat/Excessive Heat	2	Region	2001, 2018
Lightning	2	Region/Banks Township	2000, 2012
Invasive Species	-	Countywide	Ongoing
Public Health Emergency (COVID-19 Pandemic)	1	Statewide/Nationwide	2020-2023
Coastal Hazards (Lakeshore Flood, Dangerous Currents, Seiche)	0	Townships of Banks, Torch Lake, Milton, and Elk Rapids; Village of Elk Rapids	1950-2022

Sources: NOAA National Centers for Environmental Information Storm Events Database; MDNR; Michigan State Police-Dept. of Homeland Security; FEMA; Great Lakes Current Incident Database.

Note: * indicates a state or federal emergency or disaster event designation

Economic Impact Analysis

Table 21 presents the *reported* deaths, illnesses/injuries, property damages, and crop damages of hazard events in Antrim County from 1950-2022. There were 4 injuries attributed to weather events; 5,244 illness attributed to COVID-19; and 76 deaths attributed to COVID-19. The estimated economic impact of Antrim County severe weather events that were reported to NOAA is \$2,304,780 in property damages and \$11,030,000 in crop damages. It should be noted that many events, such as hail, likely cause numerous small amounts in property damage, but such damages often go unreported.

Table 21: Cost Estimates by Event Type

Event Type	Property Damage Estimate	Crop Damage Estimate	Injuries/ Illness	Deaths
Extreme Winter Weather	\$270,000	\$10,000,000		
Thunderstorms with Wind; Severe/High Winds	\$970,500	\$0	1	
Hail	\$95,000	\$1,030,000		
Lightning	\$80,000	\$0		
Tornado	\$564,280	\$0	2	
Flash Flood	\$325,000	\$0	1	
Extreme Cold / Wind Chill	\$0	\$0		
Drought	\$0	\$0		
Heat/Excessive Heat	\$0	\$0		
Coastal Hazards (Lakeshore Flooding, Seiche, Dangerous Currents)	\$0	\$0		
Public Health Emergency (COVID-19)	N/A	N/A	5,244*	76*
Invasive Species	N/A	N/A		
TOTALS	\$2,304,780	\$11,030,000	5,248	76

Sources: NOAA's National Centers for Environmental Information; <https://www.michigan.gov/coronavirus/stats>

* According to the State of Michigan, this is the total of confirmed and probable deaths and illnesses for COVID-19 in Antrim County as of as of January 31, 2023

Table 22 provides an overview of each potential hazard's impact on the permanent population and the estimated impact on the State Equalized Values (SEV) for real and personal property (residential and commercial). The SEV is equal to half the true value of the property. Population data is collected from the US Census, 2019 ACS data. Based on data from the 2022 report, *Seasonal Population Study for Northwest Lower Michigan*, assume a 153% increase from the base population of permanent residents to account for the highest estimated annual average seasonal population within the county (which occurs in July and August).

Table 22: Geographic Economic Impact by Event

Hazard Event	Geography	Population Estimates	State Equalized Value
Extreme Winter Weather, Thunderstorm, Wind, Hail, Lightning, Tornado, Extreme Temperatures, Drought, Public Health Emergency	These hazards have the potential to impact all communities in Antrim County	23,206	\$2,686,829,990.00
Inland Flooding	Chain of Lakes communities; (Echo, Kearney, Custer, Banks, Central Lake, Forest Home, Torch Lake, Milton, Helena, and Elk Rapids Townships; Villages of Elk Rapids, Central Lake, Ellsworth, and Bellaire); and	16,203	\$82,761,805.40
	Jordan River Valley communities (Chestonia, Jordan, Mancelona, Star, and Warner Townships; Village of Mancelona)	7,003	
Coastal Hazards: Flooding and Shoreline Erosion	Banks, Torch Lake, Milton and Elk Rapids Townships; Village of Elk Rapids	7,932	\$11,244,039.40
Tree Damage from High Winds	Forest Home Township (Glacial Hills Preserve area)	1,594	\$8,781,430.05
Wildfire	Scattered Pine Forest Areas (White, Red, and Jack Pine) are present in portions of every community. However,	23,206	\$206,332,648.20
	Wildfire is considered a major hazard of concern for Mancelona Township, due to the concentration of pine forest present.	4,350 (of which 1,574 estimated persons are in the Village of Mancelona)	\$131,447,697.99

Sources: 2019 ACS Estimates from the U.S. Census Bureau; Antrim County Equalization

Extreme Winter Weather

The National Weather Service defines a winter weather event as: *a winter weather phenomenon (such as snow, sleet, ice, wind chill) that impacts public safety, transportation, and/or commerce. It typically occurs during the climatological winter season between October 15 and April 15.* The Extreme Winter Weather category in this Plan's hazard analysis includes the following subcategories: winter weather, winter storm, ice storm, heavy snow, blizzard, frost/freeze, and lake effect snow. Blizzards are the most perilous snowstorms and are characterized by low temperatures, strong winds, and enormous amounts of fine, powdery snow. Snowstorms have the potential to reduce visibility, cause property damage, and loss of life.

According to the 2019 Michigan Hazard Analysis, the 29 counties of the Northern Lower Peninsula of Michigan have an annual average of 79 snowstorm events, with 0 average annual deaths or injuries, \$6.53 million in average annual property damage and \$20 million in crop damage. Michigan experiences large differences in snowfall over short distances due to the Great Lakes. The average annual snowfall accumulation ranges from 30 to 200 inches with the highest accumulations in the northern and western parts of the Upper Peninsula. In Lower Michigan, the highest snowfall accumulations occur near Lake Michigan and in the higher elevations of northern Lower Michigan. For example, the average snowfall ranges from 141 inches in the Gaylord area to 101 inches in Traverse City.

Ice and sleet storms generate sufficient quantities of ice or sleet that result in hazardous conditions and/or property damage. Ice storms occur when cold rain freezes on contact with the surface and coats the ground, trees, buildings, and overhead wires with ice. Ice storms are often accompanied by snowfall, which can cause property damage, treacherous conditions, and power loss. When electric lines are down, households are inconvenienced, and communities experience economic loss and the disruption of essential services. Conversely, sleet storms are small ice pellets that bounce when hitting the ground or other objects. The ice pellets do not stick to objects, but can cause hazardous driving conditions.

According to the 2019 Michigan Hazard Mitigation Plan, Michigan has 16 average annual ice and sleet storm events with 0.2 average annual deaths, 0.5 average annual injuries, and \$11.4 million in average annual property and crop damage.

Location

Extreme winter weather events are regional events that are not confined to geographic boundaries and can affect several areas at one time with varying severity depending on factors such as elevation and wind patterns. All of Antrim County is at risk to the occurrence and impacts from extreme winter weather; the county is more susceptible to lake-effect snow due to proximity to Lake Michigan.

Extent

Snowstorms can be measured based on snowfall accumulations or damages. According to the Antrim County Road Commission's annual snowfall records dating back to the 1938-39 season, the average annual snowfall in Antrim County is 149.5 inches. The heavy snow event on March 2, 2012 resulted in an estimated \$250,000 in property damages. A November 2007 winter storm caused \$5,000 in property damages. The December 20, 2012 winter storm caused an estimated \$12,000 in property damages, and the blizzard in February 2019 caused \$3,000 in property damages.

Extreme winter weather events on record with NOAA (Table 21) in total caused \$270,000 in property damages and \$10,000,000 in crop damages (due to the April 2012 frost/freeze event).

Previous Occurrences

Between 1996 and 2022, and including the 1978 Presidential-declared Emergency and Governor-declared disaster for a blizzard/snowstorm, there have been 165 extreme winter weather events. These include the following types of events reported in Antrim County (Table 23): Heavy Snow, Blizzard, Winter Storm, Ice Storm, Lake-Effect Snow, Winter Weather and Frost/Freeze.

In recent years, the more common events are winter storms with moderate snowfall of 5-10 inches; heavy snow, blizzards, and lake-effect snow events have been less common. Nonetheless, extreme winter weather events are the most frequently recorded extreme weather event with the potential to impact the entire county and cause widespread damage. With combined property and crop damages, winter weather events are also the most costly events to impact the county.

Table 23: Antrim County Extreme Winter Weather Events

Hazard Event	Number of Events	Property Damage	Crop Damage	Event Years
Winter Storm	66	\$ 17,000	\$ -	1997, 1998, 2000, 2001, 2003-2010, 2012-2016, 2018-2022
Heavy Snow	60	\$ 250,000	\$ -	1996-2009, 2011, 2012, 2014, 2016, 2018, 2020
Lake-Effect Snow	27	\$ -	\$ -	2006-2011, 2013, 2014, 2016, 2019
Blizzard	7	\$ 3,000	\$ -	1978*, 1997-1999, 2002, 2019, 2022
Ice Storm	3	\$ -	\$ -	2001, 2005, 2008
Frost/Freeze	1	\$ -	\$ 10,000,000	April 2012
Winter Weather	1	\$ -	\$ -	2006
TOTAL	165	\$ 270,000	\$ 10,000,000	

Source: NOAA, National Centers for Environmental Information; MSP 2019 Michigan Hazard Analysis

One of the highest-impact snowstorms in recent memory pounded Northern Michigan on the night of March 2, 2012. Low pressure tracked from Missouri, to southern Lower Michigan, and on to eastern Canada, while rapidly strengthening. Precipitation surged northward into the region on the evening of the 2nd. This was primarily snow, except in parts of east central Lower Michigan (especially near Lake Huron), where temperatures were mild enough for rain. Snow wound down on the morning of the 3rd, and though somewhat blustery winds occurred behind the system on the 3rd, blowing snow was limited because the snowfall was so wet. Snow totals ranged from 6 to 14 inches across most of Northern Michigan. Higher amounts fell near and west of Grand Traverse Bay, with a maximum amount of 20 inches near Lake Ann. With relatively warm temperatures, the snow was very wet; Traverse City saw around a foot of snow during the night, with a low temperature of 33 degrees. The snow stuck to everything, with the weight of the snow downing many, many trees and power lines. Power outages were widespread, with an outright majority of Northern Michigan residents losing power at some time during or after the storm. In Benzie County, 95 percent of residents lost power. Outages lasted up to a week in some spots. Great Lakes Energy described it as the worst snowstorm (in regards to power outages) in 30 years. A number of counties and communities opened shelters to aid those without power or heat. Also included in the tree damage was substantial damage to fruit trees in the Grand Traverse Bay region, particularly cherry trees. This events accounts for \$600,000 in reported damages.

A frost/freeze event took place on April 27, 2012 across Northwest Lower Michigan, but especially in the Traverse City region. A killing freeze caused extreme damage to agriculture, particularly in the fruit belt of Northwest Lower Michigan. Traverse City saw low temperatures of 25 degrees on the 27th, 31 degrees on the 28th, and 26 degrees on the 29th. These values were not exceptionally colder than normal lows, which are in the middle 30s. Ultimately, the main culprit was a stretch of unprecedented warmth in mid-March, which included five consecutive 80-degree days (17th-21st). This caused fruit trees to bud out far, far ahead of schedule, and left them vulnerable to even relatively normal weather as the spring progressed. The tart cherry crop was a total loss, while other orchard fruits such as sweet cherries, apples, pears, and peaches saw losses in excess of 90% of the expected crop. Total regional crop losses were estimated at \$10 million.

Probability of Future Events and Vulnerability Assessment

Since 1996, Antrim County has had 164 extreme winter weather events. This averages to about to about 6 extreme winter weather events every year. Therefore, there is a 100% chance of an extreme winter weather event occurring in a future year in Antrim County. Heavy snow events have the potential of shutting down towns and businesses for a significant period of time. Blowing and drifting snow with blizzard conditions cause driving hazards. Ice damage may occur when high winds push lake water and ice past the shoreline, causing damage to public infrastructure, and residential property. Concerns raised by participants in the development of this plan pertaining to extreme winter weather events included loss of power/utilities in cold temperatures, as well as immobilization of people and services due to large snowfall, ice, wind, and snow drifts.

Antrim County remains a leading producer of fruits, tree nuts, and berries with over \$16 million in these products sold (2017 USDA Census of Agriculture). A frost/freeze event of the magnitude in 2012 would decimate more than three quarters of the products sold today. This would be a major impact on the local economy that is heavily reliant on agriculture production and agri-tourism (wineries, orchards, etc.).

Winter-related events cause difficult driving conditions and in the event of an emergency, can make travel increasingly difficult for emergency personnel who may be more frequently dispatched to rural areas. During the winter months, the population is largely made up of the base permanent residents. However, there is increasing demand from seasonal

residents to purchase property and retire or work remotely from highly desirable northern and coastal communities like those in Antrim County. Many aspects of Antrim County, including natural wooded areas and proximity to lakes/streams, are attractive to prospective buyers and the permanent population is expected to continue to grow. New residents, especially those locating in remote areas, increase the chance of risk to life and property during severe weather events.

Additionally, elderly residents are the most likely persons to have a disability, and therefore, are the most vulnerable to extreme winter weather events. Helena Township has the highest median age of all communities in the county, at 60.9 years; an estimated 39.1% of their population (400 persons) is over age 65. Elk Rapids Township has the greatest estimated number of residents over age 65 (859 persons), followed by Milton Township (684), Mancelona Township (659), Forest Home Township (621), Central Lake Township (586), Kearney Township (530) and Torch Lake Township (494). It is important to note that a township census estimate includes the estimate of persons within any village(s) located within the township.

Thunderstorms and High Winds

The National Weather Service defines a severe thunderstorm as: *a thunderstorm that produces a tornado, winds of at least 58 mph (50 knots or ~93 km/h), and/or hail at least 1" in diameter.* These storms can also produce lightning or heavy rain (that could cause flash flooding). Severe thunderstorms can occur at any time in Michigan, although they are most frequent during the warm spring and summer months from May through September.

High wind events are also included in this hazard category. Long-lived wind events associated with fast-moving severe thunderstorms are known as a *derecho* (pronounced similar to "deh-REY-cho"). According to the National Weather Service, a derecho is a widespread, long-lived wind storm that is associated with a band of rapidly moving showers or thunderstorms. Although a derecho can produce destruction similar to the strength of tornadoes, the damage typically is directed in one direction along a relatively straight swath. As a result, the term "*straight-line wind damage*" sometimes is used to describe derecho damage. By definition, if the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho. A derecho often occurs during the spring or summer; however, it can occur any time of the year.

Severe windstorms can cause damage to homes and businesses, power lines, trees and agricultural crops, and may require temporary sheltering of individuals without power for extended periods of time.

Location

Thunderstorms and high wind are regional events that are not confined to geographic boundaries and can affect several areas at one time with varying severity, depending on factors such as elevation and wind patterns. All of Antrim County is at risk to the occurrence and impacts from thunderstorms and severe winds.

Extent

Thunderstorms can be measured based on wind speed or damages. The measured wind gusts for thunderstorm/wind and high wind / strong wind events in Antrim County ranges from 50 to 70 knots. Antrim County had a reported \$970,500 in property damages caused by thunderstorms and severe winds since 1965 (Table 24).

One (1) injury has been recorded in association with a thunderstorm/wind event. On June 11, 2005, a female hiker was struck by a falling tree in the Landslide Creek area in Chestonia Township. Her injuries were not serious.

Table 24: Thunderstorm and Wind Events

Hazard Event	Number of Events	Property Damage	Crop Damage	Time Interval/ Year Event Recorded
Thunderstorm Wind	70	\$ 900,500	\$ -	1965, 1973, 1982, 1983, 1985, 1987, 1991, 1992, 1995, 1996, 1998, 1999, 2001-2008, 2011, 2013-2016, 2018, 2019, 2021, 2022
High Wind	12	\$ 70,000	\$ -	1998, 2000, 2001, 2003, 2005, 2009, 2010, 2015, 2020, 2021
Strong Wind	1	\$ -	\$ -	2001
TOTAL	83	\$970,500	\$ -	

Source: NOAA: National Centers for Environmental Information

Previous Occurrences

Since 1965, there have been a total of 83 thunderstorm/wind and high wind events reported in Antrim County (Table 22). This is the second-most frequently occurring type of severe weather event in the county.

The most damaging event occurred on August 2, 2015. A historic severe weather outbreak in northern Michigan, as multiple waves of severe thunderstorms crossed the region. A passing cold front would finally end the activity during the evening hours. This episode featured widespread straight-line wind damage in parts of northwest Lower Michigan, and the largest hail on record in northern Michigan in Ogemaw County. This event resulted in \$600,000 in property damages.

Probability of Future Events and Vulnerability Assessment

Since 1965, Antrim County has had 83 thunderstorm/wind and high wind or strong wind events. This averages to 1.4 events in a given year. Therefore, the probability of an event occurring in a given future year is 100 percent. Damage from straight line winds usually affects multiple counties through the loss of electricity from trees/tree limbs downing power lines; causing widespread property damage; and potentially exposing the public to severe injury or fatality due to flying debris. The magnitude and severity depend on the county population, seasonal activity, and the spread of development. Between March and July, the county's population expands by an estimated 92% to include the seasonal population. Residents and visitors are attracted to both rural, sparsely populated rural areas and village centers. Mobile home parks, campgrounds, institutions (schools, places of worship, etc.), and numerous annual events that draw a large number of tourists to outdoor recreation areas were identified as specific areas of concern. The locations of mobile homes and campgrounds are identified on the Vulnerable Populations and Hazard Areas Map in Appendix A. Occupants of these structures/facilities are more vulnerable to impacts from thunderstorms and severe winds.

Hail

Hailstorms occur when a severe thunderstorm produces hail that falls to the ground. Hail is formed when the updrafts of the storm carries water droplets above the freezing level, where they form into rounded or irregular lumps of ice that range from the size of a pea to the size of a grapefruit. When the weight of the hail is no longer supported by the air, it falls to the ground and has the potential to batter crops, dent automobiles, and injure people and wildlife. Sometimes, large hail appears before a tornado since it is formed in the area of a thunderstorm that tornadoes are most likely to form.

According to the 2019 Michigan Hazard Mitigation Plan, Michigan has on average 191 hail storms, an expected annual statewide loss of about \$16.6 million, no deaths, and approximately 1 injury per year. Despite damaging hail occurring in every part of Michigan, the areas of the state most prone to severe thunderstorms (e.g. the Southern half of the Lower Peninsula) are also most prone to large and damaging hail. The majority of the hailstorms occur during the growing season from May through August when crops have the greatest potential to be damaged by hail.

The National Weather Service issues forecasts for severe thunderstorms with sufficient warning time to allow residents to take appropriate action to reduce the effects of hail damage to vehicles and some property. However, little can be done to prevent damage to crops. For example, during September 26-27, 1998, a line of severe thunderstorms moved across northern Lower Michigan producing hail up to 2" in diameter in Manistee County and destroying an estimated 30,000-35,000 bushels of apples at area farms, and damaging several homes and vehicles.

Location

Hailstorms are regional events that frequently accompany thunderstorms, and are not confined to geographic boundaries. The severity of hailstorms may range across the affected areas. All of Antrim County is at risk to the occurrence and impacts from hailstorms. According to the National Weather Service, Antrim County is in an area of the United States that has on average two days of hailstorm events per year.

Extent

According to the NOAA National Centers for Environmental Information, the approximate size of hail is described as follows in Table 25. If a thunderstorm produces hail that is 1 inch in diameter (quarter size) or larger, it is considered to be a severe thunderstorm.

Table 25: NOAA Hail Size Description

Appearance	Approximate Size in Inches
Pea	0.25-0.5 inch
Penny	0.75 inch
Nickel	0.88 inch
Quarter	1.00 inch (<i>Severe Criteria</i>)
Walnut/Ping Pong	1.50 inch
Golf Ball	1.75 inch
Hen Egg	2.00 inch
Tennis Ball	2.50 inch
Baseball	2.75 inch
Tea Cup	3.00 inch
Grapefruit	4.00 inch
Softball	4.50 inch

The greatest extent hail reported in Antrim County was 3 inches (tea cup size) on July 8, 2016 in Central Lake Township. Numerous vehicles were dented by very large hail, and some windows were broken. Area fruit crops sustained considerable damage. Approximately 60 percent of the cherry crop in northwest Lower Michigan was damaged by the severe thunderstorms with hail in the region that day.

Hail can damage aircraft, homes, vehicles, agricultural crops, and can also injure or kill livestock and people.

Previous Occurrences

Between 1979 and 2022, Antrim County had 36 hailstorms reported to NOAA (Table 26). There are no reported injuries or deaths attributed to hail.

Table 26: Antrim County Hail Events, 1979-2021

Location	Date	Magnitude	Property Damage	Crop Damage
-	6/20/1979	1		
-	10/15/1989	0.75		
EASTPORT	7/8/1996	1.5		
ELK RAPIDS	6/24/1998	0.75		
MANCELONA	6/9/2000	0.75		
KEWADIN	5/15/2001	0.75		
EASTPORT	5/15/2001	0.75		
KEWADIN	5/15/2001	0.75		
CENTRAL LAKE	8/9/2004	0.88		
MANCELONA	6/27/2005	0.88		
KEWADIN	7/17/2006	1		\$30,000
MANCELONA	7/17/2006	1.25		
ELLSWORTH	3/26/2007	0.75		
MANCELONA	10/18/2007	0.75		
ALBA	10/18/2007	1.5		
MANCELONA	6/27/2008	0.88		
CHESTONIA	7/15/2008	0.75		
ALBA	6/8/2011	0.75		
ELLSWORTH	6/8/2011	0.75		
ATWOOD	6/8/2011	1.25		
KEWADIN	6/8/2011	1.5		
BELLAIRE	6/8/2011	0.75		
CENTRAL LAKE	5/20/2012	1		
CLAM RIVER	5/20/2013	0.75		
BELLAIRE	5/20/2013	1		
CHESTONIA	5/30/2013	1		
ANTRIM	9/1/2013	1		
ELK RAPIDS	8/2/2015	1		
TORCH LAKE	8/2/2015	1		
CENTRAL LAKE	7/8/2016	1		\$200,000
CENTRAL LAKE	7/8/2016	3	\$65,000	\$800,000
ALDEN	7/10/2019	1		
MANCELONA MUNI ARPT	6/9/2021	0.75		
ALBA	5/20/2022	1.75		
ALBA	5/20/2022	2.5	\$30,000	
ALBA	5/20/2022	1		
TOTAL			\$95,000	\$1,030,000

Source: NOAA: National Centers for Environmental Information

During one particularly strong event on July 17, 2006, hail damage was significant within Antrim County and the region. A strong cold front ran headlong into warm and humid air in place over Michigan. Thunderstorms ignited by midday in Eastern Upper Michigan, and became widespread by late afternoon in Northern Lower Michigan. A large number of storms became severe, as this became the largest severe weather outbreak in Northern Michigan in several years. Millions of pounds of fruit crops were destroyed by hail and wind. The reported hail size in Kewadin was one inch. A total of \$1,030,000 in crop damages were reported during events in 2006 in Kewadin and 2016 in the Central Lake area.

Property damages totaling \$65,000 were reported for the 2016 3" diameter hailstorm event in 2016; the May 2022 event in Alba caused \$30,000 in property damages.

Probability of Future Events and Vulnerability Assessment

With 36 hail events reported between 1979 and 2022, Antrim County has an estimated 82% chance of a hailstorm event in a given year. All buildings, exposed infrastructure, and populations are at risk from hailstorms since hail causes damage to roofs, brick walls, glass, landscaping, crops, and cars. Manufactured homes and campground populations located throughout the county and are more susceptible to hail damage; the locations of these are identified on the Vulnerable Populations and Hazard Areas Map in Appendix A.

Hail can also damage roads, sidewalks, bridges, and above ground utilities. Hail has the potential to cause injury and death, and populations are advised to take shelter when an event occurs.

Riverine and Urban Flooding

Fluvial, or Riverine flooding occurs when rivers, streams, and lakes overflow into adjacent floodplains due to prolonged, intense rainfall, rapid snowmelt or ice jams. Flooding can damage or destroy property, disable utilities, destroy crops and agricultural lands, make roads and bridges impassable, and cause public health and safety concerns. Floods occur in the early spring, but also occur in the winter due to ice jams, and during the summer or fall from severe thunderstorms. Flooding caused by severe thunderstorms has a greater impact on watercourses with smaller drainage areas.

Pluvial, or Urban flooding occurs when water flows into low-lying areas because it does not have a place to go, due to impervious surface coverage. This flooding occurs from a combination of excessive rainfall, snowmelt, saturated ground, and inadequate drainage, and is becoming more common in Michigan. Since development is occurring in floodplains, the natural landscape is unable to properly disperse the water. Urban flooding also has the potential to overflow onto docks or other structures with electricity running to them, which increases the risk for an electric shock drowning. Additionally, storm and sanitary sewers are unable to handle the water flows associated with storm events, which can result in sewer overflows and affect the water quality of nearby lakes and rivers, as well as structures with basements or shallow groundwater tables.

Dam failure is also a potential source of flooding. Infrastructure in the state is aging and costly to maintain. FEMA provides Federal Guidelines for Dam Safety. These guidelines encourage strict safety standards in the practices and procedures employed by federal agencies or required of dam owners regulated by the federal agencies (2004). The National Inventory of Dams provides a catalogue of dams in the nation with a profile of each. Each profile lists the Hazard Potential Classification. This is a system that categorizes dams according to the degree of adverse incremental consequences of a failure or mis-operation of a dam. The hazard potential classification does not reflect in any way on the current condition of the dam. Three classification levels are adopted as follows: Low, Significant, and High, listed in order of increasing adverse incremental consequences.

According to the 2019 Michigan Hazard Analysis, the most damaging hazard in Michigan, based upon estimated physical damages and known response/recovery costs, appears to be floods. The MSP reports that flooding events have a statewide expected annual loss estimated at more than \$100 million (\$25.69 million had previously been estimated in the 2014 Michigan Hazard Mitigation Plan, but Federal Disaster 4195 confirmed a higher magnitude more in line with earlier EGLE estimates, as that Metro Detroit flood event was quite similar to Federal Disaster 1346 during the previous decade).

The MSP's 2019 Michigan Hazard Analysis indicates that the Northern Lower Peninsula averages 0.3 annual flooding events, with average annual property and crop damages of \$2,591,244 due to flooding.

Location

The Villages of Bellaire, Central Lake, Elk Rapids, and Ellsworth are at risk for riverine and urban flooding, due to their locations along the Chain of Lakes watershed. One of the three flash flooding events on record with NOAA occurred in the Village of Elk Rapids. Not only does the Village have a fair amount of impervious surface coverage, but the Chain of Lakes waterway outlet connects to Lake Michigan just past the Elk Rapids hydropower dam.

The Elk River Chain of Lakes (ERCOL) watershed begins in Echo Township and continues through Banks Township, the Village of Ellsworth, Central Lake Township, the Village of Central Lake, Forest Home and Kearney Townships, the Village of Bellaire, Custer Township, Helena Township, Torch Lake Township, Milton Township, Elk Rapids Township and the Village of Elk Rapids. These townships and villages are likely to experience riverine flooding from the Chain of Lakes and their tributaries. Other flooding may involve low-lying areas that collect runoff waters; flaws or shortcomings in existing sewer infrastructure; undersized or poorly designed storm water control practices; collective effects of land use and development trends; illegal diversion of water, or actions that interfere with system function.

There are many various sized culverts at road/stream crossings throughout the ERCOL watershed. These vary in size and age; many are undersized and cannot accommodate the high volumes of storm water produced from the intense rainfall events that are occurring more frequently. Additionally, road/stream crossings that are improperly designed or installed, structurally failing, or no longer accommodate current stream conditions affect stream health. They can affect stream hydrology, prevent fish and other aquatic organisms from reaching up-and downstream reaches, increase water temperatures, and are sources of nutrients, sediments, bacteria, heavy metals, and other nonpoint source pollutants. In Northern Michigan, sediments pose the greatest threat to rivers and streams. Sedimentation can adversely impact fish and aquatic organisms by degrading their habitat and reducing water quality.

Antrim County has three major dams, as described in Table 27 and Figure 12. The Cedar River Dam and Bellaire Dam have a “High” hazard potential classification. This means that if the dam were to fail, there would be economic losses, environmental damages, impacts to lifeline interest, and probably cause loss of human life. The owners of these dams are required to have an Emergency Action Plan (EAP) on file with the Antrim County Office of Emergency Management and the State of Michigan.

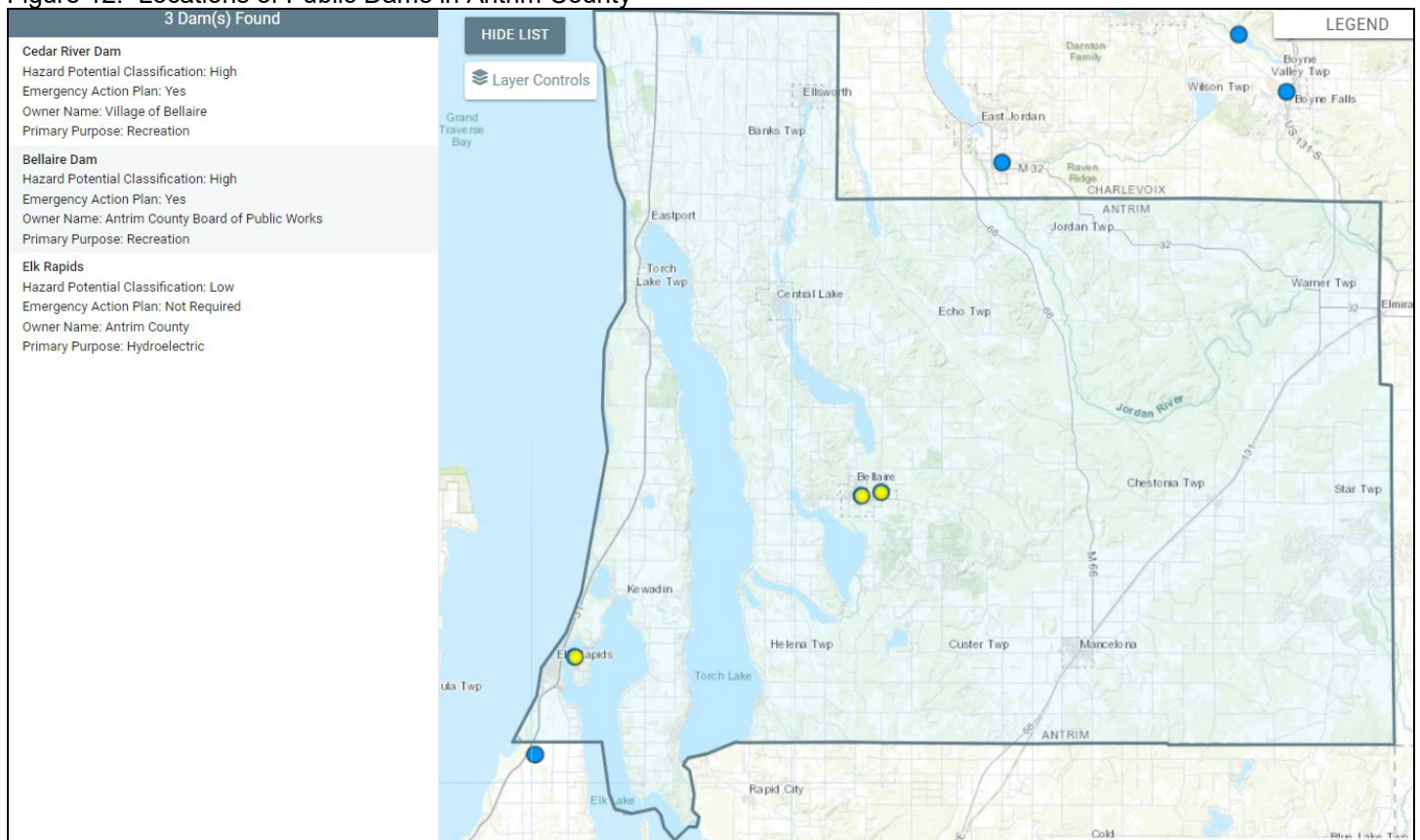
The Elk Rapids Hydroelectric Dam has a “Low” hazard potential classification. Low hazard potential dams are not required to have an EAP on file. Additionally, there is no expected loss of human life or impact to lifeline interests if the dam were to fail, and economic losses and environmental damages would be low and generally limited to that of the dam owner.

Table 27: Major Dams in Antrim County

Dam Name	Location	Hazard Potential Classification	EAP on File	EAP Last Revised	Last Inspected	Condition Assessment	Owner
Cedar River Dam	Derenzy Road, Village of Bellaire	High	Yes	1/27/1999	10/9/2021	Fair; meets applicable hydrologic and seismic regulatory criteria	Village of Bellaire
Bellaire Dam	Village of Bellaire	High	Yes	N/A	11/1/2018	Fair	Antrim County Board of Public Works
Elk Rapids Hydroelectric Dam	Village of Elk Rapids	Low	Yes	3/4/2020	7/26/2017	N/A	Antrim County

Sources: State of Michigan Dam Inventory; National Inventory of Dams

Figure 12: Locations of Public Dams in Antrim County



Source: National Inventory of Dams

Extent

Flood extent can be measured by the amount of property damage and accumulation of rainfall. There have been three (3) flood events in Antrim County (Table 28). In total, flood and flash flood events have caused \$325,000 in property damages, no crop damages, no deaths and one injury. According to the NOAA-NCEI's *Climate at a Glance County Time Series*, the average annual precipitation for Antrim County, based on records from 2000-2022, is 35.4 inches. October is historically the wettest month with an average of 4.45 inches of precipitation.

Table 28: Antrim County Flood Events

LOCATION	DATE	EVENT TYPE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE	FLOOD CAUSE
Elk Rapids	7/5/1999	Flash Flood	0	0	\$0	\$0	Heavy Rainfall
Helena and Custer Townships	8/11/2021	Flash Flood	0	1	\$325,000	\$0	Heavy Rainfall
Custer Township	8/11/2021	Flash Flood	0	0	\$0	\$0	Heavy Rainfall

Source: NOAA: National Centers for Environmental Information

Previous Occurrences

Antrim County has experienced three flash flood events; the event and episode narratives as reported in the NOAA NCEI database are as follows:

July 5, 1999 Flash Flood

Numerous thunderstorms moved across eastern upper and northwest lower Michigan with isolated severe wind reports. Training echoes (thunderstorms continuously moving over the same general area) over the Lake Michigan shoreline counties in northwest lower Michigan caused up to 4 inches of rainfall within a few hours. In the Village of Elk Rapids, secondary roads were flooded with 4-6 inches of water. Many secondary roadways near the Grand Traverse Bay area and across the Leelanau peninsula flooded. Traverse City also had several secondary city streets which had flooding. The worst was along East Front Street and 14th Street in downtown, where one business incurred minor basement flooding.

August 11, 2021 Flash Flood

After a warm front mixed northward across northern Michigan during the day, a weak shortwave progressing overhead helped initiate storms along a weak boundary over Lake Michigan. This line of storms tracked eastward across the area, producing damaging winds into the early morning hours of 8-11. Training storms across parts of NW lower Michigan also produced heavy rainfall and flash flooding in multiple locations, including washing out a roadway in Antrim county that resulted in one injury.

Alden Highway completely washed out near Comfort Rd. Two vehicles fell into road wash out causing injury to 1 person. Multiple other road sections washed throughout county. Water was over M-88 in multiple places near Bellaire.

Probability of Future Events and Vulnerability Assessment

Since 1999, Antrim County has had three flash flood events, which equates to a 12.5% chance that a flash flood would occur in a given future year. The magnitude and severity of a heavy rainfall event also depends on the population densities, seasonal activity, and the spread of development. During the warm or summer months, the population expands to include both the permanent resident base population and the seasonal short- and long-term population. The seasonal population is attracted to both rural, sparsely populated rural areas and urban activity centers. Villages are where many seasonal special events take place, drawing large crowds of people.

Floods can damage or destroy public and private property, disable utilities, make roads and bridges impassable, destroy crops and agricultural lands, cause disruption to emergency services, and result in fatalities. People may be stranded in their homes for several days without power or heat, or they may be unable to reach their homes at all. Long-term collateral dangers include the outbreak of disease, widespread animal death, broken water or sewer lines causing water supply pollution, downed power lines, broken gas lines, fires, and the release of hazardous materials.

The seasonal nature of flooding will continue to occur. Years with exceptional snowfall levels will likely result in flooding events from snowmelt. Lake Michigan water temperatures will create more active storm systems and heavier rainfalls. Lake Michigan water levels will also increase flooding events inland as the water table rises. Furthermore, increased development, reduction in green space, and subsequent soil erosion cause sedimentation to accumulate in river and lake beds reduce the amount of water flow. Rivers and lakes with sedimentation buildup will experience water backups and flooding events unless mitigated.

The Cedar River Dam and the Bellaire Dam are categorized as “high hazard potential” dams (Table 27). If the Elk Rapids Dam failed, the immediate impact would be to Dexter Street and adjoining recreation, residential and commercial land uses in the Village of Elk Rapids. If the Bellaire Dam or Cedar Dam failed, immediate impacts would be to adjoining roads and commercial, residential and recreation properties within the Village of Bellaire and downstream properties in adjoining Kearney Township and/or Forest Home Township. Additionally, other roads that cross the Chain of Lakes waterway system often act as dams. Those locations, along with floodplain areas and any nearby development, could be impacted by an upstream dam breach.

Additionally, Antrim County is located downstream of a high hazard potential dam - the Rugg Pond Dam - located on the Rapid River in southerly adjoining Rapid River Township, Kalkaska County. The dam is owned by Kalkaska County and has been given a “Fair” condition rating by the EGLE Dam Safety Unit. The Kalkaska County Board of Commissioners is currently in the process of evaluating options of whether to repair the dam and remove accumulated sediment behind the dam, or remove the dam and accumulated sediment entirely. If this dam were to fail, floodwaters would impact property along the Rapid River in Kalkaska County, which terminates at the Torch River, just south of Torch Lake, near Milton Township in Antrim County. Dam failure would also impact nearby property within Helena Township in Antrim County, and create severe navigation issues in the Torch River and Rapid River. One of the hazard mitigation strategies developed for this plan, regarding flooding, is that Antrim County stay regularly informed about the current condition and future planned actions associated with the Rugg Pond Dam in Kalkaska County.

Antrim County has partnered with the US Army Corps of Engineers (USACE) to complete a hydrology study for the Elk Rapids Chain of Lakes watershed. Conducted from 2020-2022, the study consists of two computer models: one that simulates the hydrology of the ERCOL watershed and one that simulates the hydraulics of the ERCOL lakes and connecting rivers. The two models work together to simulate certain types of future rain events. The hydraulic model calculates how high the lake levels will be, and how long it will take the water levels to recede. The report also contains the results of the 100-year storm analysis, along with the results of three scenarios: the impact of the Ellsworth culverts on lake levels upstream; dredging the Intermediate River between Intermediate Lake and the Bellaire Dam; and dredging the Torch River. This new model will serve as an important tool for future hazard preparedness.

Specific flood hazard areas were identified during public meetings and are identified on the Hazard Areas Map provided in Appendix A. Flood hazard information may be obtained from the Flood Rate Insurance Maps (FIRM) available for jurisdictions participating in the National Flood Insurance Program. Specific road/stream crossing concerns related to flooding that was noted by participants during the plan development include the following; quoted text was obtained from online survey results:

- Village of Ellsworth: a severely undersized culvert on Bridge Street that is “impeding the flow of water from the upper chain of lakes”; sediment deposits around the culvert make it very difficult to navigate the waterway in a non-motorized watercraft. Evidence of erosion/overflow/undercutting where the bridge structure meets the stream was observed during the June 2022 field trip. The two images from below, from left to right, illustrate the Bridge Street Culvert on the upstream and downstream sides. Notice the overgrown vegetation and low passage under the road, limiting non-motorized watercraft from passing through on the ERCOL.



Additionally, the Lake Street (C-48) crossing over Skinner Creek, near the Tapawingo restaurant, was noted to have flooding concerns and structural deficiencies due to aging. Refer to the pictures below. It is a stone culvert – allegedly the oldest in the County. Not much sediment deposit was observed in the stream, but the surface edge of road on the upstream side was degrading/eroding was observed during the June 2022 field trip.



- Village of Ellsworth/Banks Township (on the border of both communities): an undersized and deteriorated culvert on a main trunkline (East Jordan Road/Lake Street/C-48) that is in need of replacement. If it fails, traffic in and out of Ellsworth on the north side of Six Mile Lake will be severely impeded; private residences are also located near this problematic road/stream crossing. A member of the 6 Mile Lake Association indicated during the public hearing that they are working with the Village of Ellsworth to obtain a preliminary engineering study (at an estimated cost of \$23,300) to evaluate what is needed to replace this culvert.

- Village of Bellaire: “two dams in proximity...that could cause some issues.” “There are three bridges in the Village, and two dams within the Village.” “Craven Pond (Blair Lake) in Bellaire almost overflowed during storm events in October 2020 and August 2021... if this were to happen the dam would have been breached.” The photo on the right is a view of Blair Lake, east of Derenzy Road, looking south, taken in the Summer of 2022. The Cedar Dam is located on the west size of Derenzy Road.



An additional concern mentioned was that the Intermediate River, located within and adjoining the Village of Bellaire, has filled with sediment over time and become very shallow, thus contributing to flooding events.

- Village of Central Lake: The State Street Bridge over the Intermediate River is aging. There is a USGS water level monitoring station on the bridge – the only one in the county. Noted during the 2022 field trip: need to ask the Road Commission if work is scheduled on bridge soon, and if is this an area of water constriction/erosion concern. Below is a photo of the downstream side of the bridge, at the beginning of Intermediate Lake.



- Village of Elk Rapids: “I think that our infrastructure is aging – and there are significant pieces within our jurisdiction – but I also know that there are plans in place to inspect and maintain them. We need to monitor this to make sure that there is follow-through.” “We have a dam and a bridge (the bridge is not in the best of shape either). There is an undersized road/stream crossing on Cedar Street over the Elk River; concerns with the structural condition of the Dexter Street Bridge just south of the Elk Rapids Dam; flooding issues on Lake Street on the south side of Bass Lake. Flood would most likely have the largest impact on the community with “lots of waterfront and low-lying areas.”

- Central Lake Township: Mohrmann Road Bridge - timbers on bridge structure. Increased sedimentation over the years makes the river/lakes wider and shallower. Floods go down and around the bridge, not over. This bridge is the only way to cross the lakes between the Villages of Ellsworth and Central Lake. It is not on Road Commission’s agenda for applying for funding. It is rated as being in “Fair” condition. The Road Commission has indicated they will complete some work on it as needed with their crews at minimal expense.

Below are photos of the Mohrmann Road Bridge from the June 2022 field trip, clockwise from top left: Looking west at the bridge surface; Looking at the exterior of the north side of the bridge; Looking upstream from the bridge; Looking downstream of the bridge where adjoining residential properties have experienced flooding.



- Helena Township: "...two consecutive years of parts of town [hamlet of Alden] and homes that have flooded." The Alden Highway bridge over Finch Creek washed out in an August 2021 major rainstorm; this has since been reconstructed by the Antrim County Road Commission.

There are also many undersized culverts at road/stream crossings that result in flooding and improvements are needed at: Spencer Creek on Coy St.; Smalley, St., Manley Rd, Valley St.; and at creeks on SE Torch Lake Drive and Alden Highway, north of W. Elder Road.

Additionally, the Antrim County Road Commission has indicated they are pursuing local bridge funding for FY 2025 for preventative maintenance work at the Clam River Bridge in both Helena Township and Forest Home Township. The road at this location acts like a dam and restricts water flows from Clam Lake to Torch Lake.

- Forest Home Township: General concern about private dams and culverts. With heavy rains, we have concerns with road culverts not being able to handle the increase water flow and possibly causing erosion of the road bed and banks" (primarily along cottage Drive near Lake Bellaire and Clam Lake). Also, the Intermediate River has filled with sediment and become very shallow.
- Kearney Township: Dams and bridges; "We only have one bridge that is connected to the one dam that we have our Township, this was last renovated about 20 – 25 years ago."
- Custer Township: [General concern]: "Flooding with bridges." Need to replace/upsized culverts on/around Shanty Creek Golf Course and control runoff and flooding around Batchelder Rd.

- Milton Township: “We have concerns to the bridge in our area – Torch River Bridge – as well as utilities and the potential for weather related events.” The Road Commission is pursuing funding for local bridge funds for FY 2025 for preventative maintenance work where there has been flooding along the Torch River in Milton Township/Kalkaska County.
- Echo Township: A local government representative at the public hearing indicated that beaver dams are present near many road/stream crossings through the Township, increasing the risk for flooding. The MDNR has indicated that they will not remove the beaver dams.

NFIP Participation Status

FEMA’s online National Flood Hazard Layer (NFHL) is a geospatial database that contains current effective flood hazard data, which support the National Flood Insurance Program. Flood Insurance Rate Maps, or FIRMs, can be viewed for participating areas in the U.S. through the NFHL. The FIRMs aid in better understanding a property’s level of flood risk and type of flooding in the area. The maps show the delineation of the 1% Annual Chance Floodplain Boundary (the “100-Year Flood Boundary”) and the 0.2% Annual Chance Floodplain Boundary (the “500-Year Flood Boundary”).

For a particular river, USGS collects river streamflow data over time, determines the largest flood in each year, and then calculate statistical data for that river. The more years of data available, the more accurate the estimates for the various flood quantiles. As more years of data become available, the estimates become more refined, which can result in revisions to the quantiles and thus revised floodplain boundaries.⁵ Urban development and installation of flood controls can also result in changes in streamflow data over time.

Banks Township, Elk Rapids Township, Milton Township, Torch Lake Township, and the Village of Elk Rapids are the only Antrim County communities participating in the National Flood Insurance Program (Table 30). Their FIRM effective dates range from 1983 to 1988. In light of the changing flood potential in surrounding counties and Antrim County, Antrim County officials are in contact with FEMA to review existing flood concerns in the county. Community input and coordination with FEMA will determine the extent of future mapped flood areas. Communities that are not currently participating in the NFIP and do not have FIRMs are listed in Table 31.

FEMA defines a “repetitive loss property” as any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period since 1978 (the year at which consistent claims data collection began). County officials have not identified any properties that are defined by the National Flood Insurance Program as having suffered repetitive flood losses. FEMA officials were contacted in July 2022 with a request to provide documentation of NFIP data. The documentation was not provided prior to the completion of this plan. FEMA officials have indicated to Antrim County that updated digital flood maps for NFIP participating communities may not be available until 2024.

The 2019 Michigan Hazard Analysis, completed by the Michigan State Police, provides the following National Flood Insurance statistics for Antrim County:

Table 29: National Flood Insurance Statistics, Antrim County

Total Premium	Policies	A-Zone Policies	Total Coverage	Claims since 1978	Total Paid Since 1978
\$17,732	24	7	\$6,863,700	4	\$920

Source: MSP 2019 Michigan Hazard Analysis

Additionally, Antrim County, in conjunction with the US Army Corps of Engineers (USACE), completed a Hydrology Study and Model for a major portion of the Elk River Chain of Lakes Watershed in 2022. It is anticipated that additional changes to FIRMs that incorporate data from this model will be made by FEMA in 2024. There has been expressed interest from many of the Lake Associations and some local governments in the county to have volunteers in their organizations receive training of the modeling tool to further study identified and potential hydrology issues in the watershed. The Antrim County Operator of Dams has indicated that they will assist with this endeavor.

⁵ <https://www.usgs.gov/faqs/why-do-values-100-year-flood-seem-change-every-flood>

Table 30: NFIP Participating Communities in Antrim County

	Banks Township	Elk Rapids Township	Milton Township	Torch Lake Township	Village of Elk Rapids
Floodplain Management Adoption*	Y	Y	Y	Y	Y
FIRM Map Adoption	Y	Y	Y	Y	Y
Current Effective Map Date	9/1/1988 (L)	NSFHA (all Zone C)	2/2/1983	1/17/1997	9/30/1988 (M)
Reg-Emerg Date**	9/1/1988	9/30/1987	2/2/1983	6/16/1992	9/30/1988
Community ID #	260643#	260751	260637#	260414#	260699#
Implementation Method***	Local Zoning Ordinance	There are no Special Flood Hazard Areas where floodplain management regulations need to be implemented and enforced		Local Zoning Ordinance	
Appointed Designee****	Local Zoning Administrator - Kurtis Busman	Local Zoning Administrator - Larry Nix	Local Zoning Administrator - Sara Kopriva		Local Zoning Administrator - Kerri Janisse
Implementation of Damage Provisions*****	No damages have been claimed. If substantial damage occurred, it would be regulated by the zoning ordinance, which indicates that if over 50% of a structure is damaged, it shall be brought up to compliance with current standards.				
Source: FEMA Community Status Book Report, accessed 4/6/2023					
Notes:					
* Adoption of NFIP minimum floodplain management criteria via local regulation.					
** The date the community first joined the NFIP.					
*** How local floodplain management regulations are implemented and enforced in Special Flood Hazard Areas.					
**** The primary designee or agency that is appointed to implement the addressed commitments and requirements of the NFIP. Note that the Antrim County Building Department also requires elevation measurements for new building permits; elevation for a proposed building is confirmed when a final Certificate of Occupancy is issued by the Building Department.					
***** How participants implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.					
NSFHA = No Special Flood Hazard Area - An area that is in a moderate-to-low risk flood zone. An NSFHA is not in any immediate danger from flooding caused by overflowing rivers or hard rains. However, it's important to note that structures within a NSFHA are still at risk. Nearly 1 in 4 NFIP flood claims occur in these moderate- to low-risk areas. (www.fema.gov)					
(L) = Original FIRM by Letter - All Zone A, C and X					
(M) = No Elevation Determined - All Zone A, C and X					

Table 31: Antrim County Communities Not Participating in the NFIP*

Central Lake Township	Mancelona Township
Custer Township	Star Township
Echo Township	Warner Township
Forest Home Township	Village of Bellaire
Helena Township	Village of Central Lake
Jordan Township	Village of Ellsworth
Kearney Township	Village of Mancelona

Source: FEMA Community Status Book Report, accessed 4/6/2023

*FIRMs have not been issued for these communities

Lightning

Lightning is a random and unpredictable discharge of electricity in the atmosphere between the clouds, air, or ground to equalize the charged regions in the atmosphere. It is still being debated how the electrical charges build up in the clouds. Lightning generally occurs during thunderstorms; however, it can occur without a thunderstorm, such as during intense forest fires and heavy snowstorms. Lightning that occurs without nearby rain is most likely to cause forest fires.

Location

Lightning is not confined to geographic boundaries and is a regional event. Since lightning occurs randomly, it is impossible to predict where lightning will occur and how severe it will be. All of Antrim County is at risk to the occurrence and impacts from lightning.

Extent/Previous Occurrences

There have been two lightning events reported to NOAA for Antrim County since 2000. There were no reported injuries or fatalities related to these lightning events.

On September 1, 2000 a series of evening thunderstorms across the region produced lightning that was nearly continuous. One man was killed by the lightning (not in Antrim County) when he and his 9 year old son climbed a small hill behind a shopping mall to view the approaching lightning. The 40 year old father was struck and killed by a lightning bolt. His son was thrown to the ground, but only sustained minor injuries. Lightning that Friday night also disrupted numerous high school football games. Many games were cancelled or postponed until the following Saturday morning. Many of the schools which began play had lengthy delays and many waited an hour or more before fans and players could return to the field. This was widely covered by area newspapers and television stations. The cost of postponed games is not known.

On June 18, 2012, lightning struck a home in Banks Township, Antrim County, igniting a fire that destroyed the home. Property damages were estimated at \$80,000.

Probability of Future Events and Vulnerability Assessment

Since there have been two lightning events that have occurred on record with NOAA between 2000 and 2022, there is an 8.7% chance a damaging lightning event would occur in a given year. However, not all lightning events may have been reported since events with injuries, deaths, and extensive damages tend to be the only ones reported. Therefore, the number of lightning events and damages are likely higher.

All existing and future buildings, exposed infrastructure, and populations are at risk from lightning events since it may cause structural and wildland fires, loss of electrical and telecommunications equipment, and damage to buildings or vehicles from falling trees struck by lightning. People that work outside or participate in outdoor recreation activities are at a higher risk to be struck by lightning. The locations of campgrounds are identified on the Vulnerable Populations and Hazard Areas Map in Appendix A.

Tornado

Tornadoes are rapidly rotating columns of air that impact the ground after forming from some of the severe thunderstorms that occur during Michigan's warm months. Tornadoes can cause catastrophic damage to either a limited or an extensive area. A tornado can have winds exceeding 200 miles per hour and can have widths over one mile. These storms are the most violent of the atmospheric storms since they have the potential to destroy buildings, uproot trees, hurl objects, and cause loss of life.

According to the National Oceanic and Atmospheric Administration/National Weather Service's Storm Prediction Center, tornadoes cause approximately 60 deaths and hundreds of millions of dollars in property damage each year. The Michigan State Police's *2019 Michigan Hazards Analysis*, Michigan is located on the northern fringe of the nation's tornado belt, and since 1996 has averaged about 18 tornadoes per year. The longer term annual average (since 1950) is 8 injuries and one death per year, and over \$17 million in property damages statewide.

Between 1996 and 2017, Michigan has had 382 reported tornado events. Approximately 67% of all Michigan tornadoes have been weak tornadoes (EF0 or EF1 intensity), while 29% have been strong tornadoes (EF2 or EF3 intensity) and 4% have been classified as violent tornadoes (EF4 or EF5 intensity). However, those few violent tornadoes have been responsible for 88% of Michigan's tornado-related deaths. Strong tornadoes (EF2 or EF3 intensity) have accounted for approximately 11% of the deaths, while weak tornadoes (EF0 or EF1 intensity) have caused only 1% of all tornado-related deaths.

In Michigan, tornados are most likely to occur in the summer months, although some have occurred in the spring and fall.

Location

Tornadoes are a regional event that are not confined to geographic boundaries and can affect several areas at one time. Also, the magnitude of tornadoes may range across the affected areas. All of Antrim County is at risk to the occurrence and impacts from tornadoes. It is impossible to predict where and with what magnitude a tornado will touch down. Approximate trajectories of recorded tornadoes with NOAA are illustrated on the Vulnerable Populations and Hazard Areas Map in Appendix A.

Extent

The Fujita Scale (Table 32) categorizes tornado severity based on observed damage. The six-step scale ranges from F0 (light damage) to F5 (incredible damage). As of February 2007, the National Weather Service uses the Enhanced Fujita Scale (EF Scale). This new scale ranges from EF0 to EF5. Based on the Fujita Scale, Antrim County's most damaging tornado was an EF3 in Jordan and Warner Townships on July 3, 1974 with winds ranging from 138-167 mph. It caused \$250,000 in property damages and two injuries. The second-most destructive tornado occurred recently, in May 2022. It was an EF1 that began near Alba in Star Township and caused \$175,000 in property damage before crossing over into Otsego County.

Table 32: Fujita and Enhanced Fujita Scale Comparison

Fujita Scale (Old)			EF Scale (Current)		
Fujita Scale	3-Second Gust Speed (mph)		EF Scale	3-Second Gust Speed (mph)	
F0	45-78		EF0	65-85	
F1	79-117		EF1	86-109	
F2	118-161		EF2	110-137	
F3	162-209		EF3	138-167	
F4	210-261		EF4	168-199	
F5	262-317		EF5	200-234	

Source: FEMA

Previous Occurrences

Between 1950 and 2022, Antrim County has had eleven reported tornadoes, causing \$564,280 in property damage and two injuries (Table 33).

The event narrative for the 1974 tornado is as follows:

“Touched down near M66. Skipped through woods, continuous swath several miles west of Elmira. Two girls injured when chicken house carried 100 ft. through air. Industrial building at U.S. 131 and M32 destroyed and both highways covered by debris. Other small buildings destroyed. 350 acres of trees destroyed along track east of Elmira.”

The event narrative for the 2022 tornado is as follows:

“The tornado formed 4 miles east of Alba in a location on Olds Rd 0.5 miles east of the Alba Rd intersection. It tracked east northeast for about 1.75 miles before exiting Antrim county 200 yards southeast of the Alba Rd/Old Alba Rd intersection. The tornado continued in Otsego county for almost 16 additional miles before dissipating at 1457 EST. In Antrim county, no injuries or fatalities were reported. Several homes were damaged along with numerous softwood trees snapped at their trunks (DI 28, DOD 4) along Patterson Rd. While the highest rating of EF1 in Antrim county was assigned at this location, the tornado was rated EF3 in Otsego county. The maximum path width in Antrim county was 200 yards.”

Table 33: Antrim County Tornado Events

Event #	Beginning Location	Tornado Pathway	End Location	Date	Deaths	Injuries	Scale	Property Damage	Crop Damage
1	Kearney Twp., South end of Intermediate Lake			7/16/1958	0	0	F1	\$30	\$0
2	Jordan Township	Warner Township	Elmira Township (Otsego County)	7/3/1974	0	2	F3	\$250,000	\$0
3	Central Lake Township	Echo and Jordan Townships	Warner Township	7/31/1977	0	0	F2	\$250	\$0
4	Jordan Township		Chestonia Township	9/7/1985	0	0	F1	\$0	\$0
5	Milton Township	Helena Township	Clam Lake, between Forest Home and Helena Townships	7/8/1990	0	0	F1	\$0	\$0
6	Lake Michigan, Elk Rapids Township			8/4/1995	0	0	F0	\$0	\$0
7	Lake Michigan, Torch Lake Township			5/31/1998	0	0	F0	\$0	\$0
8	Torch Lake, Helena Township		South of the hamlet of Alden, in Helena Township	7/10/2007	0	0	EF0	\$4,000	\$0
9	Birch Lake, near the hamlet of Kewadin, Elk Rapids Township		Williams Road south of Birch Lake, near the hamlet of Kewadin, Elk Rapids Twp.	8/3/2017	0	0	EF0	\$55,000	\$0
10	Southwest of the hamlet of Alba, Mancelona Township		Northwest of Primrose and Eastcott Roads, Star Township	8/28/2018	0	0	EF0	\$80,000	\$0
11	4 miles east of Alba in a location on Olds Rd 0.5 miles east of the Alba Rd intersection, Star Township		Old Alba Road near the Otsego County Line, Star Township	5/20/2022	0	0	EF1	\$175,000	\$0
	TOTAL			11	0	2		\$ 564,280	\$ 0

Source: NOAA: National Centers for Environmental Information

Probability of Future Events and Vulnerability Assessment

Since there have been ten tornado events reported between 1974 and 2022 (the 1958 tornado was excluded from the probability analysis due to the large temporal gap of recorded events in following it in the NOAA Storm Events Database), this indicates there is a 20% chance that a tornado would occur in a given year. While the chance for a tornado is low, if an event occurs, there is potential for a higher magnitude tornado to touch down. Many of the reported historic events have caused property damage. A tornado can occur in any area in Antrim County.

Similar to thunderstorms and severe wind events, populations without access to permanent, sturdy shelter are most vulnerable to tornado events. This includes mobile home parks, campgrounds, recreation areas, and large outdoor gatherings. The locations of mobile homes and campgrounds are identified on the Vulnerable Populations and Hazard Areas Map in Appendix A. Persons with a disability or elderly persons are also more vulnerable. Tornadoes can occur suddenly with very little warning, and it may be difficult for these populations to find adequate shelter in a hurry.

The county currently utilizes the “*Rave*” mass notification system for notification of tornado warnings and watches, along with other severe weather alerts. The system notifies a participant via their mobile or land-line phone. The National Weather Service may concurrently utilize their notification system when deemed necessary in severe weather event situations to send phone notifications to all users within signal of a cellular tower. Additionally, there is one manual emergency siren located in the Village of Mancelona that is operable for tornado warnings. Input received as part of the hazard mitigation planning process indicated an interest in investigating potential funding opportunities for additional manual tornado sirens to be installed in the other four villages in the County, as these are areas where there are concentrations of people, and the audible sirens to the local village populations could be beneficial.

Antrim County Emergency Management Department maintains contracts with seven of the eleven local fire stations in the county so that they may be utilized as temporary shelters in the event of an emergency. Those seven are: Torch Lake Township, Central Lake Township, Mancelona Township, Elk Rapids Township, South Torch Lake Fire District and Milton Township. A full list of temporary shelter locations is included in the Mitigation Strategies section of this plan. Additionally, the American Red Cross can set up temporary shelters within 12-24 hours after an emergency event occurs; usually this is done within an existing structure. The two Antrim County Senior Centers in Mancelona and Bellaire, as well as local libraries, have been utilized during regular hours for temporary shelters to be used during the day. There are no homeless shelters located within Antrim County.

Additionally, the Grand Traverse Band Tribe of Ottawa and Chippewa Indians maintains two underground tornado shelters on tribal property at 11832 Wiingash Mi-kun, Rapid City, MI 49676 (Milton Township). Completed in 2008, each shelter can accommodate up to 32 individuals and their pets and belongings. The prefabricated underground shelters were designed and installed for the safety and protection of tribal residents without basements in their homes during severe storms and tornadoes. The shelters are open during the severe weather months (April – September) and are locked during the late fall and winter months.

Extreme Temperatures

Prolonged periods of very high or very low temperatures are often accompanied by other extreme meteorological conditions, such as high humidity, drought, heavy snowfall, or high winds. Extreme heat or extreme cold primarily affect the most vulnerable segments of the population, such as the elderly, children, impoverished individuals, and people in poor health.

Nationwide, there have been approximately 175 deaths per year that are attributable to extreme heat according to the 2019 Michigan Hazard Analysis. The threats from extreme heat are heatstroke, sunstroke, muscle cramps, heat exhaustion, and fatigue. It is hazardous to livestock and agricultural crops, causes water shortages, exacerbates fire hazards, exacerbates respiratory problems, prompts excessive electrical energy demands, and causes infrastructure failures. Urban areas experience the most serious extreme heat with the combined high temperatures and high humidity that produce a heat-island effect.

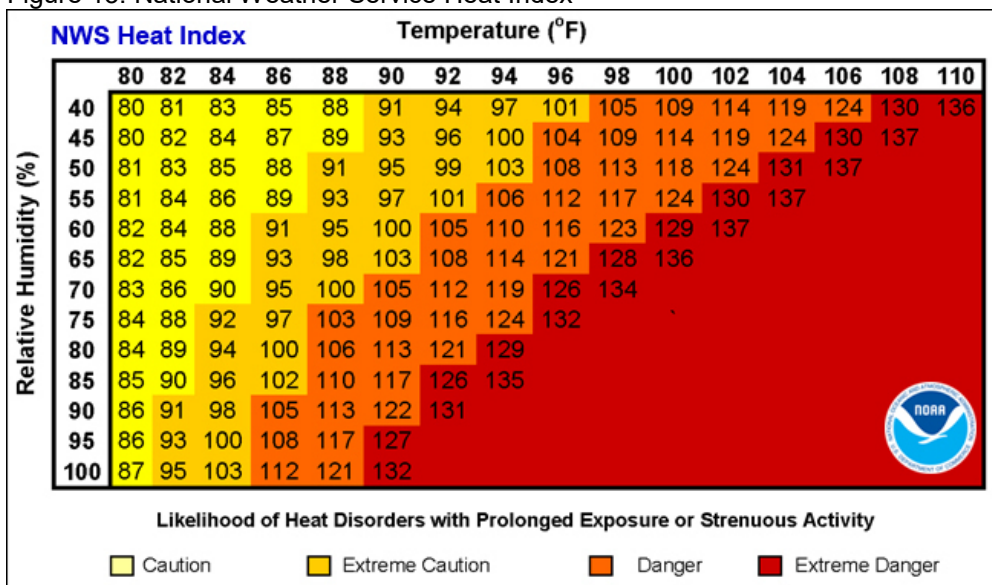
According to the 2019 Michigan Hazard Mitigation Plan, Michigan has 11 average annual extreme heat events with 0.4 average annual deaths and 41 average annual injuries.

In the United States, approximately 700 people die each year as a result of severe cold temperature-related causes according to the 2019 Michigan Hazard Analysis, with a significant number of deaths occurring due to illnesses or disease that are negatively impacted by severe cold weather, such as stroke, heart disease, and pneumonia. Exposure to extreme cold temperatures can be life threatening and can cause hypothermia and frostbite. According to the 2019 Michigan Hazard Mitigation Plan, Michigan has 35 average annual extreme cold events with 1 death, 9.4 average annual injuries, and \$6.4 million in average annual property and crop damage. Extreme cold affects transportation modes and power utilities, resulting in dead vehicle batteries and loss of power/heat.

Measuring Extreme Temperatures (Extreme Heat and Extreme Cold)

Extreme heat is measured with the National Weather Service's Heat Index Chart (Figure 13). The chart uses relative humidity and air temperature to determine the likelihood of heat disorders with prolonged exposure or strenuous activity. Individuals are unable to shed excess heat from their bodies when they experience prolonged exposure to hot temperatures, which results in heat disorders.

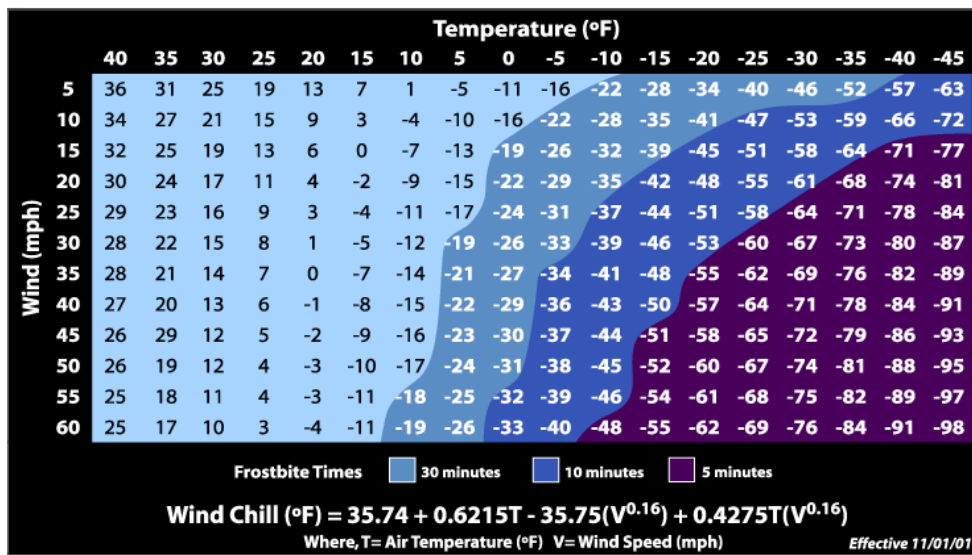
Figure 13: National Weather Service Heat Index



Source: National Weather Service

Extreme cold is measured with the wind chill index, which is a measure of the rate of heat loss from exposed skin caused by the combined effects of wind and cold. As the wind increases, heat is carried away from the body and reduces the external and internal body temperatures. Figure 14 shows the NOAA Wind Chill Chart as it corresponds to various temperatures and wind speeds.

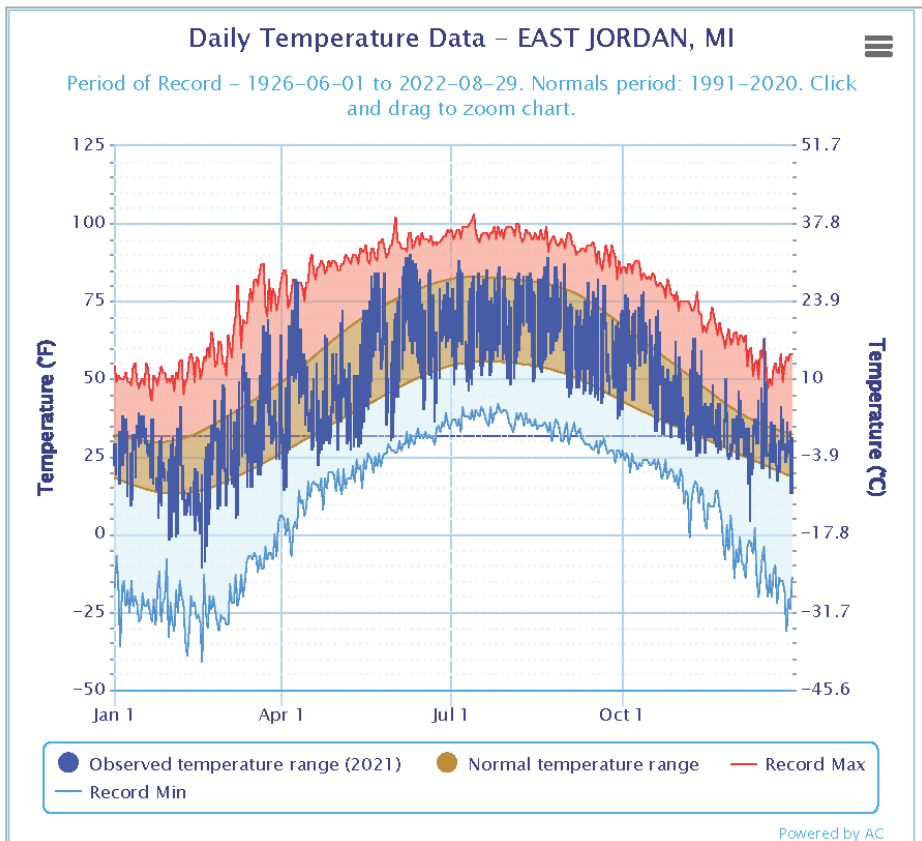
Figure 14: National Weather Service Wind Chill Chart



Source: National Weather Service

Figure 15 illustrates the observed temperatures at East Jordan (in Charlevoix County, adjoining Antrim County to the north) for 2021. The dark blue line shows temperatures recorded between January 1 2021 and December 21, 2021. The red line above shows record high temperatures for that day, and the light blue line below indicates record low temperatures for that day. Note that maximum record high temperatures were reached in 2021 on April 8 (82 degrees F), April 9 (81 degrees F), and on December 16, 2021 (63 degrees F).

Figure 15: Daily Temperature Data:



Source: NOAA Climate Data Online

Location, Extent and Previous Occurrences

Extreme temperatures are a regional event that are not confined to geographic boundaries and range in severity across the affected areas. All of Antrim County is at risk to the occurrence and impacts from extreme temperatures.

Antrim County has had two extreme heat events in 2001 and 2018. The events did not have any deaths, injuries, or property/crop damages. The heat events consisted of hot and humid conditions that caused outdoor events to be modified and attendance at outdoor events to be lower than normal.

The first instance of reported excessive heat occurred on August 1, 2001. Excessive Heat was also a problem the first two weeks in August across all of northern Michigan. Temperatures reach the mid to upper 90s, on average, a few days each year; however, for a 5 day (8/5 - 8/9) stretch overnight low temperatures failed to fall below the lower 70s in most areas. This very humid air mass was unusual for northern Michigan, an area which typically sees cool nighttime temperatures and for this reason has very few homes with air conditioners. No heat related deaths or injuries were reported; however, most outdoor events were modified due to the forecasts of hot and humid conditions. County fairs sent animals home, yet still there were livestock losses at fairs in Otsego and Alcona counties. Attendance at county fairs was well below normal and this was attributed to the heat. This period of excessive heat also brought on a drought event at the same time.

The second instance of reported excessive heat occurred on June 30, 2018. The month of June closed with one of the hottest days in recent memory. Highs were well into the 90s, including 99 at Alpena, and 98 at Traverse City and Gaylord. The National Weather Service office near Gaylord also hit 98; that was (by several degrees) the warmest reading recorded at that location since observations began there in the late 1990s. Heat indices exceeded 105 degrees across most of northern Lower Michigan, and some locations exceed 110. The warmest reported heat index on the day was 114 near Indian River. There were estimated to be between 25 and 30 individuals who visited local hospitals due to heat-related illnesses.

There have been two extreme cold events on record with NOAA for Antrim County. However, it should be noted that since cold temperatures typically occur during winter months, many events may have gone unrecorded. The first reported event occurred on February 4, 2007. Exceptionally cold air surged into Northern Michigan. High temperatures on the 4th (Super Bowl Sunday) were around zero, with low temperatures that night from five to ten below zero. Gusty northwest winds produced hazardous wind chills of 20 to 30 below zero, along with blowing and drifting snow. Many area schools closed on the 5th, due to the extreme cold and poor road conditions.

The second instance was the Governor Declared Emergency for extreme cold in the State that occurred on January 29, 2019. Wind chills of 15 to 30 below zero were common in northern Lower Michigan. Wind chills were much colder in eastern upper Michigan, including -51 at Kinross, and -42 at Sault Ste. Marie and Mackinac Island. The low temperatures caused schools to close.

Probability of Future Events and Vulnerability Assessment

There have been two extreme heat events on record with NOAA in Antrim County over the past 22 years: one in 2001 and one in 2018. This indicates that there is 9% chance of another extreme heat occurring in a given year.

There have been two extreme cold events on record with NOAA in Antrim County over the past 16 years: one in 2007 and one in 2019. This indicates that there is a 12.5% chance of another extreme cold event occurring in a given year. Since extreme cold events tend to occur during the winter months and are coupled with blustery winds and snowstorms, these events may have been reported as other hazards or not at all.

Extreme heat and cold events are more likely to impact unsheltered populations (i.e., people at campgrounds, outdoor events, and the homeless) as well as the elderly or disabled.

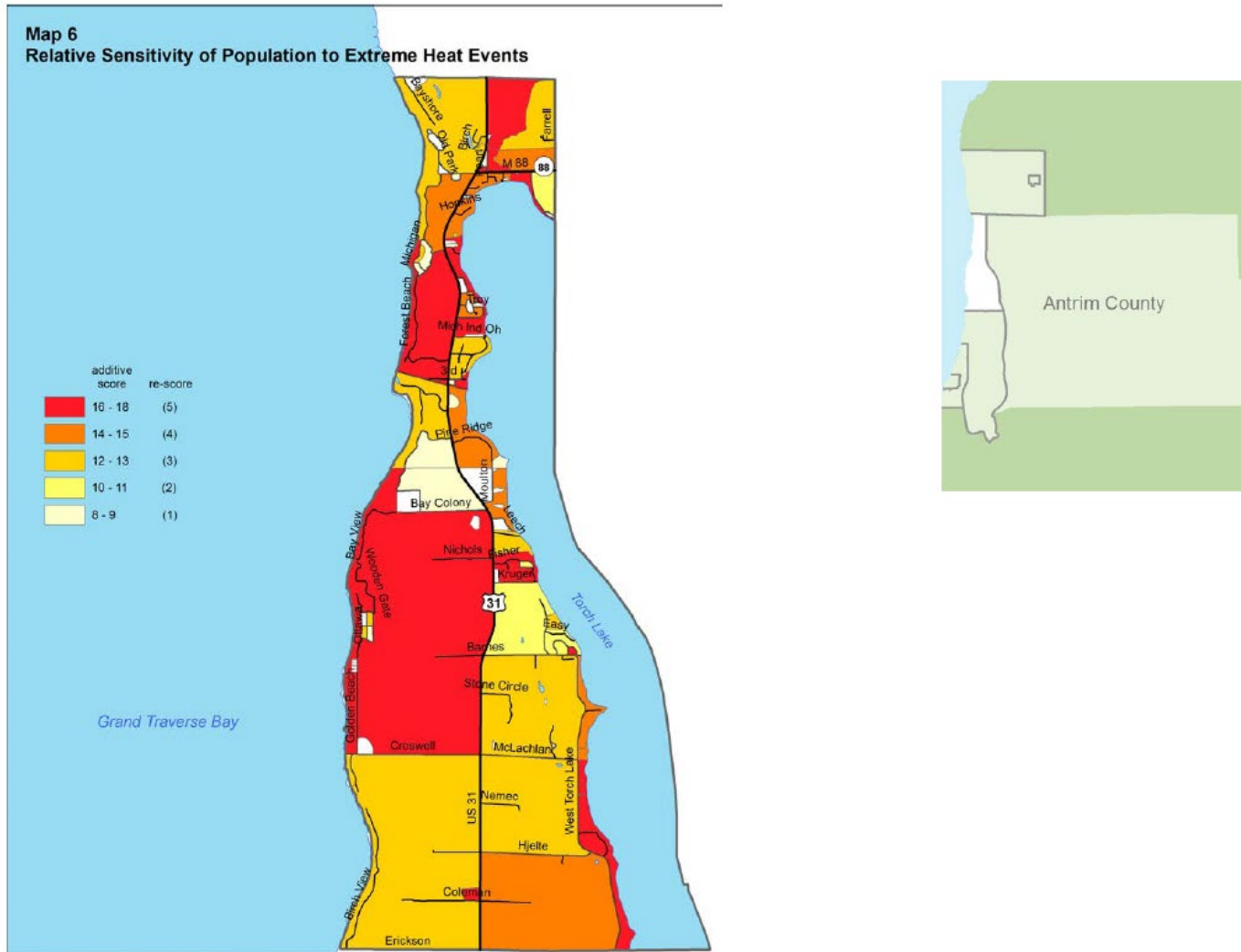
Additionally, the *Northwest Lower Michigan Coastal Resilience Atlas*, written by the Land Information Access Association (LIAA), includes a Heat Vulnerability Assessment⁶ of coastal communities. A community's vulnerability is equal to their exposure to the hazard (determined by tree canopy and impervious surface coverage) + their sensitivity. Sensitivity is determined by the following factors:

- Persons > 65 years
- Persons living alone
- Minority (non-white) persons
- Persons living below the poverty threshold
- People > age 25 with less than a high school education
- Disability status (i.e., ambulatory difficulty, mental disability)

⁶ Land Information Access Association. (2019). *Northwest Lower Michigan Coastal Resilience Atlas*. http://www.resilientmichigan.org/nw_atlas.asp

Torch Lake Township has the second highest median age (60.4 years) of all Antrim County communities. Their relative sensitivity to extreme heat events is pictured in Figure 16. Other Lake Michigan shoreline communities in Antrim County consist of Banks Township, Milton Township, Elk Rapids Township and the Village of Elk Rapids. The Heat Vulnerability maps for those communities can be found in pages 804-843 of the Atlas.

Figure 16: Torch Lake Township Relative Sensitivity of Population to Extreme Heat Events



Source: LIAA Northwest Lower Michigan Coastal Resilience Atlas

Antrim County Emergency Management Department maintains contracts with seven of the eleven local fire stations in the county so that they may be utilized as temporary shelters in the event of an emergency. Those seven are: Torch Lake Township, Central Lake Township, Mancelona Township, Elk Rapids Township, South Torch Lake Fire District and Milton Township. A full list of temporary shelter locations is included in the Mitigation Strategies section of this plan.

The American Red Cross can set up temporary shelters within 12-24 hours after an emergency event occurs; usually this is done within an existing structure. The two Antrim County Senior Centers in Mancelona and Bellaire, as well as local libraries, have been utilized during regular hours for temporary shelters to be used during the day. There are no homeless shelters located within Antrim County.

Drought

Drought is a normal part of the climate cycle. It is a slow-moving hazard, which causes people to underestimate the damage it can do. Losses from drought are as substantial as those from hurricanes, tornadoes and other faster-moving disasters. Drought causes losses to agriculture and affects domestic water supply, energy production, public health, and contributes to wildfire.

Location

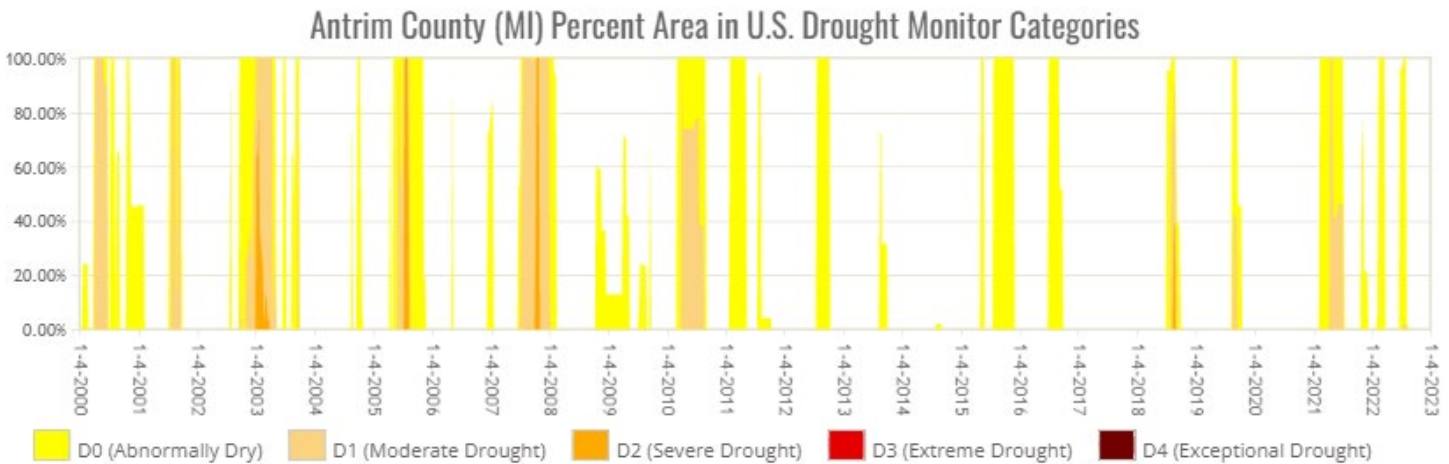
Drought is a regional event that is not confined to geographic boundaries and ranges in severity across the affected areas. All of Antrim County is at risk to the occurrence and impacts from drought.

Extent

The Palmer Drought Severity Index (PDSI) uses readily available temperature and precipitation data to estimate relative dryness. It is a standardized index that generally spans -10 (dry) to +10 (wet). Maps of operational agencies like NOAA typically show a range of -4 to +4, but more extreme values are possible. The PDSI has been reasonably successful at quantifying long-term drought.

The U.S. Drought Monitor (Figure 17) combines several input sources including the PDSI and the Standardized Precipitation Index to prepare a weekly map showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3) and exceptional (D4) (Figure 18).

Figure 17: Antrim County Historical Drought Levels



Source: [US Drought Monitor](#)

Figure 18: U.S. Drought Categories and Historically Observed Impacts

Michigan

Category	Historically observed impacts
D0	Grass fires increase
	Lawns are brown; landscape and gardens are watered more frequently
D1	Most crops and vegetation are stressed; farmed Christmas trees are stressed
	Well levels decline
D2	Corn and soybean yields are low
	Mature trees are stressed
	Streamflow is extremely low, potentially too low to irrigate

Source: [US Drought Monitor](#)

Previous Occurrences

There have been two instances of significant drought in Antrim County. No deaths, injuries, or damages are associated with these drought events.

In March 1977 there was a Presidential Declared Emergency for drought problems plaguing counties in the Upper Peninsula and Northern Lower Peninsula, which included Antrim County. This event was part of the 1976-77 drought in the Great Plains, Upper Midwest, and Western regions of the United States. At a statewide level, the drought lasted for 11 consecutive months, from September 1976 to July 1977, and reached a low point in January 1977, with a Palmer Index value of -5.29 (within the D4 exceptional drought classification).⁷

The second drought incident occurred on August 1, 2001. The event narrative is as follows:

After a cool beginning, the last half of July 2001 was characterized by warmer than normal and drier than normal weather. Less than an inch of rainfall was recorded in some areas for the month of July. This lack of rain and warm conditions became serious during the first two weeks of August when little if any rain fell and temperatures jumped into the 90s. The stress on the crops was most noted in northern Michigan corn, but also hit hay crops to a lesser extent. As a result of the drought, the U.S.D.A. declared several counties disaster areas and granted farmers in counties where the crop losses were 30% or greater special low interest loans.

Probability of Future Events and Vulnerability Assessment

Between 1977 and 2022 (46 years), there have been two drought events on record. This equates to a 4.3% annual chance for a significant drought event in Antrim County. Drought can adversely impact timber production, agricultural production, and some tourism and recreational enterprises. This can also cause a drop in personal and business income, which impacts other economic sectors. Drought conditions also increase the risk for wildfire. Almost half of Antrim County is forested, and cultivated crop land cover accounts for 13.7% of the county's land cover. These land uses may be most at risk for impacts from drought.

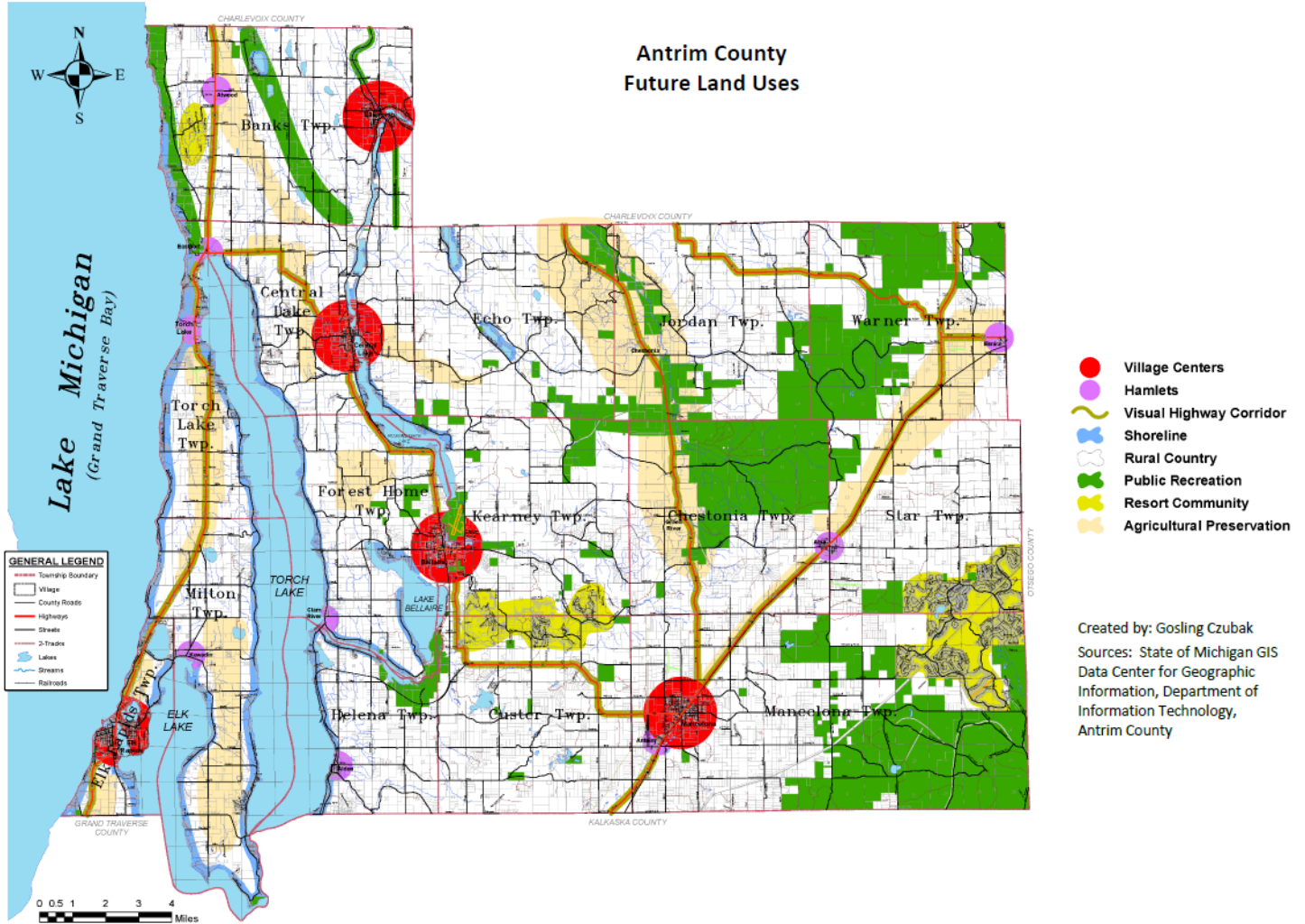
Additionally, the threat to water sources should also be considered. Many county residents rely on ground water wells for drinking water. Even drought events in category D1 experience water well level decline. Drought events combined with excessive heat can have severe impacts on the health of vulnerable populations, such as elderly and low income populations.

Agriculture and agri-tourism are also key components of Antrim County's economy. Figure 19, the County's Future Land Use Map, indicates every township in the county, except for Helena and Custer Townships, contain agricultural areas that are considered important for future preservation. Drought may cause the following damages to agricultural land:

- Agricultural production losses: crop failure and pasture losses
- Decreased water availability: water depletion from soils causes significant decline in crop/livestock productivity
- Pests and diseases: drought, coupled with high temperatures, may expand the distribution and incidence of pests and diseases that affect crops, forage, and livestock.
- Damage to specialty crops: most specialty crops (such as fruits, vegetable, tree nuts, and herbs) are more vulnerable to drought than field crops and have a higher value per unit of land/water.

⁷ MSP [2019 Michigan Hazard Analysis](#)

Figure 19: Antrim County Future Land Use Map



Source: Antrim County 2018 Master Plan

Wildfire

A wildfire is an unplanned, uncontrolled fire in grassland, brushland, or forested areas. Wildfires can occur in any forest or grassland type under dry conditions; however, some forest types are more susceptible to wildland fires. For example, jack and red pine forest stands have a high risk for wildfires, as they dependent on fire to provide all the right conditions for regeneration, while aspen and white pine forest stands have a moderate risk. The primary cause of wildfires is from human activities, specifically burning outdoor debris. Wildfires cause destruction to property and timber resources, and injuries or loss of life to wildlife and persons living or recreating in wildfire prone areas. Long-term effects include scorched and barren land, soil erosion, landslides/mudflows, water sedimentation, and loss of recreational opportunities.

Approximately 55% (20.4 million acres) of Michigan's total land area is forest cover. The vast forests provide Michigan with the largest state-owned forest system in the United States. In addition, Michigan has the fifth largest quantity of timberland acreage, with 19.3 million acres (including hardwoods and softwoods). That vast forest cover is a boon for both industry and recreation, and these areas have been gradually increasing in recent years. However, it also means that many areas of Michigan are vulnerable to wildfires.

Michigan's fire season starts in early spring, when leaves and grasses remain dry from fall and winter and trees are not yet green. Wildfires are often accompanied by drought where dry conditions increase the potential to burn. Often a lightning strike will causing sparking of dry leaves and dead wood. High winds can then spread wildfire. Wildfires can become unpredictable in windy conditions or when the wind changes direction suddenly. Cooler nighttime temperatures can suppress wildfires and the potential for wildfire; however Michigan has had several major fire events.

According to MDNR and U.S. Forest Service records, between 1910 and 1949, over 5.8 million acres of forest were burned, an average of 145,000 acres per year. By comparison, it was reported that between 1950 and 1996, the MDNR and USFS were involved in suppressing over 46,100 wildfires that burned 390,000 acres of forest, which averages only 8,300 acres burned per year. This drastic reduction in the acres of timber burned was largely the result of (1) increased use of specialized equipment to suppress the fires, and (2) intensified efforts toward fire prevention.

Recently, only about 4% of all wildfire in Michigan were caused by lightning strikes, and most other causes have been attributed to human activity. Outdoor debris burning is the leading cause of wildfires in Michigan. Most Michigan wildfires occur close to where people live and recreate, which puts both people and property at risk. The immediate danger from wildfires is the destruction of property, timber, wildlife, and injury or loss of life of persons who live in or are using recreational facilities in the area.

Location

All of the county's communities and developed areas are vulnerable to wildfires since the community centers and rural residential developments interface with the high risk forest types (e.g. Red Pine, Eastern White Pine, and Jack Pine). Approximately 157,723 acres or 49.5% of Antrim County is forested. Jack pine trees, which are considered the most flammable, comprise 1,568 acres, or 0.8%, of the predominant tree species. Red pine comprises 23,997 acres, or 11.6%, and white pine comprises 167 acres, or 0.1%. The Environmental Features Map in Appendix A shows pine forests in various places throughout every community. However, the largest groupings of pine forest are in the southeast portion of the county, in Mancelona Township and parts of Star, Chestonia and Custer Townships. These areas are highly susceptible to wildfire, as are tree farms in Banks, Central Lake, and Helena Townships (shown on the Vulnerable Populations & Hazard Areas Map in Appendix A.)

Extent and Previous Occurrences

Extent can be measured by the number of acres burned and the cost of property damage. Between 1981 and 2018 there were 256 reported wildfires on lands under MDNR jurisdiction, or 6.7 wildfires per year. This resulted in 285 total acres burned, or an average of 7.5 acres burned per year. No property damages were recorded. NOAA records do not indicate any wildfire incidents within Benzie County.

Probability of Future Events and Vulnerability Assessment

There is a 100% chance there will be a wildfire on MDNR land in a given year, and a small chance there will be a wildfire on lands outside of MDNR jurisdiction. The forest types of Red Pine, Eastern White Pine, and Jack Pine within Antrim County are susceptible to wildfires. The southwestern portions of Antrim County (Mancelona Township, Star Township, Custer Township, and Chestonia Township) are heavily forested and are therefore highly vulnerable to wildfire threats.

Additional factors that increase fire risk include dead or dying Ash trees as a result of disease/invasive species, invasive species (i.e., dense thickets of Autumn olive may create hazardous fuel loads for wildfires), lightning strikes, and human factors such as the number of persons residing, camping, or traveling through the County. Historically, Michigan's landscape has been shaped by wildfire; however, over the last several decades, the current landscape has transformed

from wildland to residential development. With the increase in residential development in and around rural areas prone to wildfires, there is an increase in the potential for loss of life and property damage. Local fire departments have mutual aid agreements in order to provide additional coverage for rural, sparsely populated, or difficult to reach areas. Residential development in rural Antrim County is often isolated from town centers and emergency services. Many of these areas interface with public lands and local emergency services coordinate fire services with State fire protection agencies.

Shoreline Hazards (Coastal Recession and Coastal Flooding)

Coastal flooding and coastal recession are two types of Great Lakes shoreline hazards. Coastal recession (subsidence) is the wearing away of land, such as loss of riverbank, beach, shoreline, or dune material. It is measured as the rate of change in the position or displacement of a riverbank or shoreline over a period of time. Short-term erosion typically results from periodic natural events, such as flooding, hurricanes, storm surge, and windstorms, but may be intensified by human activities. Long-term erosion is a result of multi-year impacts such as repetitive flooding, wave action, sea level rise, sediment loss, subsidence, and climate change. Death and injury are not typically associated with erosion; however, it can destroy buildings and infrastructure. As indicated in Figure 20, large portions of the Lake Michigan shoreline throughout west Michigan are identified as “High Risk Erosion Areas in 2019.”

Coastal (shoreline) flooding results when Great Lakes water levels rise and push inland, or when rainfall or snowmelt accumulates along the shoreline and is not able to drain properly. Shoreline flooding may also be caused during storms and wind events with high-energy waves.

The entire northwest Michigan coastline is susceptible to shoreline hazards.

Figure 20: Great Lakes Shorelines with High Risk Erosion Areas, 2019



Location

To reference the *Northwest Lower Michigan Coastal Resilience Atlas*, “Climate scientists predict that northwest Lower Michigan can expect more frequent storms of increasing severity in the decades ahead. The total amount of rainfall per year is also likely to increase. The potential for substantially larger rain events and severe storms raises concerns of harm to human health and damage to buildings and infrastructure, especially for areas along the Lake Michigan coastline.”

The following Antrim County jurisdictions are located on the Lake Michigan coast (Grand Traverse Bay) and are impacted by shoreline hazards: Banks Township, Torch Lake Township, Milton Township, Village of Elk Rapids and Elk Rapids Township (Figure 21). LIAA documented potential shoreline hazards for these communities in the *Northwest Lower Michigan Coastal Resilience Atlas*. Specific areas of shoreline hazards were identified during public input sessions. These are marked as a “Shoreline Erosion” type of hazard area on the Hazard Area Maps in Appendix A.

In developing the *Northwest Lower Michigan Coastal Resilience Atlas*, scenario planning was used to determine the potential impact of three differing levels of storms combined with high waters. The three scenarios are described as follows:

The first scenario, **“Lucky” Future**: Under the Lucky Climate Future, Great Lakes water levels will continue to stay relatively low. Although there will be wave and wind action, major storm events and wave impacts will not encroach on properties landward of current beaches. A Lucky Future projection, indicating the land areas that would be affected by high-energy waves along the shorefront and/or adjacent riverine flooding under these conditions, is shown in green on the maps.

“Expected” Future: Under the Expected Climate Future, Great Lakes water levels will continue to fluctuate according to long-term decadal patterns, including recent extreme storm events incorporated into the ongoing Great Lakes Coast Flood Study being conducted by the Federal Emergency Management Agency (FEMA). Given those ongoing fluctuations, this Climate Future accounts for periods when Great Lakes still-water elevations are closer to the long-term average. In addition, this Climate Future anticipates the so-called “100-year storm event” (or 1% storm) becoming more like a 20- or 50-year storm event (i.e., an expected storm within the normal community planning time horizon) because of increased storminess. The Expected Future projection is shown in yellow on the maps.

“Perfect Storm” Future: Under the Perfect Storm Climate Future, Great Lakes water levels will continue to fluctuate according to decadal patterns, consistent with assumptions made for the Expected Future. However, for this Perfect Storm Climate Future, the estimated still-water elevation is set higher than the long-term average and closer to the long-term high (583 feet). In addition, this Climate Future anticipates the occurrence of a so-called “500-year storm event” (or 0.2% storm) occurring within the planning time horizon while lake levels are high. The Perfect Storm Future projection is shown in red on the maps.

Figure 21: Lake Michigan Coastal Communities in Antrim County



Source: LIAA, Northwest Lower Michigan Coastal Resilience Atlas

Localized flooding for each scenario is very pronounced in areas of Elk Rapids Township, Milton Township and The Village of Elk Rapids (Figures 22 – 24). Areas shaded in green reach inland to the edge of most known structures, and covering structures in some places. The yellow shaded area reaches further inland, covering the many existing structures in the lowest elevations and up to the edge of many existing structures. The red shaded area reaches the furthest inland, covering many structures and portions roads, including US-31. These panel maps represent some of the communities that were mapped for coastal flooding scenarios; the full report includes an analysis for the remaining panels of Antrim County along Lake Michigan.

Figure 22: Panel #74 Coastal Flooding Scenarios, Milton Township and Elk Rapids Township

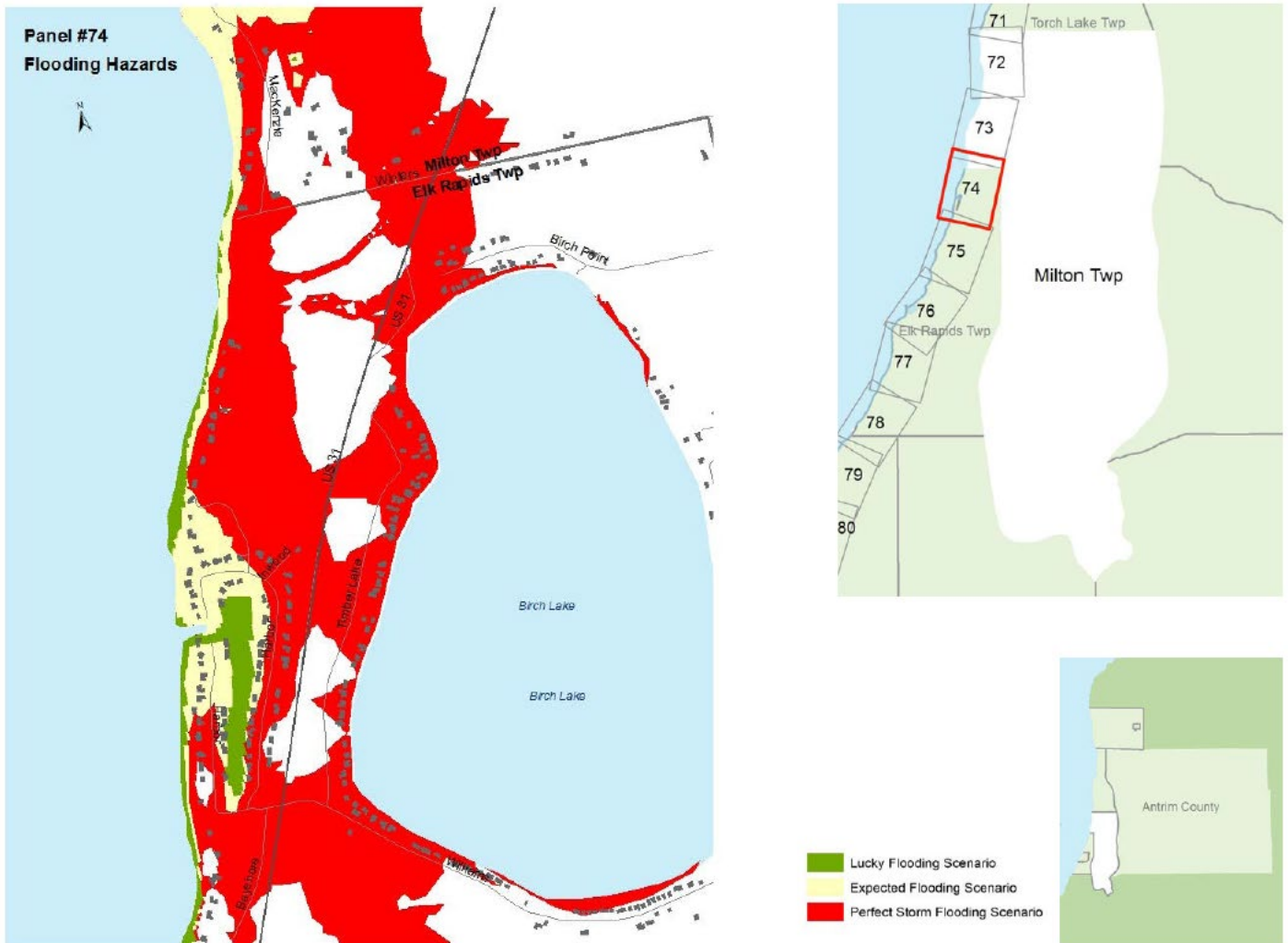


Figure 23: Panel #75 Coastal Flooding Scenarios, Elk Rapids Township

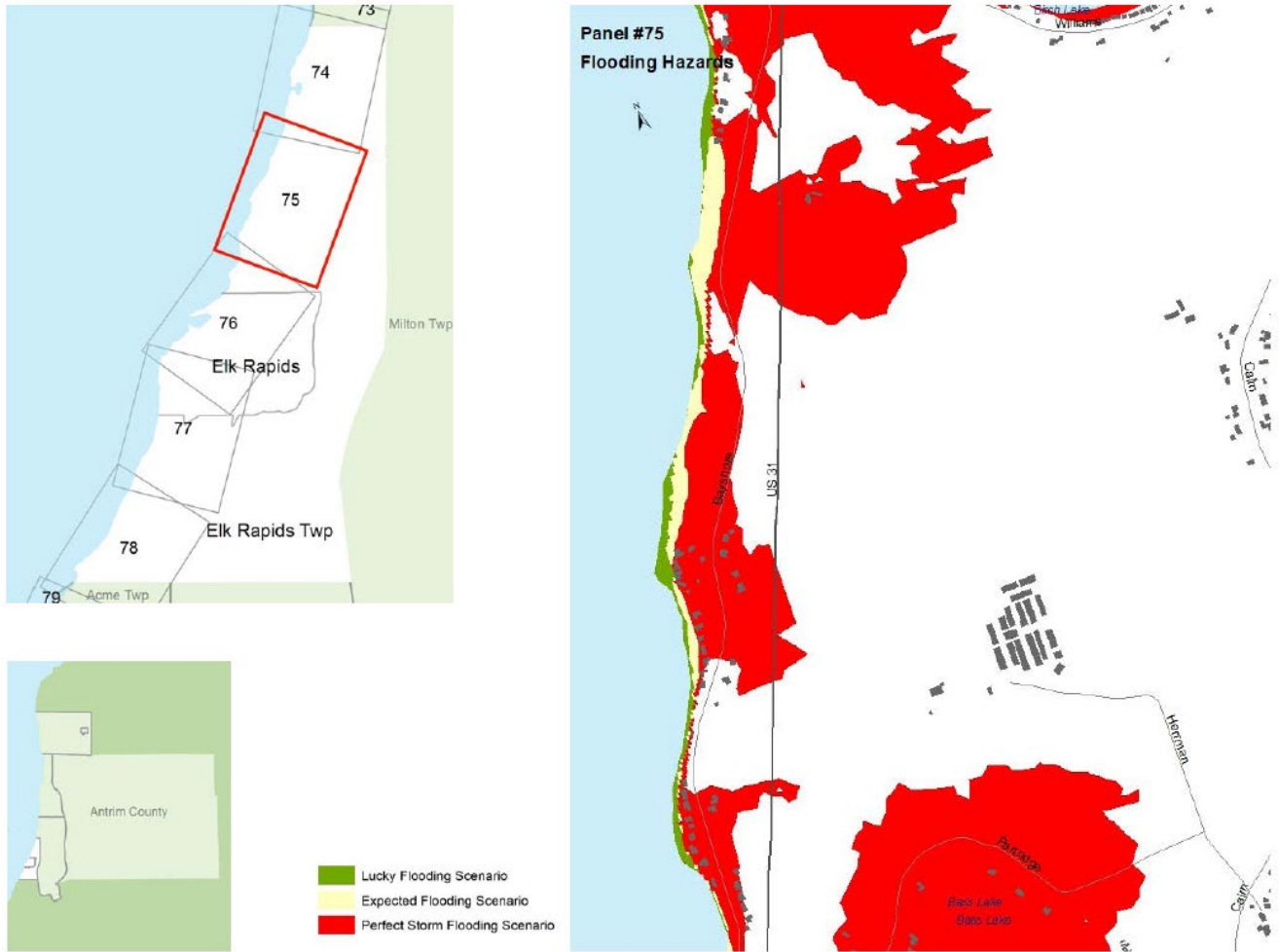
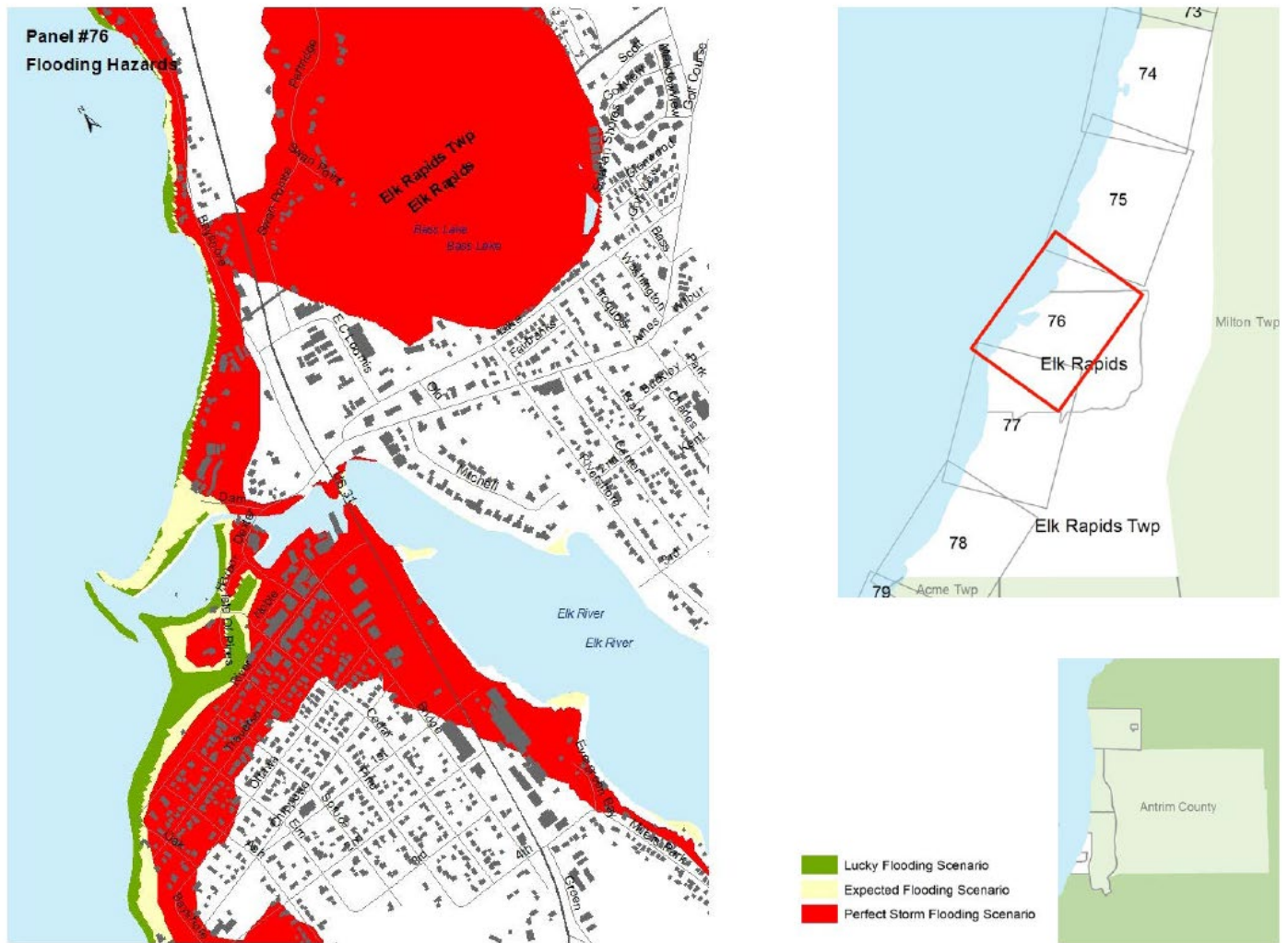


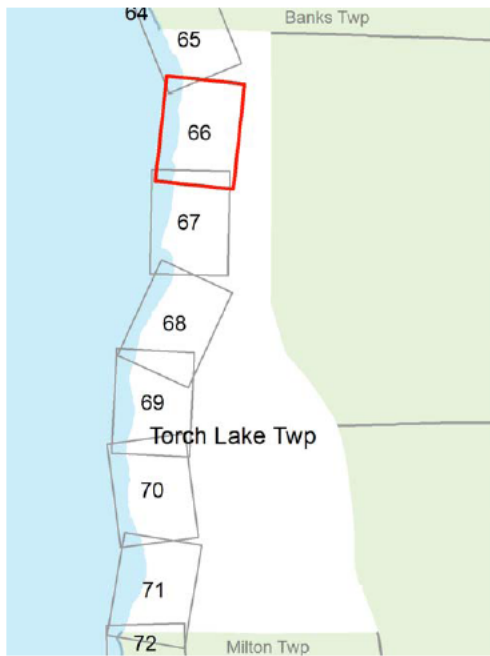
Figure 24: Panel #76 Coastal Flooding Scenarios, Village of Elk Rapids & Elk Rapids Township



Coastal recession, or erosion, to Lake Michigan communities is a constant, but very small, wearing away of the shoreline. The Great Lakes are estimated to lose one foot of shoreline per year to normal wave and wind activity. However, storms and increased wave activity have caused increased coastal recession to varying degrees in Antrim County’s coastal communities.

Chapter 4 of the *Northwest Lower Michigan Coastal Resilience Atlas* describes bluffline recession since its recorded shoreline in 1938. The blue line indicates the shoreline in 1938, the green line indicates the bluffline in 1938, the yellow line is the bluffline in 2016, and the red line is the predicted 30 year bluffline. The varying lines are shown in Figures 25 and 26 depict the recession of the shoreline/bluffline near residential development in Torch Lake Township, located south of Barnes Park Campground and west of the hamlet of Eastport. Refer to the full Atlas for panels depicting bluffline erosion for the remainder of Antrim County coastal communities.

Figure 25: Shoreline Recession, Torch Lake Township



- Shoreline 1938
- Bluffline 1938
- Bluffline 2016
- Predicted 30yr Bluffline

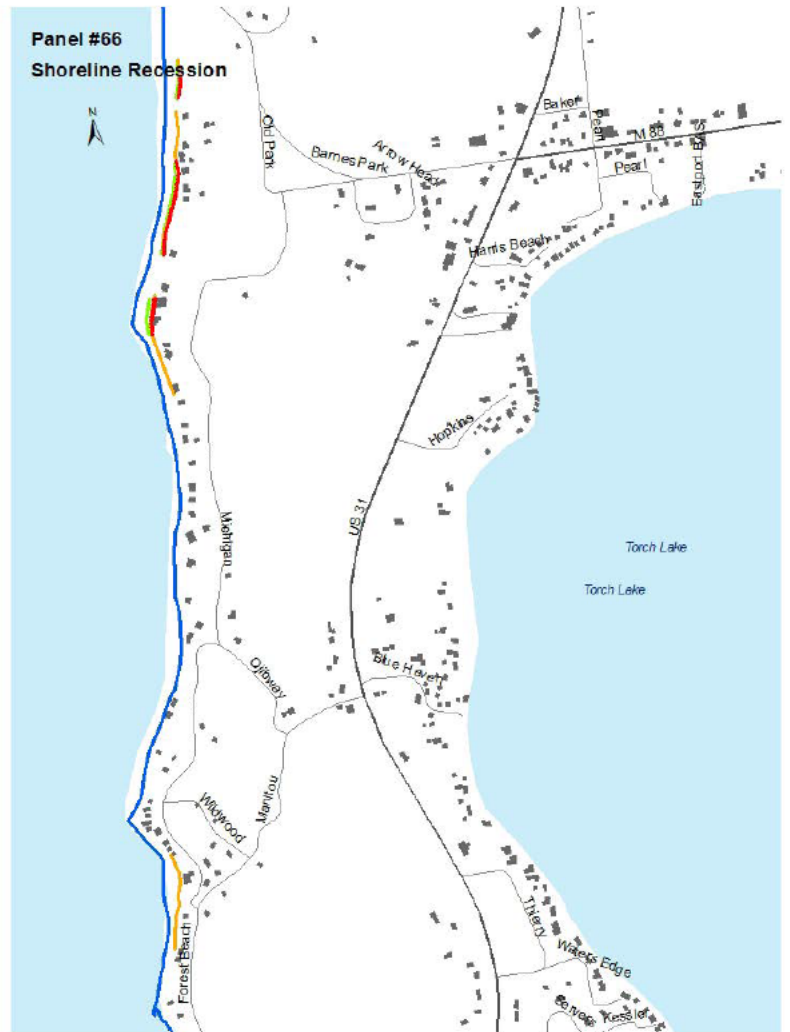


Figure 26: Bluff Recession Detail, Torch Lake Township

BLUFF RECESSION DETAIL

At least one “zoomed in” detail example of historic bluffline recession and future projections is provided at the beginning of each county section of this chapter. Shoreline and bluffline recession data can be viewed in greater detail online at <http://geospatialresearch.mtu.edu/czmp>.



Bluff Detail, Panel 66, Torch Lake Twp.



Additionally, all of the coastal communities in Antrim County (Banks Township, Torch Lake Township, Milton Township, Elk Rapids Township and the Village of Elk Rapids) contain “[High Risk Erosion Areas](#)” (HREAs) as designated and regulated by the State of Michigan’s Department of EGLE. HREAs are shorelines of the Great Lakes where the land is receding at a rate of one foot or more per year for a minimum of 15 years. Recession rates change over time as water levels fluctuate and coastal conditions change. Along these shorelines, new structures are required to meet setbacks for their protection from a changing shoreline. When structures are not in danger, the shoreline does not need to be altered to protect the structure.

A permit is required for construction, movement, or enlargement of a structure on any portion of a designated HREA parcel regardless of how far the project is from the lakeshore. Common activities requiring a permit include construction of a house, garage, or addition, substantial reconstruction of an existing home, the installation of a septic system, covered porches, or a commercial building. HREAs are regulated by the Administrative Rules of Part 323, Shorelands Protection and Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Currently EGLE administers Part 323 for all HREAs in Antrim County.

Torch Lake Township also contains State-designated “Critical Dune Areas” (CDAs), are a combination of coastal barrier dunes, land that has dune-like features, and unique plant communities along a Great Lakes shoreline. Regulatory authority goes to the water’s edge. The CDAs include public lands and private properties where developmental, silvicultural, and recreational activities are regulated and a permit is required under Part 353, Sand Dunes Protection and Management, of the Natural Resources and Environmental Protection Act for activities that significantly alter the CDA, such as the construction of a house or garage, building a road or driveway, installing a septic system, installing retaining

walls, and sand removal. The law balances the benefits of protecting, preserving, restoring and enhancing the diversity, quality, functions, and value of the critical dunes with the benefits of economic development, multiple uses, and public access. Currently EGLE administers Part 353 for all CDAs in Antrim County. There are no other designated CDAs in Antrim County aside from those in Torch Lake Township.

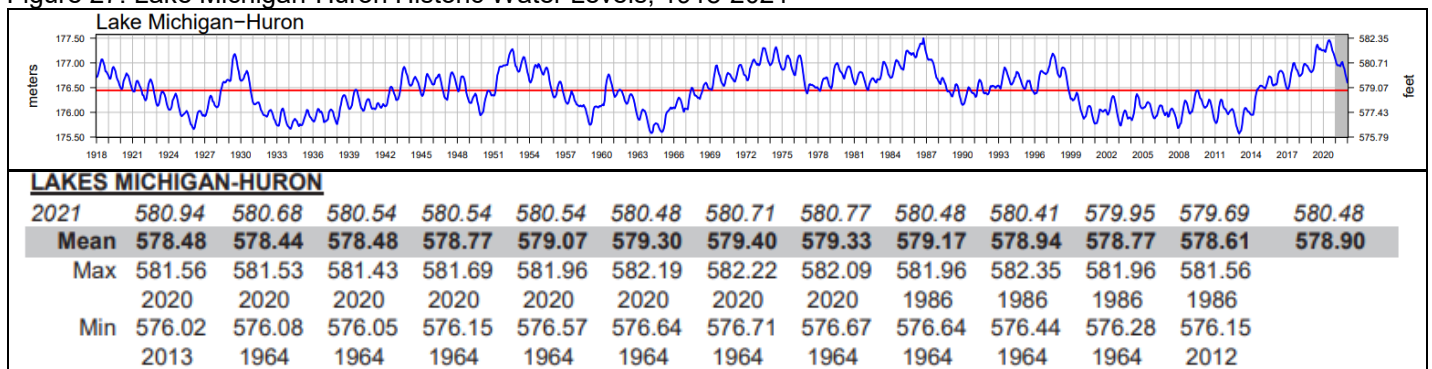
Maps of the HREAs and CDAs in Antrim County, obtained from EGLE’s online Wetlands Map Viewer, are included in Appendix A.

Extent

Shoreline recession can be measured by feet of bluffline retreat and property damages. Bluffline retreat distances vary across the county, and there are no reported damages from bluffline recession. Shoreline flooding can be measured by flood water levels, inches of rainfall, lake water levels (shown in Figure 27), and damages. There are no shoreline flooding or erosion (subsidence) incidents on record with NOAA for Antrim County.

In recent years, the swings in water levels have been unprecedented. In January 2013, Lake Michigan-Huron set an all-time record low of 576.02 feet, and seven years later in July of 2020 Lake Michigan-Huron reached a monthly record high of 582.22, only second to the October 1986 monthly record high of 582.35.

Figure 27: Lake Michigan-Huron Historic Water Levels, 1918-2021



Source: US Army Corps of Engineers

Previous Occurrences

The Great Lakes experienced record high lake levels in 1985-86, 1997-98, and 2019-20. The recent high lake levels have contributed to many areas of Lake Michigan coastal erosion as well as backups of rivers and tributaries, causing infrastructure damage and failures throughout Antrim County and many other areas in Michigan.

In June 2022, Task Force members working on the development of this hazard mitigation plan completed a field trip to view sites of concern related to hazard events in the County; the following pictures are in an area of coastal erosion along Lakeshore Drive in Banks Township, adjoining Lake Michigan. The photos below are of Lakeshore Drive, a narrow, dead-end, unpaved county road adjoining Lake Michigan that provides access to several lakeshore residences. There are no other connecting roads that would provide an alternate ingress/egress. A culvert under the roadbed is exposed due to erosion on the Lake Michigan side of the road, and the lakeside bluff at the edge of the road has eroded due to erosion of the soil. Some trees and vegetation were observed falling toward the lakeshore due to bluff erosion.



Probability of Future Events and Vulnerability Assessment

While there are no records of shoreline flooding or erosion (subsidence) incidents on record with NOAA for Antrim County, that does not mean there is 0% risk of such an event occurring in the future. Coastal flooding and/or coastal recession have been observed along various places of Antrim County's Lake Michigan shoreline (Banks Township, Torch Lake Township, Milton Township, Village of Elk Rapids and Elk Rapids Township) due to the record high lake levels observed in 2019 and 2020.

Shoreline or soil erosion hazards involve the loss of property or necessitate the relocation of homes as sand or soil is removed by flowing water (lake, river, etc.) and carried away over time. The foundation of a structure, or underground utility pipes in the area, may become fully exposed and vulnerable to weather, extreme temperatures, water damage, or other sources of risk. Shoreline banks that support roadways may erode and cause the road surface to crack, become unstable, or more prone to deposits of sand, snow, water, and ice. This hazard is especially relevant to those municipalities that contain residential and commercial development (such as the Elk Rapids Marina) along Grand Traverse Bay that experience seasonal shifts in water levels and possible ice erosion hazards.

As lake water levels fluctuate and increased storminess occurs, shoreline recession and flooding will continue. In 2021 the levels of Lake Michigan-Huron began to decline, however, as historic data shows us, the water will begin to rise again. Those communities that have already faced shoreline hazards are likely to experience issues in the future. Changes in land use practices and improvements to the shoreline such as natural vegetation plantings or shoreline armoring may reinforce the shoreline for a period of time, but is likely not a permanent solution.

Dangerous Currents

Dangerous currents and breaking waves are common in the Great Lakes region. Rip currents and other currents found near piers are extremely dangerous for swimmers and can lead to drownings. Currents in the Great Lakes can form from any combination of wind, waves, bottom formation, beach slope, water temperature, man-made structures, and natural outlets. In the Great Lakes, swimmers are most likely to encounter one of five common currents: rip, longshore, structural, outlet, and channel.

During rip currents, the water “piles up” between a sandbar and the beach. It has to find a way back out to sea. After the pressure builds up, the water creates a pathway and gushes from the shore back out to open water. That’s a rip current: a narrow but powerful stream of water and sand moving (ripping) swiftly away from shore. Rip currents vary in size and speed and can be found on many beaches every day. They typically extend from the shoreline through the surf zone, and past the line of breaking waves. Typically, they form at breaks in sandbars, and also near structures, such as jetties and piers, as well as cliffs that jut into the water.

Rip currents carry swimmers into deeper water, where they may not be able to get their footing. These currents rarely extend far out, and will not pull a swimmer underwater. Rip currents vary in size from very narrow to more than 50 yards wide. Speeds can also vary. The average speed is 1-2 feet per second, but they have been measured as fast as 8 feet per second.

Longshore currents move parallel to or the “long” way along the shoreline. These currents will exert a force to move along shore, making it difficult to remain in front of a spot on the beach. They often happen between the first and second sandbars near the shore. Longshore currents become more dangerous when they combine with rip currents or structural currents since they can move a swimmer swiftly down a beach and into the path of another current or into a structure (pier or breakwall), making it more difficult to swim to shore.

Structural currents - the currents found alongside or as a result of structures like piers and breakwalls - are usually always present. Structural currents are dangerous on their own, but when paired with others like longshore or rip currents, the combination can create a washing machine effect, moving the swimmer from one dangerous current area to another with no clear path to safety.

Outlet currents can be found where rivers and streams empty into the Great Lakes. The flow of water from the river or stream can move quickly. As it enters the open water of a lake, it may take awhile for that current to dissipate. Pair that with currents that are present in the lake and the situation can become dangerous.

Channel currents are like a river running parallel to shore. With a channel current, typically there is an island or structure such as a large group of rocks not far from shore. A channel current forms when the flow of water speeds up as it goes between the island and shore, like a bottleneck. This is made worse by the presence of a submerged or partially submerged sandbar connecting the beach to the island, which allows pressure to build behind the water and waves until it breaks through. When the wind speed increases, the waves also increase in intensity, and this causes the current to become stronger and faster.

According to the Great Lakes Current Incident Database, between 2002 and 2020, there have been 75 deaths and 274 persons rescued from dangerous current incidents along the Lake Michigan coastline of Michigan’s Lower Peninsula.

It is important to note that there are no “rip tides” or “undertows” in the Great Lakes. Since there are no tides in the Great Lakes, and rip currents don’t pull a person down under the water (it will carry them out to the open water, away from shore), “rip tides” or “undertows” are inaccurate coastal hazard terms.

Location

All Lake Michigan coastal areas in Antrim County are at risk to the occurrence and impacts from dangerous currents.

Dangerous current-related incidents in the Great Lakes most often occur when:

- Winds are blowing towards the shore
- Wave heights reach 3 to 6 feet
- A cold weather front is passing through

Extent

The National Weather Service provides a Surf Zone Forecast to measure the risk level associated with rip current hazards. Surf Zone Forecasts contain three levels of Rip Current Outlooks:

- Low Risk: The risk for rip currents is low, however, life threatening rip currents often occur in the vicinity of groins, jetties, reefs, and piers.
- Moderate Risk: Life threatening rip currents are possible in the surf zone.
- High Risk: Life threatening rip currents are likely in the surf zone.

Dangerous current events can be measured by damages caused, including rescues, injuries and deaths. There have been no such events recorded for Antrim County.

Previous Occurrences

The nearby counties of Benzie, Emmet, Leelanau, and Manistee have a history of dangerous current events. Each of these counties has recorded death(s) and/or rescue(s) due to a dangerous current event. There are no dangerous current events listed for Antrim County in the NOAA-NCEI Storm Events Database or the Great Lakes Current Incident Database.

Probability of Future Events and Vulnerability Assessment

There is a possibility of a dangerous current incident in Antrim County; however, the likelihood of an event is very small. Therefore, dangerous currents remain as a low probability, but possible hazard for Antrim County. These events likely happen occasionally, but may be unreported if injuries or deaths do not occur. Dangerous currents are a hazard to all swimmers, especially those who are unprepared to be swept up in the current. Swimmers who are caught unaware may panic when caught up in the fast-moving water, tire as they try to swim against the current (instead of sideways, parallel to the beach), and drown. Many Lake Michigan beaches also do not have a lifeguard on duty who may identify potential hazardous swimming conditions.

Another stop on the June 2022 field trip to sites of hazard concern areas in Antrim County included the public beach access at Torch Bay Preserve, at the end of Traverse Bay Road in Torch Lake Township. The narrow dirt access road dead ends at the beach with very limited parking. This parking area fills up quickly during the summer months and can create an access issue for emergency vehicles, such as for water rescues, as shown in the photos below. High water levels on Lake Michigan compound the parking/access issue. A potential solution may be to create a larger parking area further inland and gate the beach access to prevent public parking near the shore.



Seiche

A seiche is typically caused when strong winds and rapid changes in atmospheric pressure push water from one end of a body of water to the other. When the wind stops, the water rebounds to the other side of the enclosed area. The water then continues to oscillate back and forth for hours or even days. In a similar fashion, earthquakes, tsunamis, or severe storm fronts may also cause a seiche.

A seiche is usually limited to partially or fully enclosed basins, such as Lake Erie. Lake Erie is known for seiche incidents, especially when strong winds blow from southwest to northeast. In 1844, a 22-foot seiche breached a 14-foot-high sea wall killing 78 people and damming the ice to the extent that Niagara Falls temporarily stopped flowing. As recently as 2008, strong winds created waves 12 to 16 feet high in Lake Erie, leading to flooding near Buffalo, New York.

In some of the Great Lakes and other large bodies of water, the time period between the "high" and "low" of a seiche can be as much as four to seven hours. This is very similar to the time period between a high and low tide in the oceans, and is often mistaken as a tide.

According to the NOAA-NCEI Storm Events Database, there have been 15 seiche events in Michigan since 1998. There are no deaths, no injuries, and \$31,000 in property damages due to seiche events.

Location

A seiche is a coastal event that is not confined to geographic boundaries and may occur anywhere in Lake Michigan waters. All coastal areas are at risk to the occurrence and impacts from a seiche.

Extent/Previous Occurrences

Seiche events can be measured by damages-caused including deaths, injuries, and property damages. There are no reported seiche events for Antrim County.

Probability of Future Events and Vulnerability Assessment

Seiche events have likely occurred along the Lake Michigan coastline in Antrim County, but may have been unreported if injuries, deaths, or significant property damages did not occur. However, persons and property along the lake shore, particularly marinas (such as the 213-slip Edward C. Grace Memorial Harbor/Marina in the Village of Elk Rapids), are vulnerable to high waves caused by a seiche. Seiche events are also dangerous to all swimmers, especially those who are unprepared to be swept up in the current. Many Lake Michigan beaches do not have a lifeguard on duty who may identify potential hazardous swimming conditions.

Public Health Emergency (Infectious Disease)

Public health emergencies occur when there is a widespread and/or severe epidemic, contamination incident, bioterrorist attacks, or other situation that negatively impacts the health and welfare of the public. These emergencies include disease epidemics, large-scale food or water contamination incidents, extended periods without adequate water and sewer services, harmful exposure to chemical, radiological or biological agents, and large-scale infestations of disease-carrying insects or rodents. A common characteristic of public health emergencies is that they impact or have the potential to impact a large number of people either statewide, regionally, or locally in scope and magnitude. These health emergencies can occur as primary events or as secondary events from another hazard or emergency (e.g. flood, tornado, or hazardous material incident).

Location

Public Health Emergency can be a worldwide, national, state or regional event that is not confined to geographic boundaries and range in severity across the affected areas. All of Antrim County is at risk to the occurrence and impacts from an infectious disease. Depending on the type of disease, different populations are more susceptible.

Extent

The extent of a public health emergency can be determined by the number of cases and deaths, and the amount of money spent to prepare for and respond to public health threats. In Antrim County, the Health Department of Northwest Michigan works with local, state, and federal agencies to prepare for and respond to public health threats. It developed a comprehensive emergency preparedness program capable of responding to a variety of emergency situations with funds from the Centers for Disease Control. The State of Michigan reports⁸, as of January 31, 2023, there are 5,244 cases and 76 deaths (confirmed and probable for COVID-19) in Antrim County. Those 80 years and older have the most deaths of any age range at 35 deaths; there are 15 deaths reported in the county for those aged 70-79 years and 15 deaths reported in the county for those aged 60-69 years.⁹

Previous Occurrences

Throughout the years, there have been many pandemics. For example, there was an outbreak of severe acute respiratory syndrome (SARS) in 2003. This virus was a new coronavirus that resulted in over 8,000 illnesses worldwide. Of these, 774 died. Since 2012, Middle East respiratory syndrome (MERS), a coronavirus, has been reported in 27 countries where there have been approximately 2,494 people infected and 858 deaths. In 2017, the World Health Organization (WHO) put SARS and MERS on its priority pathogen list to spur further research into coronaviruses. More recently, from March 2020 to May 2023, a Presidential and Governor Emergency was in effect for the COVID-19 Pandemic in Michigan.

Probability of Future Events and Vulnerability Assessment

Naturally occurring pandemics may result in widespread precautions around the world. The Health Department of Northwest Michigan created a pandemic plan that serves as a template for responding to a large-scale outbreak of influenza and other highly infectious respiratory diseases, and was utilized when the COVID-19 pandemic began in 2020. The elderly, immune-compromised, and low income populations are most vulnerable to public health emergencies.

⁸ <https://www.michigan.gov/coronavirus/stats>

⁹ The sum of the deaths for individual categories may be fewer than the total number of deaths due to data suppression.

Invasive Species

The National Invasive Species Council defines an invasive species as, “A species that is not native and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.” The Council was formed under Presidential Executive Orders 13112 and 13751 to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established throughout the United States. NOAA’s National Ocean Service identifies invasive species as “capable of causing extinctions of native plants and animals, reducing biodiversity, competing with native organisms for limited resources, and altering habitats.” There are a wide variety of species considered invasive. Known and monitored species include:

- Mammals
- Birds
- Insects
- Fish
- Crustaceans
- Mollusks
- Worms
- Plants
- Diseases

Invasive species harmful to Michigan and Antrim County may be either terrestrial invasive species (TIS) or aquatic invasive species (AIS). Terrestrial invasive include non-native, land-based plants, insects, animals and diseases that harm Michigan’s environment, economy, and human health. Aquatic invasive include non-native, water-dwelling plants, animals, and other organisms that have evolved to live primarily in water (aquatic habitats) rather than on land. Aquatic habitats are habitats that are covered with water all or part of every year. Michigan State Departments cooperated to prepare the Terrestrial Invasive Species State Management Plan and the 2013 Aquatic Invasive Species State Management Plan Update: Prevention, Detection, and Management in Michigan Waters. Each plan outlines a statewide strategy to reduce the environmental and economic damages caused by either TIS or AIS.

Non-native terrestrial and aquatic species are introduced to Michigan and the Great Lakes both intentionally and unintentionally. Aquatic invasive species are the result of unwanted fish and aquatic plants released from home aquariums, travelled across the ocean in ballast water carried by freighters, or entered from the ocean through human-built channels such as the Welland Canal¹⁰. There are 32 AIS specifically listed in the State Management Plan. The State TIS Management Plan lists fourteen species including insects, mollusks, plants, mammals, a shrub, and a bird.

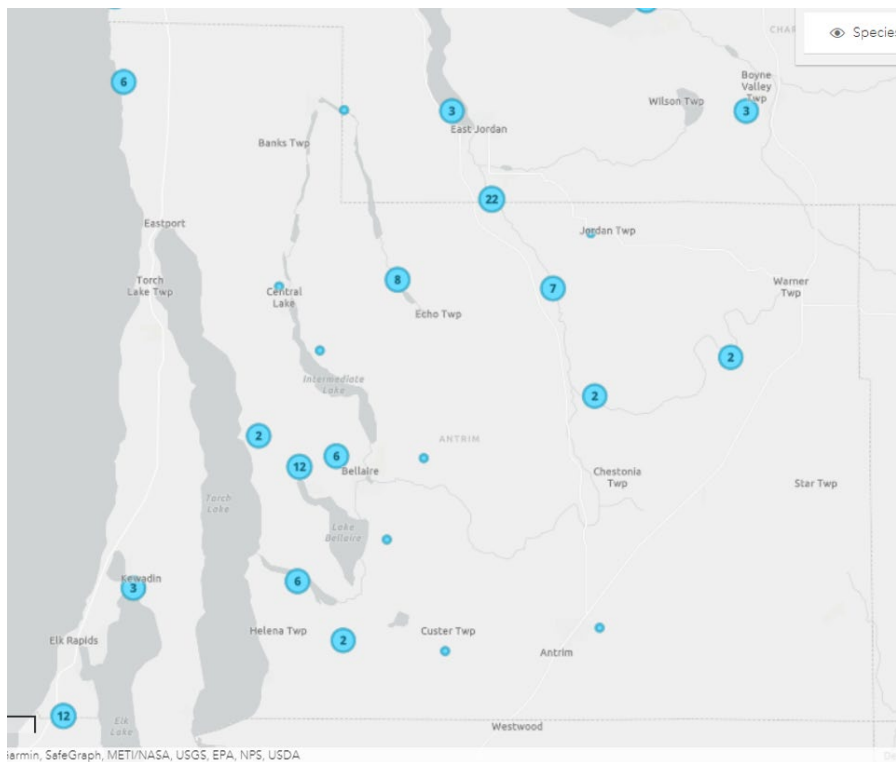
The Midwest Invasive Species Network (MISIN) is a regional effort to develop and provide early detection and response resources for invasive species. Among many tools and resources, the website (misin.msu.edu) provides a catalog of species information and a report of occurrences submitted within each state. Animals, plants, and diseases are included in the catalog. The top five reported species in Michigan are: phragmites (invasive) with 63,018, garlic mustard with 18,368, autumn olive with 16,042, spotted knapweed with 15,436, and brown marmorated stink bug with 13,351.

Location

Terrestrial and aquatic invasive species threaten sensitive ecosystems and may be present in Antrim County forest, wetland, farmland, grassland, aquatic, shoreline, and urban environments. “A Field Guide to Invasive Plants of Aquatic and Wetland Habitats for Michigan” (Campbell, Higman, Slaughter, Schools) identifies the Lake Michigan coastline as particularly vulnerable. “Lake-moderated climates along the Lake Michigan shoreline, Saginaw Bay, the Thumb, Lake St. Clair, and western Lake Erie are much milder than those in the state’s interior... These areas have the potential to harbor species typically found far south of Michigan.” TIS and AIS designation generally applies, however, to several upland species appear to be spreading to wetland and aquatic areas. Regular monitoring and reporting introductions detected is the only way to know where an invasive species has infested. The MISIN Species Observations Data Viewer (online) shares reported detections by species name (common and scientific) and family type. Figure 28 identifies reported MISIN Autumn Olive cases throughout Antrim County and in some adjoining counties.

¹⁰ The Welland Canal is a ship canal in Ontario, Canada, connecting Lake Ontario and Lake Erie.

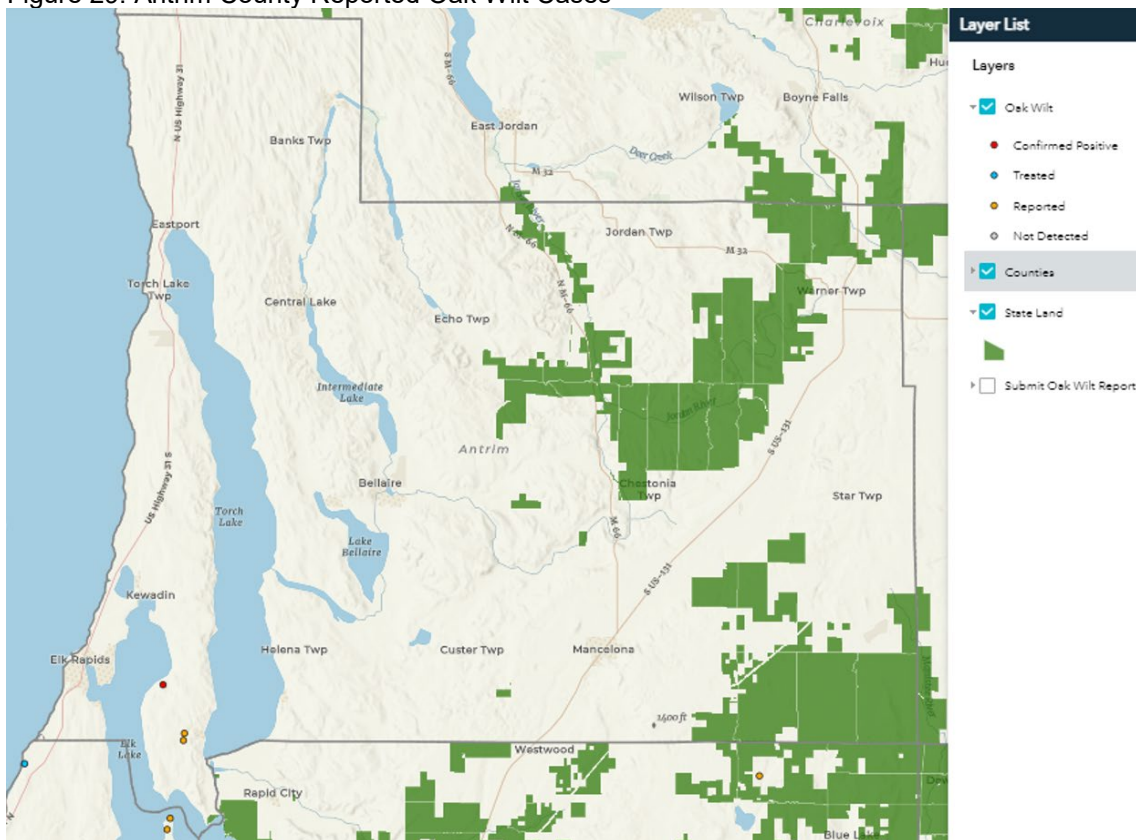
Figure 28: Antrim County Autumn Olive Reported Cases



Source: Midwest Invasive Species Information Network Accessed 2/1/23.

Figure 29 illustrates the MDNR interactive mapping resource “Look for Oak Wilt,” which allows users to submit an Oak Wilt Report throughout Michigan. Three Oak Wilt cases have been reported in the southwest portion of Antrim County, in Milton Township. These include trees confirmed positive for the disease and trees that are reported cases.

Figure 29: Antrim County Reported Oak Wilt Cases



Source: MDNR. Accessed 2/1/2023

Extent

Invasive species impact on the county can be measured by its damaging effects. TIS cause billions of dollars in damage annually, are extremely costly to control, and often have irreversible ecological effects. Native habitats, agriculture lands and livestock, and the outdoor recreation economy are threatened or damaged by invasive species. *Michigan's Terrestrial Invasive Species State Management Plan* lists these state impacts:

- The State of Michigan estimates 42% of threatened or endangered species are considered at risk due to non-native species.
- Visitors spent over \$22 billion dollars in Michigan in 2014, supporting nearly 327,000 jobs (Tourism Economics 2014). Invasive species impact the use and beauty of Michigan's shorelines, trails and parks, which may result in a reduction in visitor spending and citizen enjoyment.
- Michigan's Forest Products Industry supports 96,000 jobs and contributes more than \$20 billion to the state's economy each year (Michigan DNR 2015). Invasive forest pests including emerald ash borer, oak wilt and beech bark disease kill trees and significantly impact the value of urban properties, forests and timber resources. The estimated cost of treating or removing dead ash within developed land in Michigan's communities due to emerald ash borer was \$230 million in 2009¹¹. A map of oak wilt cases in Antrim County is shown as Figure 29.

Previous Occurrences

The Department of Environment, Great Lakes, and Energy oversees invasive species programs for the State. The State has produced prohibited and restricted species lists, watch lists, and state management plans for terrestrial and aquatic species. Many of the species listed in this plan are also listed as a prohibited or restricted species: it is unlawful to possess, introduce, import, sell, or offer that species for sale as a live organism, except under certain circumstances. A full list of prohibited and restricted species can be found at Michigan.gov/invasives.

The Cooperative Invasive Species Management Area serving Charlevoix, Antrim, Kalkaska, and Emmet counties (CAKE CISMA) and Antrim Conservation District are focused on habitat-specific management: planning to manage for the resource (aka that natural area) and restoration therefore will remove and control anything that is not supposed to be there. Natural areas for consideration are high-quality natural areas in Charlevoix, Antrim, Kalkaska, and Emmet Counties such as around coastal dunes (e.g. Lake Michigan) and waterways & riparian areas (i.e., the Elk River Chain of Lakes (ERCOL) Watershed). Many of these invasive species are detrimental to local property values if they degrade the quality of and access to valued natural resources.

Phragmites (non-native) and Purple loosestrife (described below) are two other invasive, riparian plants that grow quickly in and near rivers, lakes and streams. CAKE CISMA, in cooperation with landowners, treats these species along the Elk River Chain-of-Lakes, the Lake Michigan coast and other wet areas throughout the county in order to improve fish and wildlife habitat, as well as biodiversity.

The following terrestrial invasive species are causing significant harm in the northwestern Lower Peninsula:

- Japanese knotweed, Giant knotweed and Bohemian knotweed, *Polygonaceae*, can be a concern to homeowners, and municipalities because of these plants' ability to grow into a structure's foundation, through sidewalks and road surfaces. These plants can also be spread by root fragments and stem sections. It can create monocultures that shade out desirable vegetation, creating poor habitats for native species. This is of particular concern along water bodies and has been shown to be extremely detrimental to waterways in the Eastern US.
- (Invasive) Phragmites is a large-scale clonal grass that rapidly colonizes wetlands. Phragmites crowds out native plants and alters habitat for native fauna. In doing so, Phragmites also alters human access to water resources and has adverse economic effects, including decreasing property value, inhibiting recreational use, and limiting populations of game species. It can become a fire hazard when it dries down
- Cypress spurge is an erect, herbaceous to semi-woody perennial with bright yellow-green flowers that turn to purple-red as they mature. Cypress Spurge is toxic to horses and cows.
- Black Swallow Wort is a rapidly growing, herbaceous perennial in the Milkweed family. However, Black Swallow Wort is toxic to animals and the monarch butterfly.
- Oriental bittersweet is a vine plant that can strangle a tree and causes tree mortality. This impacts ecosystem health and economic health that is associated with trees' health.
- Autumn olive is very widespread in Michigan. It is spread by birds and is recolonizing old farm fields. Its value to wildlife is relatively low (low in protein and other nutrients compared to our natives). It also is known for its nitrogen-fixing abilities. Specific areas of problematic autumn olive infestation provided by a participant in this plan

¹¹ Kovacs, K.F., R.G. Haight, D.G. McCullough, R.J. Mercader, N.W. Siegert and A.M. Liebhold. 2010. Cost of potential emerald ash borer damage in U.S. communities, 2009–2019. *Ecological Economics* 69: 569-578.

development include these areas of Forest Home Township: properties along Miley Pointe Drive down to Cottage Drive, and along sections of Steiner Road between Clam Lake Road and SE Torch Lake Drive.

- Oak wilt is an infectious vascular disease that can affect all species of oak. Red oaks get the disease more often and succumb more readily than white oak. The disease spreads via root grafts and sap-feeding beetles.
- Beech bark disease is caused by the combination of the *Neonectria* fungus and beech scale. Beech scales are yellow, soft-bodied insects that are 0.5 to 1.0 mm long as adults. The insects, found on the tree trunk and branches, feed on sap in the inner bark. The minute wounds caused by the scale insects eventually enable the Nectria fungus to enter the tree. The Nectria kills areas of woody tissue.
- Garlic mustard is an herbaceous biennial, up to 4 feet in height. Forms round basal rosette the first year, flowers the second year and dies. Grows in forests, particularly floodplain forest, open wetlands, parking lots, campgrounds, paths, and roadsides. A specific area of garlic mustard infestation, as provided by a participant in this plan development, is at the Coy Mountain Natural Area in Helena Township.

The following aquatic invasive species are causing significant harm in the northwestern Lower Peninsula:

- Didymo or “rock snot” is an aquatic diatom that is brown, tan, or yellow in color. Unlike most algae, it feels like wet cotton and is not slimy. Grows in rivers, streams, and lakes. It occurs particularly in cool, oligotrophic, clear water.
- Purple loosestrife is an herbaceous wetland perennial reaching 5 feet with reddish-purple flowers with five to seven petals are held in dense terminal cluster. Grows in moist soils, in wet meadows and prairies, shallow marsh, ditches, waste areas, and along lakes, ponds, streams, and rivers.
- Eurasian water-milfoil is a submergent, aquatic perennial that reached 3-10 feet or more in length. Grows in ponds, lakes, and low-energy zones in rivers and streams. Specific areas of autumn olive infestation provided by a participant in this plan development include Six Mile Lake in Echo and Banks Townships, the Clam River and Alden Harbor on Torch Lake.
- New Zealand mudsnail is an aquatic mollusk with an elongated shell 1/8 inch long with 7-8 whorls. Shell color varies from gray and dark brown to light brown. Grows in flowing freshwater with silt/sand to very brackish rivers; lives in water as deep as 60 feet in lakes or reservoirs.
- Red swamp crayfish is an aquatic crustacean with a dark red body and claws with spiky, bright red bumps, and black wedge-shaped stripe on underside. Grows in flowing to non-flowing freshwater or salt water; permanent ponds; areas of streams and ditches with organic debris; agricultural areas; wetlands.
- Zebra mussel is an aquatic mollusk with striped shells or dark or light shells with no stripes. They attach to objects (pipe, boats, etc.) causing major damage as colonies can block pipes, affecting power and water-treatment plants.

Many of the species listed above are monitored and managed by CAKE-CISMA. However, the list of all invasive species impacting the county is extensive and many established species are treated on a case-by-case basis. Other species of concern include: Honeysuckle (non-native); Glossy buckthorn; Common buckthorn; Wild parsnip; Multiflora rose; and Periwinkle.

Probability of Future Events and Vulnerability Assessment

The State TIS Management Plan provides a list of eleven terrestrial species on the [Michigan Watch List](#) (Table 34). These are priority species that have been identified as posing an immediate and significant threat to Michigan’s natural resources. These species have either not been confirmed in Michigan, have very limited distribution, or are localized. Early detection and timely reporting of occurrences of these species is crucial for increasing the likelihood of stopping an invasion and limiting negative ecological and economic impacts. This list is reviewed and updated periodically, and the most current list is available at www.michigan.gov/invasives.

Table 34. Terrestrial Species on the Michigan Watch List

Common Name - Scientific Name - Category
1. Asian longhorned beetle <i>Anoplophora glabripenni</i> Insect
2. Asiatic sand sedge <i>Carex kobomugi</i> Plant
3. Balsam woolly adelgid <i>Adelges piceae</i> Insect
4. Chinese yam* <i>Dioscorea oppositifolia</i> Plant
5. Hemlock woolly adelgid* <i>Adelges tsugae</i> Insect
6. Himalayan balsam* <i>Impatiens glandulifera</i> Plant
7. Japanese stiltgrass* <i>Microstegium vimineum</i> Plant
8. Kudzu* <i>Pueraria montana</i> Plant
9. Mile-a-minute weed <i>Persicaria perfoliata</i> Plant
10. Nutria <i>Myocastor coypus</i> Mammal
11. Thousand Cankers Disease <i>Geosmithia morbida</i> <i>Pityophthorus juglandis</i> Tree Disease

Local land and water management groups are also monitoring for the presence of other invasives that are on the [Michigan Watch List](#), such as:

- Hemlock woolly adelgid is an insect native to East Asia. It is small, less than 1/16 inches long and varies from dark reddish-brown to purplish-black color. As it matures, it produces a covering of wool-like wax filaments to protect itself. Heavy infestations can kill a tree within four to ten years; trees are also weakened and made vulnerable to attack by other insects and diseases. All hemlock trees are vulnerable; eastern and Carolina hemlocks are most susceptible. Often found along ravines, hillsides, and stream banks, eastern hemlock offer habitat for wildlife and provide shade for streams, effectively lowering stream temperatures and increasing oxygen for fish and other aquatic species. Hemlocks provide aesthetic value and are loved by homeowners.

CAKE CISMA began conducting grant-funded surveys of eastern hemlock trees within 5 miles of the Lake Michigan shoreline lakeshore for Hemlock Woolly Adelgid in the winter of 2023. The area within 5 miles of the Lake Michigan shoreline is the most probable area for new infestations. The adelgids tend to favor the temperatures and conditions found near the lake more than those inland.

- Spotted lantern fly which impacts fruit and winery production. Winery and fruit production issues can impact agri-tourism.
- Hydrilla is an aquatic, perennial plant that forms dense mats in slow-moving water of lakes, ponds, stream, and rivers.
- European frog-bit is an aquatic, floating, herbaceous annual that forms large colonies, creating dense mats. Grows in open, still waters.
- Parrot feather water-milfoil is an aquatic, herbaceous perennial that can grow 6.5-16.5 feet in length and forms monotypic stands. Grows in lakes, ponds, slow streams, and mudflats, where the emergent form is found.
- Starry stonewort is an aquatic microalga which forms dense mats that cover lake bottoms. Grows in still or slow moving waters.
- Asian Carp (bighead, black, grass, and silver carp) are in direct competition with native aquatic species for food and habitat. Their rapid population increase is disrupting the ecology and food web of the large rivers of the Midwest.
- Beech leaf disease causes dark stripes or banding between leaf veins. A nematode (microscopic worm) is associated with symptoms. Ongoing research is investigating the possibility of other contributing microorganisms.

Potential impact from the species listed on watch lists could be catastrophic for Antrim County's natural resources, agriculture, recreation, tourism, and economy.

CAKE CISMA, Antrim Conservation District, MSU Extension, and other land and water management partners protect, enhance, and promote Northwest Michigan's natural communities through terrestrial and/or aquatic invasive plant management, education, and outreach. Antrim County's natural resources are highly vulnerable to invasive animals, plants, and diseases. Significant natural features include forested areas such as Glacial Hills Pathway and Natural Area in Forest Home Township; the Mackinaw State Forest in the northeast portion of the county which includes the Jordan River, Jordan River National Fish Hatchery, Jordan River Pathway, Warner Creek Pathway and MDNR campgrounds; the Mackinaw State Forest lands in the southeast port of the county, and of course the Elk River Chain of Lakes Watershed in the western half of the county. Additionally, Lake Skegemog is part of the ERCOL Chain of Lakes in Milton Township, but is also present in Kalkaska County community of Clearwater Township. The Elk-Skegemog Lakes Association works with CAKE CISMA to combat problematic invasive species such as purple loosestrife and phragmites.

Impacts from Climate Change

Climate describes the average weather conditions for a particular location and over a long period of time. The changing climate impacts society and ecosystems in a broad variety of ways. For example, climate change can alter rainfall, influence crop yields, affect human health, cause changes to forests and other ecosystems, and even impact our energy supply. Climate-related impacts are occurring across the country by increasing the severity of storms and weather-related events. Natural disasters then have a direct impact on our economy.

According to a new comprehensive report from the World Meteorological Organization (WMO), “A disaster related to a weather, climate or water hazard occurred every day on average over the past 50 years – killing 115 people and causing \$202 million (US \$) in losses daily. The number of disasters has increased by a factor of five over the 50-year period, driven by climate change, more extreme weather and improved reporting. But, thanks to improved early warnings and disaster management, the number of deaths decreased almost three-fold¹²” (World Meteorological Organization, 2021).

The impacts of climate change already are, and continue to be, deep and widespread in the Great Lakes Region and Michigan as a whole. The National Climate Assessment (NCA) assesses the science of climate change and variability and its impacts across the United States, now and throughout this century. Chapter 21 of the NCA *Fourth National Climate Assessment Volume II: Impacts Risks, and Adaptation in the United States* reports, the Great Lakes influence regional weather and climate conditions and impact climate variability and change across the region. The lakes influence daily weather by:

- 1) Moderating maximum and minimum temperatures of the region in all seasons,
- 2) Increasing cloud cover and precipitation over and just downwind of the lakes during winter, and
- 3) Decreasing summertime convective clouds and rainfall over the lakes.

The Great Lakes Integrated Sciences and Assessments (GLISA) is one of 11 NOAA Regional Integrated Sciences and Assessments teams that focus on helping the nation prepare for and adapt to climate variability and change. A summary of findings from NCA and the GLISA report, *Climate Change in the Great Lakes Region*¹³, are provided to show the impacts of climate change throughout the state of Michigan.

Temperature

Warm-season temperatures are projected to increase more in the Midwest than any other region of the United States.¹⁴ Since 1951, annual average air temperatures have increased by 2.3°F (1.3°C) in the U.S., Great Lakes region. By mid-century (2050), average air temperatures are projected to increase by 3°F to 6°F (1.7°C to 3.3°C). By end of century (2100), average air temperatures are projected to increase by 6°F to 11°F (3.3°C to 6.1°C).

The frost-free season is projected to increase 10 days by early this century (2016–2045), 20 days by mid-century (2036–2065), and possibly a month by late century (2070–2099) compared to the period 1976–2005 according to the higher scenario (RCP8.5).¹⁵

Precipitation

Since 1951, total annual precipitation has increased by 14% in the U.S., Great Lakes Region. Future projections suggest more precipitation on average, but not necessarily during all seasons (summer to be drier) and not for all locations depending on which model is used. Reduced lake ice cover and enhanced evaporation may lead to increased lake-effect snowfall in the near-term, but rising temperatures will cause more winter precipitation to fall as rain as opposed to snow across the region by late century.

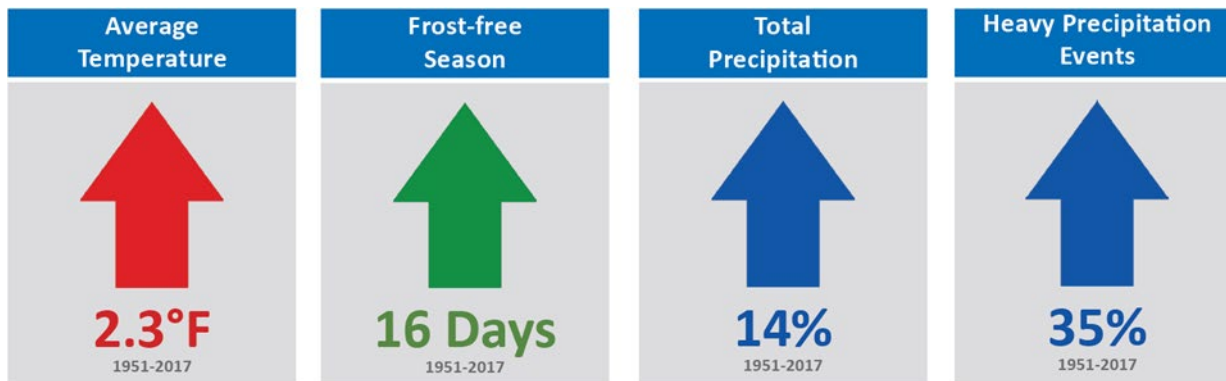
¹² World Meteorological Organization. (2021, August 31). Retrieved from Weather-related disasters increase over past 50 years, causing more damage but fewer deaths: <https://public.wmo.int/en/media/press-release/weather-related-disasters-increase-over-past-50-years-causing-more-damage-fewer>

¹³ (2019, February 14). Retrieved from Climate Change in the Great Lakes Region: <https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Page.pdf>

¹⁴ Vose, R. S., D. R. Easterling, K. E. Kunkel, A. N. LeGrande, and M. F. Wehner, 2017: Temperature Changes in the United States. *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. Wuebbles, D. J., D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock, Eds., U.S. Global Change Research Program, Washington, DC, USA, 185–206. doi:[10.7930/JON29V45](https://doi.org/10.7930/JON29V45).

¹⁵ Hibbard, K. A., F. M. Hoffman, D. Huntzinger, and T. O. West, 2017: Changes in Land Cover and Terrestrial Biogeochemistry. *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. Wuebbles, D. J., D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock, Eds., U.S. Global Change Research Program, Washington, DC, USA, 277–302. doi:[10.7930/J0416V6X](https://doi.org/10.7930/J0416V6X).

From 1951-2017, the United States, Great Lakes Region, overall, has seen increases in average temperature, frost-free season, total precipitation, and heavy precipitation events.



Snow, Ice Cover and Lake Temperature

Summer lake surface temperatures have been increasing faster than the surrounding air temperatures, with Lake Superior increasing by 4.5°F between 1979 and 2006. Annual average ice cover on the Great Lakes shifted from higher amounts prior to the 1990s to lower amounts in recent decades. There remains strong year-to-year variability, and high ice years are still possible. Lake-effect snowfall has increased in northern areas and may continue to increase through mid-century.

Extreme Weather

The frequency and intensity of severe storms has increased. This trend will likely continue as the effects of climate change become more pronounced. The amount of precipitation falling in the heaviest 1% of storms increased by 35% in the U.S. Great Lakes region from 1951 through 2017. More severe storms may have a negative economic impact due to resulting damages and increased costs of preparation, clean up, and business disruption.

The NCA *Fourth National Climate Assessment Volume II: Impacts Risks, and Adaptation in the United States* reports, “Climate change is transforming where and how we live and presents growing challenges to human health and quality of life, the economy, and the natural systems that support us. Risks posed by climate variability and change vary by region and sector and by the vulnerability of people experiencing impacts. Social, economic, and geographic factors shape the exposure of people and communities to climate-related impacts and their capacity to respond. Risks are often highest for those that are already vulnerable, including low-income communities, some communities of color, children, and the elderly” ([Ch. 14: Human Health, KM 2](#); [Ch. 15: Tribes, KM 1–3](#); [Ch. 28: Adaptation, Introduction](#)).

A vulnerability assessment can be found in the two-page report: *Climate Change in the Great Lakes Region* by GLISA. The report identifies key challenges from climate change such as:

- **Public Health**
 - Increased risk of heat waves and increased humidity may amplify the number of heat-related deaths and illnesses.
 - More storm activity and flooding, resulting in increased point- and non-point source pollution, will likely increase watershed contamination and water-borne illnesses, while warmer surface waters amplify the risk of toxic algal blooms and fish contamination.
- **Tourism and Recreation**
 - *Winter recreation/tourism are likely to suffer* due to reduced snow cover and shorter winters. Reduced lake ice cover and enhanced evaporation may lead to increased lake-effect snowfall in the near-term, but rising temperatures will cause more winter precipitation to fall as rain as opposed to snow across the region by late century.
 - Increasing temperatures and a longer summer season may *increase the demand for lake and beach use*.
 - Overall, *summer tourism may grow before temperature rise becomes unfavorable* for outdoor recreation.
 - *The fishing industry* (commercial and recreation) is likely to be impacted by the *decline of coldwater species of fish, such as lake trout and whitefish*.

- **Natural Environment**

- Despite increasing precipitation, land surfaces in the region are expected to become drier overall due to increasing temperatures and evaporation rates.
- More frequent summer droughts could affect soil moisture, surface water, and groundwater supply.
- Increased evaporation rates and sustained levels of high or low water levels may change wetland areas in the region.
- The rate of warming may *outpace the rate at which ecosystems are able to migrate and adapt*.
- *Wildlife populations better adapted to cold temperatures will continue to decline* as competing species migrate into the region with rising air and surface water temperatures.
- *Forest productivity will likely increase in the short term*, until other impacts of climate change such as increased drought, fire and invasive species present additional stressors to forests.

The full two-page report can be found at: <https://glisa.umich.edu/summary-climate-information/>

Climate Change has impacted Antrim County in the following ways:

- Residents have reported more water in their basements and crawl spaces in recent years, where they never had issues previously.
- The culvert in Ellsworth between Lake Ellsworth and Lake St. Clair has been determined to be a “chokepoint” according to the USACE Hydrology Study. Areas located above this chokepoint experience very high water levels during and after heavy rain events.
- A section of Rushton Road between Benway Lake and Wilson Lakes in Central Lake Township deteriorated recently. The Road Commission has put caution signs out alerting drivers of bumps in the roadway. The Road Commission worked to crush, shape and re-pave this portion of this road in 2022.
- The intense rainstorm event in August 2021 blew out the Alden Highway culvert over Finch Creek, which was replaced/rebuilt in the fall of 2021.

Climate Change is expected to impact Antrim County in the following ways:

- It is anticipated that the County’s population will grow as the northern Michigan region becomes more of a destination to live and visit, as it will comparatively have cooler summers than other southern areas of the State and nation, as well as plentiful groundwater and surface water resources.

Antrim County and partner agencies are preparing for Climate Change using the following:

- Development of a Natural Hazard Mitigation plan which identifies specific community-driven strategies
- Utilizing and expanding on the 2022 Elk River Chain of Lakes Hydrology Study
- Currently the Antrim County Conservation District is re-evaluating and revising their Soil Erosion Ordinance to provide better permitting procedures so that surface water resources are protected from land development activities.
- A county-wide Road/Stream Crossing Inventory is underway
- The problematic Ellsworth culvert on the Chain of Lakes should be replaced with a free span bridge in the future.

V. Community Vulnerability Analysis

Table 35 summarizes much of the information presented in Sections III (Community Profile) and IV (Hazard Identification and Assessments) of this plan as it pertains to each community in Antrim County. While most types of hazards considered in this plan could affect every jurisdiction in the County, certain characteristics of people, property, the economy and the environment were considered to evaluate each community's unique vulnerabilities (as well as assets) for each type of hazard. For reference, the locations of some of these characteristics (i.e., public lands, pine forest area, infrastructure, campgrounds, mobile home areas, hazard areas) are illustrated in the maps provided in Appendix A.

Table 35. Community Vulnerability Analysis

	Antrim County Townships											Antrim County Villages									
	Banks	Central Lake	Chestonia	Custer	Echo	Elk Rapids	Forest Home	Helena	Jordan	Kearney	Mancelona	Milton	Star	Torch Lake	Warner	Bellaire	Central Lake	Elk Rapids	Ellisworth	Mancelona	
Population Estimates (2019)																					
Community Assets																					
Fire Stations	1 (shared with Village)	1 (shared with Village)				1 (shared with Village)		1			2	2	1	1		1	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	
Police Dept.																					
EMS Service Coverage	Jordan Valley EMS	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Contract with MMR	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Township Ambulance Authority	Contract with MMR	Contract with MMR	Township Ambulance Authority	Torch Lake Twp. EMS	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Contract with MMR	Jordan Valley EMS	Township Ambulance Authority	
Shelter Sites			1							1		3		1		2	2	2		3	
Health Care Facilities (clinics)																					
Severe Winter Weather and Extreme Temperature Vulnerabilities																					
Outdoor Recreation Lands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Communications	1				1		1		1				2	1		4	2	1		1	
Infrastructure	348	586	103	292	192	859	621	400	167	530	684	209	494	45	235	197	574	50		140	
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	91	38	22	7	0	33	0	38	40	81	240	21	30	9							
Est. # of residents that are of Hispanic or Latino origin and identify as a minority race	0	1	0	16	0	0	0	0	4	0	184	3	9	0							
Est. # of households that are lower income (ALICE or below poverty level)	190	356	119	122	143	331	214	118	121	302	769	127	175	49							

	Antrim County Townships										Antrim County Villages										
	Banks	Central Lake	Chestonia	Custer	Echo	Elk Rapids	Forest Home	Helena	Jordan	Kearney	Mancelona	Milton	Star	Torch Lake	Warner	Bellaire	Central Lake	Elk Rapids	Ellsworth	Mancelona	
Population Estimates (2019)																					
Community Assets																					
Fire Stations	1 (shared with Village)	1 (shared with Village)				1 (shared with Village)		1				2	1	1		1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)		1 (shared with Twp.)	
Police Dept.																1	1			1	
EMS Service Coverage	Jordan Valley EMS	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Contract with MMR	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Township Ambulance Authority	Township Ambulance Authority	Contract with MMR	Township Ambulance Authority	Torch Lake Twp. EMS	Township Ambulance Authority	Township Ambulance Authority	Contract with MMR	Jordan Valley EMS	Township Ambulance Authority		
Shelter Sites			1					2				1		1	2	2	2			3	
Health Care Facilities (clinics)										1					2	2	3			2	
Thunderstorm, High Winds, Hail, Tornado Vulnerabilities																					
Mobile Home Neighborhoods																1				1	5
Campgrounds		1	1	1	1	1			1					1			1			1	
Outdoor Recreation Lands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Previous Tornadoes	1	1	1	2	2	2		2	3	1	1	2									
Prior Wind Tree Damage Area							Glacial Hills Preserve														
Communications Critical Infrastructure					1		1		1					1	4	2	1			1	
Est. number of residents > age 65	348	586	103	292	192	859	621	400	167	530	684	209	494	45	235	197	574	50		140	
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	91	38	22	7	0	33	0	38	40	81	43	21	30	9							
Est. # of residents that are of Hispanic or Latino origin and identify as a minority race	0	1	0	16	0	0	0	0	4	0	184	3	9	0							
Est. # of households that are lower income (ALICE or below poverty level)	190	356	119	122	143	331	214	118	121	302	256	127	175	49							
Lightning Vulnerabilities																					
Campgrounds	1	1	1	1	1	1			1		3	1	1			1			1		
Communications Critical Infrastructure					1		1		1		3	2	1		4	2	1			1	
Outdoor Recreation Lands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

	Antrim County Townships											Antrim County Villages									
	Banks	Central Lake	Chestonia	Custer	Echo	Elk Rapids	Forest Home	Helena	Jordan	Kearney	Mancelona	Milton	Star	Torch Lake	Warner	Bellaire	Central Lake	Elk Rapids	Ellsworth	Mancelona	
Population Estimates (2019)																					
Community Assets																					
Fire Stations	1 (shared with Village)	1 (shared with Village)				1 (shared with Village)		1			2	2	1	1	1	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	1	
Police Dept.																					
EMS Service Coverage	Jordan Valley EMS	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Contract with MMR	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Township Ambulance Authority	Contract with MMR	Contract with MMR	Township Ambulance Authority	Torch Lake Twp. EMS	Township Ambulance Authority	Township Ambulance Authority	Contract with MMR	Jordan Valley EMS	Township Ambulance Authority		
Shelter Sites			1					2			3			1	2	2	2			3	
Health Care Facilities (clinics)										1					1	2	3			2	
Flooding Vulnerabilities																					
Prior Flood Incident Areas	X	X		X	X	X	X	X		X		X				X	X		X		
FEMA FIRMI issued	X					X					X							X			
Potential dam failure (for dams that have a condition rating)																					
# of Road/Stream Crossings with a Moderate to Severe Rating	14		4		15				10		4									4	
# of Bridges with Poor, Serious, Critical or Closed Ratings																			1		
Est. number of residents > age 65	348	586	103	292	192	859	621	400	167	530	659	684	209	494	45	235	197	574	50	140	
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	91	38	22	7	0	33	0	38	40	81	240	43	21	30	9						
Est. # of residents that are of Hispanic or Latino origin and identify as a minority race	0	1	0	16	0	0	0	0	4	0	4	184	3	9	0						
Est. # of households that are lower income (ALICE or below poverty level)	190	356	119	122	143	331	214	118	121	302	769	256	127	175	49						

Population Estimates (2019)	Antrim County Townships											Antrim County Villages									
	Banks	Central Lake	Chestonia	Custer	Echo	Elk Rapids	Forest Home	Helena	Jordan	Kearney	Mancelona	Milton	Star	Torch Lake	Warner	Bellaire	Central Lake	Elk Rapids	Ellsworth	Mancelona	
Community Assets																					
Fire Stations	1 (shared with Village)	1 (shared with Village)				1 (shared with Village)		1		2	2	1	1	1	1	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	
Police Dept.																					
EMS Service Coverage	Jordan Valley EMS	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Contract with MMR	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Township Ambulance Authority	Contract with MMR	Township Ambulance Authority	Torch Lake Twp. EMS	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Contract MMR	Jordan Valley EMS	Township Ambulance Authority	
Shelter Sites			1					2		1	3		1	2	2	2	2	2	2	3	
Health Care Facilities (clinics)									1					1	2	3	3	3	2	2	
Shoreline Hazards (Lake MI)																					
Previous or Current Shoreline Erosion Issue Areas	X												X								
Critical Dune Areas																					
High Risk Erosion Areas	X					X					X									X	
Dangerous Currents (potential)	X					X					X									X	
Seiche/Lakeshore flooding (potential)	X					X					X									X	
FEMA FIRM issued	X					X					X									X	
Wildfire Vulnerabilities																					
Pine Forest Campgrounds	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Previous Large Fire Incident(s)	1	1	1	1	1	1			1	3	1	1	1			1			1		
Tree Farms	2	1																			
Est. number of residents > age 65	348	586	103	292	192	859	621	400	167	530	684	209	494	45	235	197	574	50	140		
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	91	38	22	7	0	33	0	38	40	81	43	21	30	9	0	0	9	0	0		
Est. # of residents that are of Hispanic or Latino origin and identify as a minority race	0	1	0	16	0	0	0	0	4	0	184	3	9	0	0	0	0	0	0		
Est. # of households that are lower income (ALICE or below poverty level)	190	356	119	122	143	331	214	118	121	302	256	127	175	49							

Population Estimates (2019)	Antrim County Townships										Antrim County Villages									
	Banks	Central Lake	Chestonia	Custer	Echo	Elk Rapids	Forest Home	Helena	Jordan	Kearney	Mancelona	Milton	Star	Torch Lake	Warner	Bellaire	Central Lake	Elk Rapids	Ellsworth	Mancelona
Community Assets																				
Fire Stations	1 (shared with Village)	1 (shared with Village)				1 (shared with Village)		1		2	2	1	1	1 (shared with Twp.)	1	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	1 (shared with Twp.)	1
Police Dept.																				
EMS Service Coverage	Jordan Valley EMS Authority	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Contract with MMR	Township Ambulance Authority	Township Ambulance Authority	Jordan Valley EMS	Township Ambulance Authority	Contract with MMR	Township Ambulance Authority	Torch Lake Twp. EMS	Township Ambulance Authority	Township Ambulance Authority	Township Ambulance Authority	Contract with MMR	Jordan Valley EMS	Township Ambulance Authority	Township Ambulance Authority
Shelter Sites			1					2		1	3		1	2	2	2	2			3
Health Care Facilities (clinics)										1					1	2	3			2
Drought Vulnerability																				
Outdoor Recreation Lands	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tree Farms	2	1						1												
Commercial Agriculture Facilities	Fritske Orchards	King Orchards											Kitchen Farms							
Invasive Species Concerns																				
Areas mapped as locations of particular concern					X	X	X	X			X			X			X			
Public Health Emergency Vulnerabilities																				
Assisted Living Facility				2		1	1			2	2	1	1						1	2
Est. number of residents > age 65	348	586	103	292	192	859	621	400	167	530	659	684	209	494	45	235	197	574	50	140
Est. # of residents that are of a minority race (not Hispanic or Latino origin)	91	38	22	7	0	33	0	38	40	81	240	43	21	30	9					
Est. # of residents that are of Hispanic or Latino origin and identify as a minority race	0	1	0	16	0	0	0	0	4	0	4	184	3	9	0					
Est. # of households that are lower income (ALICE or below poverty level)	190	356	119	122	143	331	214	118	121	302	769	256	127	175	49					

VI. Goals and Objectives

The mission of the Antrim County Natural Hazards Mitigation Plan is to protect the health and safety of the public and property in the County which includes prevention of injury, loss of life, property damage, breakdown in vital services like transportation and infrastructure, economic slumps, maintain tourist base, and liability issues. This is done by taking action to permanently eliminate or reduce the long-term risks from natural hazards.

Specific goals and objectives have been established based upon the community's natural hazards analysis, as well as input from the Task Force participants and the public through meetings, request for comments on the draft plan, and the presentation of the plan to the Local Emergency Planning Team.

Goal 1: Increase local awareness and participation in natural hazards mitigation strategies

- Encourage cooperation and communication between planning and emergency management officials
 - Develop partnerships and procedures with adjoining county Emergency Managers to coordinate resources in the event of an emergency; for example, identifying long-term and short-term shelter sites for a large amount of displaced people (i.e., campgrounds, hotels, community centers, special event spaces).
- Encourage additional local governmental agencies to participate in the natural hazards mitigation process
- Encourage public and private organizations to participate, including organizations who advocate for individuals with functional or access needs (vulnerable populations)

Goal 2: Integrate natural hazards mitigation considerations into the community's comprehensive planning process

- Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures; and into the county's comprehensive master plan
- Update zoning ordinances to reflect building codes, shoreline protection rules, etc.
- Incorporate natural hazards mitigation into basic land use regulation mechanisms
- Improve hazard preparedness and mitigation through increased community education and promotion of public warning systems
- Strengthen the role of the Local Emergency Planning Committee in the land development process
- Integrate natural hazards mitigation into the capital improvement planning process so that public infrastructure does not lead to development in natural hazards areas
- Encourage county agencies to assess local roads, bridges, dams, and related transportation infrastructure for natural hazards vulnerability

Goal 3: Utilize available resources and apply for additional funding for natural hazards mitigation

- Provide a list of desired community mitigation measures to the State for possible future funding
- Encourage the application for project funding from diverse entities

Goal 4: Develop and complete natural hazards mitigation projects in a timely manner

- Encourage public and business involvement in natural hazards mitigation projects

VII. Mitigation Strategies and Priorities

Types of Mitigation Strategies

The mitigation planning regulations requires that each participating jurisdiction identify and analyze a comprehensive range of specific mitigation actions and projects to reduce the impacts of the hazards identified in the risk assessment. The emphasis is on the impacts or vulnerabilities identified in the risk assessment, not on the hazards themselves. The types of mitigation actions can be classified into the following types:

- Local Plans and Regulations
- Building and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Programs

Furthermore, a set of evaluation criteria was developed to determine which mitigation strategies were best suited to address the identified problems in Antrim County.

- The measure must be technically feasible.
- The measure must be financially feasible.
- The measure must be environmentally sound and not cause any permanent, significant environmental concerns.
- The measure must be acceptable to those participating in the strategy and/or primarily affected by the strategy.

By anticipating future problems, the County can reduce potential injury, structure losses, loss of utility services such as electric and internet connectivity, and prevent wasteful public and private expenditures. The County Infrastructure, Vulnerability, and Hazard Maps in Appendix A can assist with the determining future problem areas.

Emergency Warning System Coverage

Integrated Public Alert & Warning System (IPAWS): FEMA's national system for local alerting that provides authenticated emergency and life-saving information to the public through mobile phones using Wireless Emergency Alerts, to radio and television via the Emergency Alert System, and on the National Oceanic and Atmospheric Administration's Weather Radio.

Mobile warning system: Antrim County uses the *Rave* Emergency Communications Network, which is an electronic high-speed outbound notification service available to the general public. The system notifies a participant via their mobile or land-line phone. The National Weather Service may concurrently utilize their mobile warning notification system when deemed necessary in severe weather event situations to send phone notifications to all users within signal of a cellular tower.

Radio warning system: Antrim County uses radio channels 580 AM and 103.5 FM for emergency weather alerts.

Tornado/Severe Weather Systems: The mobile warning systems indicated previously are primarily used in the event of a potential or current severe weather event. An operable tornado siren is located in the Village of Mancelona.

Flood warning system: For dam failures/flooding downstream an active warning system is pre-determined utilizing geographic boundary information and the *Rave* Emergency Communications Network and IPAWS alerts.

The Antrim County Emergency Management Department maintains contracts with the following local fire stations in the county so that they may be utilized as temporary shelters in the event of an emergency: Torch Lake Township, Central Lake Township, Mancelona Township, Elk Rapids Township, South Torch Lake Fire District and Milton Township. Additionally, the two Antrim County Senior Centers in Mancelona and Bellaire, as well as local libraries (in the communities of Central Lake, Bellaire, Elk Rapids, Mancelona, Alden, and Chestonia Township) can be utilized during regular hours as temporary shelters. Addresses for these sites are provided in Table 36.

The American Red Cross can also set up temporary shelters within 12-24 hours after an emergency event occurs; usually this is done within an existing structure. These locations include various 21 church and municipal buildings located throughout the County.

Table 36: Temporary Shelter Locations in Antrim County

LOCATION	ADDRESS
Central Lake Fire	1924 S. Main St., Central Lake, MI 49622
Elk Rapids Fire	209 N. Bridge Elk Rapids, MI 49629
Mancelona Township Fire	8665 Cedar River Rd, Mancelona, MI 49659
Mancelona Fire #2	8062 Pineview Dr. Mancelona, MI 49659
Milton Township Fire	7015 Cairn Hwy., Kewadin, MI 49648
Milton Township Fire #2	12105 Cherry Ave., Rapid City, MI 49676
South Torch Lake Fire	8765 Helena Rd, Alden, MI 49612
Torch Lake Township Fire	2355 N US 31 Eastport, MI 49627
Area Seniors Inc., Community Center	102 Maple St, Bellaire, MI 49615
Antrim County Senior Center	122 E State St, Mancelona, MI 49659
Alden District Library/ Helena Township Community Center	8751 Helena Rd, Alden, MI 49612
Bellaire Public Library	111 S Bridge St, Bellaire, MI 49615
Central Lake District Library	7900 Maple St, Central Lake, MI 49622
Chestonia Township Library	3995 2nd St, Alba, MI 49611
Elk Rapids District Library	300 Isle of Pines Dr., Elk Rapids, MI 49629
Mancelona Township Library	202 W State St, Mancelona, MI 49659
Grand Traverse Band of Ottawa and Chippewa Indians (tornado shelter for tribal residents)	11832 Wiingash Mi-kun, Rapid City, MI 49676 (Milton Township)

Source: Antrim County Department of Emergency Management

Mitigation Strategies and Implementation

Strategies were developed based on discussions with local officials and a review of FEMA best practices for hazard mitigation. A list of alternative strategies considered is included as Appendix D. The strategies table is grouped according to purpose. Purpose types include: Awareness & Preparation, Shelters, Buildings & Infrastructure, Utilities & Technology, and Environment & Natural Resources. The table also includes: a description of each strategy; what natural hazards they address; where the strategy applies; who is responsible for implementing the strategy; how the strategy will be implemented (what resources are available to help execute the strategy); when the strategy could feasibly begin; the level of priority; and what type of strategy it is. Strategies are intended to be action items completed during the 5-year timeframe in which the plan is active. Some strategies may extend beyond the 5-year timeframe due to feasibility or level of difficulty.

Appendix C provides a review of mitigation strategies included in the 2016 plan, their current status, and how they have or have not been incorporated into the 2023 plan. The assigned priority levels for the 2016 strategies are also compared to what the 2023 plan has assigned for them. The 2015 plan simply identified the top five most significant priority areas by geography and vulnerability to specific types of hazards. The general rationale used to determine the priority levels of strategies in the 2023 plan differs greatly, as hazards are not prioritized based on geography, and is described on page 103. The rationale for prioritizing each individual strategy is presented in a column in the Strategies Table.

Resources to Assist with Implementing the Strategies

To assist with the funding of the proposed natural hazards mitigation strategies, a “Resources Table” of potential financial assistance entities and programs to help fund the implementation projects of the Plan is provided. Other organizational resources are also provided to assist with education, outreach, and capacity efforts. Each potential resource is assigned a letter code, and the appropriate letters are listed in the “Resources” column of the Strategies Table.

Resources Table for Antrim County HM Strategies

ID	Resource	Description	Hazard Type	Website
A	Antrim County Government	Antrim County staff and funding sources as appropriate	All hazards	https://www.antrimcounty.org/
B	Local Governments	All local units of government - employees, elected and appointed officials - and local funding sources as appropriate	All hazards	
C	Local Emergency Services and Fire Departments	MDNR Field Office (Bellaire); Banks Twp. Fire (Ellsworth station), Bellaire Fire, Central Lake Fire, East Jordan Fire, Elk Rapids Fire, Elmira/Warner Fire (Elmira station), Mancelona Fire (2 stations), Milton Twp. Fire (Kewadin and Radio City stations), South Torch Fire (Alden station), Star Twp. Fire (Alba station), Torch Lake Fire (Eastport station)	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Wildfire; Flooding; Extreme Temperatures; Public Health Emergency	
D	Antrim County Commission on Aging	The Antrim County Commission on Aging helps seniors and their families by answering questions, finding specific products and services, and by providing guidance on how to access a variety of programs and agencies available to residents of our County. Services include: Home-Delivered Meals ☐ Congregate Meals ☐ Dining Out Program ☐ Senior Project Fresh ☐ Personal Care ☐ Respite Care ☐ Homemaker Program ☐ Snow Removal Program ☐ Medical Transportation ☐ Flu Immunizations ☐ Medicare/Medicaid Assistance Program ☐ Volunteer Opportunities ☐ Loan Closet for Durable Medical Equipment ☐ Tax Assistance ☐ Monthly Newsletter ☐ Project Lifesaver ☐ Information & Assistance ☐ Assistance w/Unmet Needs	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency	https://www.antrimcounty.org/departments_services/commission_on_aging/index.php
E	Health Department of Northwest Michigan (HDNW)	Provide programs and services such as: immunizations; community clinics; school health services; permitting processes for proper location and installation of water wells and septic systems; education about cleaning, monitoring and maintaining septic systems; septic or well repair financial assistance, and the inspection and licensing of food service establishments.	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency	https://www.nwhealth.org/
F	Northern Michigan Community Action Association (NMCAA)	Weatherization Assistance Program and Emergency Home Repair Program for low- to moderate- income households. Provides food distribution via the following USDA programs: monthly food package to low-income senior citizens via the Commodity Supplemental Food Program (CSFP), and The Emergency Food Assistance Program (TEFAP) to low-income persons through a quarterly distribution.	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency	https://www.nmcaa.net
G	"MI HOPE" Grants (Michigan Housing Opportunities Promoting Energy Efficiency)	Program for up to \$25K to repair or replace roofs, doors, windows, insulation, heating/cooling systems, water heaters, security lighting, Energy Star appliances and electrical systems for eligible low-income residents.	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency	www.michigan.gov/mi-hope
H	Otsego-Antrim Habitat for Humanity	<i>Critical Home Repair and Aging in Place</i> Programs. Habitat selects partner families based on income, need and willingness to partner. They also help elderly persons preserve their independence by providing critical repairs to their house so they can safely stay in their home longer than they might have been able to without the repairs. Habitat affiliates use volunteer labor and donated materials to keep their costs low and take no profit for their services.	Flooding, Thunderstorms, Hail, High Winds, Severe Winter Weather, Lightning, Extreme Temperatures, Public Health Emergency	https://www.otsegoantrimhabitat.org/critical-home-repairs
I	Grand Traverse Regional Community Foundation	GTRCF supports a variety of community need areas, including youth, arts and culture, education, environment, and health and human services. We do this by promoting giving, engaging in collaborative leadership, supporting nonprofit organizations through meaningful grants and local students through scholarships, and building endowments that make a lasting impact for generations to come. Service area includes Antrim, Benzie, Grand Traverse, Kalkaska, and Leelanau Counties.	Invasive Species, Flooding, Extreme Temperatures, Public Health Emergency	https://www.gtrcf.org/
J	Groundwork Center for Resilient Communities	With roots firmly embedded in the pro-health, pro-environment, and pro-economy principles of a local food system, the Groundwork Food and Farming team creates markets for local farmers, and helps connect locally grown food to school children, food pantry clients and families across the state.	Public Health Emergency	https://www.groundworkcenter.org/food-farming/
K	Midwest Agriculture Climate Team	MAC-T members are Extension specialists and state climatologists from many of the states represented in the Midwest Climate Hub, and NOAA NWS climate and weather specialists. The goal of this team is to share expertise regionally, discuss impacts and opportunities as it relates to agriculture and outlooks, and maintain an open line of communication so when weather/climate events do occur, the Midwest agriculture community is set to respond. The team meets monthly during the growing season regularly, and as needed during the winter season.	Drought, Extreme Temperatures, Flooding, Severe Winter Weather, High Winds, Hail	https://www.climatehubs.usda.gov/hubs/midwest/topic/midwest-agriculture-climate-team-mac-t
L	NWS Climate Prediction Center	The U.S. Drought Monitor is a map released every Thursday, showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3) and exceptional (D4).	Drought	https://www.cpc.ncep.noaa.gov/products/Drought/
M	National Fire Protection Association Firewise USA Program	Firewise USA Program: Each applicant must create a board/committee, complete a community wildfire risk assessment with a 3-year action plan to reduce ignition risk to homes, and complete annual educational and risk reduction actions identified in the plan.	Wildfire, Drought	https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA
N	NFPA Community Wildfire Defense Grants	Communities can use these grants from the USFS in a variety of ways to reduce the wildfire risk to people and property. One key use is capacity building for wildfire mitigation. For example, communities can use the grants to support the implementation and enforcement of wildfire-related codes and standards; to train people to assess wildfire risk and implement effective mitigation measures; and to perform outreach to community members through programs like Firewise USA®. Communities that build these fundamentals—sound land use and building practices, a skilled workforce, and an educated public—will be better prepared for sustained and effective risk reduction and better equipped to take advantage of future federal grants that prioritize communities with codes in place.	Wildfire, Drought	https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire
O	Consumer's Energy Utility Services	Consumers Energy provides electrical and natural gas utility services. Energy through renewable energy sources is available. A power outage map is available to track outage locations.	All hazards.	https://www.consumersenergy.com/outagemap
P	Great Lakes Energy Utility Services	GLE provides electric and high-speed fiber internet and voice services. GLE provides an online power outage map to track outage locations. Also, Trustream's Status Map indicates where fiber internet is available or is being explored in the region.	All hazards.	https://www.gtlakes.com/power-outages/ https://www.trustreamfiber.com/status-map/
Q	Connected Nation Michigan	Connected Nation develops and provides the tools, resources, and methods that help states and communities create and implement solutions to their broadband and digital technology gaps. They assess and plan for the expansion of broadband access, adoption, and use. They empower people with technology skills and resources to improve their quality of life, and we develop public-private partnerships to bring technology access to targeted geographies and population.	All hazards.	https://connectednation.org/michigan/
R	Great Lakes Shoreviewer Tool	View aerial imagery of Lake MI shoreline and associated risk levels for coastline, infrastructure/roads, and buildings.	Shoreline flooding and erosion	http://www.greatlakesshoreviewer.org/
S	Northwest Lower MI Coastal Resilience Atlas	Mapped coastal flooding and coastal erosion based on three future climate scenarios for communities adjoining Lake MI; areas of the shoreline population, by census tract, that are most vulnerable to extreme heat events.	Shoreline flooding and erosion, Extreme Heat	http://www.resilientmichigan.org/nw_atlas.asp
T	State-designated High Risk Erosion Areas: programs and maps	High risk erosion areas are those shorelands of the Great Lakes where recession of the landward edge of active erosion has been occurring at a long-term average rate of one foot or more per year, over a minimum period of 15 years.	Shoreline erosion	https://www.michigan.gov/egle/about/organization/water-resources/shoreland-management/high-risk-erosion-areas
U	State-designated Critical Dune Areas	Michigan's critical dune program protects the dune resource using alternative construction techniques to reduce the impacts of development on dunes and protects dune vegetation essential to dune preservation and stability. Earthmoving, vegetation removal, and construction activities within a critical dune area are regulated through a permit program.	Shoreline erosion	https://Michigan.gov/CriticalDunes
V	Michigan EGLE's Coastal Zone Management Program	A plethora of resources to improve coastal and climate resiliency through both planning and best management projects.	Shoreline flooding and erosion	https://www.michigan.gov/egle/about/organization/water-resources/coastal-management
W	Resilient Lakeshore Heritage Program	This grant program is administered by the Michigan State Historic Preservation Office. Funding for the program is provided by the Paul Bruhn Historic Revitalization Grant from the National Park Service to support the preservation of historic buildings in rural communities located along the Great Lakes statewide.	Shoreline flooding and erosion	
X	Great Lakes Water Safety Consortium	A nonprofit community of BEST practice, connecting and serving safety experts & water enthusiasts, educating the public on safer ways to enjoy the water, and encouraging leaders to take bold action to make their shoreline safer for residents and visitors.	Coastal Hazards - rip currents	https://www.greatlakeswatersafety.org/
Y	EGLE's Wetlands Map Viewer	The WMV application was created for the Department of Environment, Great Lakes, and Energy to provide the public with quick and easy access to wetland spatial data.	Flooding, Drought, Extreme Temperatures	https://www.mcqMap.html https://www.egle.state.mi.us/data/miner/
Z	EGLE's Michigan Oil, and Gas and Minerals Division Data Explorer	Interactive mapping tool to search for oil and gas well facilities and associated records throughout Michigan; list of oil and gas well types and status codes.	Flooding, Lightning, Tornado, Severe Winter Weather, High Winds	https://www.michigan.gov/egle/about/organization/oil-gas-and-minerals/oil-and-gas/oil-and-gas-well-type-and-status

ID	Resource	Description	Hazard Type	Website
AA	Antrim County Government	Antrim County staff and funding sources as appropriate	All hazards	https://www.antrimcounty.org/
BB	FEMA Flood Mitigation Assistance (FMA) Grant Program	FMA is a non-disaster, competitive grant program that provides funding to states, local communities, federally recognized tribes. Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program. • \$800 million available in funding for FY22 • Application Period: September 30, 2022, to January 27, 2023 • Period of Performance: 3 Years • Cost-share: 25% non-federal • Severe Repetitive Loss (up to 100% federal) • Repetitive Loss (up to 90% federal) • Priorities are set each fiscal year	Inland and coastal flooding	https://www.fema.gov/grants/mitigation/floods
CC	FEMA Building Resilient Infrastructure and Communities (BRIC) Grant Program	BRIC is a non-disaster grant program, which provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. Funding has doubled for BRIC to \$2.295 billion for FY21. • Caps: States/Territories Allocation and Activities: \$2 million; Tribal set-aside: \$2 million; National Competition: \$2.133 billion • Application Period: September 30, 2022 to January 27, 2023 • Period of Performance: 3 year from start date on Recipient's federal award • Cost-share: 25% non-federal • Economically disadvantaged rural communities are eligible for 10% non-federal • Priorities are set each fiscal year	All hazards	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
DD	FEMA Hazard Mitigation Grant Program (HMGP)	HMGP is a post-disaster grant program, where funding is only made available under a Presidential major disaster declaration, in the areas of the State requested by the Governor. Federally-recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas.	All hazards	https://www.fema.gov/grants/mitigation/hazard-mitigation
EE	HMGP Post-Fire Assistance (PFA) grant program	This grant funds projects that make a community more resilient after a designated wildfire disaster. States and federally-recognized tribes affected by fires resulting in a Fire Management Assistance Grant (FMAG) declaration on or after October 5, 2018, are eligible to apply.	Wildfire, Drought	https://www.fema.gov/grants/mitigation/post-fire
FF	State of MI: Resources and Best Practices to prevent and manage invasive species	Prevention tips and action steps to control or remove invasive species.	Invasive Species	https://www.michigan.gov/invasives/take-action
GG	EGLE's "NotMISpecies" webinar series	This webinar series explores how agencies, universities and locally led organizations are working together to protect Michigan's natural resources through the Michigan Invasive Species Program. If you are concerned about the impacts of invasive species or interested in the techniques used to control them, join us as we examine species-specific actions, innovations in research and technology, and programs designed to help communities prevent and manage harmful invasive species.	Invasive Species	https://www.michigan.gov/invasives/take-action
HH	Michigan Invasive Species Grant Program	The Departments of Natural Resources, Environmental Quality and Agriculture and Rural Development work together to address strategic issues of prevention, detection, eradication, and control for both terrestrial and aquatic invasive species in Michigan. This program is designed to address strategic issues of prevention, detection, eradication and control for both terrestrial invasive species (TIS) and aquatic invasive species (AIS) in Michigan.	Invasive Species	www.michigan.gov/invasives/grants/misgp
II	Clean Boats, Clean Waters Program	Funding from the Michigan Department of Environment, Great Lakes, and Energy and the Great Lakes Restoration Initiative has enabled Clean Boats, Clean Waters to grow into a comprehensive aquatic invasive species boater outreach program. The program's mission: to prevent new aquatic invasive species introductions and limit their dispersal from water recreation activities through outreach and engagement. The program promotes understanding of boat cleaning practices and regulations through the distribution of educational materials, an online resource library, boat washing demonstrations, grants and partnerships.	Invasive Species	www.canr.msu.edu/clean_boats_clean_waters/index
JJ	Michigan State University Extension (MSUE)	Resources available for: training elected and appointed officials, agriculture and food support programs, and natural resources protections.	Inland flooding, shoreline erosion; Invasive Species; Public Health Emergency	https://www.canr.msu.edu/outreach/
KK	MSUE's Michigan Inland Lakes Partnership	The purpose of the Michigan Inland Lakes Partnership (Partnership) is to engage state and local agencies, Native American Nations, outreach institutions (universities and other educational institutions), non-governmental organizations (NGOs), businesses, industries and citizens in a collaborative effort to ensure the quality, sustainability and ecological diversity of lakes, while considering society's needs. The Partnership will promote communication and cooperation between partners, communities and citizens interested in the management of Michigan's inland lakes, educating leaders, and strengthening stewardship efforts.	Inland flooding, shoreline erosion; Invasive Species	https://www.canr.msu.edu/michiganlakes/convention/
LL	USDA Natural Resources Conservation Service (NRCS)	The NRCS helps America's farmers, ranchers, and landowners conserve our nation's resources through voluntary programs and science-based solutions. NRCS also provides some funding for treatment of the invasive plant species Autumn Olive - Contact person: Monica Caster, District Conservationist with NRCS Bellaire Service Center for Antrim & Kalkaska Counties, 106 Depot Street, Bellaire, MI 49615, 231-533-6450 ext. 3	Drought; Extreme Temperatures; Invasive Species; Public Health Emergency	https://www.nrcs.usda.gov/
MM	Antrim Conservation District	Our mission is to promote the exploration and conservation of Antrim County's natural resources. Our current programs include forestry, water quality and soil erosion, invasive species, and recycling/household hazardous waste. Our partners include: Michigan Agriculture Environmental Assurance Program (MAEAP), CAKE-CISMA, USDA-NRCS, MI On-Farm Produce Safety program, and several local recreation advocacy groups.	Flooding, shoreline erosion; Invasive Species; wildfire, drought	https://www.antrimcd.com/
NN	Charlevoix-Antrim-Kalkaska-Emmet Cooperative Invasive Species Management Area	CAKE-CISMA was established in 2015 as a joint effort between local conservation districts and various non-profits. Their mission is to protect the natural resources, economy, and human health of Northern Lower Michigan through collaborative outreach and management of invasive species. They host educational events at schools, conduct invasive species treatment days with local non-profits, and treat high priority invasive species throughout the 4 county area. Most often they work with terrestrial invasive species, but occasionally work with aquatic invasive species as well. A particular funding source they are looking into is the NRCS' Environmental Quality Incentives Program (EQUIP) grant to fund workshops for landowners about Autumn Olive management options.	Invasive Species	https://www.cakecisma.org/
OO	The Watershed Center Grand Traverse Bay	Advocates for clean water in Grand Traverse Bay and acts to protect and preserve the bay's watershed.	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency	https://gtbay.org/
PP	Tip of the Mitt Watershed Council	Dedicated to protecting lakes, streams, wetlands, and groundwater resources of Antrim, Charlevoix, Cheboygan and Emmet Counties through respected advocacy, innovative education, technically sound water quality monitoring, thorough research, and restoration actions. The Watershed Council speaks for our members, including full-time and seasonal residents, lake associations, and businesses. We work to maintain the environmental integrity and economic and aesthetic values of the Great Lakes, inland lakes, rivers and streams, wetlands, and groundwater.	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency	https://www.watershedcouncil.org/
QQ	Elk River Chain of Lakes - Watershed Plan Implementation Team	ERCOL-WPIT was formed in 2011 to implement activities pertaining to the Elk River Chain of Lakes in the Grand Traverse Bay Watershed Protection Plan. Organized by The Watershed Center and Tip of the Mitt Watershed Council, ERCOL-WPIT engages lake associations, local governments, area nonprofits, and interested citizens in collaborative efforts to protect and preserve water quality throughout the entire watershed.	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency	https://gtbay.org/elk-river-chain-of-lakes-watershed-implementation-team/

ID	Resource	Description	Hazard Type	Website
RR	Torch Lake Protection Alliance	Encourages members to be good neighbors within their communities by keeping informed and acting when necessary to prevent activities harmful to Torch Lake. Promotes policies that are beneficial to Torch Lake. Places a priority on issues relevant to the protection of Torch Lake. Commissions academic and scientific research to understand and ensure the health of the lake. Consults and retains counsel to address erroneous behavior that compromises lake quality and safety.	Flooding, Invasive Species, Public Health Emergency, Drought	https://tlpa.co/
SS	Three Lakes Association	The mission of the Three Lakes Association is to provide leadership to preserve, protect, and improve the environmental quality of the Elk River Chain of Lakes Watershed for all generations with emphasis on Lake Bellaire, Clam Lake, Torch Lake and their tributaries. From monitoring water quality to actively engaging with our local and state governments to providing grants for local science education in our schools, TLA has worked to insure that our lakes will remain the wonderful natural resource that we all love and enjoy.	Flooding, Invasive Species, Public Health Emergency, Drought	https://www.3lakes.com/
TT	Intermediate Lake Association	Dedicated to protecting and improving the water quality and wildlife habitat on Intermediate Lake.	Flooding, Invasive Species, Public Health Emergency, Drought	http://intermediatelake.org/home.htm
UU	Elk-Skegemog Lakes Association	ESLA's focus is in protecting the environment, monitoring development, tracking water quality and following trends in boating, fishing, and other uses of our lakes. ESLA has worked closely with other environmental organizations to sustain high water quality, responsible shoreline development, and safe recreational use.	Flooding, Invasive Species, Public Health Emergency, Drought	https://www.elk-skegemog.org/
VV	Grand Traverse Regional Land Conservancy	GTRLC's service area includes Antrim, Benzie, Grand Traverse, Kalkaska and Manistee Counties. Land conservation efforts are focused on protecting crucial wildlife habitat and corridors, critical watersheds, unique high-quality farm lands, valuable forestland and ecologically significant dunes along Lake Michigan's beautiful and endangered shore.	Flooding, Invasive Species, Coastal Hazards, Public Health Emergency, Drought, Extreme Heat	https://www.gtrlc.org/
WW	Conservation Resource Alliance	Create a special county construction code to address updated wind loads on one and two-family structure types.	Flooding & Erosion; Invasive Species; Drought; Extreme Heat; Public Health Emergency	https://www.rivercare.org/
XX	Great Lakes Stream Crossing Inventory	Previously, individual inventories were conducted by partnership agencies, watershed organizations, and road agencies but were not readily accessible to stakeholders and did not contain comparable information. The newly developed protocol and datasheet are intended to promote consistent data collection, selection criteria for improvement projects, and selection of appropriate Best Management Practices for each project to benefit all stakeholders. Information gathered on the datasheet can and has been used to prioritize structure replacement and successfully seek funding.	Flooding & Erosion	https://great-lakes-stream-crossing-inventory-michigan.hub.arcgis.com/

The Antrim County Emergency Manager and Task Force considered factors like level of need, economic impact, ease of execution/level of effort, cost, and range of benefit (short term, long-term, small group/area, large group/area) when determining the level of priority for each strategy. In general, strategies were given either a high, medium, or low priority level based on the following rationale:

- Strategies that addressed a community need and provided a direct benefit to the community were prioritized as "high" priority strategies.
- Strategies that provided a direct benefit to property and natural resources were also categorized as either "high" or "medium" priority strategies.
- Strategies with minimal direct benefit to the community or natural resources were marked as "low priority". The cost of the strategy was considered, but not above the strategy's potential benefit to the community.

Specific details informing each strategy's prioritization is provided in the "rationale" column of the strategies table.

PRIORITY LEVEL

HIGH
MEDIUM
LOW

The key for the strategy types in the far right columns of the strategies table are as follows:

STRATEGY TYPES

1	Local Planning & Regulations
2	Building & Infrastructure Projects
3	Natural Systems Protection
4	Education & Awareness Efforts

	ANTRIM COUNTY HAZARD MITIGATION STRATEGIES	HAZARD TYPE										WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in BOLD)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY LEVEL	RATIONALE FOR PRIORITY LEVEL	STRATEGY TYPE			
		Extreme Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, seiche)	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency	1							2	3	4	
Awareness and Preparation	1	Incorporate the County Hazard Mitigation Plan's strategies into elements of County and local master plans.	X	X	X	X	X	X	X	X	X	Countywide	Antrim County Planning Commission; Villages of Bellaire, Central Lake, Elk Rapids, Ellsworth, and Mancelona; Townships of Banks, Elk Rapids, Forest Home, Helena, Kearney, Milton, and Torch Lake.	A, B	Ongoing	High	Mitigation strategies allow for the community to be proactive; incorporating them into local and county Master Plans increases the likelihood of implementation with the overall purpose of protecting life and property from impacts from natural hazards.	X	X	X	X
	2	Continue to pursue interdepartmental cooperation and coordination of police, fire, rescue and EMS services to achieve community-wide coverage availability.	X	X	X	X	X	X	X	X	X	Countywide	County Sheriff, all Village Police Departments; local fire/EMS	A, B, C	Ongoing	High	Dwindling volunteer first responders requires cooperation and coordination.	X			
	3	Continue and strengthen partnerships with local government agencies, businesses and non-profits to provide public education on hazard scenario preparedness and prevention.	X	X	X	X	X	X	X	X	X							X	X	X	X
	3a	Continue to inform the public about emergency events and shelter sites via utilization and promotion of the Rave mass notification system, NWS weather radios (as a good backup plan) and website/social media.	X	X	X	X	X	X	X	X	X	Countywide	County EM	A, B, C	Ongoing	High	With seasonal population growth and lack of other types of warning systems, RAVE is key.				X
	3b	Continue the preparedness practice of conducting the annual statewide tornado drill.		X								Countywide	County EM	A, B, C	Annually	High	Enhances public safety.	X			X
	3c	Continue to promote participation in Storm Spotter Training via partnership with the NWS.		X								Countywide	County EM	A, B, C	Annually	Medium	Building a strong Skywarn team is essential to early warning.				X
	3d	Provide public education regarding structural modifications (such as foundation anchoring and tie downs for older mobile homes) and tree management practices to reduce risk of damage from high winds.		X								Countywide	Antrim County Building Dept.	A, B, F, G, H, I	Ongoing	Low	Limited number of older trailers remain.		X		X
	3e	Ensure that communities have a good snow removal plan and share this with the Antrim County Road Commission (ACRC)	X									Villages of Bellaire, Ellsworth, Central Lake, Elk Rapids, and Mancelona	Villages of Bellaire, Ellsworth, Central Lake, Elk Rapids, and Mancelona	A, B, C	Annually	Low	The sharing of information is critical to preparedness.	X			X
	3f	Increase public education efforts regarding natural resilient shoreline preservation strategies to protect against beach erosion and coastal flooding.			X	X						Communities in the ERCOL watershed and/or adjoining Lake Michigan (Townships of Echo, Kearney, Custer, Banks, Central Lake, Forest Home, Helena, Milton, Elk Rapids, Torch Lake and the villages within them); particularly areas with "Special Flood Hazard Areas" on FIRMS	ACD, TOMWC, The Watershed Center Grand Traverse Bay, lake associations/ improvement boards	A, B, R - W, JJ, KK, MM - WW	Ongoing	Low	Erosion prevention is key to shoreline preservation.			X	X
	3g	Utilize resources offered by the Great Lakes Water Safety Consortium to increase beach safety awareness and incident prevention at public beaches along Lake Michigan.				X						Townships of Banks, Torch Lake, Milton, and Elk Rapids; Village of Elk Rapids	Townships of Banks, Torch Lake, Milton, and Elk Rapids; Village of Elk Rapids; County EM.	X	Ongoing	Medium	Most of our public beach visitors are tourists so safety briefs are essential.				X
	3h	Promote (via social media, etc.) awareness of vegetation/fuel management for fire prevention around homes and other structures.			X							Countywide	County EM, County Building Dept., Local Fire Depts./First Responders, MDNR	M, N	Ongoing	Low	Limited volunteer first responders require personal safety responsibility.				X
	4	Continue operation of the local tornado siren in the Village of Mancelona.		X								Village of Mancelona	Village of Mancelona DPW, Fire	B, C	Ongoing	Medium	Early warning is the key to preparedness.				X
	5	Investigate the cost and feasibility of installing new tornado sirens in the Villages of Bellaire, Central Lake, Elk Rapids and Ellsworth.		X								Villages of Bellaire, Central Lake, Elk Rapids and Ellsworth	County EM; Villages of Bellaire, Central Lake, Elk Rapids and Ellsworth	A, B	2 Years	High	While countywide sirens are cost prohibitive, replacing the retired sirens in our villages will provide early warning to a high percentage of our population.		X		X

	ANTRIM COUNTY HAZARD MITIGATION STRATEGIES	HAZARD TYPE										WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in BOLD)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY LEVEL	RATIONALE FOR PRIORITY LEVEL	STRATEGY TYPE							
		Extreme Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, seiche)	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency	1							2	3	4					
Awareness and Preparation	6	Evaluate additional designated sites to temporarily store cleanup debris from downed trees after storm events.	X	X		X									Countywide	Community DPWs, ACRC, County EM	A, B, O, P	Ongoing	Low	A current debris plan is in place. It has not been utilized since 2015. Regular review is important	X				
	7	Improve emergency communication with the public by issuing road closure notifications and snow plowing updates via emergency alert systems, County EM social media, and the county website.	X	X	X	X		X	X	X					Countywide	County EM, ACRC, MSP, County Sheriff, local governments	A	Ongoing	High	Promotion and use of all alerting types is important.					X
	8	Continue to offer the Antrim County Commission on Aging's snow plowing services to seniors through their "Home Chore" program; the "telephone reassurance" call service to check on homebound seniors; and the snowmobile club's "rescue service".	X	X	X	X		X					X		Countywide	Antrim County Commission on Aging	D	Ongoing	High	This services assists a large segment of our aging population.	X				
	9	Ensure that County residents, particularly vulnerable populations, have access to healthy, affordable food options.							X	X	X				Countywide	County EM, NMCAA, local food pantries, school districts, local communities		Ongoing	High	Antrim County has a high population of those that fit the low to moderate income definition.	X	X	X	X	
	9a	Create community gardens in hamlets, villages, and/or school locations to promote learning about growing local food, native pollinating plants, and provide access to fresh produce.	X	X	X	X			X	X	X				Villages of Bellaire, Ellsworth, Central Lake, Elk Rapids, and Mancelona; Hamlets of Alba, Alden, and Kewadin	Local governments, local schools, churches, senior living facilities, parks	D, I, J, JJ	1 year	Low	This expands the MSU Extension Service programs.		X	X	X	X
	9b	Continue to provide and improve food assistance programs and emergency food programs to help communities prepare for unanticipated pandemics, but also increase year-round food accessibility.	X	X	X	X							X		Countywide	NMCAA; local food pantries; School Districts (school meal programs)	State grant funds; F, I, J	Ongoing	High	Continue to grow the structure created by the Star Township Fire Dept. - offer emergency programs through our fire depts.	X				
	9c	Food rescue programs, involving public/private partnerships between restaurants, hotels and other venues of large food production, can partner with local food pantries to make good food more widely available.	X	X	X	X							X		Countywide	NMCAA; local food pantries; School Districts (school meal programs)	F, I	3 years	Low	Need to expand the volunteer base to add this program.	X				X
	10	Continue programs and services offered by the Health Department of NW MI and/or MDHHS, such as: immunizations; community clinics; school health services; permitting processes for proper location and installation of water wells and septic systems; education about cleaning, monitoring and maintaining septic systems; septic or well repair financial assistance, and the inspection and licensing of food service establishments				X							X		Countywide	HDNW MI; MDHHS	E, MDHHS	Ongoing	High	Our limited health care options require a keen partnership with the Health Department.	X	X	X	X	
	11	Continue to coordinate with the MDHHS for guidance via their State Pandemic Plan and information about new or emerging disease threats.											X		Countywide	HDNW MI; MDHHS; County EM; Meadow Brook MCF	A-E, MDHHS	Ongoing	Medium	Having MDHHS located in the county building allows for this great partnership.	X				X
	12	Maintain proper levels of PPE for healthcare workers and first responders, with additional supplies for long-term care facilities.											X		Countywide; Local fire stations and EMS services.	County EM; local fire/EMS; Meadow Brook MCF	A, C	Ongoing	High	We have found that our pre-pandemic ordering of bi-weekly ordering of PPE was not appropriate. The EOC now assists all first responders with surplus.	X				
	13	Continue to develop Emergency Action Plans through the Antrim County Dept. of Emergency Services as needed for large public events.	X	X	X	X	X	X					X		Countywide	County EM	A, B, C	Ongoing/ As needed	High	A requirement of local emergency management services.	X				
	14	Prepare emergency evacuation plans for potential flooding events and coordinate with surrounding communities				X									Communities in the ERCOL watershed and/or adjoining Lake Michigan (Townships of Echo, Kearney, Custer, Banks, Central Lake, Forest Home, Helena, Milton, Elk Rapids, Torch Lake and the villages within them); particularly areas with "Special Flood Hazard Areas" on FIRMS	County EM, local governments	A, B, C, R - W, AA, BB	2 Years	High	High rains and the recent hydrology and hydraulic modeling studies show this as a priority.	X				

	ANTRIM COUNTY HAZARD MITIGATION STRATEGIES	HAZARD TYPE										WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in BOLD)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY LEVEL	RATIONALE FOR PRIORITY LEVEL	STRATEGY TYPE				
		Extreme Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, seiche)	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency	1							2	3	4		
Awareness and Preparation	14a	Stay informed about the current condition and future plans (such as repair or removal) of the Rugg Pond Dam in adjoining Kalkaska County.				X							Milton Township, Helena Township	County EM, Milton and Helena Townships	A, B	Ongoing	Medium	Failure of the Rugg Pond Dam would impact the ability to navigate the Torch River and Rapid River, and impact land in Helena and Milton Townships.	X	X		
	15	Review and adopt FEMA's revised FIRM Maps, which should include findings from the 2022 ERCOL hydrology study, that identify flood hazard areas.				X							Townships of Banks, Torch Lake, Milton and Elk Rapids; Village of Elk Rapids	Local Governments, County EM, Drain Commissioner, MI EGLE	A, B, AA, EGLE	2 years	Medium	The new models will bring new flood maps to the county in 2025.	X			X
	16	Identify flood-prone areas and areas that have reported repetitive loss damages due to flooding on FIRMs and pursue FEMA hazard mitigation assistance grants related to flood mitigation, such as innovative stormwater management solutions, property acquisition, structure demolition or relocation, dry flood proofing, structure elevation, or project scoping (engineering, environmental, feasibility, and/or benefit-cost analysis)				X							Townships of Banks, Torch Lake, Milton and Elk Rapids; Village of Elk Rapids	Drain Commissioner, EM, MI EGLE	A, B, AA - DD	2 years	Medium	The new models will bring new flood maps to the county in 2025. This formalize the identification of the areas.	X	X	X	X
	17	Provide outreach to all communities in the County that contain areas that have been affected by flooding events, but do not participate in the NFIP, explaining the benefits of participation.				X							Townships of Central Lake, Forest Home, Helena, Custer, Kearney and Echo; Villages of Bellaire, Central Lake and Ellsworth	Drain Commissioner, EM, MI EGLE	A, B, AA, EGLE	2 Years	Low	The proper time for outreach is after the adoption of the new maps.	X			X
	18	Reference LIAA's NW MI Coastal Resilience Atlas Ch. 5 for maps of areas along the Lake MI shoreline where vulnerable populations are most at risk from extreme heat events. Share with the Antrim COA, local charities/non-profits, emergency responders and local governments.				X							Townships of Banks, Torch Lake, Milton, and Elk Rapids; Village of Elk Rapids	Townships of Banks, Torch Lake, Milton, and Elk Rapids; Village of Elk Rapids	A, B, C, D, S	4 years	Low	Excessive high temperatures are rare in Antrim. The locations for cooling shelters will be tied to warming shelters.	X			X
	19	Consider developing a drought communication plan and early warning system to facilitate timely communication of local drought conditions/outlook to officials, decision makers, emergency responders, and the general public.								X			Countywide	County EM, ACD/USDA-NRCS	A, B, C, K, L, K	Ongoing	Low	Antrim works with the Farm Bureau to address draught conditions as the farmers have the best eye on this. Drought conditions are rare.	X			X
	20	Consider developing agreements for secondary water sources that may be used during drought conditions.								X			Countywide	County EM, ACD/USDA-NRCS	A, B, C, LL	Ongoing	Low	Drought conditions are rare.	X			
	21	Consider establishing an irrigation time/scheduling program or process so that all agricultural land gets the required amount of water. Through incremental timing, each area is irrigated at different times so that all water is not consumed at the same time. Spacing usage may also help with recharge of groundwater.								X			Countywide	County EM, ACD/USDA-NRCS	B, LL	2 years	Low	Drought conditions are rare.	X			
	22	Consider implementing mandatory water conservation measures during drought emergencies, such as: - Developing an ordinance to restrict the use of public water resources for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc. - Adopting ordinances to prioritize or control water use, particularly for emergency situations like fire fighting.								X			Countywide	County EM, USDA-NRCS, local governments	B, LL	2 years	Low	Drought conditions are rare.	X			
	23	Continue collaboration with MSUE to provide information on agriculture management and best practices in drought situations.								X			Countywide	County EM, MSUE, ACD/USDA-NRCS	KK	Ongoing	Low	Drought conditions are rare.			X	X
24	Support the USDA - NRCS's provision of technical assistance such as the Conservation Stewardship Program, resource assessment and monitoring, and determination of financial assistance for local farmers, ranchers and forest managers in the wake of a natural disaster.	X	X	X	X			X	X	X		Countywide	ACD/USDA-NRCS	LL	Ongoing	Low	While supported, MSU Extension and the Farm Bureau make that aim their entire mission allowing us more energy to devote to other strategies.			X	X	

	ANTRIM COUNTY HAZARD MITIGATION STRATEGIES	HAZARD TYPE								WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in BOLD)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY LEVEL	RATIONALE FOR PRIORITY LEVEL	STRATEGY TYPE			
		Extreme Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, seiches)	Extreme Temperatures	Drought	Invasive Species							Public Health Emergency	1	2	3
Shelters	25	Maintain an accurate inventory of emergency shelter sites (overnight vs. daily use types); review annually and update as needed.	X	X	X	X	X	X	X	Countywide	County EM; American Red Cross	A	Annually	Medium	Keeping our shelter inventory current, allowing CERT to annually train allows us to promote shelter locations through social media.	X			
	26	The Antrim County Office of Emergency Management will continue to collaborate with local communities and non-profits to increase the number of emergency shelters available to the public during emergency events (i.e., expand agreements with libraries, senior centers).	X	X	X	X	X	X	X	Countywide	County EM; American Red Cross; Local Fire Depts.; Senior Centers; Municipal Offices	A, B, C	Ongoing	High	The collaboration is important as some sites lose their usefulness to life changes. It is important to increase the number of sites available whenever possible. Pre-planning makes for better preparedness.	X	X		X
	27	Provide local governments or public/private organizations information on funding sources for the installation of generators to enhance capabilities of emergency shelter locations.	X	X	X	X	X	X	X	Countywide	County EM; Local Fire Depts.; Senior Centers; Municipal Offices	A, B, C, D, CC, DD	Ongoing	Medium	Many local governments are still without backup generators and the funding to purchase them.		X		X
	28	Evaluate the feasibility and need to construct storm shelters, such as concrete "safe rooms", at campgrounds, day camps and mobile/modular home communities.	X	X	X	X		X		See hazard map for locations of campgrounds and mobile homes	County Building Dept.; County EM; local govts; private and public campground managers	A, B, C, D, CC, DD	Ongoing	Medium	Antrim bases much of it economy on a tourist economy. With numerous campgrounds, shelters are needed.		X		
	29	Continue to establish areas of refuge and evacuation routes from campgrounds, recreation areas, and other sites of large outdoor events.	X	X	X	X		X	X	See hazard map for locations of campgrounds and mobile homes	County EM; private and public campground managers; local fire depts.	A, B, C	Ongoing	High	Antrim bases much of it economy on a tourist economy.	X	X		X
	30	Create signage in public parks/beaches that illustrate the nearest emergency shelter locations.	X	X	X	X		X		Countywide	County and local governments; GTRLC; MNR	A, B, I, X, UU	3 years	High	Antrim bases much of it economy on a tourist economy.				X
	31	Maintain procedures to create quarantine areas in group living quarters, such as overnight shelters or assisted living facilities.							X	Various shelter sites; Meadow Brook Medical Care Facility	ARC, HDNW MI, Meadow Brook Medical Care Facility	A, C, E; MDHHS	Ongoing	High	The pandemic showed us the need for quarantine areas.	X			
Buildings & Infrastructure	32	Continue enforcement of current State building codes (particularly for campground pavilions), applicable zoning codes, and soil erosion regulations with new construction through local permitting processes.	X	X		X	X	X		Countywide			Ongoing	High	Codes and regulations promote health and safety.	X		X	
	32a	Complete the update of Antrim County's Soil Erosion and Sedimentation Code (applicable if the project involves earth change that disturbs one or more acre, or is within 500 feet of a lake, stream or wetland.)				X	X			Countywide	Antrim County, ACD	A, MM	Ongoing	High	The existing code is antiquated and needs updating.	X		X	
	32b	Continue enforcement of building codes and EGLE permitting requirements by verifying floodplains, EGLE-designated Critical Dune areas and High Risk Erosion Areas relative to new construction or site modification.				X	X			Townships of Banks, Torch Lake, Milton, and Elk Rapids; Village of Elk Rapids	County Building Dept., EGLE	A, B, R-U	Ongoing	High	Codes and regulations promote health and safety.	X		X	
	33	Consider revising zoning code requirements in high fire-risk areas to include wildland fire risk mitigation practices (i.e., provide a 25 foot cleared space/defensible space between houses and other structures.)			X					Countywide	Local governments with zoning (Villages of Bellaire, Central Lake, Elk Rapids, Ellsworth, and Mancelona; Townships of Banks, Elk Rapids, Forest Home, Helena, Kearney, Milton, and Torch Lake.)	A, B, C, M, N	Ongoing	Medium	The hardest issue here will be convincing half of our non-zoned to add regulation to address these issues in lieu of zoning.	X			
	34	Create a special county construction code to address updated wind loads on one and two-family structure types.		X						Countywide	County Building Dept.	A, B, CC, DD	2 years	Medium	To be addressed after the soil erosion ordinance is adopted.	X			
	35	Improve the ability of public buildings to shed or hold snow load.	X							County and Local Government Buildings	County and Local Governments	A, B, BB - DD	2 years	Medium	To be addressed after the soil erosion ordinance is adopted.	X			
	36	Promote the availability of low-cost residential weatherization and home improvement programs.	X	X	X	X		X	X	Countywide	NMCAA	F, G, H	3 years	Medium	The home improvement division of the County needs to be revamped in order to address this.		X		X

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		Extreme Winter Weather T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, seiche)	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency							1	2	3	4
37	Evaluate the need/potential to provide reduced-cost program to install air conditioning in the homes of low-income senior citizens.		X			X		X	Countywide	Antrim County Commission on Aging	D, G, I	3 years	Medium	The home improvement division of the County needs to be revamped in order to address this.		X			
38	Improve ventilation techniques in areas, facilities, or vehicles that are prone to crowding or that may involve exposure to contagion or noxious atmospheres.							X	Countywide	Local and county governments, schools, private venues.	A, B, BB - DD	Ongoing	High	COVID brought this issue to the forefront.	X	X			
39	Continue to pursue opportunities for brownfield and blight clean-up activities, including demolition and clearance of vacant, condemned structures, to remove actual and potential sources of land, water and air contamination.	X	X	X				X	Countywide	Antrim County Brownfield Authority; Local Governments	A, B	Ongoing	Medium	Again, showing the worth of such activities will be a hard sell to non-zoned communities.	X	X	X	X	
40	Continue collaboration with local non-profits to complete an inventory and evaluation of road/stream crossings and lakeshore erosion areas in the County.			X	X			X	Countywide	Antrim County, TOMWC, ACD, The Watershed Center Grand Traverse Bay, ACRC, MDOT, Drain Commissioner, Villages, Townships, homeowner associations, lake associations	R-T, W, BB - DD, XX	Ongoing	Medium	This is an ongoing activity with our environmental advocacy organizations.	X		X	X	
41	Complete infrastructure improvements in areas of high flooding potential, such as upgrading aging stormwater abatement structures, or replacing undersized/aging culverts and bridges to improve river function and high volume streamflow.			X	X				Countywide			3 years	Medium	We are awaiting the new FIRM maps to undertake this project.		X	X		
41a	Reconstruct Bridge Street culvert at the river between St. Clair Lake and Ellsworth Lake			X					Village of Ellsworth	ACRC; Village of Ellsworth	A, B, BB - DD	2 years	High	Funding is the hold up.		X	X		
41b	Reconstruct C-48/Lake St. culvert over Skinner Creek by Tapawingo restaurant			X					Village of Ellsworth	ACRC; Village of Ellsworth; Banks Twp.	A, B, BB - DD	4 years	Medium	Funding is the hold up.		X	X		
41c	Reconstruct the East Jordan Road (C-48) culvert over a tributary to St. Clair Lake			X					Village of Ellsworth & Banks Township	ACRC; Village of Ellsworth	A, B, BB - DD	4 years	Medium	Funding is the hold up.		X	X		
41d	Replace/upsizes culverts at: Spencer Creek on Coy St.; Smalley, St., Manley Rd, Valley St.; and at creeks on SE Torch Lake Drive and Alden Highway, north of W. Elder Rd.			X					Helena Twp., Hamlet of Alden	ACRC, Helena Twp., Hamlet of Alden	A, B, BB - DD	1-5years	Medium	Funding and inspection will dictate order of replacements		X	X		
41e	Replace/upsizes culverts on Cottage Drive along north side of Clam Lake and west of Lake Bellaire			X					Forest Home Twp.	ACRC, Forest Home Twp.	A, B, BB - DD	2 years	Medium	Funding is the hold up.		X	X		
41f	The Road Commission is pursuing local bridge funds for FY 2025 for preventative maintenance work on the Torch River Bridge. The road at this location acts like a dam and restricts water flows from Clam Lake to Torch Lake.								Helena Township and Forest Home Township	ACRC	Road Commission Funding	2-3 years	High	Funding is the hold up.		X	X		
41g	Replace/upsizes culverts on/around Summit Golf Course; control runoff and flooding around Batchelder Rd.			X					Shanty Creek Resort, Custer Twp.	ACRC; Shanty Creek Resort, Custer Twp.	A, B, BB - DD	3 years	Low	Inspections will dictate replacement.		X	X		
41h	State Street Bridge over Intermediate Lake - bridge is aging; upgrade when due for replacement			X					Village of Central Lake	Village of Central Lake, ACRC	A, B, BB - DD	Ongoing	High	Preventative maintenance May 2023		X	X		
41i	Mohrman Bridge Rd. over the Green River - continue to monitor structural condition and upsizes when due for replacement			X					Central Lake Twp.	ACRC, Central Lake Twp.	A, B, BB - DD	Ongoing	Low	Inspections will dictate replacement.		X	X		
41j	Continue to evaluate the best course of action to mitigate the deteriorating culverts/street infrastructure at water crossings on Dexter and Cedar Streets, considering that area is part of the hydro dam overflow zone.			X					Village of Elk Rapids	Village of Elk Rapids	A, B, BB - DD	Ongoing	High	Studies are underway		X	X		

Buildings & Infrastructure

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		Extreme Winter Weather T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, selche)	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency							1	2	3	4
Buildings & Infrastructure	41k			X					Village of Elk Rapids	Village of Elk Rapids	A, B, BB - DD	Ongoing	High	Some improvements have been made.		X			
	42	X			X			X	Townships of Banks, Torch Lake, Milton, and Elk Rapids; Village of Elk Rapids	Townships of Banks, Torch Lake, Milton, and Elk Rapids; Village of Elk Rapids	A, B, R - W, BB - DD	Ongoing	Low	No reported repetitive loss.	X	X		X	
	43			X	X			X	Milton Township	Milton Township, HDNMMI	B, E	Ongoing	Medium	The Environmental Advocacy groups are very committed to this effort and its expansion.	X		X	X	
	44				X			X	Communities in the ERCOL watershed and/or adjoining Lake Michigan (Townships of Echo, Kearney, Custer, Banks, Central Lake, Forest Home, Helena, Milton, Elk Rapids, Torch Lake and the villages within them); particularly areas with identified "Special Flood Hazard Areas" on FIRMS	Communities in the ERCOL watershed and/or adjoining Lake Michigan; The Watershed Center; HDNW MI	A, B, E, Y, NN - TT	2-3 years	Medium	The Environmental Advocacy groups are very committed to this effort.	X		X	X	
	45				X				Village of Elk Rapids	Village of Elk Rapids, Antrim County Operator of Dams	B, EGLE	Ongoing	High	The County maintains an employee whose job is dam oversight.	X				
	46				X				Village of Bellaire	Antrim County Operator of Dams; Village of Bellaire	A, EGLE	Ongoing	High	The County maintains an employee whose job is dam oversight.	X				
	47				X				Village of Bellaire	Village of Bellaire; Antrim County Operator of Dams	B, EGLE	Ongoing	High	The County Dam employee assists the Village with these tasks.	X				
Utilities & Technology	48	X	X					X	Countywide	RC, MDOT, local villages, utility companies	A, B, O, P, MM, NN	Ongoing	Medium	This is a regular activity as underground utility placement is not financially feasible due to low population density in the majority of the County.	X		X		
	49	X	X	X	X		X		Countywide	Consumers Energy or Great Lakes Energy and the County Emergency Mgmt.	A, B, C, O, P	Ongoing	High	As several utility companies serve the County, great communication is paramount.				X	
	50	X	X	X		X			Countywide	Local governments with zoning; Consumers Energy or Great Lakes Energy	A, B, O, P, CC, DD	Ongoing	Low	Low density populations make this financially tough. New developments in zoned communities have this rule in place.	X	X			
	51	X	X	X	X		X		Countywide	Citizen volunteers, Consumers Energy or Great Lakes Energy	B, O, P	Ongoing	Medium	County CERT has retired utility company staff that document and report these interruptions.	X			X	
	52				X				Townships of Milton, Torch Lake, Central Lake, Forest Home, Helena, Custer, and Kearney; Village of Bellaire	Townships of Milton, Torch Lake, Central Lake, Forest Home, Helena, Custer, and Kearney; Village of Bellaire; The Watershed Center; HDNW MI	OO, SS	Ongoing	Medium	The Environmental Advocacy groups are very committed to this effort.	X	X	X	X	

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		Extreme Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, selche)	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency	1							2	3	4		
Utilities & Technology	53				X						X	Villages of Elk Rapids, Bellaire, Central Lake, Mancelona, Ellsworth (water only).	Villages of Elk Rapids, Bellaire, Central Lake, Mancelona, Ellsworth (water only).	B, E, EGLE	Ongoing	High	All municipal water systems are making regular improvements.	X			X	
	54	X	X	X							X	Villages of Elk Rapids, Bellaire, Central Lake, Mancelona.	Villages of Elk Rapids, Bellaire, Central Lake, Mancelona.	B, EGLE	Ongoing	Medium	All municipal water systems are making regular improvements that include separation.	X	X		X	
	55	X	X	X							X	Villages of Elk Rapids, Bellaire, Central Lake, Mancelona.	Villages of Elk Rapids, Bellaire, Central Lake, Mancelona.	B, CC, DD	Ongoing	High	All municipal water systems are making regular improvements.			X		
	56		X	X							X	Villages of Elk Rapids, Bellaire, Central Lake, Mancelona.	Villages of Elk Rapids, Bellaire, Central Lake, Mancelona.	A, B, CC, DD	Ongoing	High	All municipal water systems are making regular improvements.			X		
	57										X	County Government and Local Government Agencies; Public Schools	County Government and Local Government Agencies; Public Schools	A, B, School Systems	Ongoing	High	HR and EM are working with all departments to update plans with the lessons learned from COVID.	X				
	58										X	Countywide	Local service providers; Connected Nation MI	A, B, P, Q	Ongoing	High	Priority for the County at this time	X	X			X
	59				X			X				Townships of Echo, Kearney, Custer, Banks, Central Lake, Forest Home, Helena, Milton, Elk Rapids, Torch Lake and the villages within them; Local Lake Associations/ Improvement Boards			Ongoing	High	Priority for County and local Environmental Advocacy groups. Staff overseeing projects.	X			X	X
	59a				X							Townships of Banks, Central Lake, Echo, Forest Home and Kearney; Villages of Bellaire, Central Lake and Ellsworth	Antrim County Drain Commissioner, Antrim County Operator of Dams, EGLE	A, B, QQ	Ongoing	High	Priority for County and local Environmental Advocacy groups. Staff overseeing projects.	X			X	X
	59b				X							Villages of Elk Rapids and Bellaire	Antrim County Drain Commissioner, Antrim County Operator of Dams	A, B, QQ	Ongoing	High	Priority for County and local Environmental Advocacy groups. Staff overseeing projects.	X			X	X
	59c				X							Milton Township (Antrim County) and Clearwater Township (Kalkaska County)	Antrim County Drain Commissioner, Antrim County Operator of Dams, Kalkaska County Drain Commissioner, EGLE	A, B, QQ, RR, UU	3 years	Medium	The bridge acts as a dam. Model and FIRM projects need to be completed first.	X	X		X	
	59d				X							Banks Township, Village of Ellsworth	Antrim County Drain Commissioner, Antrim County Operator of Dams	A, B, AA - DD, QQ	2 years	Medium	This project will take place with the culvert improvements.	X			X	X
	59e				X							Village of Elk Rapids	Antrim County Drain Commissioner, Antrim County Operator of Dams	A, B, AA - DD, QQ	Ongoing	High	Priority for County and local Environmental Advocacy groups. Staff overseeing projects.	X			X	X
59f				X							Village of Bellaire	Antrim County Drain Commissioner, Antrim County Operator of Dams	A, B, AA - DD, QQ	Ongoing	High	Priority for County and local Environmental Advocacy groups. Staff overseeing projects.	X			X	X	

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		Extreme Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, seiche)	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency	1							2	3	4	
Environment & Natural Resources	60										X	Countywide	ACD, CAKE CISMA, USDA-NRCS, MSUE, MDARD, Lake Associations		Ongoing	Medium	Environmental Advocacy groups have this activity built in to their outreach and education programs.	X		X	X
	60a										X	Countywide	CAKE-CISMA, ACD, USDA-NRCS	NN	Ongoing	Medium	CAKE-CISMA performs these tasks.			X	X
	60b										X	Countywide	CAKE-CISMA, ACD	HH, MM - PP, RR - WW	Ongoing	Medium	CAKE-CISMA performs these tasks.			X	X
	60c										X	Townships of Echo, Kearney, Custer, Banks, Central Lake, Forest Home, Helena, Milton, Elk Rapids, Torch Lake and the villages within them	CAKE-CISMA, ACD	B, FF, NN - PP; RR - WW	Annually	Low	The Environmental Advocacy groups host these events yearly. Due to the number and large size of our lakes, it is not feasible to cover all launches all the time. It serves as an educational opportunity.			X	X
	60d										X	Townships of Echo, Kearney, Custer, Banks, Central Lake, Forest Home, Helena, Milton, Elk Rapids, Torch Lake and the villages within them	CAKE-CISMA, ACD		Annually	Low	The Environmental Advocacy groups host these events yearly. Due to the number and large size of our lakes, it is not feasible to cover all launches all the time. It serves as an educational opportunity.	X		X	X
	60e									X		Countywide	CAKE-CISMA, ACD	B, GG, NN - PP; RR - WW	Ongoing	Medium	CAKE-CISMA performs these tasks.			X	X
	60f			X							X	Countywide	ACD, CAKE CISMA, MDNR, MSUE	JJ, LL - NN, MDNR Forestry Division	2 year	Medium	CAKE-CISMA has added this to its list of projects.			X	X
	60g										X	Countywide	ACD, CAKE CISMA, MDNR, MSUE	JJ, LL - NN, MDNR Forestry Division	2 years	Medium	CAKE-CISMA has added this to its list of projects.			X	X
	61										X	Villages of Bellaire, Central Lake, Elk Rapids, Ellsworth, and Mancelona; Townships of Banks, Elk Rapids, Forest Home, Helena, Kearney, Milton, and Torch Lake.	Villages of Bellaire, Central Lake, Elk Rapids, Ellsworth, and Mancelona; Townships of Banks, Elk Rapids, Forest Home, Helena, Kearney, Milton, and Torch Lake.	B, GG, MM, NN	2 years	Low	CAKE-CISMA has added this to its list of projects.	X		X	X
	62										X	Countywide	Local governments	A, B, MDHHS	3-5 years	Low	CAKE-CISMA has added this to its list of projects.	X			X
63				X		X		X			Countywide	ACD, Grand Traverse Regional Land Conservancy, lake associations	A, B, Y, AA, MM, VV, WW	3-5 years	Low	This will wait until after the FIRM maps have been updated and the new soil erosion ordinance has been adopted..	X		X	X	

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		Extreme Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Riverine and Urban Flooding	Shoreline Hazards (coastal flooding or recession, dangerous currents, seiche)	Extreme Temperatures	Drought	Invasive Species	Public Health Emergency	1							2	3	4	
Environment & Natural Resources	64	Establish a "green infrastructure" link system that connects and expands existing parks, preserves and greenways in the County.										Countywide	ACD, Grand Traverse Regional Land Conservancy, Antrim County , local governments, lake associations.	A, B, Y, AA, MM, VV, WW	Ongoing	Low	Several organizations are active in this. One along US-31 and another along and around US 131. No County funding has been committed as of yet.	X		X	X
	65	Incorporate green infrastructure and stormwater management initiatives into master plans and recreation plans.										Antrim County; Villages of Bellaire, Central Lake, Elk Rapids, Ellsworth, and Mancelona; Townships of Banks, Elk Rapids, Forest Home, Helena, Kearney, Milton, and Torch Lake.	Antrim County; Villages of Bellaire, Central Lake, Elk Rapids, Ellsworth, and Mancelona; Townships of Banks, Elk Rapids, Forest Home, Helena, Kearney, Milton, and Torch Lake.	A, B, VV	Ongoing	Medium	The Conservation District is active in this.	X	X	X	X
	66	Continue to provide the ACD's Healthy Landscapes Program to help lakeshore residents learn what they can do to help protect their property value and the health of the lake on which they live by protecting, stabilizing and beautifying their shorelines with nature-based solutions.										Countywide	Antrim County, ACD , lake associations	MM, QQ - UU	Ongoing	Medium	The County provides financial assistance to the ACD for this and other purposes.	X	X	X	X
	67	X	X	X					X			Forest Home Township, Village of Bellaire, Helena Twp.	Helena Twp., Forest Home Township, Village of Bellaire, Friends of Glacial Hills, Antrim County, Grand Traverse Regional Land Conservancy	A, B, VV, volunteers	Ongoing	High	The large wind storms of the past decade have damaged large swaths of trees. Volunteers are active in this project.	X		X	X
	68	X	X	X	X		X	X	X			Countywide	ACD	MM	Ongoing	Medium	The County Forester oversees the management.	X		X	X
	69			X					X			Countywide	MDNR, GTRLC	VV, MDNR Forestry Division	Ongoing	Medium	The County Forester oversees the management.	X		X	X
	70				X							Countywide	River & Lake Associations, The Watershed Center, GTRLC, ACD, MDNR	MM - PP, RR - WW	Ongoing	Medium	Environmental advocacy groups undertake this project annually.			X	X
71	X	X	X					X			Countywide	RC, MDOT, local villages	A, B, XX, MDOT, ACRC	Ongoing	High	The Road Commission understands that with limited funding, maintenance is important.	X		X	X	

VIII. Implementation

Hazard mitigation is any action taken before, during, or after a disaster to permanently eliminate or reduce the long-term risk to human life and property from hazards. Mitigation is an essential element of emergency management, along with preparedness, response, and recovery. Emergency management includes four phases: actions to mitigate a disaster, a community prepares for a disaster; responds when it occurs; and then there is a transition into the recovery process. The process is cyclical and mitigation measures are evaluated and adopted constantly. The evaluation improves the preparedness posture of the County for the next incident, and so on. When successful, mitigation will lessen the impacts of natural hazards to such a degree that succeeding incidents will remain incidents and not become disasters.

Plan Review, Monitoring, and Evaluation

This Plan is intended to be a resource for building coordination and cooperation within a community for local control of future mitigation and community preparedness. The County Board will lead the implementation of the Natural Hazards Mitigation Plan with assistance from the Emergency Services Coordinator and the Administration. The Antrim County Local Emergency Planning Committee (LEPC) is an inter-agency partnership and will collaborate to accomplish the goals and objectives of the Plan. The LEPC meets on a regular basis to carry out its duties and has expanded its role to function as the Natural Hazards Task Force. The Natural Hazards Task Force will be responsible for monitoring and implementing the mitigation plan. Staff support will be provided by the Antrim County Emergency Services Coordinator and will coordinate with the County Board of Commissioners.

The Natural Hazards Task Force will perform an annual review of the Antrim County Hazard Mitigation Plan and consider the list of mitigation strategies identified in the plan. The Task Force will identify projects that have been completed and identify new projects to be completed. The following agencies have been encouraged to actively participate in revising, updating, and maintaining the plan.

- Antrim County Government Staff
- Townships and Villages
- Antrim County Conservation District
- Antrim County Drain Commissioner
- Antrim County Road Commission
- Grand Traverse Band of Ottawa and Chippewa Indians
- Grand Traverse Regional Land Conservancy
- Charlevoix, Antrim, Emmet and Kalkaska – Cooperative Invasive Species Management Area (CAKE-CISMA)
- The Watershed Center Grand Traverse Bay
- Tip of the Mitt Watershed Council
- Networks Northwest
- Health Department of Northwest Michigan
- Michigan State University Extension
- Michigan Department of Environment, Great Lakes, and Energy
- Michigan Department of Natural Resources
- U.S. Environmental Protection Agency
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture Natural Resources Conservation Service
- Insurance Companies
- Real Estate Companies

In addition, the townships and villages (whether or not they have their own zoning) have indicated to the county emergency manager that they will follow the county's lead in identifying mitigation projects and developing grant applications to fund those projects. Land use issues associated with those projects (where applicable) will be handled by each jurisdiction that have an adopted Master Plan and regulate zoning in the project area.

Community planning services are provided by the professional staff that may serve a municipality within the county. The respective planners assist communities in developing plans and zoning ordinances, provides resource information and technical assistance, and convenes communities to address land use issues of common interest.

Building permits are issued by the Antrim County Construction Code Department. Soil erosion permits are issued by the Antrim Conservation District. Permits related to water well and septic systems are issued by the Health Department of Northwest Michigan. Michigan's Department of EGLE issues permits for proposed land alterations in Critical Dune Areas and High Risk Erosion Areas along the Lake Michigan in Antrim County.

Plan Integration

All townships and villages in Antrim County, and local and state agencies will consider integrating information from the hazard mitigation plan into their comprehensive and operations plans. All communities - except for the Townships of Central Lake, Chestonia, Custer, Echo, Jordan, Mancelona, Star and Warner - administer zoning. As part of the education and outreach aspect of the hazard mitigation effort, the other townships and villages will be encouraged to adopt zoning regulations to minimize the effect of hazards.

All natural hazards mitigation planning could be pursued using Michigan Public Act 226 of 2003, the Joint Municipal Planning Act. This Act provides for joint land use planning by cities, villages, and townships, and allows two or more municipalities' legislative bodies to create a single joint planning commission to address planning issues. This tool helps with planning for the "big picture" issues such as natural hazards that cross jurisdictional boundaries.

The intent of this legislation is for local governments to consider the following:

- Individual units of government modifying their ordinances simultaneously to include language that would incorporate aspects of protection
- Developing an overlay zoning district that would cross jurisdictional boundaries which would be incorporated into existing independent units of government's zoning ordinances
- Forming a new joint (multi-jurisdictional) planning commission or zoning board
- Sharing zoning administration and enforcement activities

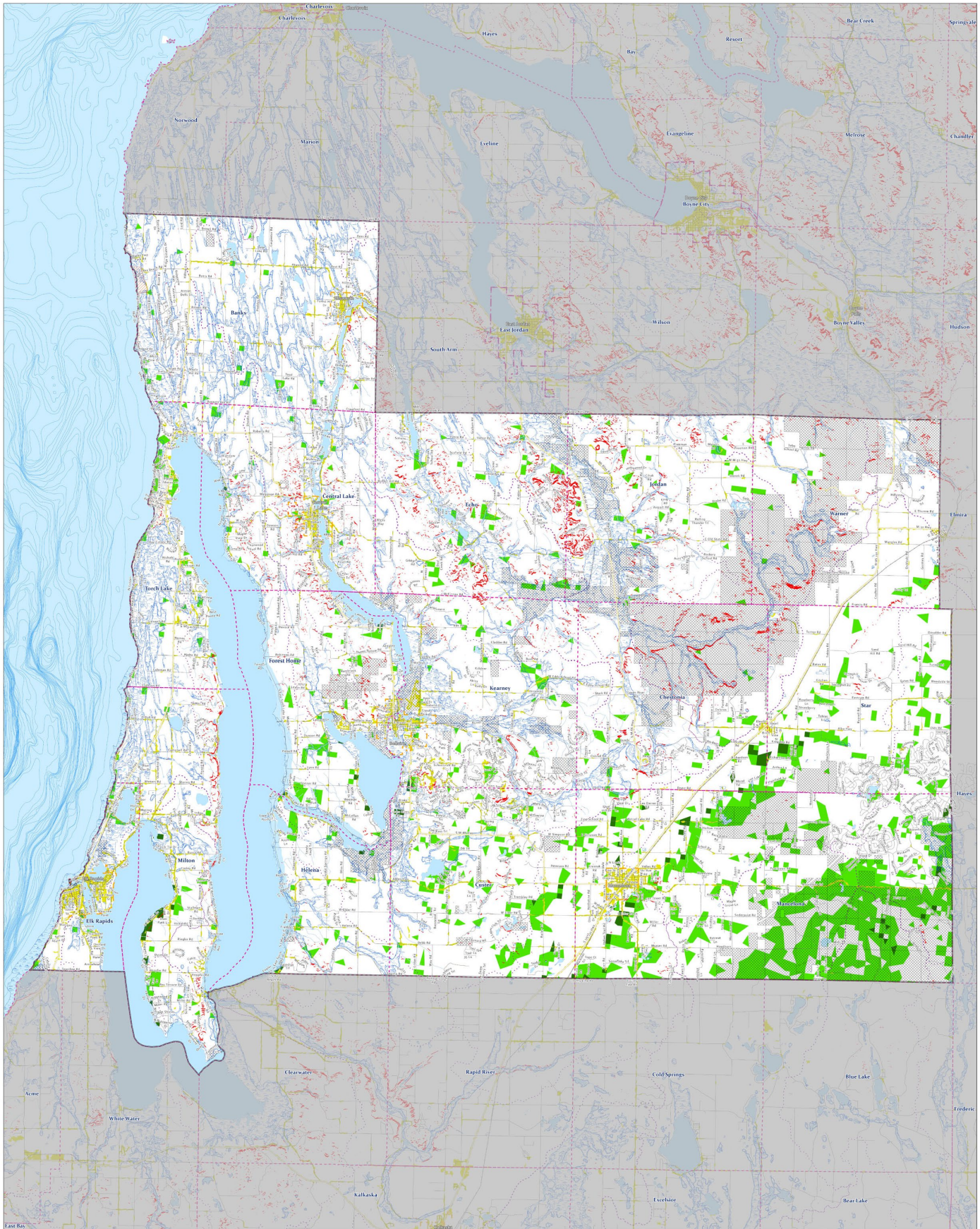
Five Year Plan Review and Update

The Stafford Act, as amended by the Disaster Mitigation Act of 2000, requires the Antrim County Hazard Mitigation Plan to be updated, adopted, and re-submitted for Federal Emergency Management Agency (FEMA) approval every five years. The plan will be reviewed by the Natural Hazards Task Force every five years in alignment with federal regulations. The update will include determining changes in the county, such as changes in development, an increase in exposure to hazards, an increase or decrease in the communities' capability to address hazards, addition and/or removal of mitigation actions and strategies, reviewing goals, and a change in federal or state legislation. Upon plan review and update completion, the plan will be sent to the State Hazard Mitigation Officer at the Michigan State Police for final review and approval in coordination with FEMA. When the plan has received an "approved pending adoption" status from FEMA, the Antrim County Board of Commissioners can review, approve, and adopt the plan, along with individual local units of government. In order to properly update the plan in the future, Antrim County will need to seek funding from appropriate state and/or federal agencies.

Continued Public Involvement

Antrim County is committed to keeping the public involved in the implementation and update of the Hazard Mitigation Plan. Copies of the plan will be available at the county libraries, county clerk's office, and all local government offices, and will be posted on the community websites and/or regional planning agency website. The Emergency Management Office will be responsible for keeping a record of public comments on the plan.

APPENDIX A – Maps



**Antrim County
Environmental Features**
2023 Hazard Mitigation Plan

- Legend**
- Highways
 - Roads
 - Railroad
 - Rivers/Streams
 - Water Bodies
 - Lake 903 Bathymetric
 - Lake 910 Bathymetric
 - Waterfowl Boundary 12
 - Digit
 - High Risk Invasive Zones
 - Critical Dune Areas
 - Slope 20% or Greater
 - Developed Land
 - High Wetland & Low Intensity Forest
 - Sack Pine
 - Red Pine Eastern White Pine
 - Public Land
 - Winters
 - Other
 - Township Boundaries
 - Antrim County
 - Adjacent Counties

Note:
FEMA Floodplain Data is not available in a digital shapefile format for Antrim County. Available Floodplain Maps are by FEMA Portal as an image and are unable to be displayed in the GIS files prepared for this planning process.

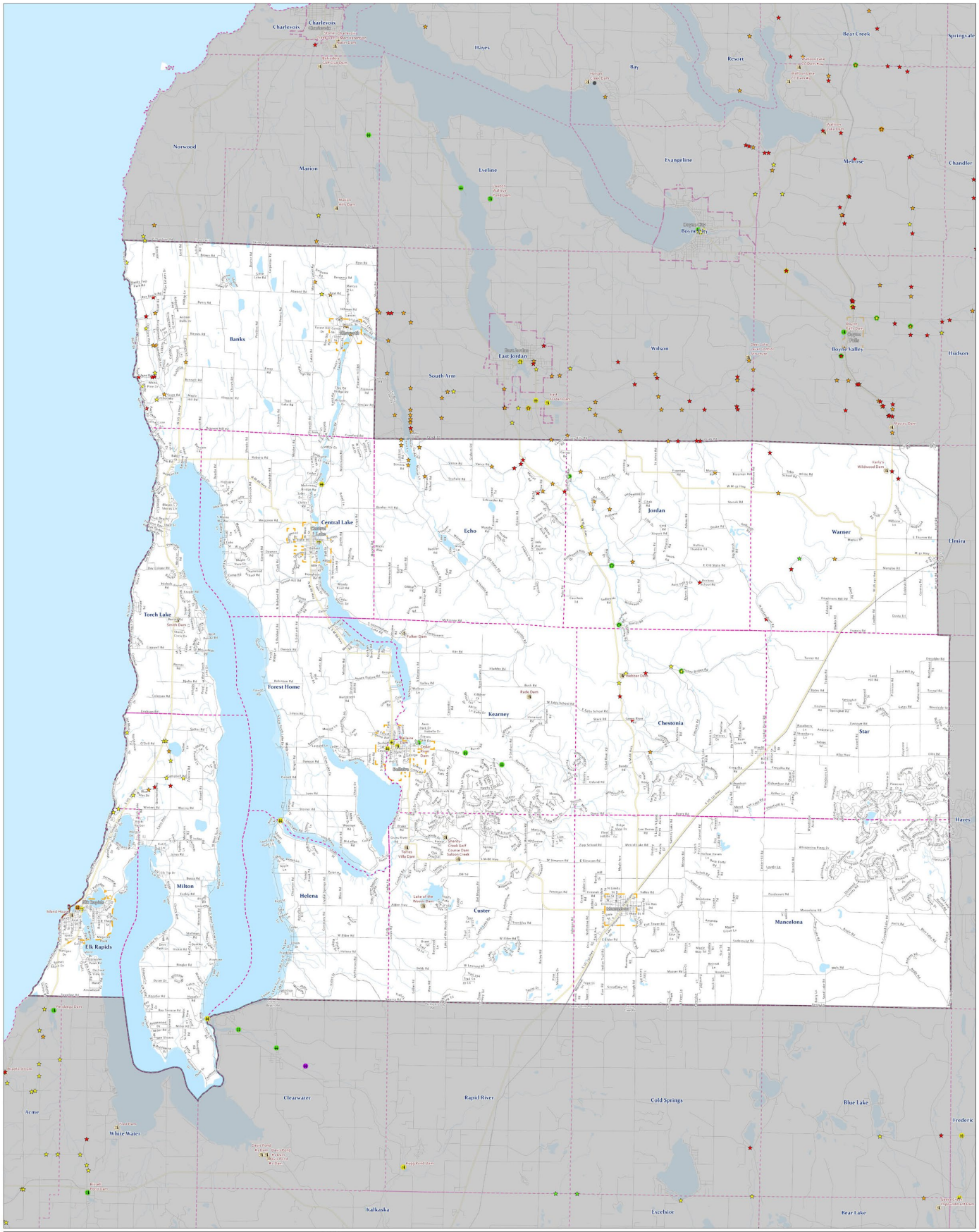
0 2,500 5,000 10,000 15,000 20,000
Feet

0 2.5 5 7.5 10
Miles

N
W E
S

Antrim County Hazard Mitigation Planning Process
Map produced by Networks Northwest, Columbia, Washington 2023
Map data sources: State of Michigan, EPSR, MCLD, USGS, USGS

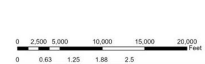
Networks Northwest
Plan / Assess / Monitor



Antrim County Infrastructure
2023 Hazard Mitigation Plan

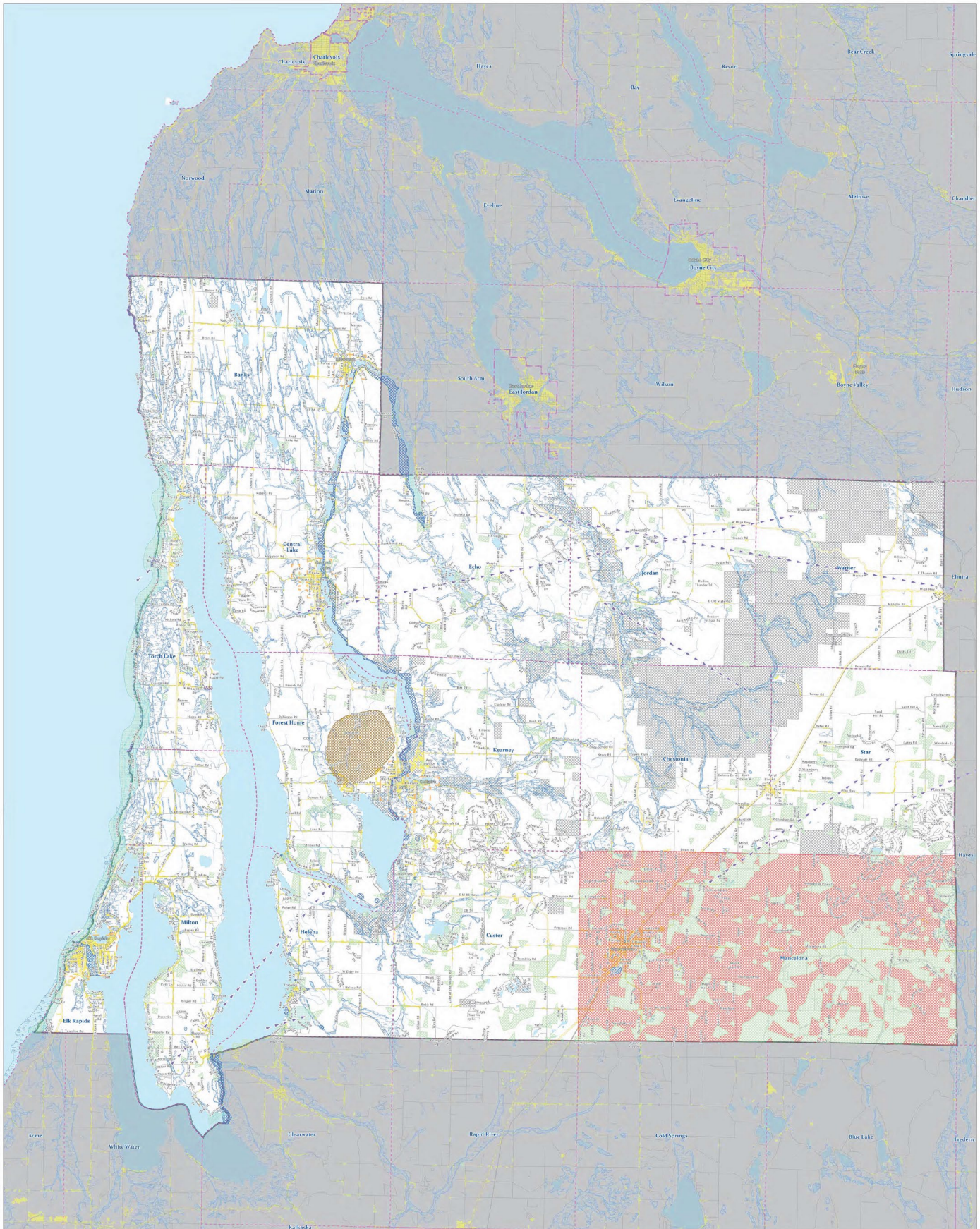
- Legend**
- Stream Crossings (CRA)**
 - Severity
 - Negligent
 - Minor
 - Major
 - Critical
 - Closed
 - Bridge Condition**
 - Rating
 - Good
 - Fair
 - Poor
 - Unsatisfactory
 - Critical
 - Closed
 - MI Dam Inventory**
 - Condition
 - Satisfactory
 - Fair
 - Poor
 - Unsatisfactory
 - Not Rated

- Waters**
 - Watershed
 - Waters
- Other**
 - County
 - Watershed
 - Waters



Antrim County Hazard Mitigation Planning Process
Map produced by Networks Northwest Community Development 2023.
Map data sources: State of Michigan, ESRI, MGLS, USGS, USGS, USGS, CNA, NOAA

Networks Northwest
Water / Resilient / Community

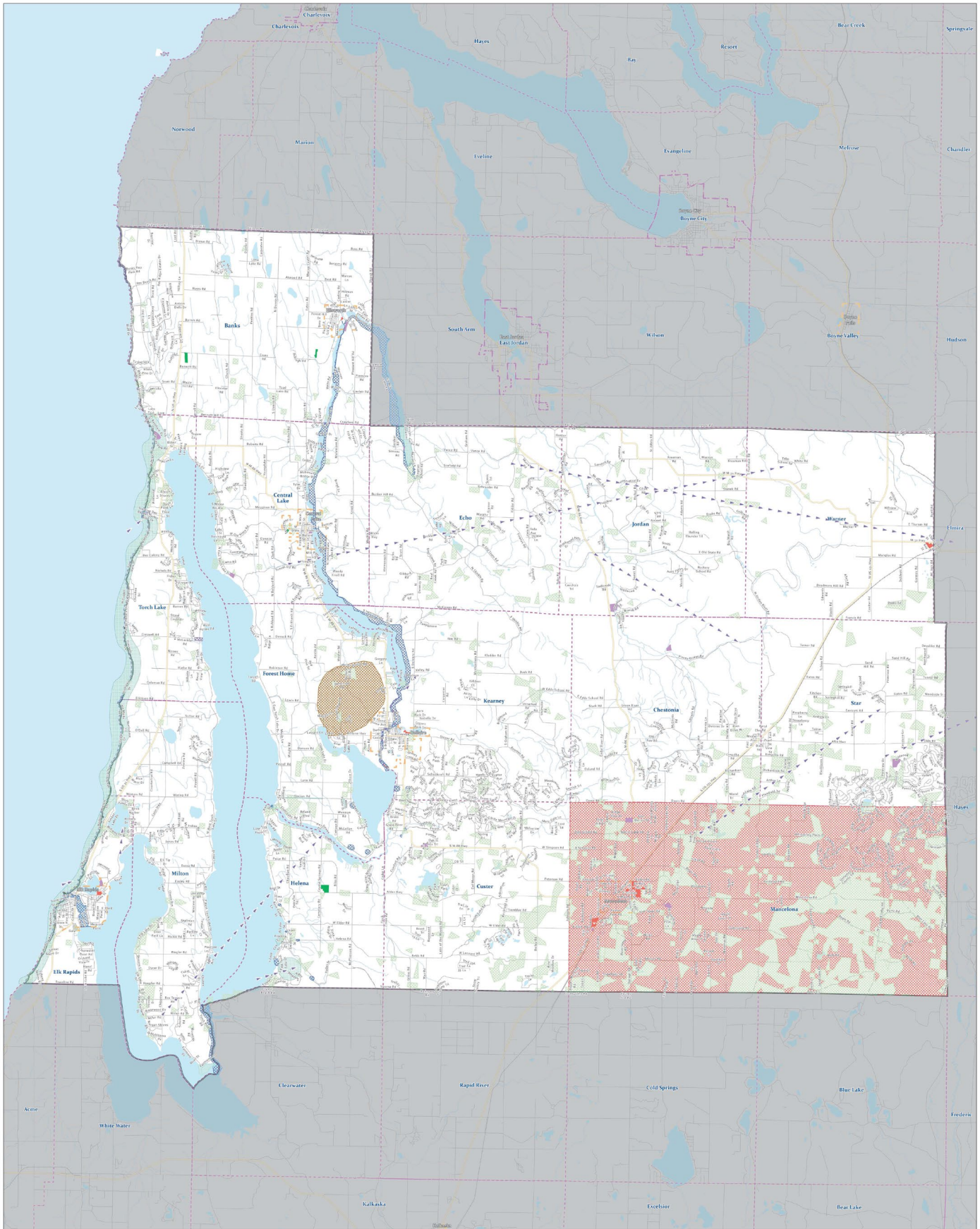


**Antrim County
Hazard Areas**
2023 Hazard Mitigation Plan

- Hazard Areas**
- Type
 - Flood
 - Shoreline Erosion
 - Fire
 - Wine Tree Damage
 - Pine Forest
 - Endemic Species
 - Tombola Fish
- Legend**
- Highways
 - Roads
 - Railroad
 - Stream/Streams
 - Water Bodies
 - Part 303 Wetlands
 - Public Land
 - Developed Land
 - High, Medium & Low Intensity
 - Village
 - City
 - Township Boundaries
 - Antrim County
 - Adjacent Counties



Antrim County Hazard Mitigation Planning Process
 Map produced by Silverado Northwest Community Development 2023.
 Map data source: State of Oregon, OREGON, USDA, NRS, Antrim County Emergency Management

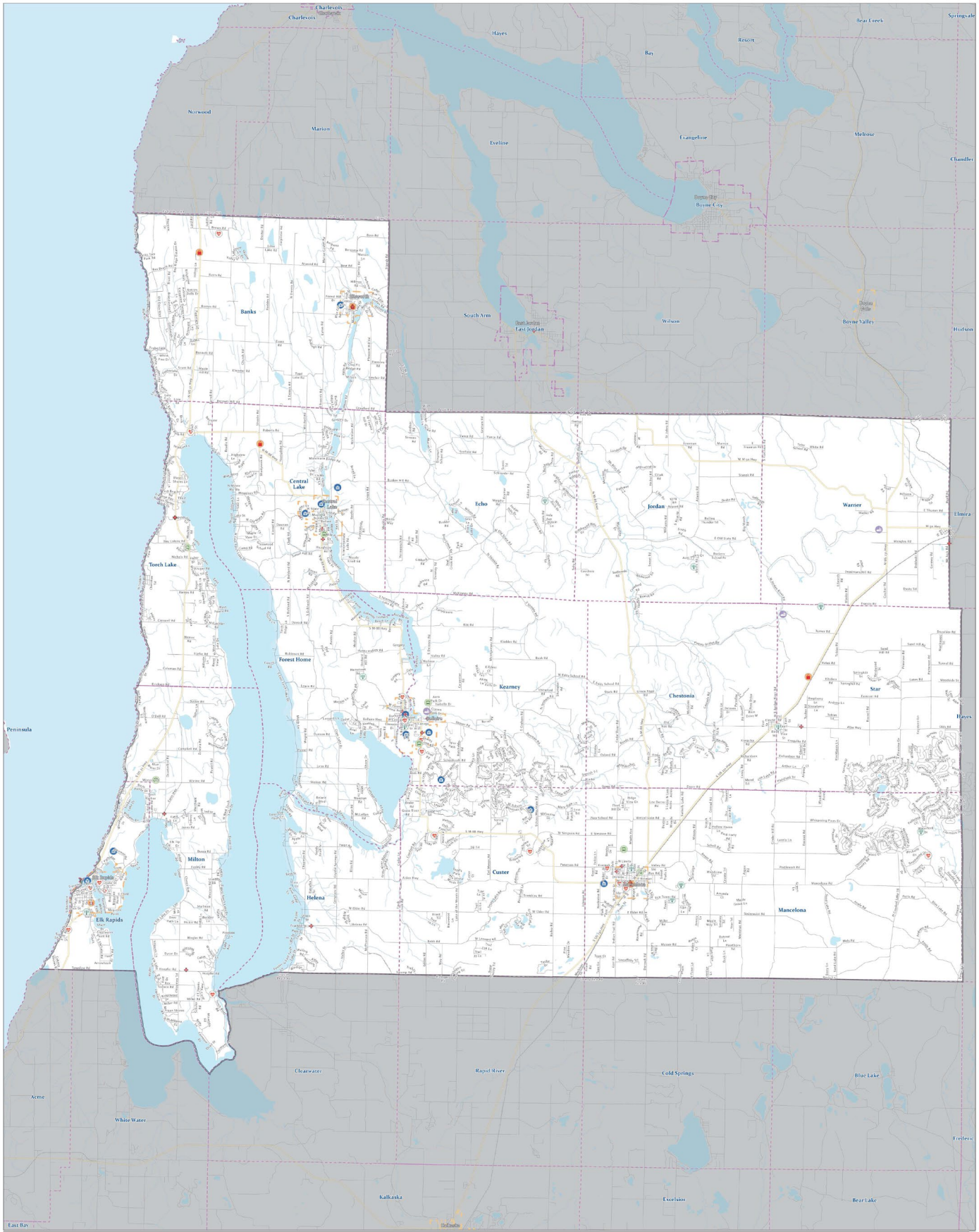


Antrim County Hazard Areas & Vulnerable Populations
 2023 Hazard Mitigation Plan

Vulnerable Populations Type: Congregations Public Home New Home	Hazard Areas Type: Flood Shoreline Erosion Fire Wild Tree Damage Pine Row Invasive Species Tornado Path	Legend Highway Road Railroad County Boundary Adjacent Counties	Unincorporated Area Village City Antrim County Adjacent Counties
			River/Stream Water Bodies



Antrim County Hazard Mitigation Planning Process
 Map produced by Networks Northwest Community Development 2023
 Map data sources: State of Michigan, ESRI, NCEM, USDA, USGS, CMA, NOAA
 Antrim County Emergency Management

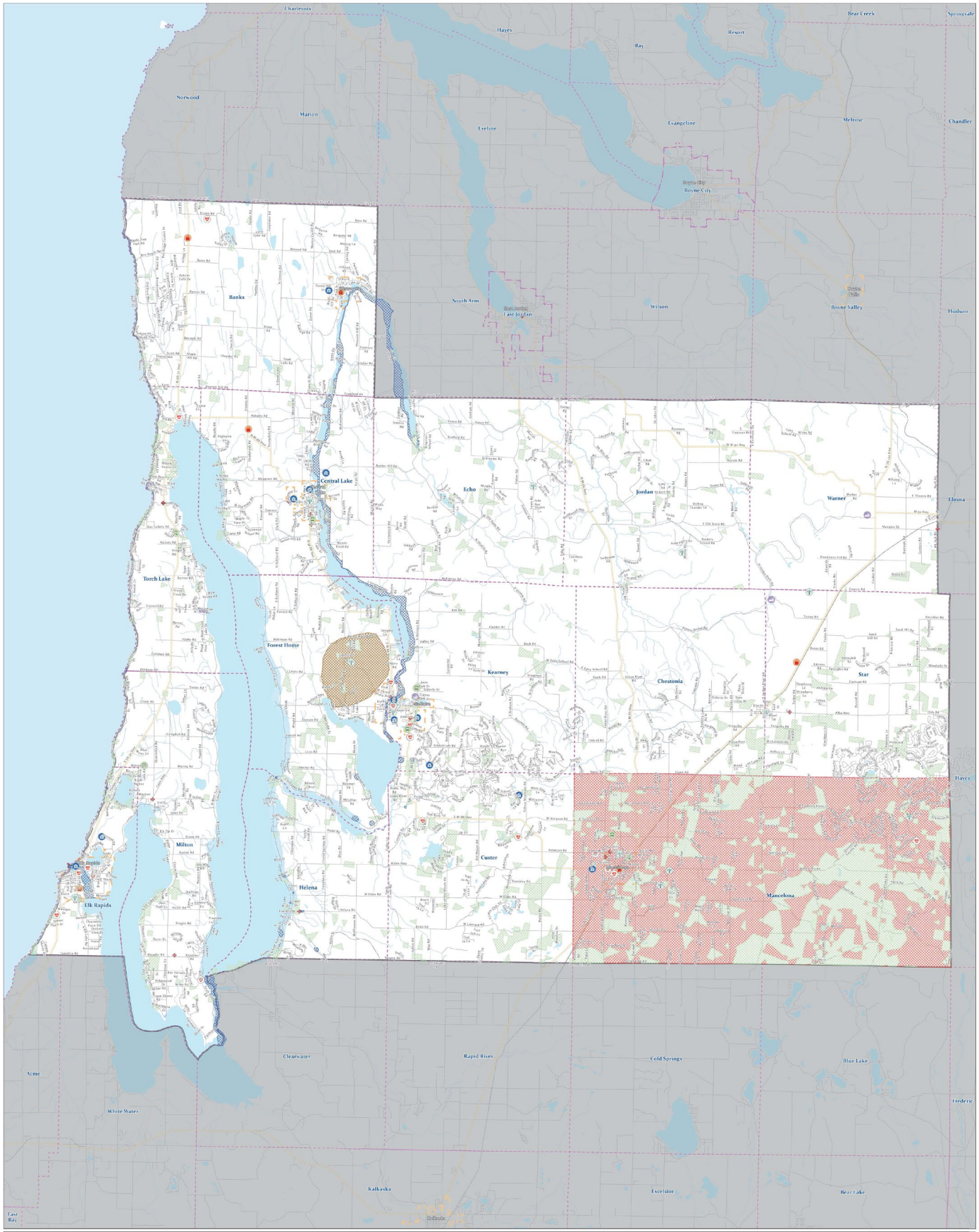


**Antrim County
Critical Infrastructure
Points**
2023 Hazard Mitigation Plan

- Legend**
- Critical Infrastructure Points**
- | | |
|---------------------|----------------|
| Commercial | Transportation |
| Communications | Warehouse |
| Emergency Services | Industry |
| Government Facility | |
- Sector**
- Airport
 - Office
 - Township Boundaries
 - Antrim County
 - Adjacent Counties

Antrim County Hazard Mitigation Planning Process
 Map produced by Networks Northwest Community Development 2023.
 Map Data Sources: State of Michigan, USGS, NAD83, USGS, USGS, CMA, NOAA,
 Antrim County Emergency Management

Networks Northwest
 Community Development



**Antrim County
Critical Infrastructure
Points & Hazard Areas**
2023 Hazard Mitigation Plan

<p>Hazard Areas</p> <p>TYPE</p> <ul style="list-style-type: none"> Flood Fire Fire Damage Fire Fuel 	<p>Critical Infrastructure Points</p> <table border="0"> <tr> <td>Sector</td> <td>Symbol</td> </tr> <tr> <td>Commercial</td> <td>●</td> </tr> <tr> <td>Transportation</td> <td>●</td> </tr> <tr> <td>Communications</td> <td>●</td> </tr> <tr> <td>Healthcare</td> <td>●</td> </tr> <tr> <td>Emergency Services</td> <td>●</td> </tr> <tr> <td>Government Facility</td> <td>●</td> </tr> <tr> <td>Industry</td> <td>●</td> </tr> </table>	Sector	Symbol	Commercial	●	Transportation	●	Communications	●	Healthcare	●	Emergency Services	●	Government Facility	●	Industry	●	<p>Legend</p> <ul style="list-style-type: none"> Highway Road Railroad River/Stream Water Bodies Village City Township Boundaries Antrim County Water Bodies Adjacent Counties 	<p>Scale: 0 2,500 5,000 10,000 15,000 20,000 Feet</p> <p>Scale: 0 0.63 1.25 1.88 2.5 Miles</p>	<p>N W E S</p> <p>North West Networks Northwest Energy / Power / Control</p> <p>Antrim County Hazard Mitigation Planning Process Map produced by Networks Northwest Community Development 2023. Map Data Sources: State of Michigan, USGS, NCEM, USGS, USGS, CIA, NOAA, Antrim County Emergency Management</p>
Sector	Symbol																			
Commercial	●																			
Transportation	●																			
Communications	●																			
Healthcare	●																			
Emergency Services	●																			
Government Facility	●																			
Industry	●																			

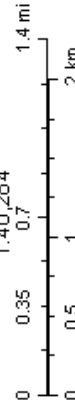
Banks Township



July 26, 2023

High Risk Erosion Zones

1:40,284



Source: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCA, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Disclaimer: This map is not intended to be used to determine the specific

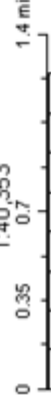
Torch Lake Township (north)



July 26, 2023

- High Risk Erosion Zones
- Critical Dune Areas

1:40,353



Source: Esri, HERE, Garmin, USGS, Imagery, Inc., INCREMENT P, NRCA, Esri Japan, NTT, Esri, China (Hong Kong), Esri Korea, Esri (Thailand), NOAA, Swisstopo, Mapbox Contributors, and the OpenStreetMap community

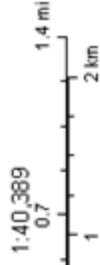
Disclaimer: This map is not intended to be used to determine the specific

Torch Lake Township (south)



July 26, 2023

- █ High Risk Erosion Zones
- █ Critical Dune Areas



SOURCES: ERIT, HERE, GARMIN, USGS, NADMAP, INCREMENT P, NAD83, ERIT
 JAPAN MERIT, ERIT CHINA (BYG), ERIT, ERIT, ERIT (CHINA), NAD83, ERIT
 OpenStreetMap contributors, and the GIS User Community

Disclaimer: This map is not intended to be used to determine the specific

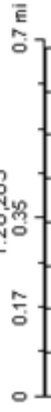
Milton Township



July 26, 2023

High Risk Erosion Zones

1:20,203



Sources: Esri, HERE, Garmin, USGS, AIRMAP, INCREMENT P, NRCA, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Slovakia), NOAA, Esri OpenStreetMap contributors, and the GIS User Community

Disclaimer: This map is not intended to be used to determine the specific

Elk Rapids Village and Elk Rapids Twp. (south)



July 26, 2023

High Risk Erosion Zones

1:40,438

0 0.35 0.7 1.4 mi

0 0.5 1 2 km

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCA, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Taiwan), Esri (Thailand), Swatch, © OpenStreetMap contributors, and the GIS User Community

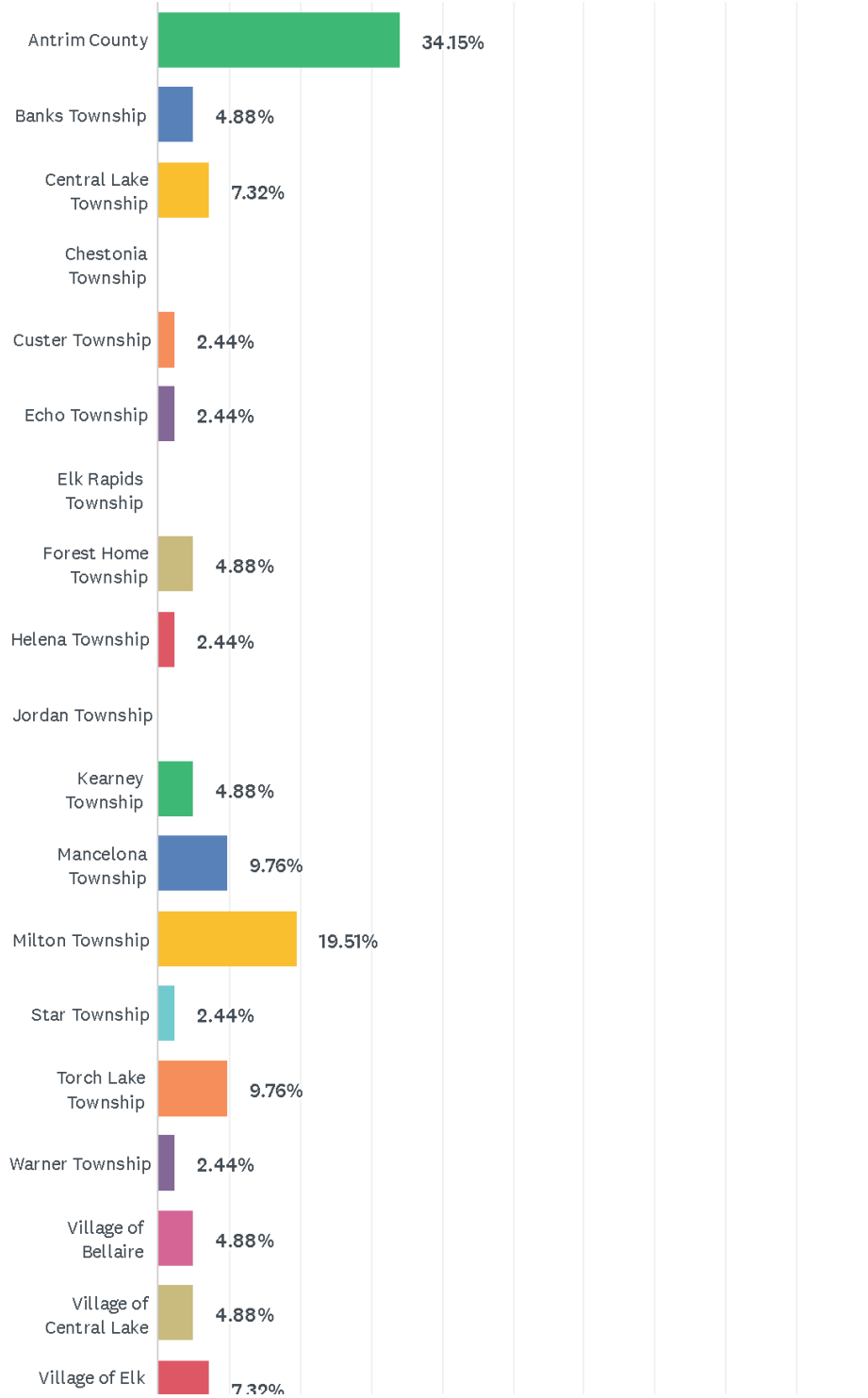
Disclaimer: This map is not intended to be used to determine the specifics

APPENDIX B – Community Survey Results

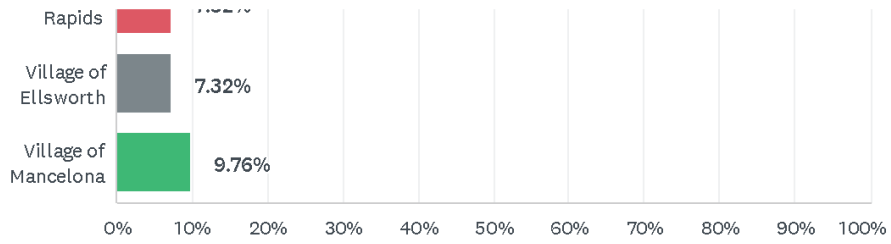
Antrim County Hazard Mitigation Community Survey

Q1 Please indicate the local jurisdiction you represent in Antrim County.

Answered: 41 Skipped: 0



Antrim County Hazard Mitigation Community Survey



ANSWER CHOICES	RESPONSES	
Antrim County	34.15%	14
Banks Township	4.88%	2
Central Lake Township	7.32%	3
Chestonia Township	0.00%	0
Custer Township	2.44%	1
Echo Township	2.44%	1
Elk Rapids Township	0.00%	0
Forest Home Township	4.88%	2
Helena Township	2.44%	1
Jordan Township	0.00%	0
Kearney Township	4.88%	2
Mancelona Township	9.76%	4
Milton Township	19.51%	8
Star Township	2.44%	1
Torch Lake Township	9.76%	4
Warner Township	2.44%	1
Village of Bellaire	4.88%	2
Village of Central Lake	4.88%	2
Village of Elk Rapids	7.32%	3
Village of Ellsworth	7.32%	3
Village of Mancelona	9.76%	4
Total Respondents: 41		

Antrim County Hazard Mitigation Community Survey

Q2 What is your role/organizational representation within Antrim County (i.e., citizen, type of local government employee, elected official, etc.) ?

Answered: 41 Skipped: 0

#	RESPONSES	DATE
1	Twp Trustee	1/28/2022 7:34 PM
2	President	11/22/2021 9:30 AM
3	Elected Official	11/18/2021 8:53 AM
4	elected official	11/8/2021 1:28 PM
5	Planning com. chairman	11/4/2021 11:29 AM
6	Planning Commission	11/2/2021 8:51 AM
7	Both Citizen and Antrim County employee.	11/2/2021 8:38 AM
8	Twp Trustee	10/31/2021 12:00 AM
9	Village of Elk Rapids Treasurer/Planning/Zoning/Community Development and Village of Elk Rapids Citizen	10/29/2021 12:16 PM
10	Lieutenant of the south Torch lake fire department, planning commission And life long resident.	10/29/2021 11:48 AM
11	Summer resident	10/29/2021 10:44 AM
12	Zoning Administrator	10/29/2021 10:28 AM
13	COUNTY GOVERNMENT EMPLOYEE	10/28/2021 9:21 PM
14	Trustee on the Village Council	10/28/2021 5:19 PM
15	Citizen CERT member	10/28/2021 4:38 PM
16	Firefighter, Planning Commissioner	10/28/2021 4:08 PM
17	Township Planning Commission member	10/28/2021 3:21 PM
18	Citizen	10/28/2021 2:37 PM
19	President ProTem	10/28/2021 2:11 PM
20	911 Manager	10/28/2021 1:19 PM
21	Elected official	10/28/2021 1:17 PM
22	Deputy Assessor	10/28/2021 12:49 PM
23	citizen - Custer Township EDC Board member - Antrim County	10/28/2021 12:34 PM
24	Milton Township Planning Commission	10/27/2021 11:07 AM
25	citizen	10/26/2021 6:54 PM
26	Planning Commission	10/26/2021 2:32 PM
27	elected official	10/26/2021 12:04 PM
28	FIRE CHIEF - MILTON TOWNSHIP	10/26/2021 10:25 AM
29	Village Clerk/Zoning Administrator	10/26/2021 9:00 AM
30	Engineer-Manager, Antrim County Road Commission	10/26/2021 7:23 AM
31	Clerk/Treasurer	10/26/2021 7:16 AM

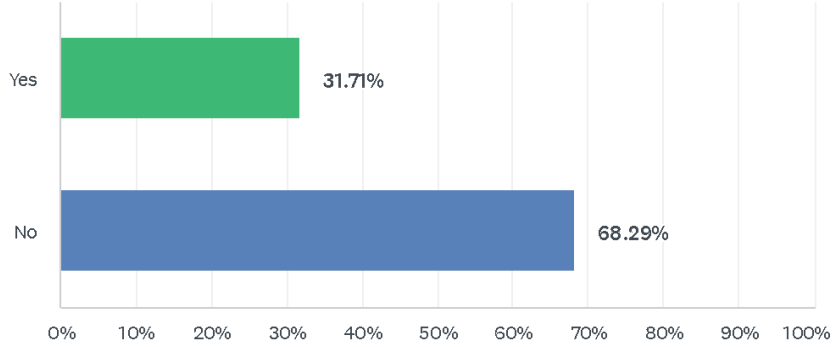
Antrim County Hazard Mitigation Community Survey

32	Planning Commissioner for 4+ years-appointment ending October 31.	10/25/2021 8:22 PM
33	Star township supervisor	10/25/2021 8:11 PM
34	Township Clerk	10/25/2021 7:11 PM
35	township trustee	10/25/2021 4:52 PM
36	Elected official	10/25/2021 4:50 PM
37	Township Trustee, Planning Commision	10/25/2021 3:32 PM
38	Emergency Services Coordinator	10/25/2021 3:30 PM
39	Zoning Administrator	10/25/2021 3:21 PM
40	Elected Official	10/25/2021 3:12 PM
41	County commissioner	10/25/2021 3:09 PM

Antrim County Hazard Mitigation Community Survey

Q3 Are you familiar with the county's Natural Hazard Mitigation Plan?

Answered: 41 Skipped: 0

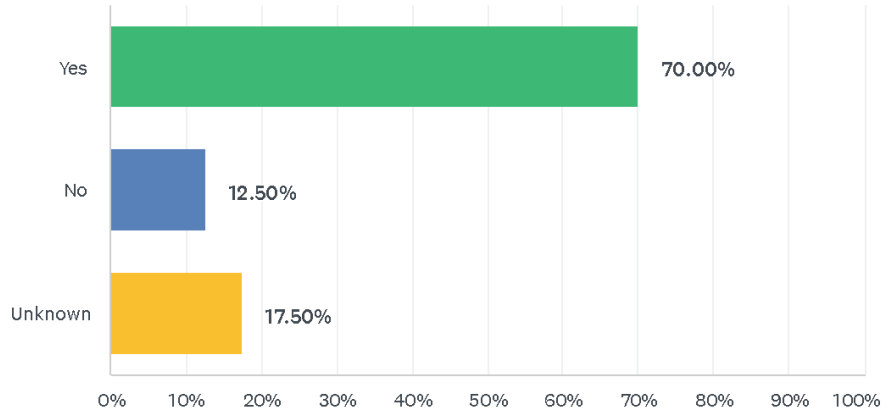


ANSWER CHOICES	RESPONSES	
Yes	31.71%	13
No	68.29%	28
TOTAL		41

Antrim County Hazard Mitigation Community Survey

Q4 Does the community you represent have an adopted Master Plan?

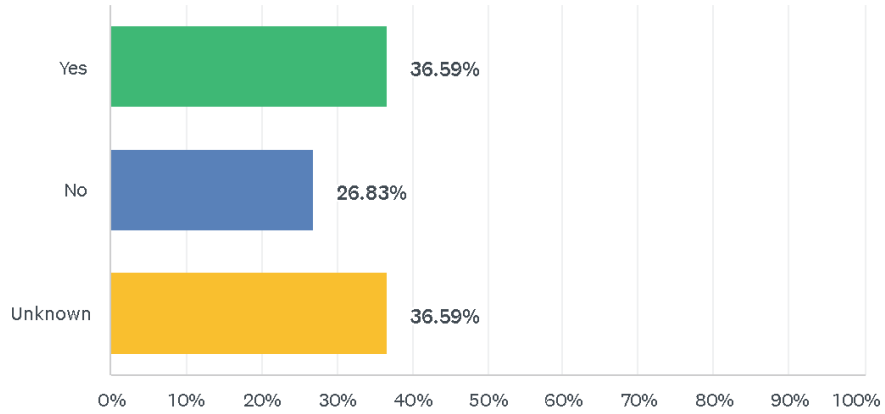
Answered: 40 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	70.00%	28
No	12.50%	5
Unknown	17.50%	7
TOTAL		40

Q5 Does the community you represent have an adopted Capital Improvements Plan?

Answered: 41 Skipped: 0

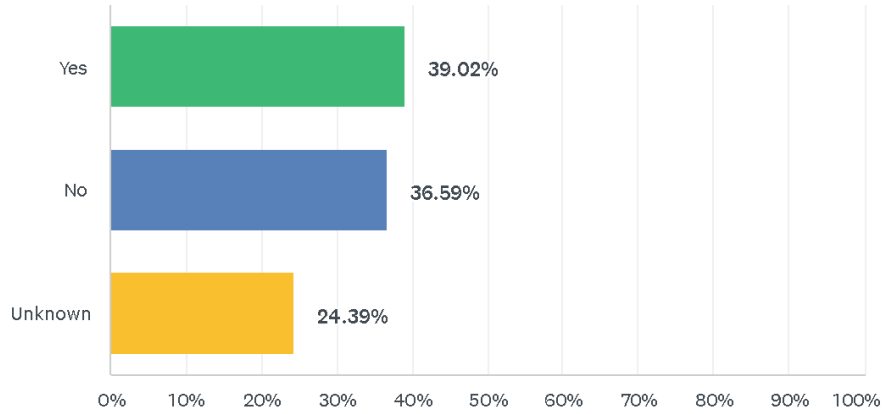


ANSWER CHOICES	RESPONSES	
Yes	36.59%	15
No	26.83%	11
Unknown	36.59%	15
TOTAL		41

Antrim County Hazard Mitigation Community Survey

Q6 Has the community you represent experienced a significant natural hazard event within the last 10 years?

Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	39.02%	16
No	36.59%	15
Unknown	24.39%	10
TOTAL		41

Antrim County Hazard Mitigation Community Survey

Q7 If so, what was the nature of the event?

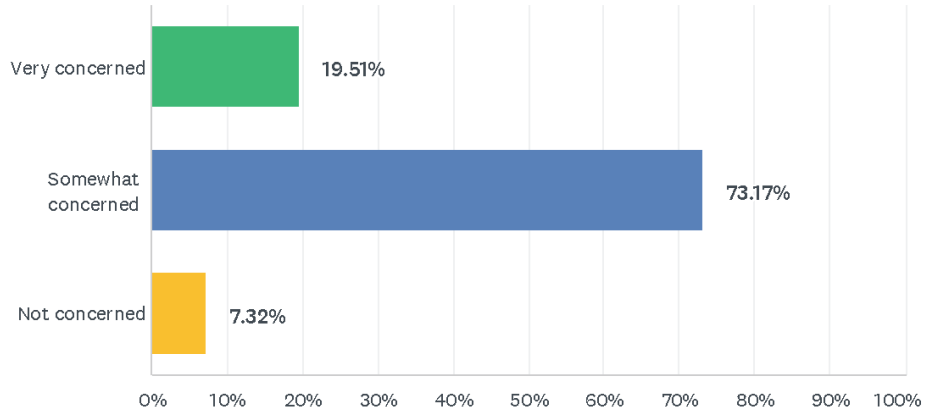
Answered: 23 Skipped: 18

#	RESPONSES	DATE
1	/	1/28/2022 7:34 PM
2	flooding, multiple day power outages, high winds, significant snow fall with road closures for multiple days, multiple years drought conditions	11/18/2021 8:53 AM
3	severe flooding on inland waterways and severe high waters on Lake Michigan also, the COVID-19 Pandemic	11/8/2021 1:28 PM
4	Extreme amount of rainfall	11/4/2021 11:29 AM
5	?	11/2/2021 8:51 AM
6	N/A	10/29/2021 12:16 PM
7	We had a main road wash away in a 100 year storm, And an abundance of flooding And other road damage done, inadequate culverts And or drainage for storm run off.	10/29/2021 11:48 AM
8	TORNADO AND FLOODING	10/28/2021 9:21 PM
9	A severe wind/rain storm created a lot of damage through fallen trees and flooding.	10/28/2021 5:19 PM
10	Na	10/28/2021 2:11 PM
11	A large scale Thunder Storm struck Antrim, Benzie, Grand Traverse, Kalkaska and Leelenau Counties with in a 20 minute period with multiple fronts over a six hour period. High winds brought down thousands of trees in each county. These trees caused wide spread damage, injury and incapacitated the 9-1-1 system in some places. The sheer volume of call also prevented action on all but the most severe requests for help.	10/28/2021 1:19 PM
12	Heavy snow-power outage Thunderstorms- significant flooding/erosion	10/27/2021 11:07 AM
13	flooding, strong winds,	10/26/2021 6:54 PM
14	Rain Storms	10/26/2021 2:32 PM
15	2015 - SEVERE THUNDERSTORM AND HIGH WIND DAMAGE SUSTAINED IN THE SOUTHERN END OF OUR TOWNSHIP	10/26/2021 10:25 AM
16	COVID-19	10/26/2021 9:00 AM
17	Heavy rainfall causing damage to roads and culverts including the complete failure of culverts and closing of roads.	10/26/2021 7:23 AM
18	N/A	10/26/2021 7:16 AM
19	Tornado /wind shear	10/25/2021 8:11 PM
20	Not applicable	10/25/2021 7:11 PM
21	no	10/25/2021 4:52 PM
22	Wind Sheers, Flooding, Tornadoes, Fire, Pandemics	10/25/2021 3:30 PM
23	Wind event	10/25/2021 3:12 PM

Antrim County Hazard Mitigation Community Survey

Q8 How concerned are you about future natural hazard events impacting your community?

Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES
Very concerned	19.51% 8
Somewhat concerned	73.17% 30
Not concerned	7.32% 3
TOTAL	41

Antrim County Hazard Mitigation Community Survey

Q9 What type of natural hazard events are likely to have the largest impact on your community, for example fire, flood, drought, illness outbreak, etc.?

Answered: 38 Skipped: 3

#	RESPONSES	DATE
1	Fire, illness outbreak	1/28/2022 7:34 PM
2	Tornado, high winds, blizzards	11/22/2021 9:30 AM
3	drought, illness outbreak, power outages	11/18/2021 8:53 AM
4	flood, illness outbreak	11/8/2021 1:28 PM
5	Flood	11/4/2021 11:29 AM
6	?	11/2/2021 8:51 AM
7	Tornado	11/2/2021 8:38 AM
8	illness, fire	10/31/2021 12:00 AM
9	illness outbreak, flooding	10/29/2021 12:16 PM
10	Flood and fire.	10/29/2021 11:48 AM
11	Storm damage	10/29/2021 10:44 AM
12	ILLNESS	10/28/2021 9:21 PM
13	Most likely, flood. Lots of waterfront and low-lying areas. Would eventually have implications with drought, but it would have to be incredibly severe to have large impacts.	10/28/2021 5:19 PM
14	Illness outbreaks Winter storms Power outage Drought	10/28/2021 4:38 PM
15	Weather related	10/28/2021 4:08 PM
16	fire, severe weather, illness,	10/28/2021 3:21 PM
17	Fire, illness outbreaks	10/28/2021 2:37 PM
18	I do not know	10/28/2021 2:11 PM
19	A winter storm with high winds, large volumes of snow coupled with freezing temperatures is the most critical hazard. Large Drifts with downed trees and power lines will severely limit rescue efforts and could trap home owners with out access to life saving utilities.	10/28/2021 1:19 PM
20	With heavy rains, we have concerns with road culverts not being able to handle the increase water flow and possibly causing erosion of the road bed and banks.	10/28/2021 1:17 PM
21	Blizzard and floods	10/28/2021 12:34 PM
22	Flooding, flooding properties and road erosion.	10/27/2021 11:07 AM
23	flood, wind	10/26/2021 6:54 PM
24	flood	10/26/2021 2:32 PM
25	fire	10/26/2021 12:04 PM
26	FLOODING / WND DAMAGE	10/26/2021 10:25 AM
27	Fire	10/26/2021 9:00 AM
28	Heavy short duration rainfall.	10/26/2021 7:23 AM
29	Flood	10/26/2021 7:16 AM

Antrim County Hazard Mitigation Community Survey

30	In my opinion, fire especially any forest fire with winds after a drought.	10/25/2021 8:22 PM
31	Severe weather, Fire	10/25/2021 8:11 PM
32	Possibly fire or Covid related issues	10/25/2021 7:11 PM
33	illness?	10/25/2021 4:52 PM
34	fire, illness	10/25/2021 3:32 PM
35	Tornado, fire and pandemic	10/25/2021 3:30 PM
36	drought, fire, flood	10/25/2021 3:21 PM
37	Flood and illness event	10/25/2021 3:12 PM
38	Illness,fire	10/25/2021 3:09 PM

Antrim County Hazard Mitigation Community Survey

Q10 Does your community have concerns about infrastructure (dams, bridges, utilities, etc.) and the potential for a hazardous event in the future?
Please describe.

Answered: 33 Skipped: 8

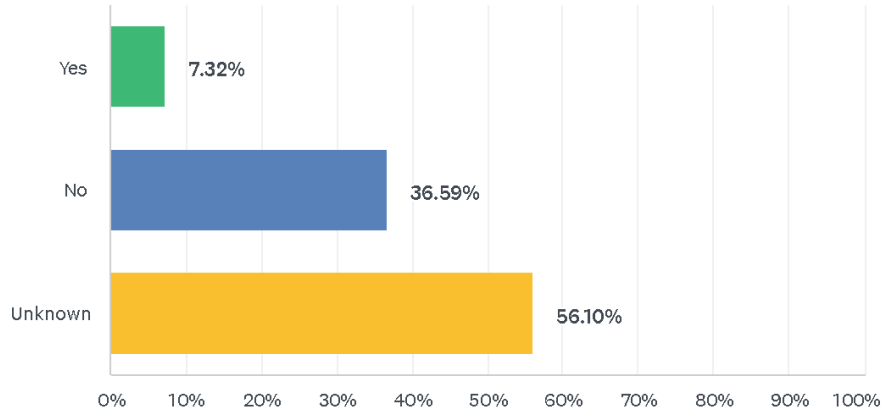
#	RESPONSES	DATE
1	/	1/28/2022 7:34 PM
2	yes on all infrastructure, we seem to not invest in our infrastructure to keep it up to date	11/18/2021 8:53 AM
3	the village within our township has a bridge/culvert that is impeding the flow of water from the upper chain of lakes. Also, they have a culvert on a main trunkline that is deteriorated and in need of replacement.	11/8/2021 1:28 PM
4	No	11/4/2021 11:29 AM
5	?	11/2/2021 8:51 AM
6	None that I know of.	11/2/2021 8:38 AM
7	Yes. We have a dam and a bridge (the bridge is not in the best of shape either). Utilities are always a concern as well.	10/29/2021 12:16 PM
8	They should now after 2 consecutive years of parts of town And homes that have flooded.	10/29/2021 11:48 AM
9	YES. BRIDGES AND DAMS	10/28/2021 9:21 PM
10	I think that our infrastructure is aging -- and there are significant pieces within our jurisdiction -- but I also know that there are plans in place to inspect and maintain them. We need to monitor this to make sure that there is follow-through.	10/28/2021 5:19 PM
11	Unknown	10/28/2021 4:38 PM
12	Not to my knowledge	10/28/2021 4:08 PM
13	dams, bridges, Power outage	10/28/2021 3:21 PM
14	No	10/28/2021 2:37 PM
15	Yes	10/28/2021 2:11 PM
16	Bellaire has two dams in proximity of Bellaire that could cause some issues.	10/28/2021 1:19 PM
17	We only have one bridge that is connected to the one dam that we have in our township, this was last renovated about 20 - 25 years ago.	10/28/2021 1:17 PM
18	I would say as an average all areas are experiencing an aging infrastructure.	10/28/2021 12:49 PM
19	Utilities regarding storms, flooding with bridges	10/28/2021 12:34 PM
20	unknown	10/27/2021 11:07 AM
21	yes, dams, bridges	10/26/2021 6:54 PM
22	utilities	10/26/2021 2:32 PM
23	bridges and culverts	10/26/2021 12:04 PM
24	WE HAVE CONCERNS TO THE BRIDGE IN OUR AREA - TORCH RIVER BRIDGE - AS WELL AS UTILITIES AND THE POTENTIAL FOR WEATHER RELATED EVENTS	10/26/2021 10:25 AM
25	There are three bridges into the Village, and two dams within the Village.	10/26/2021 9:00 AM
26	Culverts, bridges and roads.	10/26/2021 7:23 AM

Antrim County Hazard Mitigation Community Survey

27	State Street Bridge	10/26/2021 7:16 AM
28	do not know	10/25/2021 8:22 PM
29	No	10/25/2021 7:11 PM
30	no	10/25/2021 4:52 PM
31	no	10/25/2021 3:32 PM
32	Our dams are aging. Power outages are a regular occurrence. Elected Officials at the County Level do not believe that a pandemic is upon us. We had a road washout from the storm in August that is still not fixed and requires up to a 32 mile detour for some.	10/25/2021 3:30 PM
33	Yes Bridges and dam	10/25/2021 3:12 PM

Q11 Has your community requested assistance for mitigation projects in the past?

Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	7.32%	3
No	36.59%	15
Unknown	56.10%	23
TOTAL		41

Antrim County Hazard Mitigation Community Survey

Q12 If so, was your request granted and what type of project did the request include?

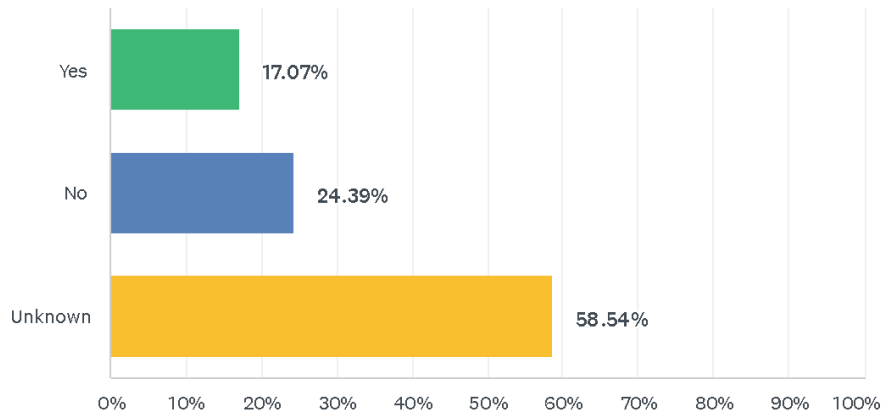
Answered: 13 Skipped: 28

#	RESPONSES	DATE
1	/	1/28/2022 7:34 PM
2	?	11/2/2021 8:51 AM
3	Unknown	10/29/2021 12:16 PM
4	Unknown	10/29/2021 11:48 AM
5	N/A	10/28/2021 9:21 PM
6	Unknown	10/28/2021 4:38 PM
7	Culvert,,it was not funded.	10/28/2021 2:11 PM
8	n/a	10/26/2021 2:32 PM
9	YES, ASSISTANCE FROM EMERGENCY SERVICES COORDINATOR DURING THE STORM OF 2015	10/26/2021 10:25 AM
10	N/A	10/26/2021 7:16 AM
11	Not applicable	10/25/2021 7:11 PM
12	no	10/25/2021 4:52 PM
13	Unknown	10/25/2021 3:12 PM

Antrim County Hazard Mitigation Community Survey

Q13 Has your community considered mitigation strategies for potential or current hazards?

Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES
Yes	17.07% 7
No	24.39% 10
Unknown	58.54% 24
TOTAL	41

Antrim County Hazard Mitigation Community Survey

Q14 If so, please identify potential strategies you would like to explore in the near future.

Answered: 14 Skipped: 27

#	RESPONSES	DATE
1	.	1/28/2022 7:34 PM
2	not our jurisdiction, have expressed concern to the village officials without much response	11/8/2021 1:28 PM
3	?	11/2/2021 8:51 AM
4	Unknown	10/29/2021 12:16 PM
5	I would need to know what And where the problem is.	10/29/2021 11:48 AM
6	N/A	10/28/2021 9:21 PM
7	Funds to replace a culvert under a County road...	10/28/2021 2:11 PM
8	n/a	10/26/2021 2:32 PM
9	Replacement of bridge and culvert	10/26/2021 12:04 PM
10	Working with partner agencies on grants to replace old/damaged/obsolete/undersized culverts.	10/26/2021 7:23 AM
11	N/A	10/26/2021 7:16 AM
12	Not applicable	10/25/2021 7:11 PM
13	unknown, I am fairly new	10/25/2021 4:52 PM
14	A slew of mitigation strategies were identified in the prior plan. Some have been accomplished - including adopting base flood elevations for new construction. It is my hope that many others will be identified this time around.	10/25/2021 3:30 PM

Antrim County Hazard Mitigation Community Survey

Q15 Is there any additional information you would like us to consider as we update the county's Natural Hazard Mitigation Plan?

Answered: 20 Skipped: 21

#	RESPONSES	DATE
1	/	1/28/2022 7:34 PM
2	Please address the two culverts that are failing with the Village of Ellsworth officials. Maybe you can get somewhere. The ACRC also needs to take some interest in these before a catastrophe occurs and people are not able to get to/from their homes when the roadway collapses.	11/8/2021 1:28 PM
3	No	11/4/2021 11:29 AM
4	?	11/2/2021 8:51 AM
5	I am not sure at this time	10/29/2021 12:16 PM
6	Talk to your local firefighters about information, they are your first line of defense, we respond to everything.	10/29/2021 11:48 AM
7	NO	10/28/2021 9:21 PM
8	Water quality could be considered. We have a large amount of lakes and a lot of livelihoods and quality of life rely on the continued good quality of the water. A spill, leak, or unattended issues could create water quality issues that could have an affect on the entire chain of lakes (and most of the county).	10/28/2021 5:19 PM
9	None I can think of at this time.	10/28/2021 4:38 PM
10	No	10/28/2021 4:08 PM
11	No	10/28/2021 2:11 PM
12	Water drainage management	10/28/2021 12:34 PM
13	no	10/26/2021 2:32 PM
14	No	10/26/2021 12:04 PM
15	MORE INFORMATION ON RESOURCES AVAILABLE FROM THE COUNTY LEVEL TO HELP MITIGATE A HAZARDOUS CONDITION	10/26/2021 10:25 AM
16	N/A	10/26/2021 7:16 AM
17	no--never knew had one. Will it be on the Antrim County website and alerted via news stores in local papers?	10/25/2021 8:22 PM
18	Not at this time	10/25/2021 7:11 PM
19	forest management	10/25/2021 4:52 PM
20	No not at this time	10/25/2021 3:12 PM

APPENDIX C – 2016 Natural Hazards Mitigation Plan Strategies and Current Status

2016 Antrim County HM Plan Priority Areas

Priority Area 1: Severe Thunderstorms/High Winds and Flooding - The Village of Bellaire area

Priority Area 2: Severe Thunderstorms/High Winds and Erosion - Highway U.S. 31 through the Village of Elk Rapids and Torch Lake shoreline (Milton, Torch Lake, Central Lake, Forest Home, and Helena Townships).

Priority Area 3: Extreme Winter Weather - Torch Lake shoreline (Central Lake, Helena, Milton, Torch Lake townships and Village of Central Lake) and Village of Mancelona

Priority Area 4: Central Lake area (Village of Central Lake, Central Lake Township) – Severe Thunderstorms/High Winds

Priority Area 5: The Cedar River area (Kearney and Custer Townships, Shanty Creek resort), has the potential for severe thunderstorms and high winds, snow and ice hazards.

2016 Antrim County Natural Hazard Mitigation Plan Action Strategies and 2023 Status

2016 Action Strategies	Responsible Parties	Timeframe	2023 Status/EM Comments	2023 Related Strategies & Priority Level
Priority Area 1: Flood Mitigation Strategies				
a. Identify potential flood areas and wetlands	Emergency Management Coordinator, Drain Commissioner, County Conservation District County Planning, Drain Commissioner, County Building Inspector GIS Department	1-3 years from adoption of the plan	This is now required as part of the construction permit approval process, per County Construction Codes. Also, preliminary FIRMs are due in 2023.	#15 & #16 (Medium), #17 (Low), #63 (Low)
b. Ensure protection of wetlands for flood control via land acquisition/conservation easements	County Conservation District, MDEQ, Non-profit conservation organizations, Drain Commissioner, County Planning	Ongoing	The Torch Conservation Center land conservancy was created and provides information to visitors and homeowners on how to care for the land and waters within the Torch Lake Watershed. There are also six lake associations within the county doing the same. The 389 acre Maplehurst Natural Area in Milton Township was established in 2018 with assistance from the Grand Traverse Regional Land Conservancy. This preserve includes 150 acres of steep hardwood forested bluffs that drain into Torch Lake and open meadows that surround the 60-acre, spring-fed Lake Maplehurst.	#63 (Low)
c. Soil erosion and sedimentation control	County Conservation District Drain Commissioner, County Planning	Ongoing	Incorporated into Guiding Principles regarding water protection in the 2018 Antrim County Master Plan. As of July 2022, the County issued an RFP for the development of a new Soil & Erosion Control ordinance.	#32a (High)
d. Building code enforcement for new construction	County Building Inspector	Ongoing	The County Construction Code Dept. now requires construction permits to include elevation certificates and NFIP compliance.	#32, #32a, #32b (High)
e. Public education and awareness	County Planning Emergency Management Coordinator, County Conservation District, Drain Commissioner, County Planning, Townships, Villages	Ongoing	Incorporated into Guiding Principles regarding maintaining rural character in the 2018 Antrim County Master Plan. The Antrim Conservation District has ongoing soil erosion education such as an annual contractor's workshop and the quarterly Clean & Healthy Landscaping program.	#3f (Low), #14 (High), #17 (Low), #42 (Low), #59 (High)

2016 Action Strategies	Responsible Parties	Timeframe	2023 Status/EM Comments	2023 Related Strategies & Priority Level
Priority Area 2: Erosion Mitigation Strategies				
a. Inventory shoreline erosion sites	County Planning Emergency Management Coordinator, County Conservation District, Townships, Villages	1-3 years from adoption of the plan	Ongoing; Lake associations have worked with the Tip of the Mitt Watershed Council, the Watershed Center of Grand Traverse Bay, and the Antrim Conservation District to inventory erosion sites and identify all stream culverts throughout the county.	#40 (Medium)
b. Open Space Designations via land acquisition, conservation easements by land conservancies, county and local governments	County Planning, County Conservation District, MDEQ, Non-profit conservation organizations	Ongoing	Incorporated into Guiding Principles regarding maintaining rural character in the 2018 Antrim County Master Plan. In addition to the 389 acres of the Maplehurst preserve, Antrim County has partnered with Mancelona Township and the Antrim Conservation District to establish a 40-acre Day Park at Wetzel Lake, near Mancelona. The land the park sits on is owned by the State of Michigan, but Antrim County has a long-term lease agreement for the site through the forestry management unit of the MDNR.	#63 (Low)
c. Soil erosion permits to include specifications on erosion areas, drainage control, grading, debris flow measures, placement of native vegetation	County Conservation District County Planning	Ongoing	Incorporated into Guiding Principles regarding water protection in the 2018 Antrim County Master Plan. The Antrim Conservation District holds its Clean and Healthy Landscapes education event quarterly.	#32a (High)
d. Zoning administration and enforcement of ordinances	County Planning, Townships, Villages	Ongoing	Antrim County consists of 15 townships and 5 villages. To date there are have more zoned communities (13) than not. All zoned municipalities have an identified zoning coordinator which also performs code enforcement, unless there is a law enforcement agency specific to the municipality, as they address enforcement. The new soil erosion ordinance that is being created will be a countywide ordinance regardless of zoning.	#32 (High), #32b (High)
e. Building code enforcement through permits	County Building Inspector	Ongoing	The County Building Inspector will report to Soil Erosion Officer if soil erosion problems are identified.	#32 (High)

2016 Action Strategies	Responsible Parties	Timeframe	2023 Status/EM Comments	2023 Related Strategies & Priority Level
Priority Areas 3, 5: Snow and Ice Mitigation Strategies				
a. Data collection – study of snowfall patterns and occurrence of damage	County Planning, Emergency Management Coordinator, County Building Inspector, Villages, Townships	Ongoing	No progress; this strategy was ultimately not feasible due to lack of persons to collect the data, and is no longer needed. Antrim County's current way to study snowfall patterns is to use a snowfall gauge location in Mancelona, Michigan. We will also use NWS data collection. However, due to the current climate, there is no discernible pattern to the area's snowfall. One area of Antrim County could receive a foot of snow, while another area obtained only inches. To answer the question of the occurrence of damage, this would be done during extreme snow storms or self-reported to the county and/or local emergency services. Due to the area's experience with erratic snowfall, County residents are prepared to handle the amount of snow that could fall.	This strategy is no longer included in the 2023 Hazard Mitigation Plan.
b. Develop a planning grant for a study of the county areas for snow load design standards	County Planning, Emergency Management Coordinator, County Building Inspector, Villages, Townships	2-5 years from adoption of the plan	No progress; this strategy was ultimately not feasible/needed. Antrim County has adopted the State of Michigan minimal lbs. per sq. ft. (60 psf.) for certain parts of the county and has gone beyond the state code with certain areas needing 70 psf. However, the current political climate in Antrim County does not see a need to develop a planning grant for snow load in the area. They feel following the State of Michigan snow load code is sufficient.	This strategy is no longer included in the 2023 Hazard Mitigation Plan.
c. Adoption/Enforcement of building codes; consider increase in minimal lbs. per sq. ft.	County Planning, Emergency Management Coordinator, County Building Inspector, Villages, Townships	Ongoing	Enforcement of existing/current building codes is ongoing. There has been no progress on adoption of new county-specific building codes. See above paragraph for explanation.	#32 (High), #35 (Medium)
d. Promote structural maintenance/improvements	County Building Inspector, Emergency Management Coordinator, Villages, Townships	Ongoing	Non-conformities are identified during the permitting process for new construction or renovations.	#3d (Low), #35 & #36 (Medium)
e. Public education and awareness	County Planning Emergency Management Coordinator, County Building Inspector, Villages, Townships	Ongoing	The County Construction Codes webpage provides the ground snow load criteria for each community in the county, as well as links to many documents explaining the various building code requirements.	#3e (Low), #7 (High), #8 (High), #36 (Medium)

2016 Action Strategies	Responsible Parties	Timeframe	2023 Status/EM Comments	2023 Related Strategies & Priority Level
Priority Areas 1, 2, 4, 5: Thunderstorm and High Wind Mitigation Strategies				
a. Education for Businesses and Homeowners on creating shelters and safe rooms	Emergency Management Coordinator, County Building Inspector, Villages, Townships	Ongoing	We have currently begun the process of education within the county. We provide information via several Facebook pages and informational flyers. Any new information sent to my office from the State of Michigan and pertinent to Antrim County will be passed off to local representatives to disseminate to constituents and the response area. Also, already conducted county-wide weather drills and begun to make this a priority due to the changing weather conditions in Antrim County.	#27 & #28 (Medium)
b. Designate shelter areas for camps, campgrounds	Emergency Management Coordinator, State/County campground managers, Villages, Townships	1-3 years after adoption of the plan	Per the old Emergency Service Coordinator, the individual who was in charge of the county campgrounds did not see this as a concern or wanted to partake in the HM plan. The old ESC, attempted this will no success under the old administration. She was also part-time during this timeframe. However, with new individuals in place, the park director and I are currently in the talks to move forward with this and to work together to create an emergency plan. This will also be part of the County employee emergency plan.	#28 (Medium), #29 (High)
c. Building code enforcement of state and county codes for new construction	County Building Inspector	Ongoing	The County Code Enforcement office continues to do this, which includes an information sheet on how to install anchors and tie-down requirements for mobile homes. Note – there are no county codes in addition to state laws and codes.	#32 (High), #34 (Medium), #50 (Low)
d. Tree management by power companies; promoting urban forestry practices	County Planning, Emergency Management Coordinator, County Conservation District, Power Companies	1-3 years from adoption of the plan	The 2018 County Master Plan includes this implementation project: "Work with the County Forester to develop a Countywide tree planting plan. This plan should discuss the environmental, scenic, and financial benefits of hardwood trees to Antrim County. It should also have an outreach component." The county's Forester position continues to be a full-time job.	#6 (Low), #48 (Medium), #67 (High), #68 (Medium)

2016 Action Strategies	2023 Status/EM Comments	2023 Related Strategies & Priority Level		
Other Strategies				
Work on a Multi-Hazard Warning Plan	The County has adopted the RAVE Alert System, which is being regularly promoted.	This strategy has been completed and is not included in the 2023 Plan.		
Increase Collaboration with other governmental entities, organizations, businesses and the public	The County Emergency Manager serves as a liaison with local lake associations, the Tip of the Mitt Watershed Council and Grand Traverse Bay Watershed Center. The EM also works with governmental units regarding emergency operation and evacuation plans. All local fire department stations in the county have been identified as secondary shelters if needed. Otherwise, the primary shelters are provided by Community Emergency Response Team (CERT) members.	Just about every strategy in the 2023 plan relies on collaboration for implementation.		
Incorporate Natural Hazard Mitigation concepts, strategies and policies into existing elements of the County Master Plan.	Incorporated into some of the Guiding Principles in the 2018 County Master Plan, as described previously. The County's Master Plan is being updated in 2023.	#1 (High)		

APPENDIX D – Consideration of Alternative Strategies

Hazard Mitigation Alternatives Considered for Antrim County

A check mark indicates it was included in the list of mitigation strategies.

Sources of alternatives: Michigan State Police's 2019 Michigan Hazard Analysis and Hazard Analysis Supplement

Hazard Mitigation Alternatives for General Thunderstorm Hazards, Hail, and/or Lightning	
✓	Increased coverage and use of NOAA Weather Radio, and public early warning systems and networks.
✓	Buried/protected power and utility lines. (NOTE: Where appropriate: Burial may sometimes cause additional problems and costs in cases where eventual cable breakages are harder to locate and more expensive to repair.)
✓	Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
✓	Using structural bracing, window shutters, laminated glass in window panes, and impact-resistant roof shingles to minimize damage to public and private structures.
	Moving vehicles into garages or other covered areas.
	Installing lightning protection devices on the community's communications infrastructure and critical structures. More widespread use of lightning protection devices might also occur.
	Purchase of insurance that includes coverage for hail damage.
	Using surge protectors on critical electronic equipment.

Hazard Mitigation Alternatives for Tornadoes and Severe Winds	
✓	Increased coverage and use of NOAA Weather Radio, or comparable device-based notifications.
✓	Public early warning systems and networks.
✓	Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
✓	Buried/protected power and utility lines. (NOTE: Where appropriate. Burial may cause additional problems and costs when breakage or malfunction occurs, due to the increased difficulty in locating and repairing the problem.)
✓	Using appropriate wind engineering measures and construction techniques (e.g. structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced entry and garage doors, window shutters, waterproof adhesive sealing strips, and interlocking roof shingles) to strengthen public and private structures against severe wind damage.
✓	Proper anchoring of manufactured homes and exterior structures such as carports and porches.
✓	Securing loose materials, yard, and patio items indoors, or where winds cannot blow them about. (<i>Advice to be provided in public outreach efforts</i>).
✓	Construction of concrete safe rooms in homes and shelter areas in mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas or event locations.

Hazard Mitigation Alternatives for the Extreme Temperatures Hazard	
✓	Organizing outreach to vulnerable populations during periods of extreme temperatures, including establishing and building awareness of accessible heating and/or cooling centers in the community, and other public information campaigns about this hazard.
✓	Increased coverage and use of NOAA Weather Radio.
✓	Provide and publicize designated heating and cooling centers within the community, where persons in need may go to obtain relief from outdoor temperatures.

Hazard Mitigation Alternatives for Winter Weather Hazards (Includes snowstorms, ice & sleet storms)	
✓	Increased coverage and use of NOAA Weather Radio.
✓	Tree trimming and maintenance to prevent limb breakage and safeguard nearby utility lines. (Ideal: Establishment of a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public rights-of-way.)
✓	Buried/protected power and utility lines. (NOTE: Where appropriate. Burial may cause additional problems and costs in case of breakage, due to the increased difficulty in locating and repairing the problem.)
✓	Establishing heating centers/shelters for vulnerable populations.
✓	Home and public building design and maintenance to prevent roof and wall damage from "ice dams."
✓	Proper building/site design and code enforcement relating to snow loads, roof slope, snow removal and

	storage, etc.
	Agricultural activities to reduce impacts on crops and livestock.
	Pre-arranging for shelters for stranded motorists/travelers, and others.
	Using snow fences or "living snow fences" (rows of trees or vegetation) to limit blowing and drifting of snow over critical roadway segments.

Hazard Mitigation Alternatives for Fluvial (Riverine) Flooding	
✓	Floodplain management—planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
	Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
✓	Dry floodproofing of structures within known flood areas (strengthening walls, sealing openings, use of waterproof compounds or plastic sheeting on walls).
	Wet floodproofing of structures (controlled flooding of structures to balance water forces and discourage structural collapse during floods).
✓	Elevation of flood-prone structures above the 100-year flood level.
✓	Purchase or transfer of development rights – to discourage development in floodplain areas.
	"Floating" architectural designs for structures in flood-prone areas.
✓	Construction of elevated or alternative roads that are unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
✓	Government acquisition, relocation, or condemnation of structures within floodplain or floodway areas.
✓	Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
✓	Protection (or restoration) of wetlands and natural water retention areas.
✓	Higher engineering standards for drain and sewer capacity, or the expansion of infrastructure to higher capacity.
✓	Joining the National Flood Insurance Program (NFIP).
	Obtaining flood insurance. (Requires community participation in the NFIP.)
	Participation in the Community Rating System (CRS).

Hazard Mitigation Alternatives for Urban Flooding	
✓	Stormwater management—Adequate design, installation, maintenance, and monitoring of municipal storm sewer systems. Ordinances or amendments to assist in stormwater management (e.g. forbidding illicit discharges). Planning for and regulating areas prone to flooding (acceptable uses and development restrictions through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, purchased or transferred development rights, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
	Homeowner's and rental insurance that includes coverage of damages and cleanup of sewer backflow impacts.
✓	Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, flood gates and pumps, wetlands protection and restoration).
✓	Higher engineering standards for drain and sewer capacity, or the expansion of infrastructure to higher capacity.
	Drainage easements (allowing the planned and regulated public use of privately owned land for temporary water retention and drainage).
✓	Installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation of storm and sanitary sewage systems.
✓	Farmland and open space preservation.
	Elevating mechanical and utility devices above expected flood levels.
	Flood warning systems and the monitoring of water levels with stream gauges and trained monitors.
✓	Increased coverage and use of NOAA Weather Radio.

	Anchoring of manufactured homes to a permanent foundation in flood areas, but preferably these structures would be readily movable if necessary or else permanently relocated outside of flood-prone areas and erosion areas.
✓	Control and securing of debris, yard items, or stored objects (including oil, gasoline, and propane tanks, and paint and chemical barrels) in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs. <i>(Advice to be provided in public outreach efforts).</i>
✓	Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure clear drainage infrastructure.
	Detection and prevention/discouragement of illegal discharges into storm-water sewer systems, from home footing drains, downspouts and sump pumps.
✓	Increasing the function and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance), including possible separation of combined storm/sanitary sewer systems, if appropriate.
✓	Wetlands protection regulations and policies.
✓	Use of check valves, sump pumps and backflow preventers in homes and buildings.
	Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
✓	Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
✓	Protection (or restoration) of wetlands and natural water retention areas.
✓	Landslide mitigation ideas: Do not build houses, buildings, parks, or playgrounds close to steep slopes; install flexible pipe fittings to avoid gas and water line breakage.

Hazard Mitigation Alternatives for Dam Failures	
✓	Regular inspection and maintenance of dams.
	Garnering community support for a funding mechanism to assist dam owners in the removal or repair of dams in disrepair.
	Regulate development in the dam's hydraulic shadow (where flooding would occur if a severe dam failure occurred).
✓	Ensuring that dams meet or exceed the design criteria required by law.
✓	Public warning systems.
	Obtaining insurance.
✓	Increased coverage and use of NOAA Weather Radio
	Increased funding for dam inspections and enforcement of the Dam Safety Program (Part 315 of the Natural Resources and Environmental Protection Act) requirements and goals.
	Constructing emergency access roads to dams, where needed.
	Pump and flood gate installation/automation.

Mitigation Alternatives for Drought Hazard	
	Storage of water for use in drought events (especially for human needs during periods of extreme temperatures, and for responding to structural fire and wildfire events).
✓	Legislative acts, local ordinances, and other measures to prioritize or control water use.
✓	Encouragement of water-saving measures by consumers (including landscaping, irrigation, farming, lower priority lawn maintenance, and non-essential auto washing).
✓	Anticipation of potential drought conditions, and the preparation of drought contingency plans.
	Designs, for recreational and other water-related structures and land uses, that take into account the full range of water levels (of lakes, streams, and groundwater).
	Designs and plans for water delivery systems that include a consideration of drought events.
	Obtaining agricultural insurance.

Hazard Mitigation Alternatives for Wildfire Hazard (Note: Many of these actions are included in the Firewise USA public education program on wildfire preparedness)	
✓	Proper maintenance of property in or near wildland areas (including short grass; thinned trees and removal of low-hanging branches; selection of fire-resistant vegetation; use of fire resistant roofing and building materials; use of functional shutters on windows; keeping flammables such as curtains securely away from windows or using heavy fire-resistant drapes; creating and maintaining a buffer zone (defensible space) between structures and adjacent wild lands; use of the fire department's home safety inspections; sweeping/cleaning dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches, and yards; keeping woodpiles and other combustibles away from structures; use of boxed or enclosed eaves on houses; thorough cleaning-up of spilled flammable fluids; and keeping garage areas protected from blowing embers).
✓	Safe disposal of yard and house waste rather than through open burning. (Advice to be provided in public outreach efforts).
	Use of fire spotters, towers, planes.
✓	Use of structural fire mitigation systems such as interior and exterior sprinklers, smoke detectors, and fire extinguishers.
✓	Arson prevention activities, including reduction of blight (cleaning up areas of abandoned or collapsed structures, accumulated junk or debris, and lands with a history of flammable substances stored, spilled, or dumped on them).
✓	Public notification of fire weather and fire warnings.
✓	Prescribed burns and fuel management (thinning of flammable vegetation, possibly including selective logging to thin out some areas. Fuels cleared can be given away as firewood or made into wood chips for distribution.)
	Have adequate water supplies for emergency fire-fighting (in accordance with NFPA standards).
	The creation of fuel breaks (areas where the spread of wildfires will be slowed or stopped due to removal of fuels, or the use of fire-retardant materials/vegetation) in high-risk forest or other areas.
✓	Keeping roads and driveways accessible to vehicles and fire equipment—driveways should be relatively straight and flat, with at least some open spaces to turn, bridges that can support emergency vehicles, and clearance wide and high enough for two-way traffic and emergency vehicle access (spare keys to gates for properties should be provided to the local fire department, and an address should be visible from the road so homes can be located quickly). (Advice to be provided in public outreach efforts).
	Enclosing the foundations of homes and buildings rather than leaving them open with their underside exposed to blown embers or materials.
	Safe use and maintenance/cleaning of fireplaces and chimneys (with the use of spark arresters and emphasis on proper storage of flammable items). Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year.
	Proper maintenance and storage of motorized equipment that could catch on fire (from blown embers, etc.)
	Proper storage and use of flammables, including the use of flammable substances (such as when fueling machinery). Store gasoline, oily rags and other flammable materials in approved safety cans. Stack firewood at least 100 feet away and uphill from homes.
	Avoid building structures on hilltop locations, where they will be at greater risk from wildfires (also, hillsides facing south or west are more vulnerable to increased dryness and heat from sun exposure).
	Use of proper setbacks from slopes (outside of the "convection cone" of intense heat which would be projected up the slope of the hill as a wildfire "climbs" it).
	Obtaining insurance.

Hazard Mitigation Alternatives for Invasive Species	
	Restrictions on the import and transport of species carriers.
	Adjustments to hunting, fishing, and other policies and regulations related to wildlife populations.
✓	Use of barriers to prevent invasive species travel.
✓	Use of competing species or other population control techniques.

Hazard Mitigation Opportunities for Public Health Emergencies	
✓	Maintaining proper levels of PPE for healthcare workers and first responders, with additional supplies for long-term care facilities.
✓	Immunization programs to vaccinate against communicable diseases.
✓	Improving ventilation techniques in areas, facilities, or vehicles that are prone to crowding or that may involve exposure to contagion or noxious atmospheres.
✓	Maintaining community water and sewer infrastructure at acceptable operating standards.
✓	Providing back-up generators for water and wastewater treatment facilities to maintain acceptable operating levels during power failures.
✓	Demolition and clearance of vacant condemned structures to help prevent vermin infestation.
✓	Adequate community clinics and school health services.
✓	Brownfield and urban blight clean-up activities.
✓	Proper location, installation, cleaning, monitoring, and maintenance of septic tanks.
✓	Separation of storm and sanitary sewer systems.
✓	Spraying programs to properly control mosquito populations.
✓	Updated Continuity of Operations (COOP) plans and alternative "work from home" schedules.

APPENDIX E – Participation Table

Participating Entity	Representative	Title	Online Community Survey Oct 2021-Jan 2022	LEPC /LPT 9/1/21	LEPC/ LPT 11/9/21	LEPC/ LPT 2/8/22	Community Input Meeting on Hazards - Inland Communities 03/16/22	Community Input Meeting on Hazards - Coastal Communities 03/15/22	June 2022 email	LEPC/LPT Field Trip to Hazard Sites 06/14/22	LEPC/LPT 08/30/22	Public Input Session 10/4/22	Public Input Session 10/5/22	LEPC/LPT 01/10/23	County PC 01/10/23	Emails 2/14/23 - 3/1/23	County PC/Public Hearing 03/07/23
	Leslie Meyers	Antrim County Emergency Management Coordinator (former); Antrim County Operator of Dams (current)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Matt Adamek	Antrim County Emergency Management Coordinator (current)														X	
	Mike Gank	911 Administrative Sergeant	X	X													
	Peter Ganwood	Antrim County Administrator (former)		X	X						X						
	Jeremy Scott	Antrim County Deputy Administrator (former)/ Administrator (current)						X		X					X		X
	Mark Stone	Antrim County Operator of Dams (former)					X	X									
	Scott Kleinhuizen	Antrim County Assistant Operator of Dams					X	X									
	Julie Weston	Antrim County GIS								X							
	Dan Bean	Antrim County Sheriff		X	X								X				
	Judy Parliament	Commission on Aging Director		X	X						X			X			
	Amy Tate	Commission on Aging Clerk I, Office Manager									X						
	Alan Schumaker	Meadowbrook County Medical Facility - Director of Maintenance		X	X					X				X			
	?	County Deputy Assessor	X														
	?	EDC Board Member	X														
	Bill Hefferan	County Planning Commissioner/ County Commissioner District 1													X		X
	Terry VanAlstine	Antrim County BOC Chair, District 3					X										X
	Jason Helwig	County Commissioner, District 4											X				

Antrim County

Participating Entity	Representative	Title	Online Community Survey Oct 2021- Jan 2022	LEPC /LPT 9/1/21	LEPC/ LPT 11/9/21	LEPC/ LPT 2/8/22	Community Input Meeting on Hazards - Inland Communities 03/16/22	Community Input Meeting on Hazards - Coastal Communities 03/16/22	June 2022 email	LEPC/LPT Field Trip to Hazard Sites 06/14/22	LEPC/LPT 08/30/22	Public Input Session 10/4/22	Public Input Session 10/5/22	LEPC/LPT 01/10/23	County PC 01/10/23	Emails 2/14/23 - 3/1/23	County PC/Public Hearing 09/07/23
	Dawn LaVanway	County Commissioner, District 5										X					
	Leslie Elrod	County Planning Commissioner												X			X
	James Gurr	County Planning Commissioner												X			X
Antrim County	Ron Tschudy	County Planning Commissioner										X		X			X
	Richard Friske, Jr.	County Planning Commissioner												X			
Antrim County Road Commission	Peter Stumm	Superintendent					X										
	Burt Thompson	Engineer/Mgr	X														
Banks Township	Donna Heeres	Clerk	X		X												
Central Lake Township	Judith Kosloski	Clerk	X														
Chestonia Township	Dawn LaVanway	County Commissioner, District 5										X					
	Roxann Flake	Supervisor										X				X	
Custer Township	Terry VanAlstine	Antrim County BOC Chair, District 3					X						X	X			
	Jason Helwig	County Commissioner, District 4										X					
	Bill Derenzy	Supervisor															
Echo Township	Ron Tschudy	County Planning Commissioner											X	X			X
	Ed Boettcher, III	(Former) County Commissioner District 1										X					
Elk Rapids Township	Bill Hefferan	County Planning Commissioner/ County Commissioner District 1													X		X
	Terry Smith	Supervisor										X					
	Bonnie Robbins	Trustee					X										
Forest Home Township	Stephen C. Bernard	Zoning Administrator	X														
	Paul Trumbler	Twp. Planning Commission Chair	X														
	Clark "Butch" Peoples	Supervisor					X										
Helena Township	Mike Robinson	Planning Commissioner and S. Torch Lake Fire	X														
	Bonnie Robbins	Trustee					X										
Jordan Township	Dawn LaVanway	County Commissioner, District 5										X					
	Ed Niapoth	Supervisor							X								
Kearney Township	Dick Jacques	Twp. Planning Commissioner	X			X											

Participating Entity	Representative	Title	Online Community Survey Oct 2021- Jan 2022	LEPC /LPT 9/1/21	LEPC /LPT 11/9/21	LEPC/ LPT 2/8/22	Community Input Meeting on Hazards - Inland Communities 05/16/22	Community/ Input Meeting on Hazards - Coastal Communities 05/16/22	June 2022 email	LEPC/LPT Field Trip to Hazard Sites 06/14/22	LEPC/LPT 08/30/22	Public Input Session 10/4/22	Public Input Session 10/5/22	LEPC/LPT 01/10/23	County PC 01/10/23	Emails 2/14/23 - 3/1/23	County PC/Public Hearing 03/07/23
Manuelona Township	Jason Helwig	County Commissioner, District 4															
	Dawn LaVanway	County Commissioner, District 5															
		Community Emergency Response Team Member	X														
Wilton Township	Jeremy Ball	Fire Chief										X					
	Joe Ranis	Twp. Planning Commissioner	X														
	Brett Pharo	Trustee	X														
Star Township	Bill Hefferan	Twp. Planning Commission Chair						X									
	Dawn LaVanway	County Commissioner, District 5										X					
	Robert Marsh	Supervisor	X														
Torch Lake Township	Teod Schroeder	Assistant Fire Chief						X					X				
	Kevin Lane	Fire Chief															
	Virginia Hawkins	Deputy Clerk															X
Warner Township	Mike Robinson	S. Torch Lake Fire Dept.	X														
	Sara Kopriva	Zoning Administrator	X														
	Jerry Kulka	Planning Commissioner (former)	X														
Village of Belleaire	Dawn LaVanway	County Commissioner, District 5										X					
	Nicole Essad	Clerk/Zoning Administrator	X														
	Dave Gadjja	Treasurer/DDA member					X										
Village of Central Lake	Andrew Smith	Clerk/Treasurer (former)	X													X	
	David Centala	Chief of Police						X									
	Kerri Esterly	Treasurer/Planning/Zoning/Community Development (former)	X														
Village of Elk Rapids	Laura Schumate	Trustee	X														
	Kevin Lane	DPW Superintendent						X					X				
	Lynn Alfrich Spearing	President Pro Tem	X														
Village of Ellsworth	Ross Maxwell	Resident															X
	Jason Helwig	County Commissioner, District 4										X					
	Michael Allison	President	X														

Participating Entity	Representative	Title	Online Community Survey Oct 2021- Jan 2022	LEPC /LPT 9/1/21	LEPC/ LPT 11/9/21	LEPC/LPT 2/18/22	Community Input Meeting on Hazards - Inland Communities 03/16/22	Community Input Meeting on Hazards - Coastal Communities 03/16/22	June 2022 email	LEPC/LPT Field Trip to Hazard Sites 06/14/22	LEPC/LPT 08/30/22	Public Input Session 10/4/22	Public Input Session 10/5/22	LEPC/LPT 01/10/23	County PC 01/10/23	Emails 2/14/23 - 3/1/23	County PC/Public Hearing 03/07/23
Antrim Conservation District	Melissa Zelenak	Executive Director (current)								X							
	Kyle Williams	Soil Erosion Officer (current)					X										
	Mike Meriwether	Forester								X							
	Heidi Schafer	Soil Erosion Officer (former)															
	Wendy Warren	Executive Director (former)		X	X												
CAKE-CISMA	Lindsey Bona-Eggeman	Program Coordinator														X	
Three Lakes Association	Fred Sittel	President				X											
Six Mile Lake Association	Linda VanAndel	Board Member															X
Grand Traverse Bay Watershed Center	Heather Smith	Grand Traverse Baykeeper												X			
MSU Extension	Stan Moore	Farm Business Management Educator - Northern Michigan													X		
	Sue Palmisano	Executive Director					X										
Bellaire Family Health Center	Christine Wilhelm	HR Director		X	X					X	X						
Health Department of Northwest Michigan	Chloe Capaldi	Emergency Preparedness Coordinator		X	X						X						
MDHHS	Bob Bush	Assistant Payments Specialist		X	X	X											
MI EGLE	Brian Flickenger	Program Manager		X										X			
Michigan State Police	Lt. Mike deCastro	District 7 Coordinator		X													
American Red Cross	Darlene Windish	Disaster Assistant Volunteer		X	X	X				X							

APPENDIX F – Meeting and Public Input Documentation

Antrim County Office of Emergency Management



Leslie Meyers, Coordinator
110 Grove Street, P.O. Box 333
Bellaire, Michigan 49615-0333
meyersl@antrimcounty.org
231-533-6569 FAX 231-533-5803

LEPC-LPT AGENDA Special Meeting 9-1-21 10 am VIA ZOOM

<https://us02web.zoom.us/j/83264643622?pwd=SVFuWkNsR0ZpZ0lWbkIyUDcxRG5MQT09>

Meeting ID: 832 6464 3622

Passcode: 303729

+1 301 715 8592 US (Washington DC)

+1 312 626 6799 US (Chicago)

Approval of Minutes: August 10, 2021

Old Business

- 1) Update to Natural Hazards Plan

New Business

Comments or Suggestions

Public Comment

Next Meeting Date

LOCAL EMERGENCY PLANNING COMMITTEE/LOCAL PLANNING TEAM
(LEPC/LPT) SPECIAL MEETING MINUTES

September 1, 2021

10:00 AM

Meeting Held Via Zoom

Meeting called to order by Leslie Meyers, Secretary, at 10:00 am.

Members present: Alan Schumaker, Meadowbrook; Leslie Meyers, Emergency Management Coordinator; Bob Bush, DHHS; Darlene Windish, Red Cross; Judy Parliament, COA; Chloe Capaldi, Health Department of Northwest MI; Chris Wilhelm, East Jordan Family Health Centers; Sheriff Dan Bean; Wendy Warren, Antrim Conservation District (arrived at 10:20)

Members absent: Lt. Mike de Castro; Niepoth, Thompson, Garwood, Flickenger

Others Present: Frank Post, Networks Northwest

Approval of Minutes: Tabled until next meeting.

Update to Natural Hazards Plan: This Special Meeting's purpose is to discuss goals, mitigation priorities and the top 5 natural hazard priority areas.

Frank Post informed the group that this will be an updated plan, not a new plan. Housekeeping issues will be addressed, as well as the new census data that is now becoming available. He stated that we would begin the focus on the Executive Summary, specifically the Goals listed.

- 1) **Increase local participation in natural hazards mitigation.** Mitigation and response overlap. Mitigation needs people to react and be effective.
- 2) **Integrate natural hazards mitigation considerations into the County's Comprehensive planning process.** As an example – Flood insurance participants. Bring them into the process.
- 3) **Utilize available resources and apply for others for natural hazards mitigation projects.** The group determined that this doesn't really make sense and should be addressed in the update.
- 4) **Develop and complete natural hazards mitigation projects in a timely manner.**

Vulnerabilities – our aging population.

Frank stressed that mitigation is not totally about correcting a problem, but improving the vulnerability of the problem.

Compounding issues seem to be the way of the future. I.e. a pandemic with flooding. Mitigation is about limiting the effects when they cannot be completely fixed.

Communication is key. Chris asked how this can be better accomplished. One thing the pandemic has brought forward is the ability to communicate in new ways.

Al asked about inventory of resources available. Leslie explained that she is required to keep a list of all county resources (i.e. all large scale fire and dpw equipment, police assets, and EM assets. This information is shared statewide and she has access to knowing what others have as well as a way to request shortfalls from others.

Page 9, Natural Hazards Mitigation Priority Areas: The discussion focused on vulnerable areas vs priority areas for the county. It appears that we are mission most of the east side of the County. John Davis, DNR Fire Officer will be contacted to address fire danger.

The group was asked to study and contemplate the following priority areas for next meeting.

Natural Hazards Mitigation Priority Areas
<p>Priority Area 1: The Village of Bellaire (County Seat) area has a high damage potential from high winds and tornados; and flooding of residential areas.</p> <p>Mitigation Strategies: <i>High Winds, Flooding</i></p>
<p>Priority Area 2: Highway U.S. 31 through the Village of Elk Rapids and Torch Lake shoreline (Milton, Torch Lake, Central Lake, Forest Home, and Helena Townships). A high damage impact potential from severe thunderstorms and high winds affecting a high seasonal population rate and festivals in the summer. There are erosion concerns along Lake Michigan and Torch Lake coastal areas.</p> <p>Mitigation Strategies: <i>Erosion, Severe Thunderstorm and High Winds</i></p>
<p>Priority Area 3: Torch Lake shoreline (Central Lake, Helena, Milton, Torch Lake townships and Village of Central Lake) and Village of Mancelona - A high damage impact potential from extreme winter weather including snow and ice hazards.</p> <p>Mitigation Strategies: <i>Extreme Winter Weather</i></p>
<p>Priority Area 4: The Central Lake area (Village of Central Lake, Central Lake Township) has a high damage impact potential from severe thunderstorms and high winds, specifically affecting seasonal population increases at summer camps such as Camp Hayo-Went-Ha.</p> <p>Mitigation Strategies: <i>Severe Thunderstorms</i></p>
<p>Priority Area 5: The Cedar River area (Kearney and Custer Townships, Shanty Creek resort), has a high damage impact potential from severe thunderstorms and high winds; snow and ice hazards.</p> <p>Mitigation Strategies: <i>Severe Thunderstorms, Extreme Winter Weather</i></p>

Meeting adjourned at 11:10 AM.

Next Meeting: November 9, 2021

Respectfully Submitted,
Leslie Meyers

LOCAL EMERGENCY PLANNING COMMITTEE/LOCAL PLANNING TEAM
(LEPC/LPT) SPECIAL MEETING MINUTES

September 1, 2021

10:00 AM

Meeting Held Via Zoom

Meeting called to order by Pete Garwood, Chair, at 10:02 am.

Members present: Alan Schumaker, Meadowbrook; Leslie Meyers, Emergency Management Coordinator; Pete Garwood, County Administrator; Brian Flickenger, MDEQ; Bob Bush, DHHS; Darlene Windish, Red Cross; Judy Parliament, COA; Chloe Capaldi, Health Department of Northwest MI; Lt. Mike deCastro, MSP, Wendy Warren, Antrim Conservation District

Members absent: Bean, Kenderzsky, Niepoth, Wilhelm, Thompson

Others Present: None

Approval of Minutes: June 2021 minutes. Motion by Windish, supported by Schumaker to approve the minutes with a corrected date. Motion unanimously approved.

Old Business:

- Full Scale Exercise Update: The Exercise Committee will be meeting later this afternoon.

New Business:

- Mobile Command Center: A new mobile Command Center is in the works. We have gotten it approved under the Capital Improvements Plan for 2021 and are making the final adjustments to the layout and build. Alan suggested that a covered area for the trailer be found as no matter how good a trailer is, the membranes take a beating and it should be protected. Leslie stated that she would talk with ACT about possibilities there for storage.
- Bridgeway Generator: Leslie explained that the trailer was purchased with DHS funds in the mid 2000's. Due to the hook-ups required, it is currently limited for use in three locations throughout the County. The new mechanic, Bob White, has worked out a plan for the generator that would allow power cords and lights attached for use where needed if not in use for the three predetermined locations. Bob is working with Rob from Arndt on these improvements.
- SARA Title III Update: All required paperwork has been submitted to the State. There really wasn't much activity this past year so our award payment will be about \$400 to \$600.
- Update to Natural Hazards Plan: Leslie introduced Frank Post, retired EM for Benzie County and since he just can't rest, he is contracting with Networks Northwest for the Natural Hazards Plan updates for each of the 9 counties.

In 2000, the Disaster Mitigation Act shifted the Federal Emergency Management Agency's (FEMA) scope of work to promoting and supporting prevention, or what is

called hazard mitigation planning. FEMA requires government entities to have natural hazards mitigation plans in place and updated on a 5-year cycle as a condition for receiving grant money related to natural hazard remediation.

The purpose of the Natural Hazards Mitigation Plan is to find solutions to existing problems, anticipate future problems, prevent wasteful public and private expenditures, protect property values, and allocate land resources. The implementation of the Plan is to prevent injury, loss of life, property damage, breakdown in vital services like transportation and infrastructure, economic slumps, diminished tourist activity, liability issues, and damage to a community's reputation.

COVID has slowed the update cycle but we need to now get busy. In person meetings will be difficult as the variants of COVID-19 are knocking on the door. Leslie added that electronic meetings may allow for more involvement in the process as the drive to a meeting can be a limiting factor for many participants. Frank added that in order to address the match requirements, electronic meetings will have to be carefully documented.

Other information included:

- FEMA grades the plan on public participation
- Networks northwest is looking for a community to fast track the process and get it done in 7-9 months. Leslie strongly volunteered Antrim County.
- The Plan is then sent to the State for approval and then it heads to FEMA for final approval.
- This plan identifies potential mitigation opportunities such as communications improvements, storm shelters for parks.
- Mitigation can also include minimizing hazards or risks, not just fixing them.
- Leslie will work with Jeremy to see what types of features the Zoom option has to track attendance.

Next Steps: It was determined that fast-tracking the plan was a good idea and all members were directed to review the plan with specific emphasis of the 2015 plan on pages 8, 9 & 22, the planning goals, mitigation priority areas and the top 5 natural hazard priority areas. A special meeting was set for September 1 at 10 AM.

Comments or Suggestions:

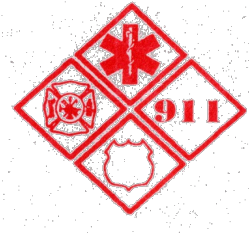
- Alan stated that Meadow Brook had installed the communications booster to its facility.
- Wendy reminded everyone that the ACD is assisting small businesses in getting rid of their hazardous waste and to direct folks to them.

Next Meeting: Special Meeting for September 1, 2021 via ZOOM. Purpose is to Discuss Goals, Mitigation Priorities and the top 5 Natural Hazard Priority Areas.

Meeting adjourned at 11:15 AM.

Respectfully Submitted,
Leslie Meyers

Antrim County Office of Emergency Management



Leslie Meyers, Coordinator
110 Grove Street, P.O. Box 333
Bellaire, Michigan 49615-0333
meyersl@antrimcounty.org
231-533-6569 FAX 231-533-5803

LEPC-LPT AGENDA Regular Meeting 11-9-21 10 am VIA ZOOM

Join Zoom Meeting

<https://us02web.zoom.us/j/82519747025?pwd=dUVObUZWU0hCOGkzTIVIRClQWHI5QT09>

Meeting ID: 825 1974 7025

Passcode: 992808

One tap mobile

+13126266799,,82519747025#,,,,*992808# US (Chicago)

+16468769923,,82519747025#,,,,*992808# US (New York)

Approval of Minutes: Special Minutes September 1, 2021; August 11, 2021
Minutes

Old Business

- Natural Hazards Plan – updates from Networks Northwest

New Business

- AAR – Torch River Spill TTX
- Training/Exercise Plan for 2022-2024
- SARA Title III Update

Comments or Suggestions

Public Comment

Next Meeting Date -

LOCAL EMERGENCY PLANNING COMMITTEE/LOCAL PLANNING TEAM
(LEPC/LPT) MEETING MINUTES

November 9, 2021

10:00 AM

Meeting Held Via Zoom

Meeting called to order by Pete Garwood, Chairman, at 10:00 am.

Members present: Alan Schumaker, Meadowbrook; Leslie Meyers, Emergency Management Coordinator; Bob Bush, DHHS; Darlene Windish, Red Cross; Judy Parliament, COA; Chloe Capaldi, Health Department of Northwest MI; Sheriff Dan Bean; Wendy Warren, Antrim Conservation District, Mike Gank, 911

Members absent: Lt. Mike de Castro; Niepoth, Thompson, Garwood, Flickenger, Wilhelm

Others Present: Jennifer Neal & Stephanie Loria, Networks Northwest

Approval of Minutes: September 1, 2021 and August 11, 2021 – tabled for clarification

Old Business:

- **Natural Hazards Plan:** Stephanie and Jennifer discussed the pre-disaster funding – mitigation dollars and what is at risk. They shared the survey they would be sending out. Leslie provided a list of potential recipients with about 130 people including, but not limited to all planning commissioners, township board members and the EDC.

It was determined that we would add Dean Pratt and Stan Moore to the list. Stan can identify poop palace sand animal containment.

New Business:

- **AAR: Torch River Spill TTX:** over 30 participated in the exercise at Kearney Township Hall. The biggest issue was how would you evacuate the sandbar of 8-10K people? Getting them to leave their boats was paramount. Leslie will be working with some of the water organizations to further discuss this.
- **Training/Exercise Plan for 2022-2024:** The plan was shared. Leslie is doing her best to bring as much of the training locally as travel can make some training next to impossible to achieve.
- **SARA Title III Update:** Leslie stated that we received a small grant of \$250 for 2021 as more of her time was devoted to vaccinations than SARA paperwork. We usually receive about \$1000 per year. The cycle will begin again early 2022. She hopes to be able to devote more time.

Meeting adjourned at 11:10 AM.

Next Meeting: November 9, 2021

Respectfully Submitted,

LEPC/LPT Draft 11-9-21

Leslie Meyers

Antrim County Office of Emergency Management



Leslie Meyers, Coordinator
110 Grove Street, P.O. Box 333
Bellaire, Michigan 49615-0333
meyersl@antrimcounty.org
231-533-6569 FAX 231-533-5803

LEPC-LPT AGENDA Regular Meeting 2-8-22 10 am VIA ZOOM

Join Zoom Meeting

<https://us02web.zoom.us/j/85950902753?pwd=TEFnM21nQUVNdHVhNFVsNFhPaExBQT09>

Meeting ID: 859 5090 2753

Passcode: 054496

One tap mobile

+13126266799,,85950902753#,,,,*054496# US (Chicago)

+16468769923,,85950902753#,,,,*054496# US (New York)

Dial by your location

+1 312 626 6799 US (Chicago)

+1 646 876 9923 US (New York)

Approval of Minutes: November 9, 2021 Minutes

Old Business

- Natural Hazards Plan – updates from Networks Northwest

New Business

- SARA Title III Update – Application Sent for 2022.
-

Comments or Suggestions

Public Comment

Next Meeting Date -

LOCAL EMERGENCY PLANNING COMMITTEE/LOCAL PLANNING TEAM
(LEPC/LPT) MEETING MINUTES

February 8, 2022

10:00 AM

Meeting Held Via Zoom

Meeting called to order by Pete Garwood, Chairman, at 10:02 am.

Members present: Alan Shumaker, Meadowbrook; Leslie Meyers, Emergency Management Coordinator; Bob Bush, DHHS; Darlene Windish, Red Cross; Judy Parliament, COA; Pete Garwood, County Administrator, Christine Wilhelm, Bellaire Family Health Care Center

Members absent: Lt. Mike de Castro; Niepoth, Thompson, Flickenger, Warren, Wilhelm, Gank

Others Present: Jennifer Neal & Stephanie Loria, Networks Northwest, Dick Jacques, Schuss Mnt Ski Patrol & Kearney Township Planning Commission; Donna Herres, Banks Township Clerk

Approval of Minutes: November 9, 2021 tabled

Old Business:

- **Natural Hazards Plan:** Stephanie and Jennifer presented the results of the Community Survey. There were 41 responses. Interestingly flood was the biggest concern identified. Alan reminded the group that this survey went out shortly after the severe rain storm that took place in August. With the blowout of the Finch Creek culvert on Alden Highway and several other local roads, flooding was on the top of everyone's mind. There was also a dozen of the respondents that were interested in assisting the group and two joined us today.

Also discussed was the historic weather events that have taken place in Antrim County. Previous Presidential and Governor declared emergencies were reviewed, including those related to COVID, the blizzard of 1978 and the drought of 1977. We have been rather lucky in northern Michigan when it comes to declarations. Wildfires were discussed as were actual flooding events.

Next the group discussed Hazard Identification. While many bridges, dams, flood plains, coastal zones and invasive species were mentioned in the presentation, the group added additional ones including:

Pinebrook Dam
Bridge Street in Ellsworth
Derenzy Road at the Cedar River Dam
East Jordan Rd culvert
Lake Street in ER

Stephanie and Jenni will work on the next steps – several regional meetings to discuss specific threats and hazards.

New Business:

- **SARA Title III Update:** All information for the SARA Title III Grant have been submitted and Leslie hopes to have more time to devote this year as more time equates to more funds available to us.

Meeting adjourned at 11:15 AM.

Next Meeting: May 10, 2022 (special meetings to be arranged).

Respectfully Submitted,
Leslie Meyers

Natural Hazards Identification Meeting - Coastal Municipalities

5 messages

Meyers, Leslie <meyersl@antrimcounty.org>

Wed, Mar 9, 2022 at 10:11 AM

To: "mdsoper2771@gmail.com" <mdsoper2771@gmail.com>, "Elk Rapids Chamber (tom@elkrapidschamber.org)" <tom@elkrapidschamber.org>, "VanAlstine, Terry" <vanalstinet@antrimcounty.org>, "Scott, Jeremy" <scottj@antrimcounty.org>, Heidi Shaffer <heidi.shaffer@macd.org>, "Stone, Mark" <stonem@antrimcounty.org>, "Hunter, James" <hunterj@antrimcounty.org>, "rragland@elkrapids.org" <rragland@elkrapids.org>, "bmulaly@elkrapids.org" <bmulaly@elkrapids.org>, "vllgdpwsuper@elkrapids.org" <vllgdpwsuper@elkrapids.org>, "jjanisse@elkrapids.org" <jjanisse@elkrapids.org>, "kesterly@elkrapids.org" <kesterly@elkrapids.org>, David Centala <dcental@elkrapids.org>, Banks Township Clerk <clerk@bankstownship.net>, "ireneshooks@gmail.com" <ireneshooks@gmail.com>, "dieboldrm@gmail.com" <dieboldrm@gmail.com>, Banks Township <bankstownship@bankstownship.net>, "larryessenberger@gmail.com" <larryessenberger@gmail.com>, "jlklooster@gmail.com" <jlklooster@gmail.com>, "lynnspearing@gmail.com" <lynnspearing@gmail.com>, "marybneer@gmail.com" <marybneer@gmail.com>, Elk Rapids Fire Department <erfire@elkrapids.info>, Ted <torchlakefd@gmail.com>, "Jeremy Ball (miltontwpfd@gmail.com)" <miltontwpfd@gmail.com>, "Mark Groenick (banksfire6600@gmail.com)" <banksfire6600@gmail.com>, Jennifer Neal <jennifer.neal@networksnorthwest.org>, Stephanie Loria <stephanie.loria@networksnorthwest.org>, "Garwood, Peter" <garwoodp@antrimcounty.org>, "Boettcher, Ed" <boettchere@antrimcounty.org>, "Bargy, Karen" <bargyk@antrimcounty.org>, "Rubingh, Jarris" <rubinghj@antrimcounty.org>

Dear Antrim County Community Stakeholder:

The Antrim County Office of Emergency Management Department invites you to a meeting of local municipal officials and land management stakeholders to discuss natural hazard impacts and mitigation strategies in Antrim County. **Local participation is crucial** to the planning process and a requirement of FEMA, the approval agency, when preparing the County's 5-year Natural Hazard Mitigation Plan.

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Feel free to contact Leslie Meyers, Emergency Management Coordinator, at meyersl@antrimcounty.org or Stephanie Loria, Community Planner at stephanie.loria@networksnorthwest.org if you have any questions.

Leslie Meyers is inviting you to a scheduled Zoom meeting.

Join Zoom Meeting

<https://us02web.zoom.us/j/84393598677?pwd=YU1qZVlPdldYml0a2tpeHRLNC8rQT09>

Meeting ID: 843 9359 8677

Passcode: 655772

One tap mobile

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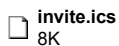
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Meeting ID: 843 9359 8677

Passcode: 655772

Find your local number: <https://us02web.zoom.us/j/84393598677>

Natural Harards Indeitafation Meeting - Inland Communities

Meyers, Leslie <meyersl@antrimcounty.org>

Wed, Mar 9, 2022 at 10:34 AM

To: "dbennett@bellairemichigan.com" <dbennett@bellairemichigan.com>, "vlgclerk@bellairemichigan.com" <vlgclerk@bellairemichigan.com>, "dpwdirector@bellairemichigan.com" <dpwdirector@bellairemichigan.com>, Bellaire Chamber <info@bellairechamber.org>, Joni Moore <moore@torchlake.com>, "Central Lake Chamber (info@centrallakechamber.com)" <info@centrallakechamber.com>, Central Lake Township Clerk <clerk@centrallaketownship.com>, "nancyshepard49611@yahoo.com" <nancyshepard49611@yahoo.com>, "custersupervisor@hotmail.com" <custersupervisor@hotmail.com>, "echotownship@live.com" <echotownship@live.com>, "beavguy@outlook.com" <beavguy@outlook.com>, "chuckj@hotmail.com" <chuckj@hotmail.com>, Clerk Warner <warnertwpclerk@gmail.com>, "warnersupervisor@gmail.com" <warnersupervisor@gmail.com>, "Drollinger, Bill" <drollinger332@live.com>, "sbarrett@centrallakemi.org" <sbarrett@centrallakemi.org>, "villageclerk@centrallakemi.org" <villageclerk@centrallakemi.org>, "gordieontorch@gmail.com" <gordieontorch@gmail.com>, "mrobinson2528@gmail.com" <mrobinson2528@gmail.com>, "rjlogee@hotmail.com" <rjlogee@hotmail.com>, "helena@torchlake.com" <helena@torchlake.com>, "VanAlstine, Terry" <vanalstinet@antrimcounty.org>, "Garwood, Peter" <garwoodp@antrimcounty.org>, "Scott, Jeremy" <scottj@antrimcounty.org>, "Bean, Daniel" <beand@antrimcounty.org>, Heidi Shaffer <heidi.shaffer@macd.org>, "Stone, Mark" <stonem@antrimcounty.org>, "Thompson, Burt" <bthompson@antrimcrg.org>, "butchdewey@gmail.com" <butchdewey@gmail.com>, "pmboyd12@gmail.com" <pmboyd12@gmail.com>, "lauryнкеiser@live.com" <lauryнкеiser@live.com>, "fharris26@charter.net" <fharris26@charter.net>, "donseman@gmail.com" <donseman@gmail.com>, "wallygator1956@hotmail.com" <wallygator1956@hotmail.com>, "laarmike@yahoo.com" <laarmike@yahoo.com>, "kwoodrep@gmail.com" <kwoodrep@gmail.com>, "ttrumble@charter.net" <ttrumble@charter.net>, "c49615awl@gmail.com" <c49615awl@gmail.com>, "danandann@torchlake.com" <danandann@torchlake.com>, "tsheneman@charter.net" <tsheneman@charter.net>, "tebonis88@gmail.com" <tebonis88@gmail.com>, "ardenfarm@torchlake.com" <ardenfarm@torchlake.com>, "laurawesterman01@gmail.com" <laurawesterman01@gmail.com>, "Bonnie Robbins (bonnie_robbins@hotmail.com)" <bonnie_robbins@hotmail.com>, "MelissaZ@macd.org" <MelissaZ@macd.org>, Stephanie Loria <stephanie.loria@networksnorthwest.org>, Jennifer Neal <jennifer.neal@networksnorthwest.org>, "Weston, Julie" <westonj@antrimcounty.org>

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Antrim County Communities – Hazard Input Meetings via Zoom 3/16/22

Inland County Community Attendees:

- Peter Stumm, Antrim County Road Commission Superintendent
- Clark “Butch” Peeples – Helena Twp. Supervisor
- Bonnie Robbins - Helena Township Trustee
- Nicole Essad – Village of Bellaire Clerk/Zoning Administrator
- Terry VanAlstine – Antrim County Board of Commissioners Chair
- Kyle Williams – Antrim Conservation District
- Mark Stone – Antrim County Operator of Dams
- Scott Kleinhuizen – Antrim County Assistant Operator of Dams
- Fred Sittel – President of Three Lakes Association (Lake Bellaire, Clam Lake and Torch Lake)
- Sue Palmisano – Bellaire Chamber of Commerce Executive Director
- Julie Weston – Antrim County GIS
- Leslie Meyers - Antrim County E.M.

Lake Michigan Shoreline Community Attendees:

- David Centala – Elk Rapids Chief of Police
- Kevin Lane - Elk Rapids DPW Superintendent
- Bill Hefferan – Milton Township Planning Commission Chair
- Ted Schroeder – Torch Lake Fire Dept.
- Lynn Aldrich Spearing – Village of Ellsworth - President Pro Tem
- Heidi Schafer– Antrim Conservation District – Soil Erosion Officer
- Kyle Williams – Antrim Conservation District – Conservation Technician
- Donna L. Heeres – Banks Twp. Clerk (for past 40 years)
- Jeremy Scott – Antrim County Deputy Administrator
- Mark Stone – Antrim County Operator of Dams
- Scott Kleinhuizen – Antrim County Assistant Operator of Dams – works with dams and waterways in the County; lives in Central Lake Twp.
- Julie Weston – Antrim County GIS
- Leslie Meyers - Antrim County E.M.

Discussion:

CHAIN OF LAKES GROUP– comprised of Intermediate Lake Association, Three Lakes Association, etc. – worked on the hydrology study that the Army Corp of Engineers (ACE) has created for the Chain of Lakes. Uses a mathematical model that accounts for terrain and hypothetical storm rainfall of 100-year storms hitting the sub-watersheds – “Micro-rainstorm” scenarios. Uses data from NOAA rain gauges, but MSUE and Weather Underground gauges report locally higher levels. Have gotten 10” of rain in the Grass River watershed in just a few hours. Each sub-watershed can become torrents in the Chain of Lakes in a major storm event.

There is not another functional model like this within the Great Lakes area. The model/study should be made available this year.

BANKS TOWNSHIP

Erosion Concerns on Lake MI side along Lake Shore Drive, north of Banks Twp. Park, where creek flows into Lake MI. The road is in very poor condition and safety will be compromised. There is an approximate 30-foot drop-off to the lake. If road collapses, will block off the one-way road access to about 60 homes here.

Village of Ellsworth

C-48 (Lake St.) culvert collapsed in 2021. Have temporarily fixed it. There will be no good alternate traffic route when they have to put in a new culvert.

Need to rebuild 2 bridges. One on Bridge St. over the river that connects St. Clair Lake to Ellsworth Lake. The other is the C-48 bridge over Skinner Creek by Tapawingo Restaurant. The roadbeds are holding the water back and are not built to uphold the water pressure against them. Have seen water flowing over the surface of the road, during the same storm that took out the road crossing over the Finch Creek in August 2021. More often having 100-year storm volumes hitting the watersheds now. May need Village staff to go after funding – Road Commission is short on funds.

Mark Stone – recommends that when the 6 Mile Lake and St. Clair Lake water control structures are replaced they should cup up with a design idea so that it won't displace the floodplain. The ACE model can predict what a new monitoring station would result in for the lake levels.

CENTRAL LAKE TOWNSHIP: Where Ogletree Creek connects to the Green River – Culprit for sediment accumulation. Vehicles have been spotted hydroplaning in the Central Lake area due to heavy rainfall – speed was not a factor.

Mohrmann Bridge – flooding concerns.

State Street Bridge in Village of Central Lake – flooding concerns.

TORCH LAKE TOWNSHIP

The Torch Lake Fire Dept. uses the following boat launches for rescue boat use on Grand Traverse Bay: Traverse Bay Trail, end of Creswell Rd. and end of Erickson Rd. All locations have coastal erosion issues, and the Fire Dept. cannot launch boats here. They also can't easily use these locations to fill their fire trucks.

The boat launches they use on the Torch Lake side are fine.

MILTON TOWNSHIP

Heidi, Antrim CD: Torch River has always been impacted by heavy rains. The Hardware Store and Party Store has regularly flooded in the past two years. Tried to work with residence/business owners for flooding assistance.

Bill H. (Milton Twp. Planning Commission) is most concerned with the continued extended power outages due to wind.

Potential idea to mitigate power outages: local government installs an interface on homes to plug in a generator. Might cost \$3,500-\$1,000 per install. This service should be publicized for people who need power to run medical equipment in their homes. No one should die from lack of power.

Also soil erosion of properties. Every single year for the last 5 years the Torch River Area has been impacted from wind and rain. People who have houses in the “bayou” areas along the Torch River/Torch Lake have water in their yards/houses.

A buildup of sediment in Torch Lake is starting to cause blockages. When Crystal Beach Road was built, all the water flowing from Torch Lake was all confined to the narrow Torch River Bridge area and the outlet constructed is too small.

ELK RAPIDS TOWNSHIP

The Elk Rapids Dam is their biggest concern - Dexter St./Bridge just upstream of the dam. The River below the kid’s fishing pond – may pull all logs because they want to save Dexter St. (cannot let it collapse) or Cedar Street Bridge (undersized culvert). All of Dexter St. is an impoundment. The lower point of the impoundment is the most significant weakness.

A policy is in place if dam fails, but it could be updated. Their evacuation plan is not adequate – needs updating.

The ACE hydrology study can better predict lake level impacts to the dam.

Lake St., south side of Bass Lake, usually floods in a rain storm. Get 3-4” of rain within a period of 4 hours occasionally. Storm sewer system is adequately sized, but gets overloaded. Backflow/overflow can impact homes along the road. Elk Rapids DPW takes precautions cleaning the drains and outfalls. The grade is lower on the lake side of the road. If someone lives on the downside of the road, they get impacted by stormwater flowing off the road as well as erosion occurring along the lake.

Serious erosion around March 2020 on Bayshore Drive along Lake MI. Lost part of the road. Village replaced it and added a new culvert.

Village did some work by Ottawa and River Street as well due to flooding impacts.

HELENA TOWNSHIP

Concerned about invasive species, such as Autumn olive, which kill adult trees and pines, therefore increasing the risk for wildfire. They are also concerned with aquatic invasives.

The CAKE CISMA group helps communities with managing invasive species. Lots of work previously with treatment for phragmites, purple loosestrife control.

In favor of burying electrical lines in trouble areas where they usually are downed in storms.

They also have many undersized culverts. In Alden, there are two concrete culverts – Coy St. and Smalley St. (they are not bridges because the span is under 20’) - over Spencer Creek were close to overflowing during the August 2021 storm. There is also a culvert just north of W. Elder Road and SE Torch Lake Drive in Alden that flooded in the August 2021 storm.

Also by the Helena Township Ballpark there are erosion problems into Torch Lake – used to be an old railroad bed there. Potential site contamination?

Culvert flooding at these locations:

- Valley St. where it crosses the Spencer Creek in two locations
- East Torch Lake Dr. where it crosses a creek, located northwest of Alden Hwy.
- Alden Hwy, north of Elder Road and south of Cedar St. – high flood area

Torch River Area has had flooding south of Crystal Beach Road - impacts Clearwater Twp. in Kalkaska County and Milton Twp. in Antrim County

East Torch Lake Drive crossing over Clam Lake – the road restricts water flows and acts like a dam. Impacts Helena Twp. and Forest Home Twp. in this location.

FOREST HOME TOWNSHIP

Fred Sittel - Cottage Drive flooded before the August 11, 2021 storm event. No speed limit sign on the road. 2 culverts flooded; water flowing across the road adjoining Clam Lake. Lots of runoff on Cottage Drive, south of Steiner Rd.; no culverts under the road here.

Tree concerns along Cottage Drive, between Clam Lake and Lake Bellaire. Also all trees in the Glacial Hills trails area. In these areas the trees are not trimmed/managed; impacted from high wind events. Many people live off of roads with no alternative in or out; takes time for first responders to saw through downed trees blocking the roads.

Would like to look at culverts in the county from an environmental standpoint – can determine if undersized by looking at the upstream side and natural land cover. If lots of dead trees, there if a flow restriction.

Many of these culverts are on private land.

KEARNEY TOWNSHIP

Shanty Creek – “Sand” traps – mini lakes. Culverts are very small, made of concrete, wood or steel (rusts). On private property but collectively could present a hazard if it fails.

Remembered Legend Golf Course – Shanty Creek – 1984 “blowout”. Concerns with golf course runoff and flooding around Batchelder Rd.

The Road Commission is planning on increasing the size of the Maury Creek Culvert located west of M-88 and adjoining Lake Bellaire.

Village of Bellaire –

Intermediate River has filled with sand and silt and become very shallow. Doesn't handle water well from the upper chain of lakes. The ACE model will predict what could happen to hydrology if they dredge the lake.

The Bellaire Dam is OK as is. It is a High hazard class because if it did go out it could possibly kill someone. They do drills with the E.M. services and evacuation plans as stated in the Emergency Action Plan.

The Cedar River Dam on Derenzy Rd – water has flowed across Derenzy Rd. before.

CUSTER TOWNSHIP

The Pine Brook Dam is a concern where Shanty Creek intersects M-88.

Not sure if there is a dry impoundment on Shanty Creek southwest of M-88 – Cold Creek dam (constructed of metal) gave way a while ago in this area?

Consider that Antrim County (Custer Twp) is downstream of the Rugg Pond Dam in Kalkaska County. The pond is filling with sediment.



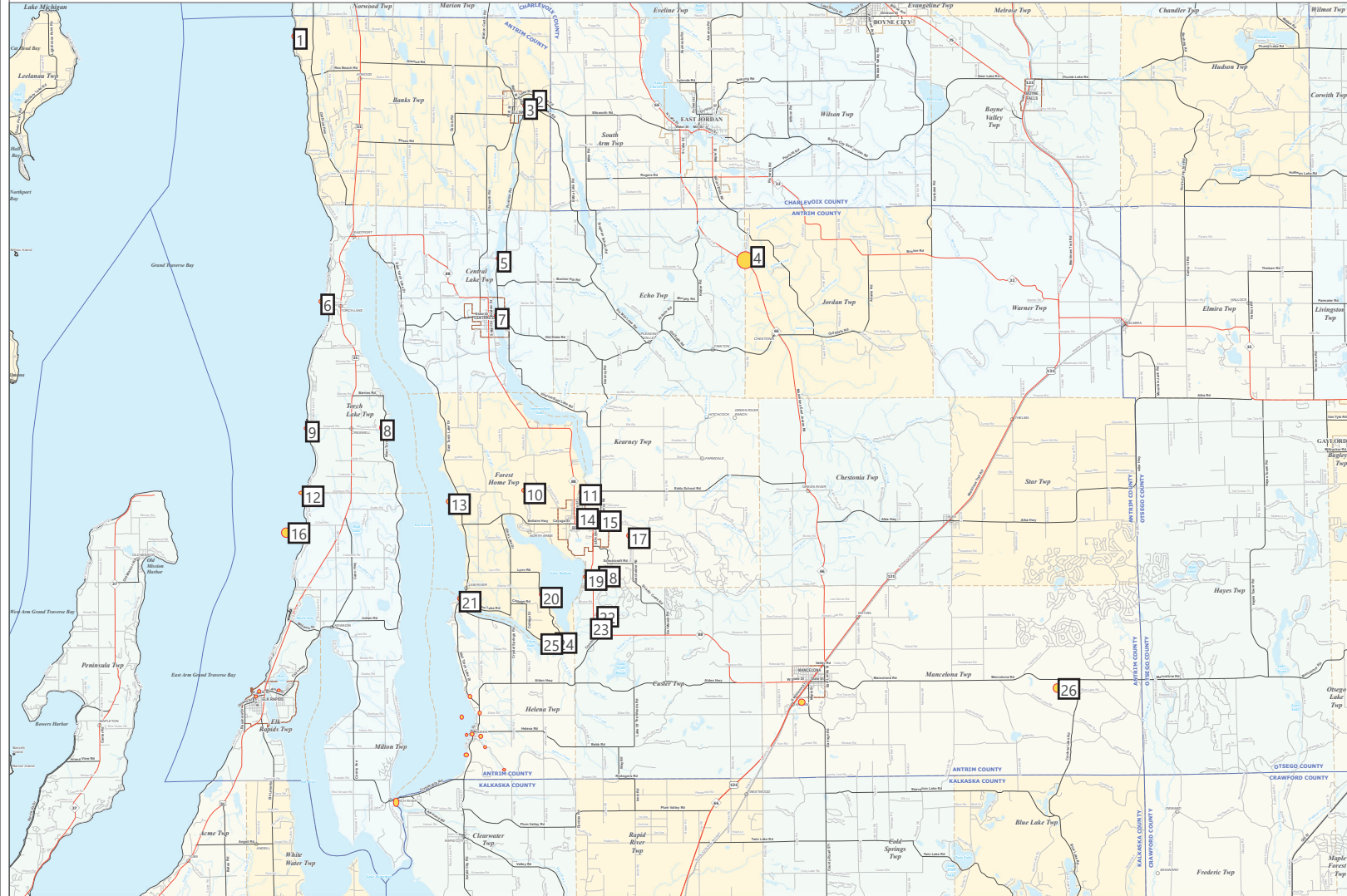
- Mark Stone – would like to have each hydraulic structure (bridge/culvert) rated. Many roads also act as dams. Inventory these to prioritize what needs to be fixed first. Also the County never established a legal drainage district. If done, they may have a way for the government to set a standards over and above the state for hydraulic structures.

Lake levels in the upper chain of lakes have been higher than ever expected. Every lake in the chain is a flood hazard. Best to ignore township lines – look at the watershed boundaries. Everything is related to everything else, including going into Charlevoix and Kalkaska Counties.

FEMA is creating new 100-year floodplain maps for the entire county in 2023. Have a formal agreement with the ACE; their study will be what FEMA uses to create the new maps. Pursuing an aggressive effort with flood mitigation – applying for grant \$ to fix.

- Antrim County Road Commission says they conducted a culvert inventory a while ago.
- Kyle Williams - Forestry management (tree cutting?) for the east half of the county regarding DNR/wildfire risks? Ask county forester Mike Merriweather.
- They also have some brownfields and sites of environmental contamination – Tar Lake site with groundwater contamination plume in Mancelona; Antrim/Kalkaska landfill south of Helena Twp/Custer Twp., near the county line, on Plum Valley Rd. in Kalkaska County. Peter Garwood has info on this. Ask FEMA if we should include these in our scope.

ANTRIM COUNTY



0 0.5 1 2 Miles

Legend	
	City
	Unincorporated Place
	Township
	Village
	Census Designated Place
	County
	State
	Freeway
	Highway
	Primary Road
	Local Road
	Railroad
	Water Feature
	River, Stream, or Drain



Source: Michigan Geographic Framework, v17s

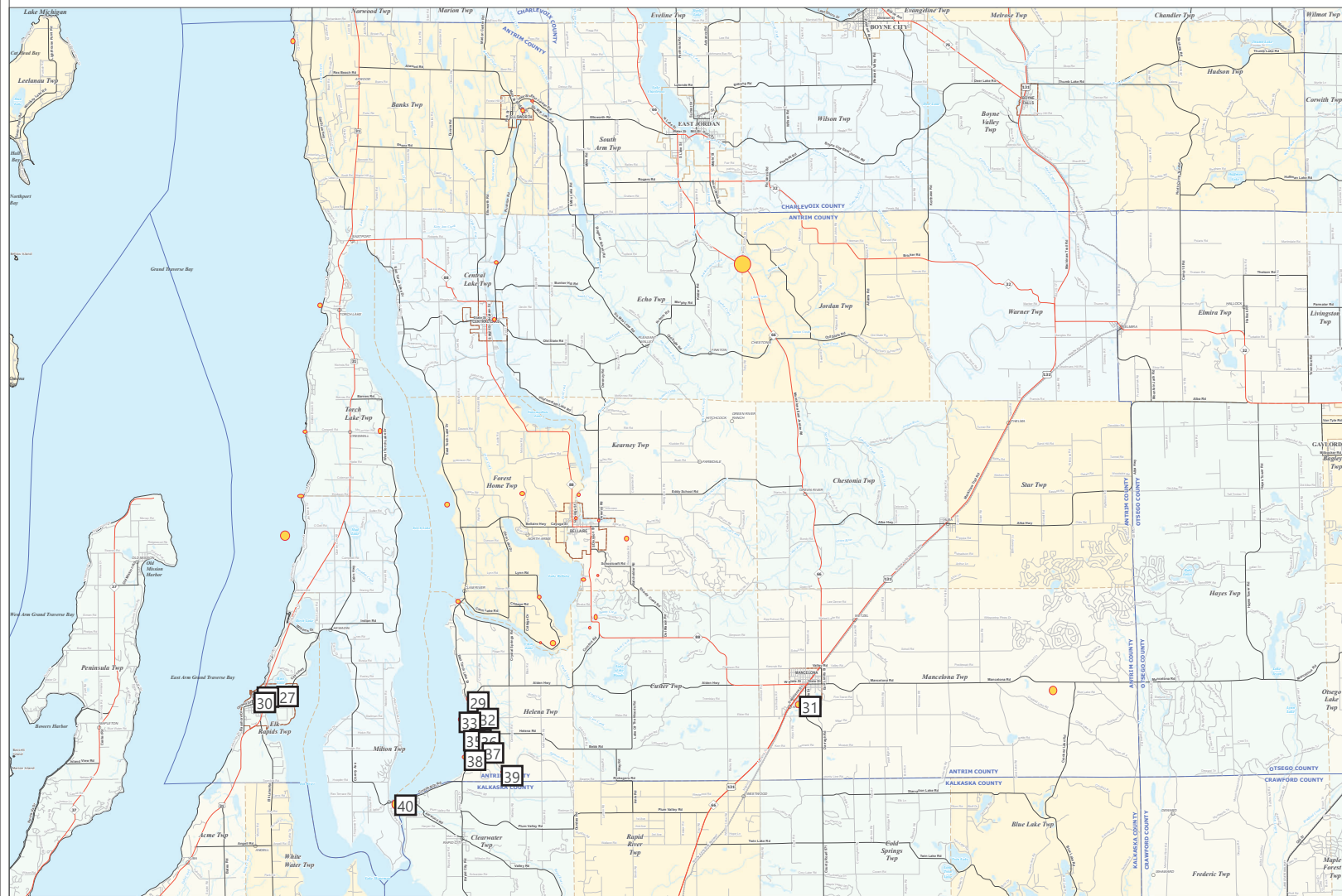
Summary of Comments on Community Zoom Meetings_Input Map_2022_03_16.pdf

Page: 1

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	Erosion concerns.			
<input type="radio"/>	Number: 2	Author: westonj	Subject: Oval	Date: 3/16/2022 12:02:07 PM
	Culvert concerns.			
<input type="radio"/>	Number: 3	Author: westonj	Subject: Oval	Date: 3/16/2022 11:55:04 AM
	Flooding, 2 bridges need work, culvert needs repair.			
<input type="radio"/>	Number: 4	Author: westonj	Subject: Oval	Date: 5/11/2022 9:54:00 AM
	General, Chain of Lakes. All of the lakes are connected together.			
<input type="radio"/>	Number: 5	Author: westonj	Subject: Oval	Date: 3/16/2022 3:34:41 PM
	Mohrmann Bridge. Flooding concerns.			
<input type="radio"/>	Number: 6	Author: westonj	Subject: Oval	Date: 3/16/2022 12:03:31 PM
	Boat Launch. Issues launching boats. Erosion.			
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	State St Bridge.			
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	Erosion concerns.			
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	Boat Launch issues. Erosion.			
<input type="radio"/>	Number: 10	Author: westonj	Subject: Oval	Date: 3/16/2022 3:17:56 PM
	Glacial Hills NA. Trees not being cleared regularly.			
<input type="radio"/>	Number: 11	Author: westonj	Subject: Oval	Date: 3/16/2022 3:27:33 PM
	Intermediate River has filled in with sediment and has become very shallow.			
<input type="radio"/>	Number: 12	Author: westonj	Subject: Oval	Date: 3/16/2022 12:06:02 PM
	Boat Launch issue. Erosion.			
<input type="radio"/>	Number: 13	Author: westonj	Subject: Oval	Date: 3/16/2022 3:14:33 PM
	General concern about private dams and culverts.			
<input type="radio"/>	Number: 14	Author: westonj	Subject: Oval	Date: 3/16/2022 3:28:07 PM
	Bellaire Dam.			
<input type="radio"/>	Number: 15	Author: westonj	Subject: Oval	Date: 3/16/2022 3:28:42 PM
	Cedar River Dam. Has flowed across Derenzky Rd.			
<input type="radio"/>	Number: 16	Author: westonj	Subject: Oval	Date: 3/16/2022 11:47:26 AM
	Concerns about extended power outages.			
	Author: westonj	Subject: Sticky Note	Date: 3/16/2022 11:51:08 AM	
	Suggestion of plugs being added to house for generators.			
<input type="radio"/>	Number: 17	Author: westonj	Subject: Oval	Date: 5/10/2022 5:28:19 PM
	Golf course concerns. Runoff/flooding.			
<input type="radio"/>	Number: 18	Author: westonj	Subject: Oval	Date: 3/16/2022 3:24:05 PM
	Legend Golf Course Blowout Area.			
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	Maury Creek Culvert.			
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	Lots of runoff in Miley Area. No culverts.			
<input type="radio"/>	Number: 21	Author: westonj	Subject: Oval	Date: 3/16/2022 3:16:46 PM
	Road restricts water flow like a dam.			
<input type="radio"/>	Number: 22	Author: westonj	Subject: Oval	Date: 3/16/2022 3:20:06 PM
	Pine Brook Dam concern.			
<input type="radio"/>	Number: 23	Author: westonj	Subject: Oval	Date: 3/16/2022 3:21:31 PM
	Dry impoundment?			
<input type="radio"/>	Number: 24	Author: westonj	Subject: Oval	Date: 3/16/2022 3:24:43 PM
	Tree concerns along Cottage Dr.			
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	Two Culverts in area. Flooding. Flowing across road.			
<input type="radio"/>	Number: 26	Author: westonj	Subject: Oval	Date: 3/16/2022 3:40:01 PM
	Fire Danger Area. Trees regularly cut?			

Comments from page 1 continued on next page

ANTRIM COUNTY



Legend	
	City
	Unincorporated Place
	Township
	County
	Village
	Census Designated Place
	Freeway
	Highway
	Primary Road
	Local Road
	Railroad
	Water Feature
	River, Stream, or Drain



Source: Michigan Geographic Framework, v17s

- Number: 27 Author: westonj Subject: Oval Date: 3/16/2022 11:31:49 AM
Flooding on Lake St.

- Number: 28 Author: westonj Subject: Oval Date: 3/16/2022 11:39:52 AM
Elk Rapids Dam. Dexter St.

- Number: 29 Author: westonj Subject: Oval Date: 3/16/2022 3:08:30 PM
Culvert concern.

- Number: 30 Author: westonj Subject: Oval Date: 3/16/2022 11:45:15 AM
Undersized passage on Cedar St.

- Number: 31 Author: westonj Subject: Oval Date: 3/16/2022 3:48:16 PM
Plume.

- Number: 32 Author: westonj Subject: Oval Date: 3/16/2022 3:05:57 PM
Culvert concerns. High flood area.

- Number: 33 Author: westonj Subject: Oval Date: 3/16/2022 12:13:58 PM
Invasive species. Wildfire threat.

- Number: 34 Author: westonj Subject: Oval Date: 3/16/2022 3:01:01 PM
Culvert concern.

- Number: 35 Author: westonj Subject: Oval Date: 3/16/2022 3:04:58 PM
Like to bury power lines in area to reduce power outages.

- Number: 36 Author: westonj Subject: Oval Date: 3/16/2022 3:03:50 PM
Culvert concern at creek.

- Number: 37 Author: westonj Subject: Oval Date: 3/16/2022 3:08:54 PM
Culvert flooding

- Number: 38 Author: westonj Subject: Oval Date: 3/16/2022 3:00:20 PM
Ball Park. Erosion.

- Number: 39 Author: westonj Subject: Oval Date: 3/16/2022 3:11:19 PM
Culvert concern. Flooding.

- Number: 40 Author: westonj Subject: Oval Date: 3/16/2022 11:43:02 AM
Torch River Area flooding occurring.

-  Author: westonj Subject: Sticky Note Date: 3/16/2022 11:49:57 AM
This was a delta area for Torch Lake.

Antrim County LEPC Bus Tour Notes– 06/14/22

In Attendance:

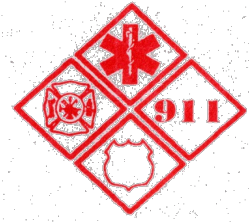
Jeremy Scott	Antrim County Deputy Administrator
Mike Merriwether	Antrim Conservation District
Alan Shumaker	Meadow Brook MCF & Bellaire Fire
Jeremy Scott	Antrim County Administration
Julie Weston	Antrim County GIS
Christine Wilhelm	Bellaire Family Health Center
Darlene Windish	American Red Cross
Leslie Meyers	Antrim County Emergency Manger
Jennifer Neal	Networks Northwest Community Planner
Stephanie Loria	Networks Northwest Community Planner

- ACE Hydrology Study presentation to technical stakeholders: June 22 at 4 pm; Presentation to general public: July 12 at 5 pm
 - ACE contributed 250K and Antrim County contributes 80K; largest study of its kind
- Don't really have flooding of buildings; it's mostly yards. FEMA will not pay for damages; also homes have to be primary homes for coverage.
- Craven Pond (Blair Lake) in Bellaire almost overflowed during storm events in October 2020 and August 2021; if this were to happen the dam would have been breached.
- Boat launch on Ohio St. behind the Bellaire Bar fell apart last weekend – part of Paddle Antrim route.
- State St. Bridge in Village of Central Lake: USGS water level monitoring station. Only one in the county. Ask Mark Stone why this location? Work scheduled on bridge soon (ask Road Commission). Area of water constriction/erosion concern?
- Forest types – most are not prone to fire. Soils hold a lot of water. Canopy burn not a concern – soils hold a lot of water. Mancelona has some Jack Pine which is more fire prone.
- Mohrman Bridge – not on Road Commission's agenda for applying for funding. In "Fair" condition. Road Commission will complete some work on it with their crews at minimal expense. Old timbers on bridge structure. Increased sedimentation over the years makes the river/lakes wider and shallower. Floods go down and around the bridge, not over. This bridge is the only way to cross the lakes between Ellsworth and Central Lake.
- Ellsworth – Bridge St. culvert is undersized. Evidence of erosion/overflow/undercutting.
- Ellsworth Bridge on CR-48 by Tapawingo restaurant – stone culvert – allegedly the oldest in the county. For Skinner Creek/Ellsworth Creek. Not much sediment deposit. Surface edge of bridge on upstream side is degrading/eroding.
- Ellsworth would be a good candidate for a FEMA mitigation grant as it is an impoverished community

- Banks Twp – Lake Shore Drive – 19-25 homes – a narrow county road. Maybe widen road, add guardrails, shore up where there may be undercutting. Road Commission’s jurisdiction. Leslie to prepare a plan for boat rescue as other access option for the narrow private road.
- Traverse Bay Road – Parking issues at beach area at road end - block emergency access for water rescue/fire truck water access. Torch Lake Twp. nature preserve – potential partnership for parking area/access control.
- There are no “Safe Harbors” in the area to accommodate emergency rescue/access for boaters.
- Julie Weston is making a GIS map of public water access points in the county.
- Elk Rapids – Village is trying to use some state funding to improve their storm water system.
- Torch River Flooding – Milton Township/Kalkaska County area and Clam River Bridge in Helena/Forest Home Twp. : RC is pursuing funding for local bridge funds for FY 2025 for preventative maintenance work.

Leslie wants to know if there are any regulation changes with public dams – check into.

Antrim County Office of Emergency Management



Leslie Meyers, Coordinator
110 Grove Street, P.O. Box 333
Bellaire, Michigan 49615-0333
meyersl@antrimcounty.org
231-533-6569 FAX 231-533-5803

LEPC-LPT AGENDA Regular Meeting August 30 10 am VIA ZOOM

Join Zoom Meeting

<https://us02web.zoom.us/j/81349164983?pwd=SkdvME54cCtsQVZtQUNhdlIlcHordz09>

Meeting ID: 813 4916 4983

Passcode: 816723

One tap mobile

+13126266799,,81349164983#,,,,*816723# US (Chicago)

+16468769923,,81349164983#,,,,*816723# US (New York)

Approval of Minutes: Notes from May Field Trip

Old Business

- Natural Hazards Plan – updates from Networks Northwest

New Business

- SARA Title III Update – Tier II Software
- Exercise Plans for 2022-2023
- CISD Annex
- County Fire and Emergency Plan

Comments or Suggestions

Public Comment

Next Meeting Date – November 8, 2022



Antrim County Planning Commission



MEMBERS

Barbara Bradford
12/31/2022

Richard Friske, Jr.
12/31/2024

James Gurr
Vice-Chair
12/31/2022

vacant
12/31/2024

Gary Lockwood
Chair
12/31/2022

Kenny Provost
12/31/2024

Ron Tschudy
12/31/2023

Jason Helwig
term elected

Dawn LaVanway
Secretary
term elected

ADVISORY

Stan Moore
MSU Extension

STAFF

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County Administrator

Jeremy Scott
Deputy Administrator

Tina Schrader
Administrative Asst.

Margie Boyd
Secretary

OFFICE ADDRESS

P.O. Box 187
Bellaire, MI 49615

PHONE: 231-533-6265

FAX: 231-533-8111

The Antrim County Planning Commission meeting is scheduled for

Tuesday, September 6, 2022

Board of Commissioners Room

203 East Cayuga Street, Bellaire, MI

AGENDA ITEMS INCLUDE:

6:00 p.m. Call to Order

Pledge of Allegiance

Approval of Agenda (*pg. 2*)

Declaration of Conflict of Interest

Public Comment

Approval of Minutes from August 2, 2022 (*pg. 2*)

Old Business

New Business (*pgs. 3-21*)

- Natural Hazards Mitigation Plan
- Kearney Township - Proposed Zoning Amendment
- Master Plan - Chapter 9

Various Matters (*pgs. 22-23*)

- Training Updates
- Communication - Elk Rapids Township (*Information Only*)
- Communication - Wilson Township (*Information Only*)

Public/Member Comment

Adjourn

County of Antrim - Planning Commission

Dawn LaVanway, Secretary
Barbara Bradford
Kenny Provost

Gary Lockwood, Chair
Richard Friske, Jr.
Ron Tschudy

Jim Gurr, Vice-Chair
Jason Helwig
vacancy

Minutes – September 6, 2022

Members Present: Gary Lockwood, Jim Gurr, Barb Bradford, Jason Helwig, Ron Tschudy, Dawn LaVanway

Members Absent: Richard Friske, Jr., Kenny Provost

Staff and Others: Stan Moore, Jeremy Scott

1. Meeting called to order at 6:02 by Mr. Lockwood

2. Pledge of Allegiance

3. Approval of Agenda

Motion by Mr. Tschudy, seconded by Mr. Helwig, to approve the September 6 agenda as presented.

Motion Passes, 6 – Yes, 0 - No, 2 - Absent

4. Declaration of Conflict of Interest

None

5. Public Comment

None

6. Approval of Minutes

Motion by Jim Gurr, seconded by Ron Tschudy, to approve the minutes from August 2, 2022 as presented.

Motion Passes, 6 – Yes, 0 - No, 2 - Absent

7. Old Business

8. New Business

Natural Hazards Mitigation Plan

Antrim County Emergency Manager Leslie Meyers was on hand to present the draft of the 2023 Natural Hazards Mitigation Plan to the Planning Commission. Ms. Meyers gave an overview of the Natural Hazards Mitigation Plan, including a brief description of some of the updates and the importance of consistency with the Master Plan. She indicated an updated draft is available and will be emailed to members the following morning.

A short discussion ensued.

Members invited Ms. Meyers to submit language for the master plan update that would keep it in line with the Natural Hazards Mitigation Plan.

Kearney Township – Proposed Amendment

It was brought up that **Note (5)** 600 square feet minimum did not line up with minimum floor area for multiple-family dwellings.

Motion by Jim Gurr, seconded by Ron Tschudy, that the Antrim County Planning Commission found no incompatibilities between the Antrim County Master Plan and the proposed zoning ordinance amendment to Appendix Table 1.

Motion Passes, 5 – Yes, 1 - No, 2 – Absent

Master Plan Chapter 9

Small corrections were pointed out and marked. A lengthier discussion ensued regarding updating the Community Opinion Survey and Visioning Sessions. The commissioners requested that they be provided a copy of the community opinion survey from 2001 and visioning session from 2003 for the next meeting.

Ron Tschudy presented a single page document as a possible addition as Chapter 9 Section 10 (see attached).

Motion by Gary Lockwood, seconded by Barb Bradford to provide the proposed Chapter 9 section 10 to the Emergency Manager for comment, to be reviewed by the Planning Commission at the next earliest opportunity.

Motion Passes, 6 – Yes, 0 - No, 2 – Absent

9. Various Matters

Training Updates

None

Communications

None

10. Public/Member Comment

Ron Tschudy and Stan Moore mentioned that the MSU meteorologist was working on providing area weather data for Bellaire over the past several years.

Gary Lockwood informed the commission of an upcoming Human Trafficking Awareness event and some of the issues in the area.

Motion by Jim Gurr, seconded by Gary Lockwood to adjourn the meeting.

Motion Passes, 6 – Yes, 0 - No, 2 – Absent

Meeting was adjourned at 7:32 pm

10) Mitigate Natural Hazards and Meet the Challenges of Climate Change

Antrim County's "Natural Hazards Mitigation Plan" (NHMP-2023) specifies the collaborative efforts and actions to be taken to deal effectively with natural disasters and emergencies such as tornadoes, pandemics, extreme winter weather, flooding, etc. Along with preparedness, response and recovery, mitigation is an essential element of emergency management, the process of minimizing (or even eliminating) the destructive consequences of such low probability-high impact natural disasters.

The NHMP is available online, and several pages, it should be noted, regard the current global and local warming --climate change-- as an amplifying factor in some of these disasters, as well as eventually likely having a negative impact on tourism and agriculture. Climate change, unlike natural elements in the environment, is a dynamic factor caused by human activity, mainly the burning of fossil fuels. Thus, for both mitigation and climate change, the following policies are recommended:

Continue to strengthen collaboration with government and other entities involved
In mitigating natural hazards.

Encourage the production of residential, community, and utility grade solar and wind
energy.

Encourage the efforts of homeowners, businesses and units of government to plan and
set goals aimed at reducing their carbon footprints as much as feasible.

Expand existing tree-planting projects and develop new ones.

Support efforts to increase public transportation and car-pooling.

Advocate for cleaner (proportionately less coal- and gas-sourced) energy from power
companies and co-ops.

Help facilitate the installation of charging stations for electric vehicles.

Natural Hazards Plan Discussion

Meyers, Leslie <meyersl@antrimcounty.org>

Mon, Oct 3, 2022 at 1:29 PM

To: "damos@elkrapids.com" <damos@elkrapids.com>, Christopher Weinzapfel <miltonzoning@gmail.com>, "Hefferan, William" <hefferanw@antrimcounty.org>, "chantal.lefebvre@me.com" <chantal.lefebvre@me.com>, "jmerillat@gmail.com" <jmerillat@gmail.com>, "tbcoble@charter.net" <tbcoble@charter.net>, "rjkingon@prodigy.net" <rjkingon@prodigy.net>, "dakskeet@aol.com" <dakskeet@aol.com>, "upnothbobb@gmail.com" <upnothbobb@gmail.com>, "suplbargy@hotmail.com" <suplbargy@hotmail.com>, "bstridiron@torchlake.com" <bstridiron@torchlake.com>, "jkulka@torchlaketownship.org" <jkulka@torchlaketownship.org>, "lcarelton@torchlaketownship.org" <lcarelton@torchlaketownship.org>, "cshoemaker@torchlaketownship.org" <cshoemaker@torchlaketownship.org>, "jmerchant@torchlaketownship.org" <jmerchant@torchlaketownship.org>, "bbudros@torchlaketownship.org" <bbudros@torchlaketownship.org>, "supervisorcook@torchlaketownship.org" <supervisorcook@torchlaketownship.org>, "Thompson, Burt" <bthompson@antrimcr.org>, "bmulally@elkrapids.org" <bmulally@elkrapids.org>, "dbennett@bellairemichigan.com" <dbennett@bellairemichigan.com>, "vlgclerk@bellairemichigan.com" <vlgclerk@bellairemichigan.com>, "dpwdirector@bellairemichigan.com" <dpwdirector@bellairemichigan.com>, Bellaire Chamber <info@bellairechamber.org>, Joni Moore <moore@torchlake.com>, "Central Lake Chamber (info@centrallakechamber.com)" <info@centrallakechamber.com>, Central Lake Township Clerk <clerk@centrallaketownship.com>, "nancyshepard49611@yahoo.com" <nancyshepard49611@yahoo.com>, "custersupervisor@hotmail.com" <custersupervisor@hotmail.com>, "echotownship@live.com" <echotownship@live.com>, "beaverguy@outlook.com" <beaverguy@outlook.com>, "chuckjy@hotmail.com" <chuckjy@hotmail.com>, Clerk Warner <warnertwpc@clerk@gmail.com>, "warnersupervisor@gmail.com" <warnersupervisor@gmail.com>, Bill Drollinger <drollinger332@live.com>, "sbarrett@centrallakemi.org" <sbarrett@centrallakemi.org>, "villageclerk@centrallakemi.org" <villageclerk@centrallakemi.org>, "gordieontorch@gmail.com" <gordieontorch@gmail.com>, "mrobinson2528@gmail.com" <mrobinson2528@gmail.com>, "rjlogee@hotmail.com" <rjlogee@hotmail.com>, "helena@torchlake.com" <helena@torchlake.com>, "butchdewey@gmail.com" <butchdewey@gmail.com>, "pamboyd12@gmail.com" <pamboyd12@gmail.com>, "laurynkeiser@live.com" <laurynkeiser@live.com>, "fharris26@charter.net" <fharris26@charter.net>, "donseman@gmail.com" <donseman@gmail.com>, "wallygator1956@hotmail.com" <wallygator1956@hotmail.com>, "laarmike@yahoo.com" <laarmike@yahoo.com>, "kwoodrep@gmail.com" <kwoodrep@gmail.com>, "tbaumcheff@mancelonaschools.org" <tbaumcheff@mancelonaschools.org>, "minch@icloud.com" <minch@icloud.com>, "treasurer@villageofmancelona.org" <treasurer@villageofmancelona.org>, "pamvesey@yahoo.com" <pamvesey@yahoo.com>, "doug@derreroil.com" <doug@derreroil.com>, Tim Murray <wildturkey380@gmail.com>, "rjacquesski@gmail.com" <rjacquesski@gmail.com>, "algers@charter.net" <algers@charter.net>, "Niepoth, Ed" <ENiepoth@daytonlamina.com>, "ttrumble@charter.net" <ttrumble@charter.net>, "c49615awl@gmail.com" <c49615awl@gmail.com>, "danandann@torchlake.com" <danandann@torchlake.com>, "tsheneman@charter.net" <tsheneman@charter.net>, "tebonis88@gmail.com" <tebonis88@gmail.com>, "ardenfarm@torchlake.com" <ardenfarm@torchlake.com>, "laurawesterman01@gmail.com" <laurawesterman01@gmail.com>, "Bonnie Robbins (bonnie_robbins@hotmail.com)" <bonnie_robbins@hotmail.com>, "MelissaZ@macd.org" <MelissaZ@macd.org>, Stephanie Loria <stephanie.loria@networksnorthwest.org>, Jennifer Neal <jennifer.neal@networksnorthwest.org>, "Weston, Julie" <westonj@antrimcounty.org>, "mdsoper2771@gmail.com" <mdsoper2771@gmail.com>, "Elk Rapids Chamber (tom@elkrapidschamber.org)" <tom@elkrapidschamber.org>, "VanAlstine, Terry" <vanalstinet@antrimcounty.org>, "Scott, Jeremy" <scottj@antrimcounty.org>, Heidi Shaffer <heidi.shaffer@macd.org>, "Stone, Mark" <stonem@antrimcounty.org>, "Hunter, James" <hunterj@antrimcounty.org>, "rragland@elkrapids.org" <rragland@elkrapids.org>, "bmulaly@elkrapids.org" <bmulaly@elkrapids.org>, "vlgdpwsuper@elkrapids.org" <vlgdpwsuper@elkrapids.org>, "jjanisse@elkrapids.org" <jjanisse@elkrapids.org>, "kesterly@elkrapids.org" <kesterly@elkrapids.org>, David Centala <dcentala@elkrapids.org>, Banks Township Clerk <clerk@bankstownship.net>, "ireneshooks@gmail.com" <ireneshooks@gmail.com>, "dieboldrm@gmail.com" <dieboldrm@gmail.com>, Banks Township <bankstownship@bankstownship.net>, "larryessenberger@gmail.com" <larryessenberger@gmail.com>, "jlklooster@gmail.com" <jlklooster@gmail.com>, "lynnspearing@gmail.com" <lynnspearing@gmail.com>, "marybneer@gmail.com" <marybneer@gmail.com>, Elk Rapids Fire Department <erfire@elkrapids.info>, Ted <torchlakefd@gmail.com>, "Jeremy Ball (miltontwpfd@gmail.com)" <miltontwpfd@gmail.com>, "Mark Groenick (banksfire6600@gmail.com)" <banksfire6600@gmail.com>, "Garwood, Peter" <garwoodp@antrimcounty.org>, "kyle.williams@macd.org" <kyle.williams@macd.org>, Benjamin Herrick <ellsworthpolicedepartment@gmail.com>, "Diane (Echotownship.clerk@gmail.com)" <Echotownship.clerk@gmail.com>, Board of Commissioners <BoardofCommissioners@antrimcounty.org>, "Boettcher, Ed" <boettchere@antrimcounty.org>, "dawn.lavanway@yahoo.com" <dawn.lavanway@yahoo.com>, Dorance and-or Julia Amos <amosdj@live.com>

If your community has not yet been represented, please join us for JUST ONE of the Zoom meeting invitations as both meetings will cover the same material, just on different days and times. If you have already RSVP'd, thank you in advance.

The Antrim County Natural Hazards Plan

Like all plans, the process is as important as the plan itself. The natural hazard mitigation planning process helps communities identify local policies and actions that can be implemented over the long term to reduce the impact of future losses from hazards.

The mission of the Plan is to promote sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. Our partners include, Fire Services, Law Enforcement, Conservation District, Public Health, EGLE, DHHS, and Govt. It **creates a framework for risk-based decision making to reduce damages to lives, property, and the economy from future disasters.**

We contacted you in March for input, again in May and we now move to a draft plan from what we have learned so far. As we don't know what the next disaster challenge we could face will be, planning and being a part of the process is most important. Having an adopted plan in your community allows for assistance should the need arise.

The Antrim County Office of Emergency Management again invites you to a meeting of local municipal officials and land management stakeholders to discuss the draft of our 2022 Plan. **Local participation is crucial** to the planning process and a requirement of FEMA.

The County's Natural Hazard Mitigation Plan will: 1) identify natural disaster risks and vulnerabilities applicable to every jurisdiction in the county; 2) develop long-term strategies for protecting people and property from similar events; and 3) establish a coordinated process to implement the plan. Please note that a community must contribute to the creation of the plan and adopt the completed plan if they are to be considered eligible for pre-disaster mitigation project grants awarded by FEMA.

In order to make sure that all our municipalities are included in this process, we strongly encourage you, or a representative from your agency, to participate in one of two input sessions:

- Oct 4, 2022 – 9:30 – 11 a.m. via Zoom

<https://us02web.zoom.us/j/87520990685?pwd=UXlialEwMkl2QWVjcWhwQEFpWk9JQT09>

Meeting ID: 875 2099 0685

Passcode: 164646

+1 301 715 8592

OR

- Oct 5, 2022 – 3:30 – 5 p.m. via Zoom

Join Zoom Meeting

<https://us02web.zoom.us/j/82492714334?pwd=c0ZESEFpVG4vdjN5R1lNNmoyVDI2QT09>

Meeting ID: 824 9271 4334

Passcode: 112916

+1 309 205 3325 US

Community planners from Networks Northwest will be facilitating this virtual discussion via Zoom. At least one representative from each community should attend one of the meetings listed above. We look forward to seeing you (virtually) soon to discuss natural hazard concerns in your community and potential mitigation strategies to address them.

Late next week we will send out links for the upcoming sessions and hope that you will be able to make one of them work for you. In the meantime, please find attached the latest draft of the plan.

Feel free to contact Leslie Meyers, Emergency Management Coordinator, at meyersl@antrimcounty.org or Stephanie Loria, Community Planner at stephanie.loria@networksnorthwest.org if you have any questions.

Leslie Meyers

Antrim County

Emergency Services Coordinator

PO Box 333

[110 Grove Street](#)

[Bellaire, MI 49615](#)

(o) 231-533-6569

(c) 231-632-6080

<https://www.facebook.com/antrimemergencymanagement/>

www.getrave.com/login/antrimcounty

Leave People Better Than You Found Them.

Utilize the "RAVE" mobile ^{safety} ~~photo~~ mass notfication system

Antrim Cty Comm Mtgs - Zoom Strategy Disc.

Day 1: 10-4-22

Terry Smith - Forest Home Twp

Ed Boettcher - Elk Rapids Twp + Village

Rete Garwood - County Administrator

Roxanna Flake - Custer Twp Supervisor

Jason Helwig - ^{Cty BOC - Manalapan Village +} ~~Milton Twp Fire Chief~~ Twp

Jeremy Ball - Milton Twp Fire Chief

~~Dan VanWeigh?~~ - Echo, Jordan, Warner +

Dawn LaVanway - Chestonia Twp

* In Nov 2022 - new Supervisor starting in Chestonia Twp.

Rete - Elk Rapids Dam is in the best shape its been in 50 yrs. New windows, other renovations. Addressed areas of swelling on the dam

Commission on Aging - has phone call program

snowmobile club ~~has~~ can go out to homebound seniors during snowstorms

The City has not yet updated their Soil Erosion Control Ordinance. The bid they got back was too high. (Antrim Cons. Dist. is working on grants to help w/ re-writes.

What it does not currently have - Design to accommodate a 25 yr storm event

- Not all of the City participates in NFIP
- Some might want to in future - Forest Home Twp is interested

27 miles of coastline - Banks(?) Twp

TLT

Milton Twp

Elk Rapids City + Twp

Custer, Helena, Central Lake, Keang, Village of Bellair,
Echo - all w/ comm. in flood plain of ERCOL watershed.

Leslie has secondary shelter agreements w/ Twp & Fire Halls. Echo has a generator - some comm. looking to fund generators w/ ARPA.

Fire Danger - Manvelona / Manvelona Twp.
w/ Eastern Jack Pine - flammable Jordan Twp - small fires from campgrounds

Ceases -

Dry Weather + Human Activity. In Jordan + Manvelona Twp
They are doing ~~a good~~ making progress on getting rid
of blight.

Drought - a county-wide issue

Invasives - Autumn + Russian olive - A Fire Threat?

Prone to fire

- very expensive + labor-intensive to remove invasives
spray, labor, - difficult for landowners to
pay for removal

ADP/Focus resources on what they can, but it's not
CAKE/CISMA enough to address all invasives.

In Forest Home Trp. - "The Meadows" - 40 Acres the
Trp. purchased to be used for govt purposes or leave
in natural state. Work w/ CAKE/CISMA -
excavate, put in piles, burn, follow up w/ chemical
treatment. Very time/labor intensive AND Expensive.

St. * Focus on education to be proactive - but must
mow or harvest at right time to not exacerbate the
problem

St. * Mitig. Strategy - investigate alternative treatment
of terrestrial invasives w/ livestock grazing
goats/sheep have 2 stomach chambers + completely
digest what they eat - don't spread seeds

Antrim - Strategy Disc. Day 2 10.5.22 Zoom

- Terry Van Alstine - County BOC Chair
- Sheriff Dan Bean
- Ron Tschudy - City PC + Echo Twp. Resident
- Kevin Lane - Fire Chief TLT + DPW Dir Elk Rapids

- Fire danger: Need to confirm w/ Star + Chestonia
Twp's Fire Chiefs.
- Need to coordinate w/ MDR - they manage fire/forestry
- → Menasha Twp - consider a dry hydrant /
water source storage, like a 50,000 gal tank
✓ in fall - make sure working well
Most Fire Engine tankers are 2,000 gal
Outdoor ponds will just dry up
- Strong southerly winds could blow smoke / embers up
to the ~~Cherry~~ lakes of the North res. dev. +
campground
- Burying power lines - this is a municipal decision
done in zoned communities. Maybe work w/ PC +
utility co. to bury power lines during road projects - otherwise
often cost prohibitive.
- keep track of power outages - where occur? initial
when

utility
co.
GLE
cons. E

- RC keeps track of snowfall evry yr - in 3 diff loc.
- Leslie to expand fire stations - ~~use~~ agreements as emergency shelters - in eastern part of county. Every one has a generator -
- Public ed. of where closest shelter sites are - signage at parks / trails
- Continue to plan for em. preparedness for public events - if they ask for it, coordinate w/ police.
- The extent of the ERIOL hydrology model does not include the Elk River + Elk Rapids areas. Expand the ACE model to include a special assessment district on the Elk River

• Elk Rapids village - failing side walk - 7" drop dug it up, found old concrete tubes w/ separation in the joints. Did a repair on it to prevent leaks, but will still be an issue. In the zone of the hydrodam overflow area.

Sinkhole on Dexter St - working on replacement costs

Might try to make it into a bridge. They have moot doing a bridge insp. w/in next 3 mos.

Brad Link - Engineer

* TLT + Chain of Lakes Group has a subcommittee to evaluate septic ordinance revisions

Elderly - extreme heat

* ~~Board~~ Create addtl. use agreements w/ local libraries, senior centers, churches? to use as secondary shelter.

↓
in Bellair

ER

Manvelore

+ Mobile wash stations

- 3 Lakes Assn owns one

- So many points of entry to the COL -

- Paddle Antrim - continue public education

- Best to clean boats when used ~~before~~ when going into non-connected waters

- Echo - tornadoes/wind incidents

Dec 13 - next LEPC mtg

↳ Post notice for public

hearing ~~for Dec~~ to be held Jan 3, 2023



Antrim County Planning Commission



MEMBERS

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12/31/2022

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12/31/2024

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Vice-Chair
12/31/2022

vacant
12/31/2024

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Ron Tschudy
12/31/2023

Jason Helwig
term elected

Dawn LaVanway
Secretary
term elected

ADVISORY

Stan Moore
MSU Extension

STAFF

Pete Garwood
County Administrator

Jeremy Scott
Deputy Administrator

Tina Schrader
Administrative Asst.

Margie Boyd
Secretary

OFFICE ADDRESS

P.O. Box 187
Bellaire, MI 49615

PHONE: 231-533-6265

FAX: 231-533-8111

The Antrim County Planning Commission meeting is scheduled for

Tuesday, October 4, 2022

Board of Commissioners Room
203 East Cayuga Street, Bellaire, MI

AGENDA ITEMS INCLUDE:

- 6:00 p.m. Call to Order
- Pledge of Allegiance
- Approval of Agenda (*pg. 2*)
- Declaration of Conflict of Interest
- Public Comment
- Approval of Minutes from September 6, 2022 (*pg. 2*)
- Old Business (*pg. 3-4*)
- Master Plan: Planes, Trains, and Automobiles
- NewBusiness(*Pgs. 5-39*)
- Kearney Township - Proposed Zoning Amendment
 - Master Plan - Chapters 5 and 9
- Various Matters (*pg. 40*)
- Communication - Kearney Township (*Information Only*)
- Public/Member Comment
- Adjourn

County of Antrim - Planning Commission

Dawn LaVanway, Secretary
Barbara Bradford
Kenny Provost

Gary Lockwood, Chair
Richard Friske, Jr.
Ron Tschudy

Jim Gurr, Vice-Chair
Jason Helwig
vacancy

Minutes – October 4, 2022

Members Present: Dawn LaVanway, Jim Gurr, Barb Bradford, Ron Tschudy, Jason Helwig

Members Absent: Gary Lockwood, Kenny Provost, Richard Friske, Jr.

Staff and Others: Pete Garwood, Jeremy Scott

1. Meeting called to order at 6:12 by Mr. Gurr

2. Pledge of Allegiance

3. Approval of Agenda

Motion by Ms. LaVanway, seconded by Mr. Helwig, to approve the October 4 agenda as presented.

Motion Passes, 5 – Yes, 0 - No, 3 - Absent

4. Declaration of Conflict of Interest

None

5. Public Comment

Leslie Elrod gave brief comments regarding the Kearney Township planning commission approval of a zoning amendment for Esteem Way, LLC.

6. Approval of Minutes

Motion by Mr. Tschudy, seconded by Ms. Bradford, to approve the minutes from September 6, 2022 as presented.

Motion Passes, 5 – Yes, 0 - No, 3 - Absent

7. Old Business

Master Plan: Planes, Trains, and Automobiles

The Commission reached a general consensus to including language provided by Ms. Meyers as provided.

8. New Business

Kearney Township – Proposed Zoning Amendment

Motion by Mr. Helwig, seconded by Mr. Tschudy, that the Antrim County Planning Commission found no incompatibilities between the Antrim County Master Plan and the proposed Kearney Township zoning ordinance amendment to their zoning districts.

Motion Passes, 5 – Yes, 0 - No, 3 – Absent

Master Plan – Chapters 5 and 9

A few small changes were noted and several grammatical errors were provided.

9. Various Matters

10. Public/Member Comment

Members made individual comments, including a suggestion to attend the Natural Hazard Mitigation Zoom meeting.

Motion by Mr. Tschudy seconded by Mr. Helwig to adjourn the meeting.

Motion Passes, 5 – Yes, 0 - No, 3 – Absent

Meeting was adjourned at 7:15 pm

DRAFT

LOCAL EMERGENCY PLANNING COMMITTEE/LOCAL PLANNING TEAM
(LEPC/LPT) MEETING MINUTES

January 10, 2023

10:00 AM

Meeting Held Via Zoom

Meeting called to order by Jeremy Scott, Chairman, at 10:02 am.

Members present: Alan Shumaker, Meadowbrook; Leslie Meyers, Emergency Management Coordinator; Judy Parliament, COA; Jeremy Scott, County Administrator, Christine Wilhelm, Bellaire Family Health Care Center, Brian Flickenger, EGLE,

Members absent: Lt. Mike de Castro; Niepoth, Thompson, Zelinek, Gank,

Others Present: Jennifer Neal & Stephanie Loria, Networks Northwest, Heather Smith, Grand Traverse Bay Harbormaster, Terry VanAlstine, County Commission Chair.

Old Business:

- **Natural Hazards Plan:** Stephanie and Jennifer presented draft plan to those in attendance. Several grammatical errors were identified and the goals were finalized. It was determined that we were ready for public hearing and the plan, once all corrections and clarifications are made, it will be sent to the Antrim County Planning Commission to hold the hearing.

(UPDATE – The Planning Commission will hold the PH on March 7, 2023)

Meeting adjourned at 11:30 AM.

Next Meeting: TBD (Update – the next meeting will take place on march 14, 2023 via Zoom).

Respectfully Submitted,
Leslie Meyers



Antrim County Planning Commission



MEMBERS

Richard Friske, Jr.
12/31/2024

Leslie Elrod
12/31/2025

James Gurr
12/31/2025

Kenny Provost
12/31/2024

Ron Tschudy
12/31/2023

Bill Hefferan
term elected

ADVISORY

Stan Moore
MSU Extension

STAFF

Jeremy Scott
County Administrator

vacant
Deputy Administrator

Tina Schrader
Administrative Asst.

Margie Boyd
Secretary

OFFICE ADDRESS

P.O. Box 187
Bellaire, MI 49615

PHONE: 231-533-6265

FAX: 231-533-8111

The Antrim County Planning Commission meeting is scheduled for

Tuesday, January 10, 2023
Board of Commissioners Room
203 East Cayuga Street, Bellaire, MI

AGENDA ITEMS INCLUDE:

6:00 p.m. Call to Order

Pledge of Allegiance

Organizational Meeting

- Election of Officers
- Selection of Meeting Dates/Times

Approval of Agenda (*pg. 2*)

Declaration of Conflict of Interest

Public Comment

Approval of [Minutes from November 1, 2022](#) (*pg. 2*)

Old Business

New Business (*Pgs. 3-20*)

- Milton Township Zoning Amendments: ZO 2022-2 & 2022-03
- **Natural Hazard Mitigation Plan**

Various Matters (*pgs. 21*)

- Communication - Banks Township (*Information Only*)

Public/Member Comment

Adjourn

County of Antrim - Planning Commission

Richard Friske, Jr., Chair
Bill Hefferan

Leslie Elrod, Secretary
Kenneth Provost

Jim Gurr, Vice Chair
Ron Tschudy

Minutes – January 10, 2023

Members Present: Leslie Elrod, Jim Gurr, Bill Hefferan, Ron Tschudy, Richard Friske, Jr.

Members Absent: Kenneth Provost

Staff and Others: Jeremy Scott - Administrator, Stan Moore - MSU Extension

1. Meeting called to order at 6:00 p.m. by Jeremy Scott

2. Pledge of Allegiance

3. Organizational Meeting

New members introduced themselves include Leslie Elrod and District 1 Commissioner, Bill Hefferan.

Election of Officers

Jeremy Scott chaired the organizational portion of the meeting.

Chair

Jim Gurr Nominated Richard Friske, Jr.

Ron Tschudy Nominated Jim Gurr

Motion by Jim Gurr seconded by Richard Friske, Jr. to close nominations.

Members voted by show of hand, Richard Friske, Jr. – 4, Jim Gurr - 1

Richard Friske, Jr. chaired the remainder of the meeting.

Vice-Chair

Bill Hefferan Nominated Jim Gurr

Motion by Bill Hefferan, seconded by Leslie Elrod to close nominations for Vice-Chair and cast a unanimous ballot for Jim Gurr.

Motion Passes: Yes – 5, No – 0, Absent - 1

Secretary

Richard Friske nominated Leslie Elrod

Motion by Jim Gurr, seconded by Bill Hefferan to close nominations for Secretary and cast a unanimous ballot for Leslie Elrod.

Selection of Meeting Dates and Times

It was pointed out to the Commission that July 4th would fall on a PC meeting and that the bylaws have the meeting rescheduled to the following Tuesday, July 11th.

Motion by Jim Gurr, seconded by Bill Hefferan to set the meeting for the first Tuesday of every other month at 4:30pm beginning in January.

Motion Passes: Yes – 5, No – 0, Absent – 1

4. Approval of Agenda

Motion by Leslie Elrod, seconded by Jim Gurr to approve the January 10, 2023 agenda as presented.

Motion Passes: Yes – 5, No – 0, Absent – 1

5. Public Comment

The resignation of Kenny Provost from the Planning Commission was read aloud (see attached).

Mack Whitehouse gave comments in support of the Milton Township zoning amendments. Dwayne Meyer from Milton Township also spoke.

6. Approval of Minutes

Motion by Leslie Elrod, seconded by Jim Gurr, to approve the minutes from November 1, 2022 as presented.

Motion Passes: Yes – 5, No – 0, Absent – 1

7. Old Business

Jeremy Scott gave an overview update on the Master Plan

8. New Business

Milton Township – Proposed Zoning Amendments

Motion by Ron Tschudy, seconded by Bill Hefferan, that the Antrim County Planning Commission found no incompatibilities between the Milton Township proposed ZO 2022-02 and ZO 2022-03 amendments and the Antrim County Master Plan. The County Planning Commission recommends approval of ZO 2022-03 but recommends that objective language be established in section 117.1605 parts R and S before approving ZO 2022-02.

Motion Passes: Yes – 5, No – 0, Absent – 1

Natural Hazard Mitigation Plan

A Short discussion ensued. Leslie pointed out that the strategies chart did not have a legend and strategy type was not explained. Bill Hefferan pointed out that on page 14, Age, Race, & Disability, Grand Traverse County was used rather than Antrim County.

9. Various Matters

None

10. Public/Member Comment

Meeting was adjourned at 7:13pm.

AFFIDAVIT OF PUBLICATION

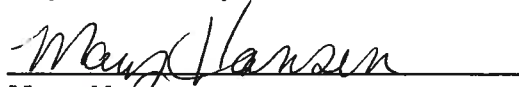
STATE OF MICHIGAN)

COUNTY OF ANTRIM)

Jacqueline L. Tarrant, Partner/General Manager of the Antrim Review hereby acknowledges that the Public Notice for Antrim Co Planners was published in the above entitled newspaper for the weeks of February 9 and February 16, 2023.


Jacqueline L. Tarrant

Subscribed and Sworn to on the 16th
Day of February 2023



Mary Hansen

Notary Public

Kalkaska County, Michigan

(Acting in Antrim County)

My Commission Expires: February 18, 2029

NOTICE OF AVAILABILITY

Notice of Availability of Draft Hazard Mitigation Plan and Public Meeting for input on the Draft Hazard Mitigation Plan. Antrim County is in the process of updating its Hazard Mitigation Plan in accordance with the Disaster

Mitigation Act of 2000. There will be a public meeting following the public review period on March 7, 2023. The meeting will be at the Antrim County Building, 2nd Floor, Board of Commissioners Room, 203 E. Cayuga St., Bellaire, MI 49615 at 4:30 p.m. Public comments are requested either in person or by representative at the public meeting or at PO Box 506, Traverse City, MI 49685 or by email at jennifer.neal@networknorthwest.org. The draft plan is available for review on Antrim County's website and Network Northwest's website.

MARY HANSEN
NOTARY PUBLIC • KALKASKA COUNTY
MY COMMISSION EXPIRES: 02/18/29

AFFIDAVIT OF PUBLICATION

Kathleen Weitschat
KATHLEEN WEITSCHAT

being duly sworn, says that she is the publisher of the Elk Rapids News, L.L.C., a newspaper printed, published and circulated in said county and otherwise qualified according to Supreme Court Rule; that annexed hereto is a printed copy of a notice which was published in said newspaper on the following date, or dates, to wit:

Feb 9, 2023
Feb 16, 2023
_____, 20____
_____, 20____
_____, 20____
_____, 20____

RECEIVED AND FILED
ANTRIM COUNTY CLERK

MAR 02 2023

BY _____

Subscribed and sworn to before me
this 1ST day of MARCH A.D. 2023

Notary Public,
Kaitlyn Szczypka
My commission expires:

KAITLYN SZCZYPKA
Notary Public - State of Michigan
County of Antrim
My Commission Expires Jan 25, 2028
Acting in the County of ANTRIM

KAITLYN SZCZYPKA
Notary Public - State of Michigan
County of Antrim
My Commission Expires Jan 25, 2028
Acting in _____

KA
Notary Public - S
My Comm
Acting in

ANTRIM COUNTY

NOTICE OF PUBLIC MEETING

Notice of Availability of Draft Hazard Mitigation Plan and Public Meeting for Input on the Draft Hazard Mitigation Plan

Antrim County is in the process of updating its Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000. There will be a public meeting following the public review period on March 7, 2023. The meeting will be at the Antrim County Building, 2nd Floor, Board of Commissioners Room, 203 East Cayuga Street, Bellaire, MI 49615 at 4:30 PM. Public comments are requested either in person or by representative at the public meeting or at PO Box 506, Traverse City MI 49685, or by email at Jennifer.neal@networksnorthwest.org. The draft plan is available for review on Antrim County's website and Network Northwest's website.

ANTRIM COUNTY

NOTICE OF PUBLIC MEETING

Notice of Availability of Draft Hazard Mitigation Plan and Public Meeting for Input on the Draft Hazard Mitigation Plan

Antrim County is in the process of updating its Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000. There will be a public meeting following the public review period on March 7, 2023. The meeting will be at the Antrim County Building, 2nd Floor, Board of Commissioners Room, 203 East Cayuga Street, Bellaire, MI 49615 at 4:30 PM. Public comments are requested either in person or by representative at the public meeting or at PO Box 506, Traverse City MI 49685, or by email at Jennifer.neal@networksnorthwest.org. The draft plan is available for review on Antrim County's website and Network Northwest's website.

VILLAGE OF ELK RAPIDS

**VILLAGE OF ELK RAPIDS
PUBLIC HEARING NOTICE**

The Village of Elk Rapids Village Council will hold a Public Hearing at their regular meeting on **Wednesday February 22, 2023**, at the Governmental Center, 315 Bridge Street, at 7:00 p.m. The purpose of the public hearing is to consider and receive citizen input on, **Proposed Ordinance 2023-01: Adoption Ordinance for New Code – Finalizing the Two-Year Recodification Project.**

PROPOSED ORDINANCE 2023-01

The Village of Elk Rapids



Jennifer Neal <jennifer.neal@networksnorthwest.org>

Re: 2023 Antrim County Hazard Mitigation Plan Current Drafts for Review

Dave Gajda <dcgajda@outlook.com>

Tue, Feb 14, 2023 at 9:22 PM

To: Jennifer Neal <jennifer.neal@networksnorthwest.org>, "Adamek, Matthew" <adamekm@antrimcounty.org>

Cc: Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Hi Jenni,

I am the Treasurer and a Board Member of the Village of Bellaire's Downtown Development Authority. Yes, you can enter my comments into your official record and share them with the Planning Commission. Unfortunately, I will not be able to attend the public hearing.

I believe you have correctly located the areas of my Autumn Olive observations. My neighbors on Miley Pointe Drive/Cottage Drive and I have been looking for any available grant funding to eradicate Autumn Olive, but to-date we have been unsuccessful. I reached out to the DNR regarding the Michigan Invasive Species Grant Program, but we don't qualify for this Program. If you know of any grant funding possibilities please let me know. Thanks.

Dave

From: Jennifer Neal <jennifer.neal@networksnorthwest.org>

Sent: Tuesday, February 14, 2023 9:02 PM

To: Adamek, Matthew <adamekm@antrimcounty.org>

Cc: Dave Gajda <dcgajda@outlook.com>; Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Subject: Re: 2023 Antrim County Hazard Mitigation Plan Current Drafts for Review

[Quoted text hidden]

February 16, 2023

Dear Antrim County Local Government Representative,

The Antrim County Emergency Services Department, with assistance from Networks Northwest, has prepared a draft of the County's Natural Hazard Mitigation Plan. The plan provides data and documentation on natural hazard events, the impact of such events on local communities, and strategies to mitigate the impact of future events. This is a multi-jurisdictional plan which addresses hazard events and strategies for all townships and villages in the county.

Your input on this draft plan is an essential requirement of the planning process. The final draft plan, and associated strategies, resources, and maps, are available for public review and comment. These can be viewed online at the project webpage:

<https://www.networksnorthwest.org/community/natural-hazard-mitigation/antrim-county.html>

Your participation in the review of this plan is also a Federal Emergency Management Agency (FEMA) requirement to be eligible for federally-funded **pre-disaster** hazard mitigation grant opportunities for five years. Many of the hazard mitigation strategies have a county-wide application, but some are site-specific. Please review the plan and materials carefully to verify your community is in support of the material provided or requests changes to the draft.

A public hearing for the plan will be held on March 7, 2023 at 4:30 PM as part of the Antrim County Planning Commission Meeting. The meeting location is in the Antrim County Building, 2nd Floor, Board of Commissioners Room at 203 East Cayuga Street, Bellaire, MI. Upon review of the plan, Planning Commission shall recommend it be sent to Michigan State Police Homeland Security Division for review/preliminary approval and then on to FEMA for their review and approval. Once FEMA has approved the plan, it will be brought before the County and all local government boards for adoption.

A copy of this letter will be shared with all local officials through electronic mail. Comments are requested either in person or by representative at the public meeting or at PO Box 506, Traverse City MI 49685, or by email at Jennifer.neal@networksnorthwest.org.

Sincerely,

Jennifer Neal, AICP
Community Planner, Networks Northwest

Re: Question for you on hazard maps for Antrim County Hazard Mitigation Plan

1 message

Meyers, Leslie <meyersl@antrimcounty.org>

Tue, Feb 14, 2023 at 12:49 PM

To: Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Cc: "Adamek, Matthew" <adamekm@antrimcounty.org>, Lindsey Bona-Eggeman <lindsey.bonaeggeman@macd.org>

The Lake MI shoreline issue is Phragmites and our entire coast is at risk. Norwood Twp even had a SAD for it- I know it's Charlevoix Co. EWM is a factor in 6 mile Lake (SAD) and near the Clam River and Alden Harbor on Torch. Garlic mustard is an issue in the Coy Mtn rec area and Autumn Olive is a threat every flipping where! My thoughts. L

Sent from my iPhone

> On Feb 14, 2023, at 11:33 AM, Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org> wrote:

>

> Leslie, Matt and Lindsey,

>

> On the draft hazard area maps (attached), are there any specific areas of concern regarding invasive species (terrestrial or aquatic) that you think should be indicated?

>

> I realize invasive species are generally a countywide concern, but for example, if a lake has a particular problem with Eurasian milfoil, we can shade that area a specific color to represent an area for invasive species concern. I know the Lake MI shoreline is a priority focus area for invasive species prevention as well - should we shade the land along the coastline to indicate this?

>

> Thanks for your input!

>

> Stephanie Marchbanks

> Community Planner

> Networks Northwest

>

> Desk: 231.439.5247

> Mobile: 231.590.0930

> stephanie.marchbanks@networksnorthwest.org <<mailto:stephanie.loria@networksnorthwest.org>>org <<mailto:stephanie.loria@networksnorthwest.org>>

>

> [https://docs.google.com/uc?export=download&id=1FbjWtoTUVdVpx_M8c5AlvU9t0_H1UwRb&revid=0B9Rotp2nSAHodIROclZ2eE1aSFJSY1JyWmkvYW4yNlhkWW1VPQ]

> 2240 Mitchell Park Dr., Suite B

> Petoskey MI 49770

Re: 2023 Antrim County Hazard Mitigation Plan Current Drafts for Review

Dave Gajda <dcgajda@outlook.com>

Wed, Mar 1, 2023 at 11:21 AM

To: Lindsey Bona-Eggeman <lindsey.bonaeggeman@macd.org>

Cc: Jennifer Neal <jennifer.neal@networksnorthwest.org>, Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>, "Adamek, Matthew" <adamekm@antrimcounty.org>

Hi Lindsey,

Thanks for the information.

No, I haven't talked to Monica. I will follow up with her.

I did receive some cost estimates a couple years ago, which were beyond my affordability. I have been doing some brush cutting on my property, but since I live downstate, my ability to work on my property to make much progress has been limited.

Dave

From: Lindsey Bona-Eggeman <lindsey.bonaeggeman@macd.org>**Sent:** Wednesday, March 1, 2023 11:00 AM**To:** Dave Gajda <dcgajda@outlook.com>**Cc:** Jennifer Neal <jennifer.neal@networksnorthwest.org>; Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>; Adamek, Matthew <adamekm@antrimcounty.org>**Subject:** Re: 2023 Antrim County Hazard Mitigation Plan Current Drafts for Review

Hi Dave,

Unfortunately no. The funding we will be receiving is to maintain CAKE's Core function and mission which can be found by reviewing our strategic plan. In addition to the Core function, we will be treating black swallow-wort which is a priority species due to its toxicity and impact on the monarch butterfly. Autumn olive is not a priority species for us to put management resources towards because it is so widespread that we wouldn't really have a significant impact. Our approach with these widespread species is to aid landowners with information on management options.

Have you spoken with Monica at NRCS? They do fund autumn olive treatment projects. Have you looked into what the cost would be to hire treatment? Or are you interested in treating it yourself? I would be happy to share with you what I can with you regarding treatment and contractors that you could hire.

Monica Caster

District Conservationist

Natural Resources Conservation Service

Bellaire Service Center- Antrim and Kalkaska Counties

106 Depot Street

Bellaire, MI 49615

Phone: 1-231-533-6450 ext. 3

Please let me know if you have any additional questions.

Lindsey

On Wed, Mar 1, 2023 at 10:34 AM Dave Gajda <dcgajda@outlook.com> wrote:

Hello,

I just received an email from the DNR listing the recent grant recipients from the Michigan Invasive Species Grant Program, which includes \$71,500 for the CAKE CISMA Core Funding Project as applied for by Antrim Conservation District. Can any of these funds be used for Autumn Olive Control Measures?

Dave Gajda

From: Jennifer Neal <jennifer.neal@networksnorthwest.org>
Sent: Tuesday, February 14, 2023 9:43 PM
To: Lindsey Bona-Eggeman <lindsey.bonaeggeman@macd.org>; Dave Gajda <dcgajda@outlook.com>
Cc: Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>; Adamek, Matthew <adamekm@antrimcounty.org>
Subject: Fwd: 2023 Antrim County Hazard Mitigation Plan Current Drafts for Review

Hello Lindsey and Dave,

Dave has contacted us regarding Autumn Olive infestations in Forest Home Township of Antrim County. I wanted to make sure he is introduced to you, Lindsey, for opportunities to maintain or remove the invasive species in his particular area. We've identified the areas in the communications below.

Lindsey, if you have any suggestions or could keep Dave in mind as opportunities arise we would appreciate it.

Thanks so much,

Jenni

----- Forwarded message -----

From: Dave Gajda <dcgajda@outlook.com>
Date: Tue, Feb 14, 2023 at 9:22 PM
Subject: Re: 2023 Antrim County Hazard Mitigation Plan Current Drafts for Review
To: Jennifer Neal <jennifer.neal@networksnorthwest.org>, Adamek, Matthew <adamekm@antrimcounty.org>
Cc: Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Hi Jenni,

I am the Treasurer and a Board Member of the Village of Bellaire's Downtown Development Authority. Yes, you can enter my comments into your official record and share them with the Planning Commission. Unfortunately, I will not be able to attend the public hearing.

I believe you have correctly located the areas of my Autumn Olive observations. My neighbors on Miley Pointe Drive/Cottage Drive and I have been looking for any available grant funding to eradicate Autumn Olive, but to-date we have been unsuccessful. I reached out to the DNR regarding the Michigan Invasive Species Grant Program, but we don't qualify for this Program. If you know of any grant funding possibilities please let me know. Thanks.

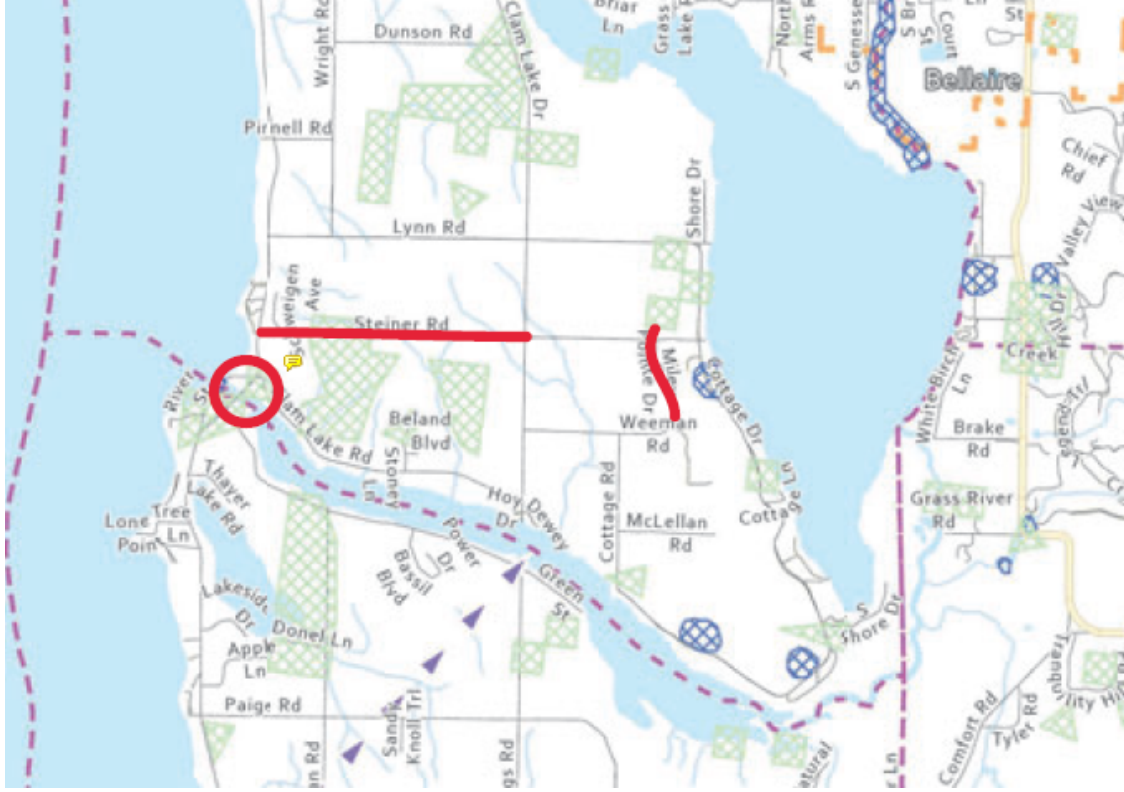
Dave

From: Jennifer Neal <jennifer.neal@networksnorthwest.org>
Sent: Tuesday, February 14, 2023 9:02 PM
To: Adamek, Matthew <adamekm@antrimcounty.org>
Cc: Dave Gajda <dcgajda@outlook.com>; Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>
Subject: Re: 2023 Antrim County Hazard Mitigation Plan Current Drafts for Review

Hi Dave,

Thank you for sharing this observation! Your input is much appreciated. Are you a local official or representative for your community? We'd like to enter your comment into our official record and share it with the Antrim County Planning Commission on March 7, 2023. Would that be ok? The Commission will be holding the final public hearing for the plan update on that date and you are welcome to attend.

In the meantime, I've marked the locations you mentioned on our map (red lines). Coincidentally, we were just talking about invasive species locations in Antrim County today (red circle - Eurasian Milfoil). Could you please make sure I have the right areas for Autumn Olive?



Best regards,

Jenni

On Tue, Feb 14, 2023 at 5:05 PM Adamek, Matthew <adamekm@antrimcounty.org> wrote:
Mr. Gajda

Thank you for the email. I had to look up this plant species. To my discover I also have this plant in my yard. The state of Michigan recognize the Autumn Olive as an invasive species. Below I attached a link you can go to, to report the shrub. I would agree with your statement that this should be added to the draft if the State of Michigan recognize it.



Autumn Olive
michigan.gov

Thank You

Matt Adamek

Sent from my iPhone

On Feb 14, 2023, at 4:09 PM, Dave Gajda <dcgajda@outlook.com> wrote:

Hello,

I own a 2.5-acre vacant parcel (Lot 8) on Miley Pointe Drive in Forest Home Township, which along with my neighbors has been invaded by Autumn Olive Shrubs in recent years. Therefore, I believe the draft Antrim

County Hazard Mitigation Plan needs to reflect this invasive species on the properties along Miley Pointe Drive and from my observations along sections of Steiner Road between Clam Lake Road and SE Torch Lake Drive.

Dave Gajda
248-231-8599

--

Jennifer Neal, AICP

Community Planner

Mobile: 231.709.3204

jennifer.neal@networksnorthwest.org

Networks Northwest
2240 Mitchell Park Dr., Suite B
Petoskey MI 49770

--

Jennifer Neal, AICP

Community Planner

Mobile: 231.709.3204

jennifer.neal@networksnorthwest.org

Networks Northwest
2240 Mitchell Park Dr., Suite B
Petoskey MI 49770



Jennifer Neal <jennifer.neal@networksnorthwest.org>

County Natural Hazard Mitigation Plan

Roxann Flake <custersupervisor@hotmail.com>

Thu, Feb 23, 2023 at 11:22 AM

To: "Jennifer.neal@networksnorthwest.org" <Jennifer.neal@networksnorthwest.org>

Good Morning, Jennifer,

The Custer Township Board has had the opportunity to review the final draft of the Natural Hazard Mitigation Plan and is in full support of the materials provided.

I have a prior engagement on March 7 and may not be able to attend the 4:30 public hearing. Please accept this email as the Custer Township Board of Trustees' full support of the Plan and thank you to all parties that helped put this Plan together.

Sincerely,

Roxann Flake

Custer Township Supervisor



Antrim County Planning Commission



MEMBERS

Richard Friske, Jr.
12/31/2024

Leslie Elrod
12/31/2025

James Gurr
12/31/2025

Kenny Provost
12/31/2024

Ron Tschudy
12/31/2023

Bill Hefferan
term elected

ADVISORY

Stan Moore
MSU Extension

STAFF

Jeremy Scott
County Administrator

Janet Koch
Deputy Administrator

Tina Schrader
Administrative Asst.

Margie Boyd
Secretary

OFFICE ADDRESS

P.O. Box 187
Bellaire, MI 49615

PHONE: 231-533-6265

FAX: 231-533-8111

The Antrim County Planning Commission meeting is scheduled for

Tuesday, March 7, 2023

Board of Commissioners Room

203 East Cayuga Street, Bellaire, MI

IMMEDIATELY FOLLOWING

A 4:30 PUBLIC HEARING

AGENDA ITEMS INCLUDE:

Call to Order

Pledge of Allegiance

Approval of Agenda (*pg. 2*)

Declaration of Conflict of Interest

Public Comment

Approval of Minutes from January 10, 2023 (*pg. 2*)

Old Business

New Business (*Pgs. 3-20*)

- Review: Natural Hazard Mitigation Plan
- Antrim County Master Plan
- Village of Central Lake Master Plan
- ROBIN Grant Letter of Support

Various Matters (*pgs. xx*)

- Communication - Milton Township (*Information Only*)
- Village of Elk Rapids Master Plan (*Information Only*)
- Intent to Plan - Otsego County

Public/Member Comment

Adjourn

If you wish to attend a Planning Commission meeting and require special assistance, please contact the Administration and Planning Office at (231)533-6265.

County of Antrim - Planning Commission

Richard Friske, Jr., Chair
Bill Hefferan

Leslie Elrod, Secretary
Kenneth Provost

Jim Gurr, Vice Chair
Ron Tschudy

Minutes – March 7, 2023

Members Present: Leslie Elrod, Jim Gurr, Bill Hefferan, Ron Tschudy, Richard Friske, Jr.

Members Absent: Richard Friske, Jr.

Staff and Others: Jeremy Scott – Administrator, Margie Boyd - Secretary

1. Meeting called to order at 5:03 p.m. by Jim Gurr

2. Pledge of Allegiance

3. Approval of Agenda

Motion by Bill Hefferan, seconded by Ron Tschudy to approve the March 7, 2023 agenda as presented.

Motion Passes: Yes – 4, No – 0, Absent – 1

4. Declaration of Conflict of Interest

None

5. Public Comment

None

6. Approval of Minutes

Motion by Bill Hefferan seconded by Ron Tschudy to approve the minutes from January 10, 2023 as presented.

Motion Passes: Yes – 4, No – 0, Absent – 1

7. Old Business

8. New Business

Review: Natural Hazard Mitigation Plan

Motion by Bill Hefferan, seconded by Leslie Elrod, to approve the Natural Hazard Mitigation Plan and recommend the Antrim County Local Emergency Planning Committee (LEPC) forward the plan to the Michigan State Police and the Federal Emergency Management Agency (FEMA).

Motion Passes: Yes – 4, No – 0, Absent – 1

Antrim County Master Plan Update

Jeremy Scott gave an update on the Master Plan and advised waiting to finalize the Master Plan until summer when census data is expected.

Village of Central Lake Master Plan

Motion by Leslie Elrod, seconded by Bill Hefferan, that the Planning Commission found no inconsistencies between the Antrim County Master Plan and the draft Village of Central Lake Master Plan & 5-Year Recreation Plan.

Motion Passes: Yes – 4, No – 0, Absent – 1

Robin Grant Letter of Support

Motion by Bill Hefferan, seconded by Leslie Elrod, to authorize the Antrim County Planning Commission Chair to sign a letter of support for the Trustream ROBIN grant application.

9. Various Matters

None

10. Public/Member Comment

Meeting was adjourned at 5:31

DRAFT



Antrim County Planning Commission



****PUBLIC HEARING****

Tuesday, March 7, 2023

Board of Commissioners Room
Antrim County Building
203 East Cayuga Street, Bellaire, MI

MEMBERS

Richard Friske, Jr.
12/31/2024

Leslie Elrod
12/31/2025

James Gurr
12/31/2025

Ron Tschudy
12/31/2023

Bill Hefferan
term elected

ADVISORY

Stan Moore
MSU Extension

STAFF

Jeremy Scott
County Administrator

Janet Koch
Deputy Administrator

Tina Schrader
Administrative Asst.

Margie Boyd
Secretary

OFFICE ADDRESS

P.O. Box 187
Bellaire, MI 49615

PHONE: 231-533-6265

FAX: 231-533-8111

AGENDA :

4:30 p.m. Call to Order

[Antrim County Hazardous Mitigation Plan](#)

Adjourn

If you wish to attend a Planning Commission meeting and require special assistance, please contact the Administration and Planning Office at (231)533-6265.

County of Antrim - Planning Commission

Richard Friske, Jr., Chair
Bill Hefferan

Leslie Elrod, Secretary

Jim Gurr, Vice Chair
Ron Tschudy

PUBLIC HEARING **Minutes – March 7, 2023**

Members Present: Leslie Elrod, Jim Gurr, Bill Hefferan, Ron Tschudy, Richard Friske, Jr.

Members Absent: Richard Friske, Jr.

Staff and Others: Jeremy Scott – Administrator, Stephanie Marchbanks and Jennifer Neal – Networks Northwest

Antrim County is in the process of updating its Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000. A hearing to accept public comments was held by the Antrim County Planning Commission at 4:30 p.m. in room 202 of the Antrim County Building, 203 East Cayuga Street in Bellaire. A public meeting was held immediately following the public hearing.

1. Meeting called to order at 4:33 p.m. by Jim Gurr

2. Informational Session – Question & Answer

Jennifer Neals and Stephanie Marchbanks of Networks Northwest provided an overview of the Natural Hazards Mitigation Plan.

3. Public Hearing – Comment Period

- Linda VanAndel of the 6-Mile Lake Association spoke on item 55D.
- Ross Maxwell and asked questions regarding grant funds
- Bill Derenzy of Echo Township commented that he had no concerns about the plan.
- Virginia Hawkins of Torch Lake Township
- Jim Gurr of the Antrim County Planning Commission pointed out that Benzie County maps were included in the back of Antrim's Plan. Mr. Gurr Additionally made comment about Autumn Olive.
- Ron Tschudy of the Antrim County Planning Commission asked questions about Table 12, Major Antrim County Employers and pointed out that page 71 included a link that would not work for a printed plan.

The Public Hearing was closed at 5:02pm



County of Antrim Planning Department

P.O. Box 187
Bellaire, Michigan 49615

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www.antrimcounty.org

Jeremy Scott
Administrator

Janet Koch
Deputy Administrator

Tina Schrader
Administrative Assistant

Margie Boyd
Secretary

March 8, 2023

Stephanie Marchbanks
Networks Northwest
2240 Mitchell Park Dr., Suite B
Petoskey, MI 49770

[sent via: Stephanie.marchbanks@networksnorthwest.org]

Dear Ms. Marchbanks,

On March 7, 2023, the Antrim County Planning Commission held a public hearing to accept comments on the draft of the Natural Hazard Mitigation Plan. At their regular meeting immediately following the hearing, the Planning Commission made the following recommendations:

...to approve the Natural Hazard Mitigation Plan and recommend the Antrim County Local Emergency Planning Committee (LEPC) forward the plan to the Michigan State Police and the Federal Emergency Management Agency (FEMA).

A draft copy of the public hearing and the regular meeting minutes are included with this communication. If you have any questions, please feel free to reach out to the Administration Office.

Sincerely,

Jeremy Scott
County Administrator

cc: Matthew Adamek, Emergency Services Coordinator
Antrim County LEPC