

Charlevoix County, Michigan

Natural Hazard Mitigation Plan

2024



U.S. Department of Homeland Security
FEMA Region 5
536 S Clark St
Chicago, IL 60605

FEMA

November 18, 2025

Mr. Matt Schnepp
State Hazard Mitigation Officer
Michigan State Police
Emergency Management and Homeland Security Division
P.O. Box 30634
Lansing, MI 48909

Dear Mr. Schnepp:

In accordance with applicable laws, regulations and policy, the Risk Analysis Branch of the FEMA Region 5 Mitigation Division has approved the Charlevoix County Hazard Mitigation Plan 2025. Enclosed is the status of all participating jurisdictions (see below).

Mitigation Plans may include additional content to meet Element H: Additional State Requirements or content the local government included beyond applicable FEMA mitigation planning requirements. FEMA approval does not include the review or approval of content that exceeds these applicable FEMA mitigation planning requirements.

The expiration date of the Charlevoix County Hazard Mitigation Plan 2025 is May 19, 2030.

An approved local mitigation plan, including adoption by the local government, is one of the conditions for applying for and/or receiving FEMA mitigation grants from the following programs:

- Hazard Mitigation Grant Program (HMGP)
- HMGP Post-Fire
- Building Resilient Infrastructure and Communities
- Flood Mitigation Assistance
- Safeguarding Tomorrow Revolving Loan Fund

Having an approved mitigation plan does not mean that mitigation grant funding will be awarded. Specific application and eligibility requirements for the programs listed above can be found in each FEMA grant program's respective policies and annual Notice of Funding Opportunities, as applicable.

Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and National Dam Safety Program Act, as amended; 44 CFR Part 201, Mitigation Planning; and Local Mitigation Planning Policy Guide (FP-206-21-0002).

A draft of the next plan update must be submitted before the end of the approval period. Remember to allow sufficient time to secure funding as well as for the update process, including the review and approval process. Please include time for any revisions, if needed, and for your jurisdiction to formally adopt the plan after the review, if not adopted prior to submission.

This will enable you to remain eligible to apply for and receive funding from FEMA's mitigation grant programs with a mitigation plan requirement. Local governments, including special districts, with a plan status of "Approvable Pending Adoption" are not eligible for FEMA's non-emergency assistance and mitigation grant programs with a mitigation plan requirement.

We look forward to discussing options for implementing this mitigation plan. If there are any questions from either you or the communities, please contact Cindy Thomack at (606) 202-1879 or cindy.thomack@fema.dhs.gov.

Sincerely,

John Wethington
Chief, Risk Analysis Branch
Mitigation Division

Enclosure: Plan Participants Status List

Attached is the list of the participating jurisdictions in the referenced Hazard Mitigation Plan.

Enclosure: Plan Participant Status List

Attached is the list of participating jurisdictions in the referenced hazard mitigation plan.

Community Name	Jurisdiction Status by FEMA	Date Approved
1) Bay township	Approved	6/25/25
2) Boyne City city	Approved	8/13/25
3) Boyne Falls village	Approved	6/4/25
4) Boyne Valley township	Approved	11/18/25
5) Chandler township	Approved	5/28/25
6) Charlevoix city	Approved	5/28/25
7) Charlevoix County	Approved	5/21/25
8) Charlevoix township	Approved	7/16/25
9) East Jordan city	Approved	6/18/25
10) Evangeline township	Approved	6/25/25
11) Eveline township	Approved	7/16/25
12) Hayes township	Approved	7/16/25
13) Hudson township	Approved	8/20/25
14) Marion township	Approved	5/28/25
15) Melrose township	Approved	6/25/25
16) Norwood township	Approved	7/16/25
17) Peaine township	Approved	6/18/25
18) South Arm township	Approved	6/25/25
19) St. James township	Approved	5/21/25
20) Wilson township	Approved	5/21/25

*If applicable, highlighted jurisdictions indicate the most recent approval.

ACKNOWLEDGEMENTS

The 2024 Charlevoix County Natural Hazard Mitigation Plan is prepared for Charlevoix County, Michigan and the jurisdictions in the county that have participated in the development of the plan update, per the table below. The plan is the culmination of an interdisciplinary and interagency planning effort that required the technical assistance and contributions from representatives of the organizations and jurisdictions listed below. Refer to Appendix G for a table of how and when the representatives of each participating entity contributed to the development of the plan. Each jurisdiction/agency is invited to be a participant in future regular review and updates of the plan.

PARTICIPATING AGENCY/ JURISDICTION	REPRESENTATIVE	TITLE
Charlevoix County Board of Commissioners	Robert Jess	District 1 Commissioner
	Chris Christensen	District 2 Commissioner
	Tim Kenney	District 3 Commissioner
	Joshua Chamberlain	District 4 Commissioner
	Scott Hankins	District 5 Commissioner; BOC Chairman
	Annemarie Conway	District 6 Commissioner
Charlevoix County	Sienna Wenz	Emergency Management Coordinator
	Kevin Shepard	County Administrator / Human Resources Director
	Julia Drost	County Clerk
	Becki King	Finance Director
	Emily Selph	Equalization Director
	Kiersten Stark	Planning Director
	Pam Grassmick	Planning Commissioner
	Larry Levengood	Planning Commissioner/ Lake Charlevoix Association
	Nancy Ferguson	Planning Commission Chair
	Michael Ritter	Planning Commissioner
	David Skornia	Planning Commissioner
	Chuck Vondra	County Sheriff
	William Church	Lieutenant, County Sheriff's Office
City of Boyne City	Michael Cain	City Manager
	Kevin Spate	Police Chief
	Jennifer Neal	Zoning Administrator (former)
	Mary Shaffer	Resident
City of Charlevoix	Jill McDonnell	Chief of Police (current)
	Gerard Doan	Chief of Police (former)
	Robert Sholey	Deputy Chief of Police (former)
	Jonathan Scheel	Zoning Administrator/Code Enforcement Official
	Mary Millington	Planning Commissioner
	Perry Irish Hodgson	Shade, Tree & Parks Commission Chair

ACKNOWLEDGEMENTS

PARTICIPATING AGENCY/ JURISDICTION	REPRESENTATIVE	TITLE
City of East Jordan	Tom Cannon	Administrator
	Mark Penzien	Mayor
	Cheltzi Wilson	Clerk
Bay Township	Xavier Gaudard	Supervisor
Boyne Valley Township	Sue Hobbs	Supervisor
Charlevoix Township	J. B. Hoyt	Trustee
	Sandra Witherspoon	Clerk (former)
Chandler Township	Myron Matz	Clerk
Eveline Township	Sandi Whiteford	Clerk
Evangeline Township	James Howell	Supervisor
	Jennifer Neal	Zoning Administrator (former)
Hayes Township	Ron VanZee	Supervisor
	Roy Griffitts	Planning Commission Chair
Hudson Township	Frank D. Wasylewski	Treasurer
Marion Township	John Martin	Supervisor
	Timothy Matchett	Clerk
	Michael Jarema	Treasurer
	Joseph Seidel	Trustee
	Julie Whitley	Trustee
Melrose Township	Vern Goodwin	Supervisor
	Robin Hissong Berry	Clerk
Norwood Township	Leslie Meyers	Zoning Administrator
Peaine Township	Doug Tilly	Supervisor (former)
	Maria Dal Pra	Supervisor (current)
	Vicki Smith	Treasurer; Beaver Island Emergency Services Authority Board Member
St. James Township	Bobbi Welke	Supervisor; Beaver Island Emergency Services Authority Board Member
	Shelby Harris	Planning/Administrative Assistant
	Beth Croswhite	Planning Commissioner
	Lori Taylor-Blitz	Planning Commission Chair
South Arm Township	Robert Christensen	Supervisor

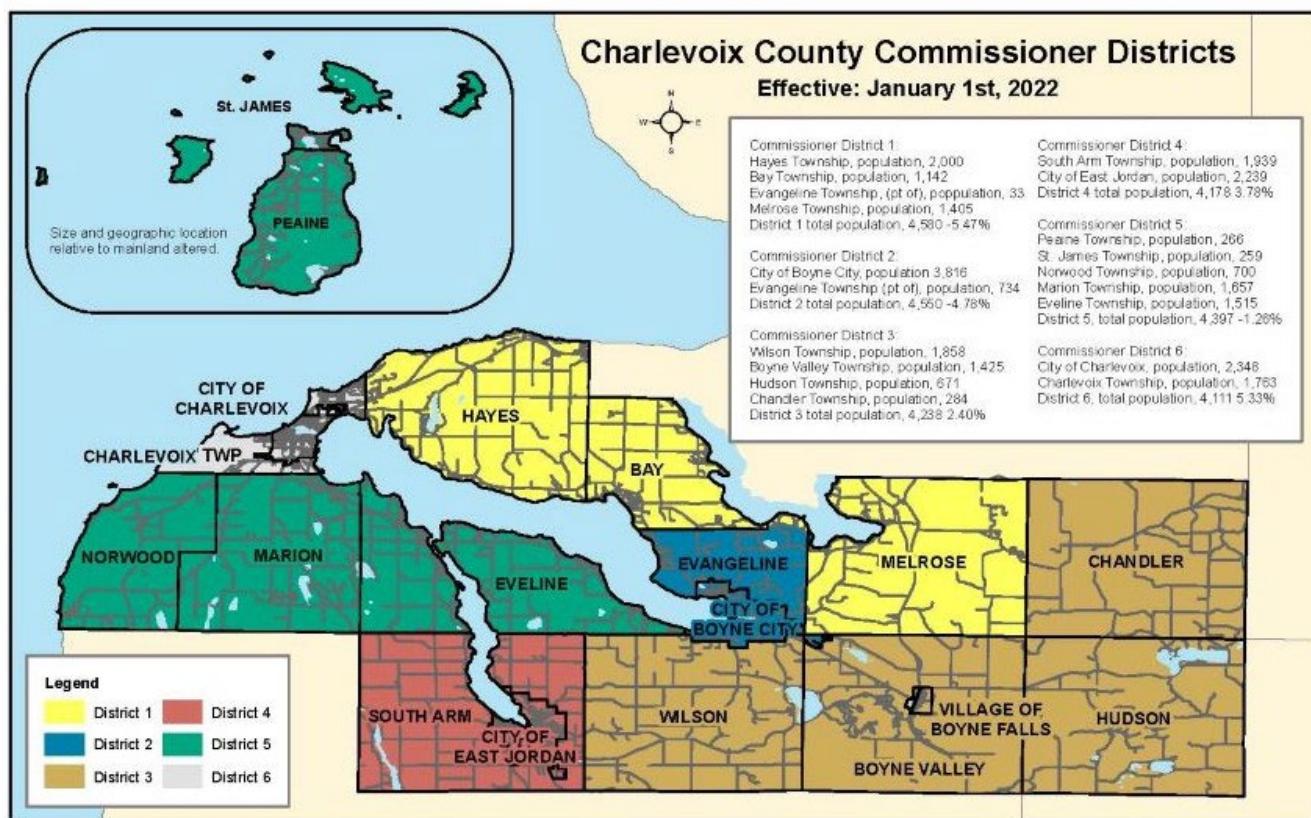
ACKNOWLEDGEMENTS

PARTICIPATING AGENCY/ JURISDICTION	REPRESENTATIVE	TITLE
Beaver Island Fire Department	Tim McDonough	Fire Chief; Beaver Island Emergency Services Authority Board Member
	John Works	Beaver Island Emergency Services Authority Chair
Wilson Township	Norman Vogt	Planning Commission Chair
Village of Boyne Falls	Marilyn Cousineau	Village President
Little Traverse Bay Bands of Odawa Indians*	David Thomm	Tribal Office of Emergency Management
Grand Traverse Band of Ottawa and Chippewa Indians*	Jolanda Murphy	Public Safety/Emergency Manager
	Becky Oien	Tribal Manager
	Sgt. Russ Cavanaugh	Tribal Police
	Garrett Fairchild	Fire Chief
	Lori Savaso	Risk Manager
	Dan Black	Safety Administrator
	Courtney Hessel	Natural Resources
	Sammie McLellan-Dyal	Tribal Historic Preservation Officer
Antrim County	Matt Adamek	Emergency Service Coordinator
Cheboygan County	Jeremy Runstrom	Lieutenant; Office of Emergency Management Director
Emmet County	Matthew Blythe	Emergency Management Coordinator
Charlevoix County Road Commission	Patrick Weeks	Manager
	James Vanek	Staff Engineer
Grandvue Medical Care Facility	Andrea Seese	Corporate Compliance Officer
Charlevoix-Cheboygan-Emmet (CCE) 911 Central Dispatch	Chris Heckman	Deputy Director
	Pamela Woodbury	Executive Director (former)
Jordan Valley EMS (JVEMS)	Meghan Meyer	Director (former)
Munson Charlevoix Hospital	John McDonald	General Manager
Health Department of Northwest Michigan	Chloe Capaldi	Emergency Preparedness Coordinator
Michigan Department of Natural Resources	Dan Duncan	Supervisor, Young State Park & Fisherman's Island State Park
US Coast Guard	Brad Bishop	Officer In Charge (former)
American Red Cross	Matthew Glenn	
Charlevoix Conservation District	Chris Anderson	Michigan Agriculture Environmental Assurance Program Technician
Charlevoix, Antrim, Kalkaska, & Emmet Cooperative Invasive Species Management Area	Katie Gray	CAKE CISMA Coordinator
Tip of the Mitt Watershed Council	Jennifer McKay	Policy Director

ACKNOWLEDGEMENTS

PARTICIPATING AGENCY/ JURISDICTION	REPRESENTATIVE	TITLE
Great Lakes Islands Alliance	Robert Anderson	Beaver Island rep., GLIA Steering Committee Interim Chair
Beaver Island EMS	Kathleena Mason	EMS Director
Forestview Senior Housing (St. James Twp.)	Alana Anderson	
Holtec Decommissioning International, Big Rock Point	Tim Horan	Contractor
	Tom LaCroix	Site Manager
East Jordan Plastics, Inc.	Marc Lercel	Employee

* These Tribal Government representatives participated in the development of the Charlevoix County Hazard Mitigation Plan Update, but are not seeking individual FEMA approval of the Plan for their respective Tribal Governments.



Source: <https://www.charlevoixcounty.org/boc/index.php>

ACKNOWLEDGEMENTS

Prepared for Charlevoix County by:



Networks Northwest
PO Box 506
Traverse City MI 49685-0506
Telephone: 231.929.5000
www.networksnorthwest.org

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

I. Introduction	1
II. Planning Process	3
Community Survey Results	4
Draft Plan Review and Comment	8
III. Community Profile.....	12
Location	12
Land Use/Land Cover	12
Transportation.....	15
Climate.....	19
Population	19
Age, Race & Disability.....	22
Housing.....	29
Areas of New Development in Charlevoix County	31
Economic Profile	32
IV. Hazard Identification and Assessments	39
Hazard Analysis Overview.....	39
Severe Winter Weather	49
Thunderstorms and Severe Winds	52
Hail.....	55
Riverine and Urban Flooding.....	58
Lightning	72
Tornado.....	74
Extreme Temperatures.....	78
Drought	85
Wildfire	87
Dense Fog	89
Coastal Hazards - Dangerous Currents.....	90
Coastal Hazards - Seiche.....	92
Coastal Hazards - Waterspout	93
Coastal Hazards - Coastal Recession and Shoreline Flooding.....	95
Space Weather and Electromagnetic Pulses.....	107
Public Health Emergency	111
Invasive Species	114
Impacts from Climate Change	122

V. Community Vulnerabilities and Capabilities	127
Emergency Warning System Coverage.....	127
Shelter Sites.....	128
Boat Access Sites for Emergency Use (such as for water withdrawal or lake rescue access)	129
VI. Goals and Objectives	138
VII. Mitigation Strategies	139
Types of Mitigation Actions.....	139
Mitigation Strategies.....	139
VIII. Implementation.....	166
Appendix A: Maps.....	169
Appendix B: Community Survey Results.....	176
Appendix C: Public Input Sessions -Feedback.....	198
Appendix D: Current Status of 2016 Plan Strategies.....	209
Appendix E: Consideration of Alternative Mitigation Strategies	215
Appendix F: Participation Table	222
Appendix G: Participation Documentation.....	229

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. This plan focuses primarily on *natural* hazards such as extreme temperatures, drought, wildfires, flooding, shoreline hazards (such as dangerous currents, flooding, erosion, waterspouts and seiche), thunderstorms, high winds, hail, tornadoes, severe winter weather, dense fog, space weather, and invasive species. The plan will also consider these technological and human-related hazards: dam failure, public illness outbreak, and human-induced electromagnetic pulses. The anticipated impacts of climate change in Michigan are also discussed with relation to expected future natural hazard events.

The following natural hazards were not included in the analysis for this Hazard Mitigation Plan: earthquakes, subsidence, and meteorites and other impacting objects. Based upon review of the Michigan State Police's 2019 *Michigan Hazard Analysis*, most of Michigan is not located in an area subject to major earthquake activity. Additionally, there are no mines in the county, and sinkhole risks in the county range from "absent or likely absent" in generally the west half of the county to "infrequent or likely infrequent" in the east half of the county. Damaging meteorite events were not evaluated due to the lack of historical impact in northern Michigan and their low probability of occurrence.

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

A broad perspective was taken in developing this plan to examine multiple hazard mitigation activities and opportunities in Charlevoix 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 following notable projects have been completed that aid in the county's hazard mitigation efforts:

- Local governments along the Lake MI coastline, and many adjoining the inland lakes of Lake Charlevoix and Walloon Lake, adopted their new or revised Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) in 2019 and/or 2022. Local units of governments interested in revising their local ordinances to include shoreline protection/property protection measures can utilize the FIRMs as a resource. The new FIRMs are also referenced in the County's building permit application process.
- In October 30, 2023 through May 2024, the Michigan Department of Transportation (MDOT) invested \$6.3 million to replace 20,000 pounds of structural steel on the US-31 bascule bridge in Charlevoix, including the bridge's tread and track components, which facilitate the structure's operation. The project also included work on the bridge railings, electrical components, joints, curbs, and gutters. This work extends the bridge's service life and maintain reliability of regular bridge operations.

Appendix D provides a list of mitigation strategies included in the Charlevoix 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 E for a list of Alternative Strategies that were considered.) Strategies are grouped according to their purpose: Awareness and Preparation; Shelters; Buildings & Infrastructure; 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, Charlevoix County is actively addressing the issue through the development and implementation of this plan. This process will help ensure that Charlevoix 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 Charlevoix 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:

- Goal 1:** Increase local awareness and participation in natural hazards mitigation strategies
- Goal 2:** Integrate hazard mitigation considerations into the community's comprehensive planning process
- Goal 3:** Utilize available resources and apply for additional funding for hazard mitigation projects
- Goal 4:** Develop and complete natural hazards mitigation projects in a timely manner

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 hazard 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. The last Natural Hazard Mitigation Plan was completed for Charlevoix County in 2016 by the former Tri-County Office of Emergency Management. The 2016 Plan also included hazard mitigation plans for Cheboygan and Emmet counties. Following the dissolution of the three-county Office of Emergency Management (OEM) in July 2020, Charlevoix County started its own OEM. The adoption of this updated Plan will reaffirm the eligibility of the county, as well as those local municipalities who participated in the planning process and adopted the plan, to apply for FEMA pre-disaster mitigation grants.

Plan Development

The update of the County's plan was led by the Natural Hazards Task Force ("Task Force") composed of the County's Local Emergency Planning Committee (LEPC), organized by the Charlevoix County Emergency Management Coordinator. LEPC members consist of first responders and local, regional, and state public entities that ensure the preparedness of the County through efforts such as coordination and cooperation amongst members; recommending equipment purchases; and conducting training, exercises, and public education. Networks Northwest staff assisted with development of the updated plan by providing meeting and public input facilitation, conducting an online survey, and writing the plan. Task Force/LEPC meetings were held both virtually and at the County Emergency Operations Center, and were open to the public. Notifications of all meetings involving work sessions/public input sessions were posted on the Charlevoix County's OEM webpage.

Representatives of all of the following types of stakeholders were invited to participate in the planning process by various methods: email invitation, phone calls, meeting attendance/presentation, or mailed letters. Stakeholders included local and regional agencies involved in hazard mitigation activities; agencies that have the authority to regulate development; neighboring communities; representatives of businesses and 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 (such as the Health Department of Northwest Michigan and the Grand Traverse Band of Ottawa and Chippewa Indians). Please refer to the Acknowledgements section in the beginning of this plan for a list of participants; Appendix F for a detailed table showing how and when representatives participated in the planning process; and Appendix G for meeting and public input documentation. All city, village, and township governments located within Charlevoix County have participated in the development of this 2024 Hazard Mitigation Plan. The 2016 Hazard Mitigation Plan for Charlevoix County did not specify which communities participated in the development of that plan, so it is not possible to identify which communities are continuing participants.

The following work contributed to the creation of the 2024 Charlevoix County Natural Hazard Mitigation Plan:

- An online survey was available from August 24, 2022 to January 11, 2023. Survey questions were crafted to obtain input from Charlevoix County stakeholders on their experiences with past hazard events; perceived level of concern regarding impacts from future hazard events; and past and future mitigation projects.
- Task Force meetings where Networks Northwest staff provided new information pertaining to the plan:
 - August 15, 2022
 - November 21, 2022
 - January 23, 2023
 - April 17, 2023
 - August 21, 2023
 - November 20, 2023
 - January 22, 2024
 - February 26, 2024
 - April 22, 2024
 - September 30, 2024

- On January 3, 2023, the Charlevoix County Emergency Manager and Networks Northwest staff met with Pat Weeks (CCRC Manager) and James Vanek (CCRC Staff Engineer) of the Charlevoix County Road Commission to discuss road infrastructure issues as well as recently completed and future planned road improvements.
- Public Input Sessions held to obtain feedback on hazards of concern and potential mitigation strategies:
 - January 23, 2023 – in person at Charlevoix County's Whiting Park in Eveline Township
 - October 9, 2023, 5:30-7:30 pm, via Zoom to discuss issues/concerns with Beaver Island communities
 - October 11, 2023, 5:30-7:30 pm, in person at the East Jordan EMS building
 - October 18, 2023, 5:30-7:30 pm, in person at the Charlevoix County Offices, Shirley Roloff Center
 - October 25, 2023, 5:30-7:30 pm, in person at the Boyne City Government Offices
- On November 29, 2023, Networks Northwest staff presented at the Charlevoix County Planner's Forum, held at the Charlevoix City Library, to summarize the purpose and content of the drafted Hazard Mitigation Plan and invite local governments to provide input and become participants in the plan's development.
- Networks Northwest staff presented the draft plan on June 6, 2024 to the Charlevoix County Planning Commission on June 6, 2024; and on October 9, 2024 to the Charlevoix County Board of Commissioners.
- Appendix C provides a summary of feedback received from meetings held with stakeholders and the public during the planning process.
- During development of the plan, all local/tribal government entities in Charlevoix County 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 Charlevoix County (listed below) were invited to participate in the planning meetings, and were able to view the draft plan materials on the hazard mitigation project page of Network Northwest's website.
 - Jolanda Murphy, Public Safety/Emergency Manager, Grand Traverse Band of Ottawa & Chippewa Indians
 - Little Traverse Bay Bands of Odawa Indians
 - Matthew Adamek, Emergency Operation Director, Antrim County Emergency Services
 - Matthew Blythe, Emergency Management Coordinator, Emmet County Office of Emergency Management
 - Lieutenant Jeremy Runstrom, Director, Cheboygan County Office of Emergency Management
 - Jon Deming, Emergency Services Coordinator, Otsego County Office of Emergency Management, EMS Rescue Chief
 - Robert Carson, Regional Director of Community Development, Networks Northwest

Community Survey Results

The community survey was available in an online format from August 2022 to January 2023 from the Charlevoix County OEM's webpage and Networks Northwest's project webpage. The Charlevoix County Emergency Management Coordinator also emailed Task Force members, local government officials and other community stakeholders with an invitation (and follow up reminders) to take the survey. The survey asked sixteen questions related to hazard mitigation and received 54 responses. The majority of responses were from elected or appointed officials, emergency personnel, and property owners/residents (Table 1). Complete survey results are included as Appendix B.

Table 1: Survey Responses by Local Municipality

Local Unit	# of Reps*	Title/Role (If Indicated)
Charlevoix County	15	Local government employees; elected or appointed officials; County Planning Commissioners; District 5 County Commissioner; City Manager; Long-term care facility employee – Emergency Preparedness; County EMC
City of Boyne City	4	City residents/property owners; City Clerk
City of Charlevoix	13	City residents; Planning Commissioner; Shade Tree and Parks Commission; Hospital employee/Emergency Management; EMS Director
City of East Jordan	3	City residents; local government employee; City Administrator
Village of Boyne Falls	1	Resident
Bay Township	3	Elected officials
Boyne Valley Township	3	Residents/property owners; Township Supervisor; elected official
Chandler Township	1	Residents/property owners
Charlevoix Township	2	Township Clerk; EMS Director
Evangeline Township	1	Resident
Eveline Township	3	Township Clerk; EMS Director
Hayes Township	1	EMS Director
Hudson Township	0	
Marion Township	2	Resident; EMS Director
Melrose Township	1	Township Supervisor
Norwood Township	2	EMS Director; Zoning Administrator
Peaine Township	1	Residents/property owners; Beaver Island Historical Society Director
South Arm Township	3	Residents/property owners
St. James Township	7	Residents/property owners; Township Supervisor; Township Admin. Assistant; Planning Commissioner; Historical Society Director
Wilson Township	2	Residents/property owners; Township Clerk
Other	5	Cheboygan County Emergency Management; Otsego County; Tip of the Mitt Watershed Council; GTB Tribal Historic Preservation Officer; Antrim County Employee

Note: *When asked to identify which jurisdiction a survey participant represented, they could select multiple communities that applied to them.

Responses to Question 3-5 asked about participants' knowledge of local planning efforts including the current hazard mitigation plan (60% indicated they were unfamiliar with the plan), local master plans (77% said yes they have an adopted Master Plan), and a local Capital Improvements Plan (CIP) (33% indicated that they have a CIP).

Questions 6 and 7 asked participants if there had been significant natural hazard event within their community in the past 10 years and, if so, to describe the nature of the event. 32% said they had experienced a significant natural hazard in the last 10 years, with descriptions provided as follows:

No Specific Location

- COVID-19
- Heavy snowfall
- Strong winds; high wind storms in December 2021
- Power outage
- Ice storm
- High water levels (Lake Michigan) 2018-2019
- Flooding
- Erosion

City of Boyne City

- Tornado

City of Charlevoix

- Blizzard; Extreme winter weather

City of East Jordan

- Flooding of public areas, parks and infrastructure. Over capacity of wastewater system with stormwater

Bay Twp.

- Wind storm

Charlevoix Twp.

- Flooding

Peaine Twp.

- High water, erosion
- Some houses threatened by high water, storm driven events

St. James Twp.

- High water, erosion
- High Lake Michigan levels and high winds combined for shore erosion and damage to homes/property

Antrim County

- Tornado
- Straight-line winds

Responses to question #8 indicated that 59% of participants were “somewhat concerned”, 31% were “very concerned”, and 10% were “not concerned” about future natural hazard events impacting their community.

Question 9 asked what types of natural hazard events were likely to have the largest impact on the survey participant’s community (Table 2).

Table 2. Survey Question #9 Results Summary

What type of natural hazard events are likely to have the largest impact on your community (i.e., flood, winter storm, thunderstorm/wind, drought, illness outbreak)?

Ranking	Hazard	Times Mentioned	Locations of Concern
#1	Severe Winter Weather	33	Countywide
#2	High Wind, Thunderstorm/Wind	32	Countywide
#3	Flooding	17	Countywide; City of Boyne City, City of East Jordan, Townships of Bay, Boyne Valley, Chandler, Charlevoix, Eveline, Peaine, South Arm, St. James, Wilson
#4	Illness Outbreak	13	Countywide
#5	Shoreline Erosion	11	Lake MI Communities: City of Charlevoix; Townships of Peaine, St. James, Bay, Hayes, Charlevoix, and Norwood
#6	Drought	7	Countywide
#7	Tornado	3	Countywide
#8	Fire	2	Countywide; St. James and Peaine Townships
#9	Lightning Strike	1	Hayes Township - (radiation leak at former Big Rock Nuclear Plant caused by lightning strike)
	Dam failure	1	Boyne Valley Township
	Hail	1	Countywide
	Increased storms	1	Countywide

Question 10 asked about community concerns regarding infrastructure withstanding a natural hazard event in the future. Areas with specific infrastructure concerns mentioned include:

- Countywide
 - Electrical outages due to storms
 - "Shoreline infrastructure damage from soil erosion due to high lake levels"
 - "High water levels in the next 15-20 yrs. could be worse than what the area had in the past couple years"
- Boyne Valley Township
 - Potential dam failure (Boyne USA-owned dam; Boyne Falls Village-owned dam on M-75)
- City of East Jordan
 - Water and sewer services
- City of Charlevoix
 - Aging drawbridge on US-31 – a major connector for the City and region
 - General utilities
 - "Water infrastructure can be challenging in extreme cold"
- Wilson and Boyne Valley Townships
 - "Dam situation on Deer Lake"
 - "Power outages due to high winds/storms"
- St. James Township
 - "Utilities are above ground wires that are open to damage by wind, trees downed, etc."
 - "Lack of generator operations during cold periods."
 - "Fragile road beds and cultural assets"
- Peaine and St. James Townships
 - "Phone/internet service on Beaver Island"
 - Concerns for repair times for island utility outages
 - "Concern for our water/sewer infrastructure in the event of heavy precipitation or freezing [temperatures]"
- Eveline Township
 - "Utility issues would most affect our residents"
- Norwood Township
 - "A local road tax doesn't address the road and culvert needs throughout the Township"
- The Mackinaw Bridge (in Cheboygan/Emmet counties)

Questions 11 and 12 asked if a community had considered mitigation strategies for potential or current hazards, and if so, what strategies they would like to explore in the future. 38% of respondents indicated "yes", with the following potential mitigation strategies they would like to explore:

- Countywide
 - Updates to the power grid
 - Backup power sources
 - Utilize climate mitigation strategies for coastal communities as encouraged by the Tip of the Mitt Watershed Council
- Culvert improvements and utilization of the new [Antrim] County Hydrology Model
 - Conducting annual emergency scenario planning drills regarding US-31 bridge outage and Big Rock [former nuclear power plant site in Hayes Township].
- Eveline Township
 - Shoreline erosion
- St. James Township/Peaine Township
 - Update Beaver Island Emergency Operations Plan with a focus on planning for power outages, backup power sources and shelters; evacuation plans; CIP
 - Strengthen building codes in high risk erosion areas
- City of East Jordan
 - "Collaborative efforts between jurisdictions, shared services, emergency response with private utility companies"
- City of Charlevoix
 - Revising infrastructure as possible

Question 13 asked if a community had requested assistance for past mitigation projects. Only 4 out of 45 respondents said “yes”. A representative from Charlevoix Township indicated they received assistance from FEMA regarding Floodplain Management Provisions.

Question 15 asked if there was any additional information to consider in the Plan update:

- Beaver Island
 - Place power lines underground
 - Keep island logistics in mind
 - Power outages for an island community is a serious issue; loss of power means loss of a winter's food supply kept in refrigerators/freezers
 - “Island needs local team to aid in emergencies, especially when off-island emergency personnel are not available and/or power, internet and phone services are disrupted.”
- Problems with maintaining staffing levels of local Fire, Police and EMS
- South Arm Township
 - Flooding in Six Mile Lake

The final survey question asked survey-takers to respond with their contact information if they wish to be involved in the plan development process. Several responded with their email address.

Draft Plan Review and Comment

The public was notified of the availability to review the draft plan and provide comment via the following methods:

- 1.) The posting of draft plan materials and public hearing notification on Networks Northwest's project webpage and the County OEM's webpage (Figure 1);
- 2.) A published notice in the Charlevoix Courier newspaper on October 17, 2024 of the availability of the County's draft Hazard Mitigation Plan for review and the opportunity to provide feedback at the public hearing held on October 23, 2024 (Figure 2); and
- 3.) Networks Northwest notified local government Clerks, Township Supervisors, City Managers and Village Presidents via USPS Certified Mail and via email informing them of the final opportunity to review and comment on the plan through the scheduled public hearing held at the October 23, 2024 County Board of Commissioner's meeting (Figure 3).

Documentation of any comments received during the public review period is included in Appendix G.

Figure 1: Screenshots of Networks Northwest Project Webpage and Charlevoix County's OEM Webpage, Accessed on 10/21/2024:

10/21/24, 9:11 AM Charlevoix County Natural Hazard Mitigation Plan

CHARLEVOIX COUNTY

Charlevoix County's Final Draft of its Natural Hazard Mitigation Plan is available for public review and comment: [10/1/2024 Draft Plan](#). A hard copy of the plan is also available for review at the Charlevoix County Clerk's Office at 203 Antrim Street, Charlevoix, MI 49720.

A Public Hearing will be held for the plan as part of the Charlevoix County Commissioner's Meeting on Wednesday, October 23, 2024 at 6:00 pm. The meeting is held in the Commissioner's Room at the Shirley Roloff Center, 13513 Division Street, Charlevoix, MI 49720.

Comments on the plan will be accepted in person at the public hearing, or via email to: stephanie.marchbanks@networksnorthwest.org

Networks Northwest will assist the [Charlevoix County Office of Emergency Management](#) with updating the County's [2016 Natural Hazard Mitigation Plan](#). To be eligible for pre-disaster mitigation project grants awarded by FEMA, participating jurisdictions must contribute to the creation of the plan and adopt the FEMA-approved plan.

CHARLEVOIX COUNTY MICHIGAN

Cities & Townships Boards, Commissions & Committees Bids, Proposals & Items For Sale How Do I... Employee Portal

Hazard Mitigation Plan

Home Search All County Documents

CHARLEVOIX COUNTY SHERIFF

What is Emergency Management? *BeAlert* Emergency Notification System Hazard Mitigation Plan School Safety What is a Local Emergency? Local Emergency Planning Committee Meetings (LEPC) Be Prepared

Home / Charlevoix County Sheriff / Emergency Management / Hazard Mitigation Plan

Charlevoix County Hazard Mitigation Plan for 2024 is in process. Charlevoix County has partnered with Networks Northwest Community Development staff planners with the update of the County's Hazard Mitigation Plan. Hazard mitigation planning reduces loss of life and property by minimizing the impact of natural disasters. Regularly updated and FEMA-approved hazard mitigation plans allow a community to remain eligible for various federally-funded hazard mitigation grant opportunities for five years.

Currently the county is in "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". [DRAFT- Charlevoix County Hazard Mitigation Plan](#) [CLICK HERE](#) to view

Current Hazard Mitigation Plan: [Hazard Mitigation Plan 2016](#)

If you should have any questions or comments, please call the Emergency Management Coordinator at (231) 547-4461 or email wenzs@charlevoixcounty.org.

II. Planning Process

Figure 2. Public Notice in the Charlevoix County News Weekly Choice Newspaper, October 17, 2024

<p>Letters or ary history and three Manager, ain@boyne- per 4, 2024 ing Director in an open until yinicity.com iate opening Delivery day or n. Nice ew hours of dependable weekends eekly- or text Dave 0-9235. ver - APS - Service.</p> <p>per delivery UTES, Gay- harlevoix, River, King- y is primarily day before weekends eekly- or text Dave 0-9235. ver - APS - Service.</p> <p>RENT oom House. Call 989- message*</p> <p>Fully m, 1 bath. lett Lake. ely - May 30, no pets. Call</p> <p>T. ROGERS work for part 06. Leave</p>		<p>with qualifying purchase. Call 855-922-0420 today to sched- ule a free quote. It's not just a generator. It's a power move. www.PetoskeyRVUSA.com</p> <p>Various styles of Utility Sheds. Finance for 48 months or Rent to Own. Free Delivery within 30 miles. Rivertown Auto Sales & Leasing, 989 VFW Rd, Cheboy- gan. 231-627-6700.</p> <p>MOTORCYCLES 2009 Honda Shadow Motor- cycle. One owner, 18 K miles. Sale Price \$3,500 cash. River- town Auto Sales & Leasing. 989 VFW Rd, Cheboygan. 231-627- 6700. www.rivertownautosales.com.</p> <p>PUBLIC HEARING NOTICE COUNTY OF CHARLEVOIX PUBLIC NOTICE</p> <p>HEARING ON 2024 NATURAL HAZARD MITIGATION PLAN</p> <p>Notice is hereby given that the proposed Natural Hazard Mitigation Plan for the County of Charlevoix is now on file and available to the public for inspection at the office of the County Clerk, 203 Antrim Street, Charlevoix, MI 49720.</p> <p>The Charlevoix County Board of Commissioners will hold a public hearing on the proposed Natural Hazard Mitigation Plan on Wednesday, October 23, 2024, at 6:00 p.m. in the Commissioner's Room, Shirley Roloff Center, 13513 Division Street, Charlevoix, MI 49720.</p> <p>CHARLEVOIX COUNTY COMMISSIONERS SYNOPSIS OCTOBER 9, 2024</p> <p>The Charlevoix County Board of Commissioners met in the Charlevoix County Commissioners room on October 9, 2024, at 9:30 a.m. Six Commissioners were present.</p> <p>Motion approved the agenda as presented.</p> <p>Motion approved the consent agenda as presented.</p> <p>Motion approved Resolution #24-116, County Expenditures.</p> <p>Motion approved Resolution #24-117, Public Hearing Notice.</p> <p>Motion approved Resolution #24-118, 2024 Apportionment Report.</p> <p>Motion approved Resolution #24-119, County Network Switches.</p> <p>The meeting was adjourned to the call of the Chair at 10:18 a.m.</p> <p>Complete copies of Board minutes can be found on the County website, www.charlevoixcounty.org.</p>
--	--	--

AFFIDAVIT OF PUBLICATION
for Legal Notice published in the Charlevoix County News

Charlevoix County News
112 E. Sixth St.
Gaylord, MI 49735

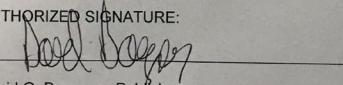
Phone: 989-732-8160 E-Mail: Office@CharlevoixCountyNews.com
STATE OF Michigan

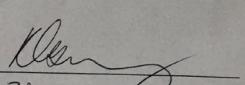
I, David Baragrey, Publisher of the Charlevoix County News, a legal newspaper, under
oath, state that the following is true and correct.
The Charlevoix County News, is a newspaper which is published weekly is of general
circulation and is in compliance with State of Michigan Statutes " 691.1051 "

The notice has been published in the newspaper listed above.
DATES OF PUBLICATION:
1) 10/17/2024

HEARING ON 2024 NATURAL HAZARD MITIGATION PLAN NOTICE

This notice was published in accordance as required and placed by the County of
Charlevoix.

AUTHORIZED SIGNATURE:

David G. Baragrey, Publisher

SUBSCRIBED AND SWORN TO BEFORE ME ON THE
14 DAY OF October 2024
Signature of Notary 
Commission Expires on: Jan. 31 2025
Otsego County, Michigan

NOTARY PUBLIC
JON KLESNEY
Notary Public - State of Michigan
County of Otsego
My Commission Expires Jan 31, 2025
Acting in the County of

Figure 3. Letter Mailed and E-mailed to Local Government Officials from Networks Northwest

<div style="text-align: center;">  <p>Chief Elected Official: Chris Christensen Board Chair: Nicole Sulak Chief Executive Officer: Janie McNabb</p> <p>October 9, 2024</p> <p>Dear Charlevoix County Local Government Representative,</p> <p>The Charlevoix County Department of Emergency Management, with assistance from Networks Northwest, has prepared a draft of Charlevoix County's 2024 National Hazard Mitigation Plan. The objective of the multi-hazard mitigation plan is to minimize or reduce long-term risks to people, property, the environment, and the economy from natural hazards. The plan also considers certain technological/human related hazards, such as a dam failure and public health emergency. Several mitigation strategies are included to address site-specific or county-wide hazard risks.</p> <p>The updated 5-year plan must pass review from Michigan State Police and the Federal Emergency Management Agency (FEMA), and then be adopted by each local unit of government that participated in the plan's development. A current, approved local hazard mitigation plan is one of the requirements* for a community to apply for and/or receive FEMA mitigation grants from the following programs¹:</p> <ul style="list-style-type: none"> • Building Resilient Infrastructure and Communities (BRIC) (a pre-disaster grant; the program's guiding principles are supporting communities through capability and capacity building; encouraging and enabling innovation; promoting preparedness, resilience, and recovery; and ensuring long-term sustainability) • Flood Mitigation Assistance (FMA) (a pre-disaster grant; projects must aim to eliminate the risk of repetitive flood damage to buildings and structures insured under the National Flood Insurance Program) • Hazard Mitigation Grant Program (HMGP) (available after a presidentially declared disaster) • HMGP Post-Fire (to implement hazard mitigation measures after wildfire disasters in any area that receives a Fire Management Assistance Grant declaration) <p>Potential projects that could be funded under one or more of the grant programs listed above include:</p> <ul style="list-style-type: none"> • Secondary Power Source • Warning System • Mitigation Reconstruction • Safe Room Construction • Structural Retrofit • Wildfire Mitigation • Property Acquisition • Site Acquisition • Localized Flood Risk Reduction • Non-Localized Flood Risk Reduction • Stabilization • Dry Floodproofing (Non-Residential Building) <p>Your participation in the development of this plan is an essential component of the planning process, as well as a Federal Emergency Management Agency (FEMA) requirement to be eligible to apply for federally-funded hazard mitigation grants. The draft can be reviewed online at www.networksnorthwest.org/charlevoix-county.html. Many of the hazard mitigation strategies have a county-wide application, but some are site-specific. Please review the plan, and the mitigation strategies in particular, from the viewpoint of your community. If you are considering applying for a FEMA mitigation grant in the next five years, your proposed project must be associated with a specific hazard issue and mitigation strategy identified in the final plan.</p> <p><small>¹ https://www.fema.gov/grants/mitigation/learn</small></p> <p><small>Antrim • Benzie • Charlevoix • Emmet • Grand Traverse • Kalkaska • Leelanau • Manistee • Missaukee • Wexford PO Box 506 • Traverse City, MI 49685-0506 • Phone (231) 929-5000 • Fax (231) 929-5012 • networksnorthwest.org</small></p> <p><small>Networks Northwest and Northwest Michigan Works! are supported by the State of Michigan and are proud partners of the American Job Center Network. Projects may be funded with the authorized and appropriate use of federal funds. Contact Networks Northwest for additional information. Equal opportunity employer/program. Auxiliary aids and services are available upon request to individuals with disabilities. Individuals with speech or hearing impairments may call the Michigan Relay Center by calling 711.</small></p> </div>	<div style="text-align: center;">  <p>Chief Elected Official: Chris Christensen Board Chair: Nicole Sulak Chief Executive Officer: Janie McNabb</p> <p>A public hearing for the plan is scheduled for 6 pm on October 23, 2024, as part of the regularly scheduled meeting of the Charlevoix County Board of Commissioners. The meeting will be held in the Shirley Roloff Center at 13513 Division Street, Charlevoix, Michigan 49720.</p> <p>Upon review of the plan, the Board of Commissioners shall recommend it be sent to Michigan State Police Homeland Security Division for review and then on to FEMA for their review and approval. Once FEMA has indicated the plan has met their review requirements, it will be brought before the County and local government boards for adoption. The plan will then be officially approved by FEMA for those communities that have adopted the plan, and will be valid for five (5) years from the earliest date of adoption.</p> <p>Comments on the plan are requested either in person at the public hearing; by mail at 2240 Mitchell Park Drive, Suite B, Petoskey, MI 49770; or by email to stephanie.marchbanks@networksnorthwest.org on or before October 23, 2024.</p> <p>A copy of this letter will also be provided to you via electronic mail.</p> <p>Sincerely,</p> <p>Stephanie Marchbanks Community Planner, Networks Northwest</p> <p>* Having an approved mitigation plan does not mean that mitigation grant funding will be awarded. Specific application and eligibility requirements for the programs listed above can be found in each FEMA grant program's respective policies and annual Notice of Funding Opportunities, as applicable. Information on the FEMA mitigation grant programs can be found at: https://www.fema.gov/grants/mitigation</p> <p><small>Antrim • Benzie • Charlevoix • Emmet • Grand Traverse • Kalkaska • Leelanau • Manistee • Missaukee • Wexford PO Box 506 • Traverse City, MI 49685-0506 • Phone (231) 929-5000 • Fax (231) 929-5012 • networksnorthwest.org</small></p> <p><small>Networks Northwest and Northwest Michigan Works! are supported by the State of Michigan and are proud partners of the American Job Center Network. Projects may be funded with the authorized and appropriate use of federal funds. Contact Networks Northwest for additional information. Equal opportunity employer/program. Auxiliary aids and services are available upon request to individuals with disabilities. Individuals with speech or hearing impairments may call the Michigan Relay Center by calling 711.</small></p> </div>
--	---

III. Community Profile

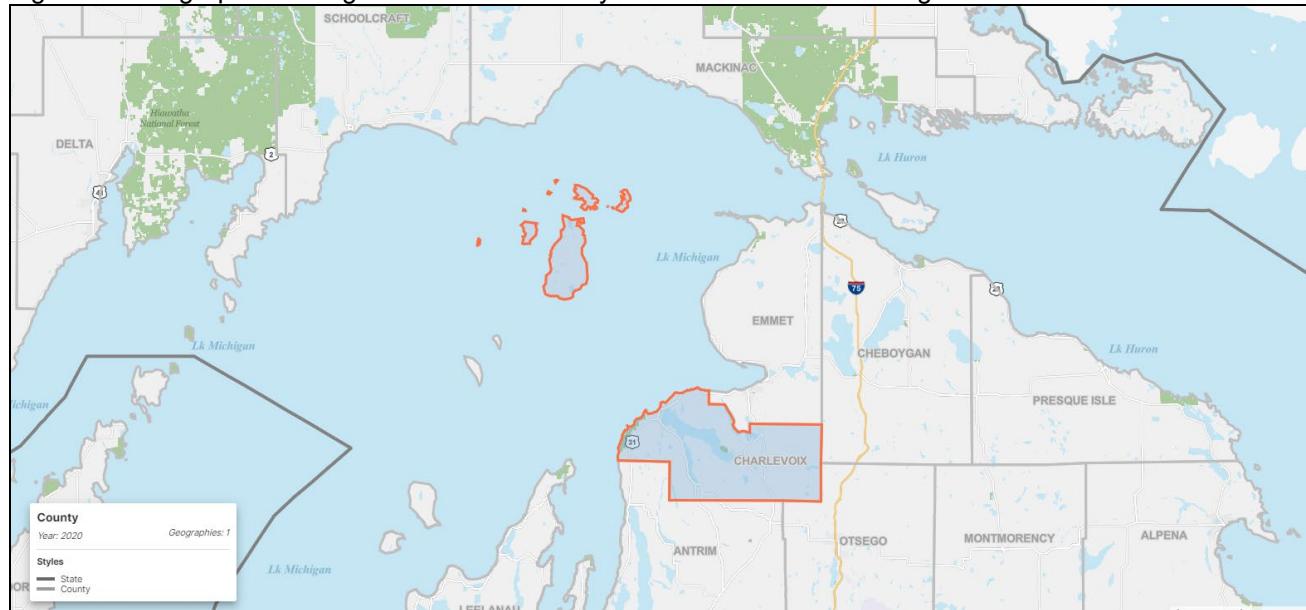
III. COMMUNITY PROFILE

Location

Charlevoix County is located in Northwest Lower Michigan (Figure 4). The mainland portion of the county is bordered by Lake Michigan, Emmet County, Cheboygan County, Otsego County and Antrim County. There are 11 outer islands in the Beaver Island Archipelago: Garden, High, Gull, Hog, Pismire, Whiskey, Trout, Shoe, Hat, Horseshoe and Squaw/Ojibwe islands. Only Trout and Squaw/Ojibwe Islands contain private residences.

Refer to Appendix A for maps illustrating Charlevoix County's main roads, water bodies and jurisdictions.

Figure 4. Geographic Setting of Charlevoix County in Northwest Lower Michigan



Source: US Census Bureau

Land Use/Land Cover

Charlevoix County contains approximately 416 square miles of land and 974 square miles of water (including Lake Michigan). It is one of the smallest counties in the state and contains a larger amount of surface water both within and adjacent to its boundaries than most other counties in Michigan. There are 38 named inland lakes in the County, ranging in size from 0.65 acre to 17,200 acres, and equal to about 40 square miles. Including the Beaver Island Archipelago (located in St. James and Peaine Townships), there are 138 miles of Great Lakes shoreline in the County. Wetlands occupy 18 percent of the County's land area. Many wetlands are small, occupying less than 5 acres. Most of the County's wetlands are wooded cedar swamps, which are important for wildlife and water quality, and are a source of cedar wood products. The highest elevation in the county is 1,561 feet and is known as "Hudson Lookout", located in the eastern portion of Hudson Township.

Critical Dune Areas are located in small parts of the City of Charlevoix as well as in the Townships of Charlevoix, Norwood, Peaine, and St. James. The State legislature identifies these coastal dunes as unique, irreplaceable, and fragile resources that provide significant recreational, economic, scientific, geological, scenic, botanical, educational, agricultural, and ecological benefits.

Natural resources and features of local and regional significance include the following:

- Lake Michigan Shoreline – Approximately 23 miles long on the mainland, this ecologically unique area is home to many threatened species and species of special concern.
- Beaver Island Archipelago – Islands in this group include 77 square miles of land area and well over 100 miles of Great Lakes shoreline. It is also home to many threatened and special concern plant and animal species.

- Lake Charlevoix – With a surface area of 17,200 acres and 56 miles of shoreline, Lake Charlevoix is the third largest and one of the highest quality inland lakes in Michigan. This lake is critical for waterfowl and fisheries. Its largest tributary is the Jordan River. The Lake Charlevoix Watershed covers approximately 332 square miles - much of the County.
- Boyne River – This river is approximately 22 miles long, with a 40,320-acre watershed. The river is a state designated blue ribbon trout stream.
- Jordan River – One of Michigan's designated Natural Rivers. Highly valued for its fishery, beautiful river valley and recreation. Most of the watershed is in Antrim County, although significant portions extend into the City of East Jordan and South Arm, Wilson and Boyne Valley Townships.
- Walloon Lake – The southern shore of this lake lies within Charlevoix County. It is the source of the Bear River.
- Bear River Wetland Complex – One of the largest wetland complexes in the County, and continues into Emmet County.

There are 48 threatened, endangered or special concern species in the county, seven of which are federally listed (Table 3). Many of these species occur in Great Lakes shoreline areas and in the Beaver Island Archipelago.

Table 3: Federally Listed Endangered and Threatened Species

Scientific Name	Common Name	Federal Status
Charadrius melanotos	Piping plover	Endangered
Cirsium pitcheri	Pitcher's thistle	Threatened
Iris lacustris	Dwarf lake iris	Threatened
Mimulus michiganensis	Michigan monkey flower	Endangered
Myotis septentrionalis	Northern long-eared bat	Threatened
Solidago houghtonii	Houghton's goldenrod	Threatened
Somatochlora hineana	Hine's emerald dragonfly	Endangered

Sources: U.S. Fish & Wildlife Service and Michigan Natural Features Inventory (MNFI), as cited in the *Charlevoix County Future Land Use Plan (2018)*

Note: MNFI provides County specific data as a reference; it is not a definitive list, and it is subject to change.

Park and recreation areas are abundant throughout the county (Table 4). One of the largest recreation areas in the county is Boyne Mountain in Boyne Valley Township. The four-season resort hosts many special events and provides recreation opportunities such as skiing, golf, fly fishing, sports fields, trails, a timber suspension bridge, an indoor waterpark, and a zip line.

Table 4. Parks and Recreation Acreage by Unit of Government

Unit of Government	Acreage
Chandler Township	16,810
Peaine Township (Beaver Island)	12,791
Melrose Township	8,678
Boyne Valley Township	4,947
Hudson Township	3,441
Norwood Township	2,282
Wilson Township	1,304
Bay Township	1,189
Evangeline Township	1,018
Hayes Township	907
South Arm Township	833
Charlevoix Township	660
City of Boyne City	649
County of Charlevoix	520
Marion Township	424
Eveline Township	401
City of Charlevoix	123
City of East Jordan	110
St. James Township (Beaver Island)	93
TOTAL	57,179

Source: Charlevoix County Parks and Recreation Plan, 2020-2024

The predominant land cover type in Charlevoix County is “Forested” (Deciduous, Mixed and Evergreen) at 129,924.09 acres, or 46.49% of the total land area (Table 5).

The second most prevalent land cover type is “Wetlands” (Emergent Herbaceous and Woody) at 53,593.49 acres or 19.18% (Table 5). Wetlands contribute significantly to water quality by acting as filters of storm water in addition to sustaining forest growth and providing habitat for wildlife. These areas generally are not suitable for development, but provide open space and recreational value as well as vital habitat for culturally significant animal and plant species.

“Cultivated Crops” and “Hay/Pasture” is the third most prevalent land cover type, at 36,043.43 acres or 12.9% (Table 5). According to the 2022 USDA Census of Agriculture, there are 23,947 acres of farmland (209 total farms) in Charlevoix County, with the average farm size being 115 acres. Compared to the 2017 Agricultural Census, this represents a 20% loss of farmland, a 23% loss in the number of farms, and a 4% increase in the average size of a farm in the County.

The total market value of agricultural products sold in 2022 was \$11,265,000. Crops (particularly fruits, tree nuts, berries, grains, oilseeds, dry beans, dry peas, other crops and hay) represented 65% of those sales, while livestock, poultry and products represented 35%. Charlevoix County ranks 64 out of 83 counties in the State of Michigan for the amount in sales of agricultural crops, and 60 out of 82 counties in the State for the amount in sales of livestock, poultry, and agricultural products sold. The top crops produced by acreage were:

- Forage (hay/haylage), all (5,488 acres)
- Corn for grain (2,095 acres)
- Cherries, tart (667 acres)
- Corn for silage or greenchop (403 acres)
- Soybeans for beans (Data withheld to avoid disclosing data for individual operations)

Developed land cover is found predominantly in and around the cities of Boyne City, Charlevoix and East Jordan; the Village of Boyne Falls; and major roads such as M-66, M-75, M-32, US-31 and US-131.

Table 5: Land Cover by Type, Charlevoix County

Classification	Acres	Percent
Forested (Deciduous)	117,818.25	42.16%
Forest (Mixed)	6,132.38	2.19%
Forest (Evergreen)	5,973.46	2.14%
Wetlands (Emergent Herbaceous and Woody)	53,593.49	19.18%
Cultivated Crops and Hay/Pasture	36,043.46	12.90%
Developed (High Intensity)	308.09	0.11%
Developed (Med. Intensity)	1,468.23	0.53%
Developed (Low Intensity)	6,531.68	2.34%
Developed (Open Space)	12,591.17	4.51%
Herbaceous	19,332.76	6.92%
Open Water	13,150.33	4.71%
Shrub/Scrub	3,487.21	1.25%
Barren Land	3,029.64	1.08%
TOTAL	279,460.15	100.00%

Source: Networks Northwest

The 2016 Charlevoix County Hazard Mitigation Plan indicated that 172,200 acres in the county were classified as forested lands, and 67,349 acres were classified as wetlands. When comparing this data to current data, forested areas have decreased by 42,276 acres and wetlands have decreased by 13,756 acres.

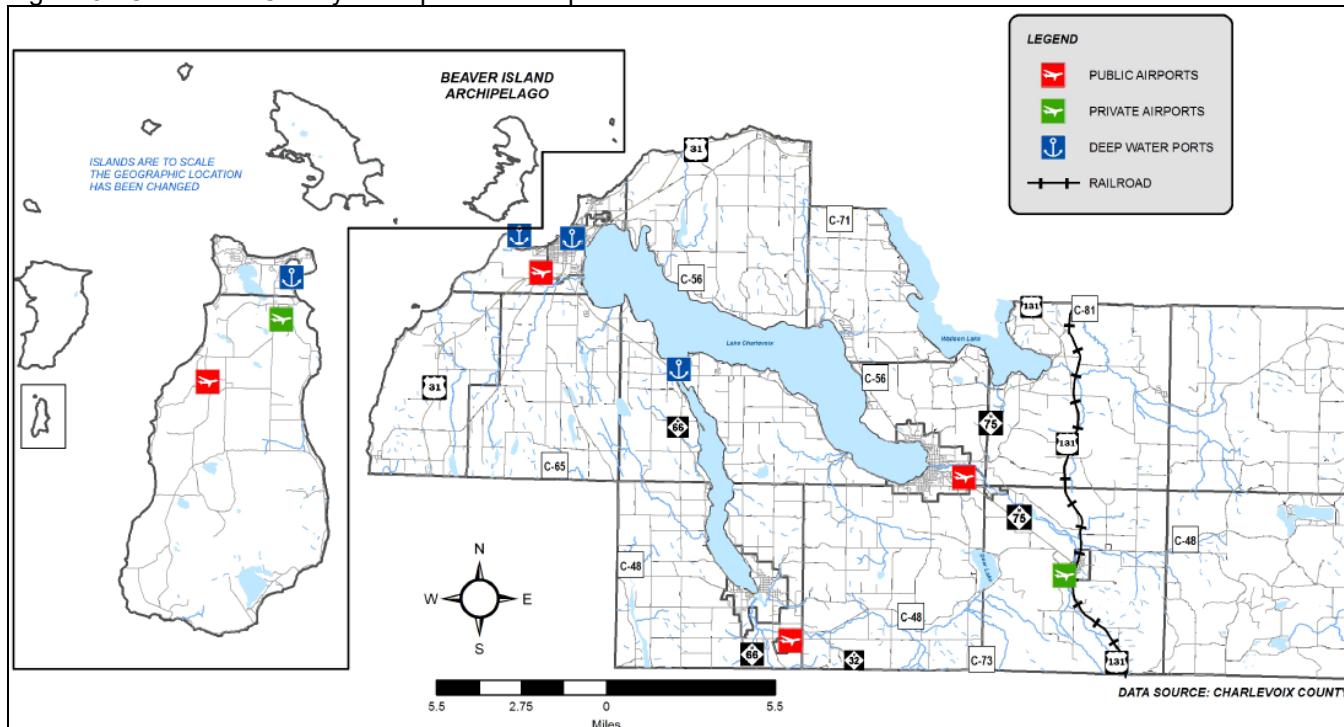
While development in the county has remained fairly steady in the past decade, it has been noted that the type of new development is changing. Office and industrial development has largely stopped, commercial development has slowed, but residential development is occurring as quickly as plans can be 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 population and local workforce, 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.

Transportation

The information in this section was primarily sourced from the Charlevoix County Future Land Use Plan (2018).

Charlevoix County's transportation network consists of approximately 968 miles of public roads, 4 public airports, 2 private airports, one rail line, 2 ferries and 4 deep water ports (Figure 5).

Figure 5. Charlevoix County Transportation Map



Source: Charlevoix County Future Land Use Plan (2018)

State highways include: M-75 connecting Boyne City, Walloon Lake and the Village of Boyne Falls; M-32 connecting East Jordan to the City of Gaylord (in Otsego County); and M-66 connecting East Jordan to Charlevoix. Federal highways include US-31 along the Lake Michigan coastal communities of Hayes, Charlevoix Township, City of Charlevoix and Norwood; and US-131 throughout Boyne Valley Township, the Village of Boyne Falls, and Melrose Township. The one rail line generally runs parallel to US-131 and experiences limited use, with typical freight traffic being one round trip per week from southern Michigan to Petoskey. Road names are indicated on the maps in Appendix A.

Two passenger ferries provide service in Charlevoix County. The Ironton Ferry, which is owned and overseen by the Charlevoix County Transportation Authority, transports passenger vehicles, as well as pedestrians and bicyclists, across the South Arm of Lake Charlevoix between the mainland and the peninsula in Eveline Township. It operates from mid-April through mid-November. The Beaver Island Transportation Authority of St. James Township is responsible for the operation of the ferry service between the City of Charlevoix and Beaver Island (St. James and Peaine Townships). The "Emerald Isle" ferry is owned by the State of Michigan and the Authority contracts with the Beaver Island Boat Company to operate the vessel. The "Beaver Islander" ferry is owned by the Beaver Island Boat Company and serves as a back-up to the Emerald Isle and for operation during the peak tourist season. Funding for half of the fuel for the Beaver Islander is provided by the Transportation Authority. The ferry service is available from mid-April through mid-December.

The publicly-owned Beaver Island Airport is overseen by the Beaver Island Airport Commission. In 2014, a new terminal building was constructed. Fresh Air Aviation, based in Charlevoix, is the main operator at the airport. Fresh Air Aviation provides year-round passenger flight service between Charlevoix and Beaver Island in addition to charter flights, lighthouse air tours, and shipping services.

The Beaver Island Airport runways are planned for reconstruction in the next few years, which will require the temporary closure of this airport and the temporary installation of an asphalt paving plant. Taking advantage of the asphalt plant's resources, both Townships are collaborating with the Charlevoix County Road Commission to prepare for needed road projects on the Island, including plans for St. James Township to initiate Phase II of the

Donegal Bay Bike Path, and Peaine Township has obtained a primary road status for East Side Drive, which will allow for future improvements to the road when the asphalt plant is in operation on Island.

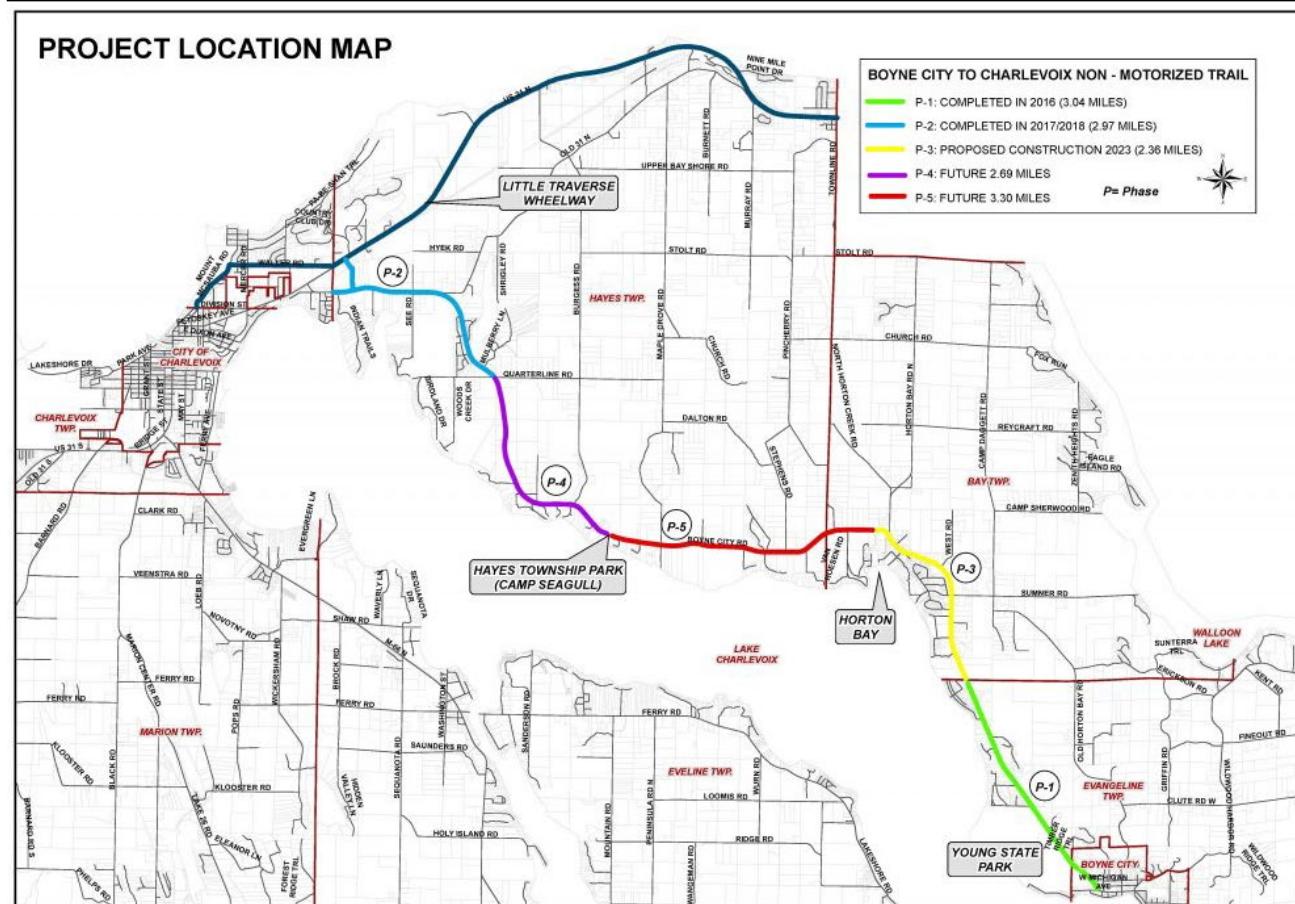
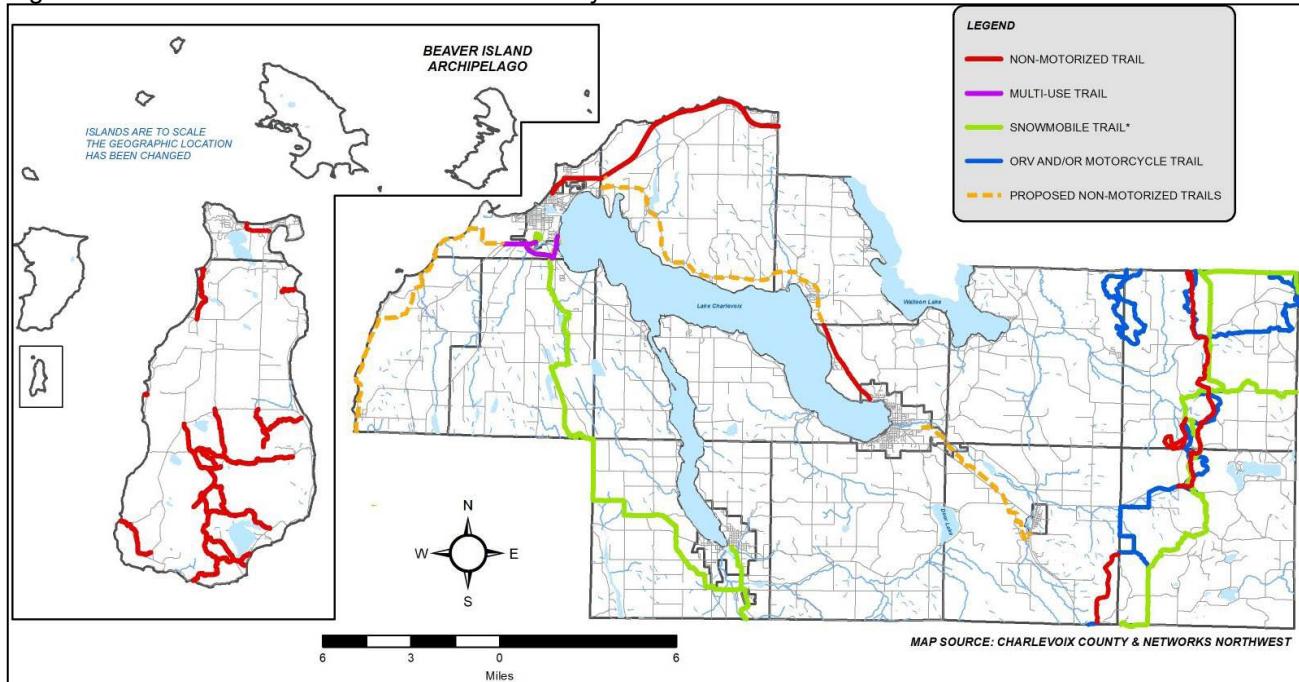
Welke Airport is the privately-owned airport on Beaver Island and is owned and operated by Island Airways. Island Airways provides passenger and freight service between Beaver Island and Charlevoix, in addition to perishables, U.S. Postal Service mail, and shipping services including prescription medication. Island Airways, the U.S. Coast Guard, Northflight and Guardian provide emergency flights at night from the Beaver Island Municipal Airport to the Charlevoix Airport.

The County's four deep water ports – Ironton (on the South Arm of Lake Charlevoix in Eveline Township), Round Lake (in the City of Charlevoix), St. Marys Cement Co. (on Lake Michigan in Charlevoix Township) and St. James Harbor (in St. James Township, Beaver Island) - serve as a means of transporting both goods and passengers to and from various locations around the Great Lakes as well as international destinations. While not highly developed for general shipping purposes, future improvements could accommodate appropriate shipping needs.

Charlevoix County's rural character and scattered development patterns leave most residents dependent on the use of private vehicles. Charlevoix County Transit provides safe, affordable and friendly public transportation service throughout all of Charlevoix County. Specializing in Demand Response (dial-a-ride), the county transit service also provides medical trips to local and out of county hospitals and care facilities. County veterans and residents over age 60 receive free rides to medical appointments as a benefit of a partnership between the Charlevoix County Commission on Aging and the Charlevoix County Department of Veteran Affairs. The transit service also offers delivery of online grocery orders.

There are also many miles of existing and proposed recreational trails for motorized and non-motorized use throughout the county (Figure 6). While these trails are an asset and draw outdoor recreation enthusiasts, some of these trails are located in remote areas and are located on public land and quasi-public land with limited cell phone reception. Also, some of the more remote trails may not be well maintained. Rescue/response efforts can be delayed or difficult for trail users who get lost or need medical assistance.

Figure 6. Recreational Trails in Charlevoix County



Sources: Charlevoix County Future Land Use Plan (2018); Top of Michigan Trails Council

Note: * Snowmobile routes are dependent on lease agreements with private land owners. Trail segments may be subject to closure.

Climate

Northwest Lower Michigan has a four season climate with mild summers and cold, snowy winters. The presence of Lake Michigan generally keeps coastal areas warmer in the winter and cooler in the summer, with less precipitation than at locations further inland. Table 6 provides historical climate data from the years 2000 to 2023.

Table 6. NOAA Online Weather Data for Charlevoix County, 2000-2023

NOAA Weather Station	Beaver Island	City of Charlevoix	Village of Boyne Falls	City of East Jordan	“East Jordan 2NW” (2 mi. N. of City of East Jordan in South Arm Twp.)
Greatest Monthly Mean Precip. (October)	4.44"	4.57"	4.71"	4.14"	5.64"
Mean Annual Precipitation	32.82"	34.32"	37.04"	31.73"	39.38"
Mean Annual Avg. Temp. (F.)	44.3	46	47.2	46.5	44.8
Warmest Month	July				
Coldest Month	February		January	February	
Maximum Record Temperature	92 degrees in July 2005	97 degrees in Aug 2006	102 degrees in June & July 2018	99 degrees in Aug 2006	95 degrees in July 2018
Minimum Record Temperature	-23 degrees in Feb. 2015	-18 degrees in Feb. 2015	-28 degrees in Feb. 2015	-30 degrees in Feb. 2015	-27 degrees in Feb. 2015
Mean Annual Avg. Snowfall	75.1"	88.6"	109.1"	124.2"	117.9"
Maximum Record Snowfall	137.9" in 2008-09	158.9" in 2008-09	172.5" in 2013-14	183.4" in 2008-09	161.3" in 2017-18
Minimum Record Snowfall	35.6" in 2009-2010	44.6" in 2020-21	60.0" in 2020-21	56.3" in 2020-21	74.2" in 2020-21

Source: National Weather Service's Climate Information, NOAA Online Weather (NOW) data <https://www.weather.gov/wrh/Climate?wfo=apx>
 Note: Some NOAA Weather Stations are missing monthly data records

On any given day, coastal areas of Charlevoix County are highly susceptible to quick, sudden changes in the weather. Depending on the time of the year, the Great Lakes have a significant impact on temperatures, precipitation, and the strength of storms. In the spring when the lake water is colder than the air over them, they extract heat from the atmosphere. During the fall, the Great Lakes give off heat and moisture. In both cases, storms arrive on land stronger and more persistent than they might otherwise be. Thunderstorms, extreme winter weather events, and excessive rainfall are common natural hazards with the potential to cause loss of life and significant property damage. This plan identifies potential hazards and mitigation strategies to reduce the impact of those hazard events.

Population

Charlevoix County is the 4th most populated county in the ten county region of Northwest Lower Michigan with a population of 26,054 persons (Table 7).

Table 7: Population by County, State, 2020

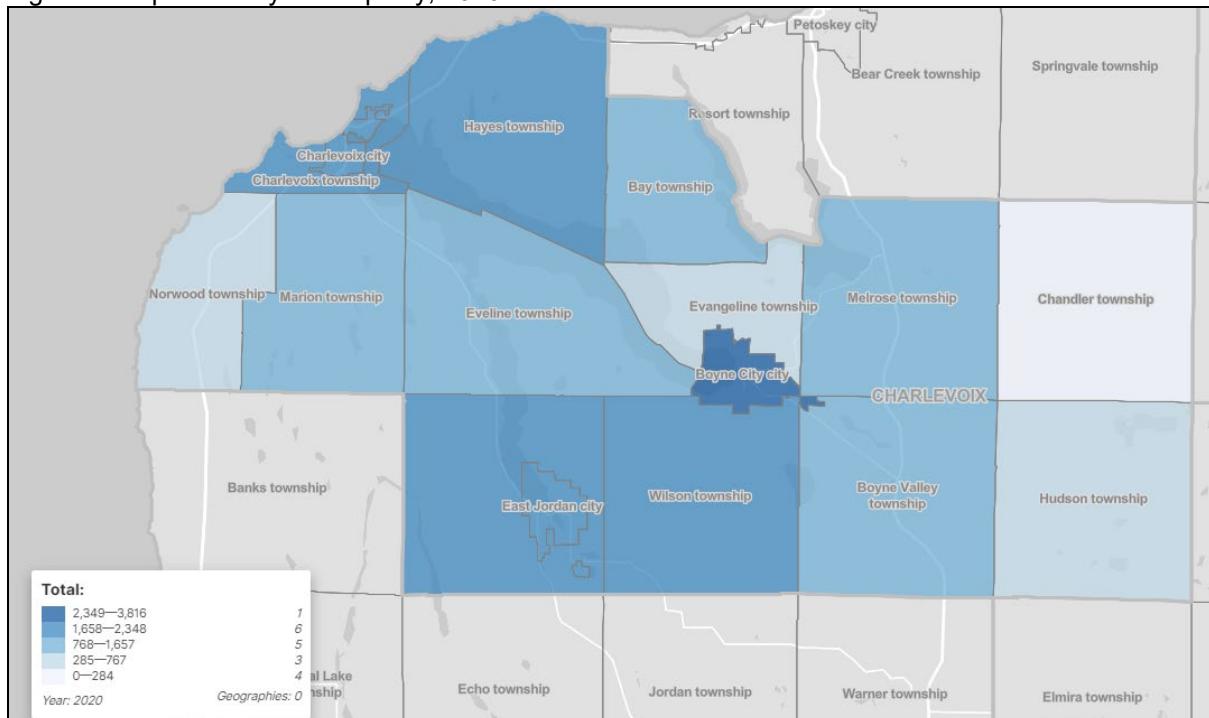
Jurisdiction	Population
Missaukee County	15,052
Kalkaska County	17,939
Benzie County	17,970
Leelanau County	22,301
Antrim County	23,431
Manistee County	25,032
Charlevoix County	26,054

Emmet County	33,673
Wexford County	34,112
Grand Traverse County	95,238
State of Michigan	10,077,331

Source: US Census Bureau, 2020 Decennial Census, File DP1

Charlevoix County contains 15 townships, 3 cities, and the Village of Boyne Falls. In addition, there are indigenous tribal lands within the county under the ownership of the Grand Traverse Band Tribe of Ottawa and Chippewa Indians (GTB) and the Little Traverse Bay Bands of Odawa Indians (LTBB). These include, but are not limited to, the LTBB Satellite Offices in Hayes Township and the GTB Tribal Satellite Office and housing units in Eveline Township.

Figure 7: Population by Municipality, 2020



Source: US Census Bureau, 2020 Decennial Census, 2020 DEC Redistricting Data (PL 94-171)



Source: US Census Bureau, 2020 Decennial Census, 2020 DEC Redistricting Data (PL 94-171)

III. Community Profile

A comparison of 2010 and 2020 decennial census data indicates there was slight increase in county population from between 2010 and 2020 of 105 persons (0.4%) (Table 8). The communities with the greatest number of new residents include Boyne Valley Township (230); Charlevoix Township (118); Hayes Township (81) and the City of Boyne City (81). The City of Charlevoix lost the most residents (165), followed by the City of East Jordan (112), Wilson Township (106) and St. James Township (on Beaver Island; 106), and Marion Township (57). Peaine Township, which adjoins St. James Township on Beaver Island, also lost 26 residents. St. James Township had the greatest percentage of population loss, while the Village of Boyne Falls had the greatest percentage of population gain.

Table 8: Population by Municipality and County, 2010 and 2020

Jurisdiction	2010 Total Population	2020 Total Population	Numeric Change	Percent Change
Charlevoix County	25,949	26,054	105	0.40%
City of Boyne City	3,735	3,816	81	2.17%
City of Charlevoix	2,513	2,348	-165	-6.57%
City of East Jordan	2,351	2,239	-112	-4.76%
Hayes Township	1,919	2,000	81	4.22%
South Arm Township	1,873	1,939	66	3.52%
Wilson Township	1,964	1,858	-106	-5.40%
Charlevoix Township	1,645	1,763	118	7.17%
Marion Township	1,714	1,657	-57	-3.33%
Eveline Township	1,484	1,515	31	2.09%
Boyne Valley Township	1,195	1,425	230	19.25%
Melrose Township	1,403	1,405	2	0.14%
Bay Township	1,122	1,142	20	1.78%
Evangeline Township	712	767	55	7.72%
Norwood Township	723	700	-23	-3.18%
Hudson Township	691	671	-20	-2.89%
Village of Boyne Falls*	294	358	64	21.77%
Chandler Township	248	284	36	14.52%
Peaine Township (Beaver Island)	292	266	-26	-8.90%
St. James Township (Beaver Island)	365	259	-106	-29.04%

Source: US Census Bureau, 2010 and 2020 Decennial Census, DEC Redistricting Data (PL- 94-171). Note: *The population counts for the Village of Boyne Falls are included in the population counts for Boyne Falls Township

Like many northwest Michigan communities, Charlevoix County experiences an influx of seasonal residents and tourists during the summer months. However, the decennial Census only consistently and comprehensively tracks the permanent population. The 2022 *Seasonal Population Study for Northwest Lower Michigan* analyzed the 2020 seasonal population for these ten counties: Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Kalkaska, Leelanau, Manistee, Missaukee, and Wexford. 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, a 118% increase.

Charlevoix County's combined population (full-time residents, part-time residents and overnight visitors) increases by as much as 72% (24,930 persons) from the minimum monthly population of 34,603 in April to the greatest monthly population of 59,533 in July. In July, the county experiences 33,479 part-time and overnight visitors - a 128% increase from the base population of 26,054. On average, the county's population grows by 61%, or 15,791 people, throughout the year (Table 9).

Table 9: Charlevoix County Seasonal Population by Month

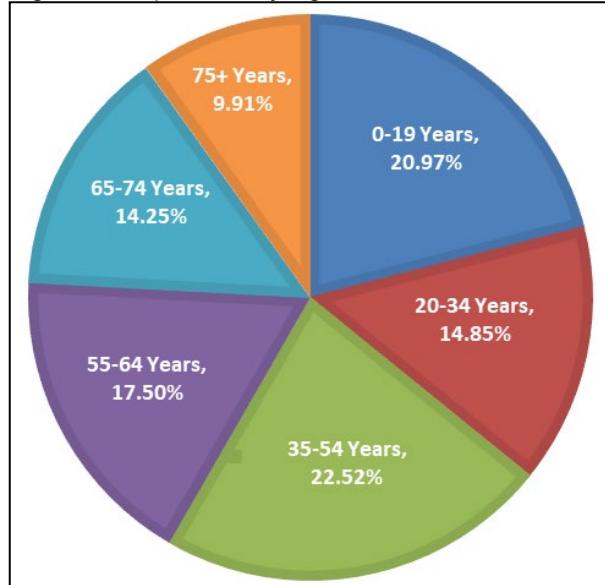
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
Permanent Population	26,054	26,054	26,054	26,054	26,054	26,054	26,054	26,054	26,054	26,054	26,054	26,054	26,054
Combined Population	34,781	34,949	34,780	34,603	40,504	53,131	59,533	55,564	42,809	40,635	34,694	36,153	41,845
Difference	8,727	8,895	8,726	8,549	14,450	27,077	33,479	29,510	16,755	14,581	8,640	10,099	15,791
% Change	33%	34%	33%	33%	55%	104%	128%	113%	64%	56%	33%	39%	61%

Source: 2022 Seasonal Population Study for Northwest Lower Michigan

Age, Race & Disability

Understanding the age distribution and median age of Charlevoix County can help identify social, economic, and public service needs in the community. The county's total estimated 2020 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 8 indicates the cohort group with the largest population is the 35 to 54 year old group, followed by those in 0 to 19 year old group. This indicates a fairly young population, and a population likely to grow in the future due to a large number of persons within the family-forming age group (mid-20s to mid-40s). As shown in Figure 9, in 2020 the median age (the midpoint where half the population is younger and half the population is older) of Charlevoix County is older (49.1 years) than the State (39.8 years). The county, like the State, is aging, but at a faster rate. The youngest community in the county is Chandler Township with a median age of 36.3 years; the oldest community in the county is Peaine Township (on Beaver Island) with a median age of 68.2 years, followed by St. James Township (also on Beaver Island) with a median age of 59.7 years (Figure 10).

Figure 8: Population by Age Cohort, Charlevoix County, 2020



Source: U.S. Census Bureau, 2020 ACS 5-Yr Estimates

Figure 9: Median Age Trends, 2000, 2010, and 2020

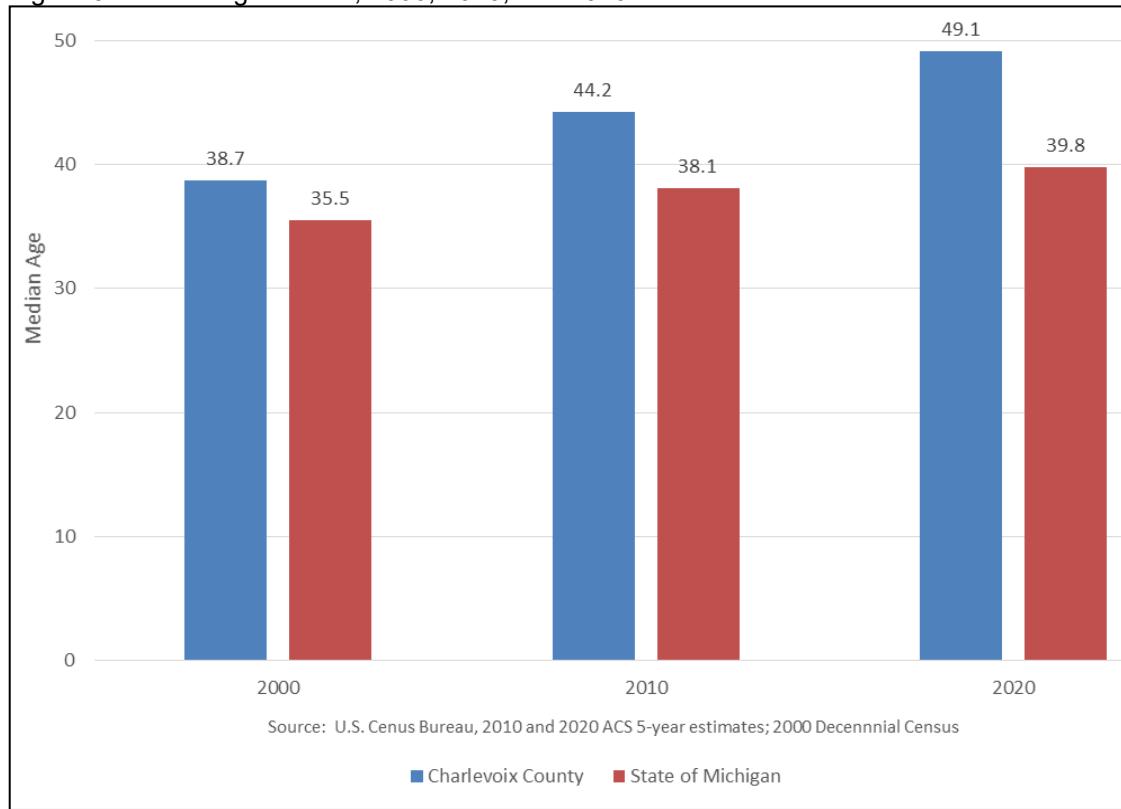
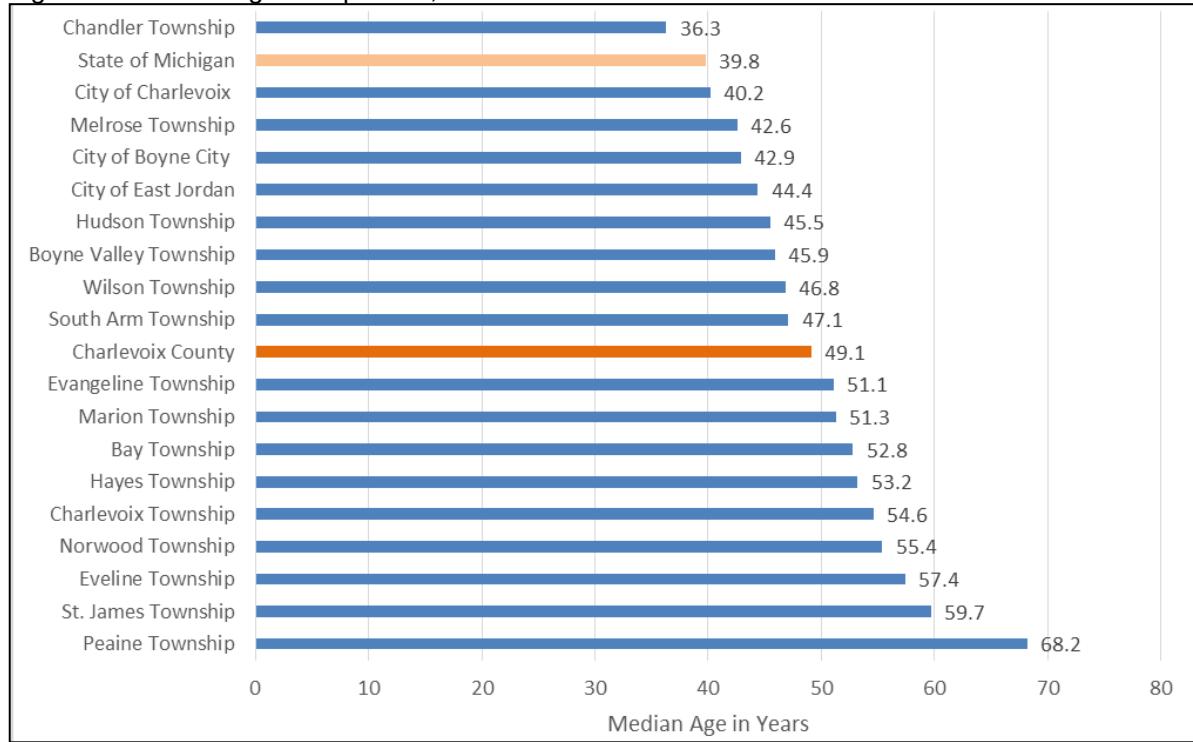


Figure 10: Median Age Comparison, 2020



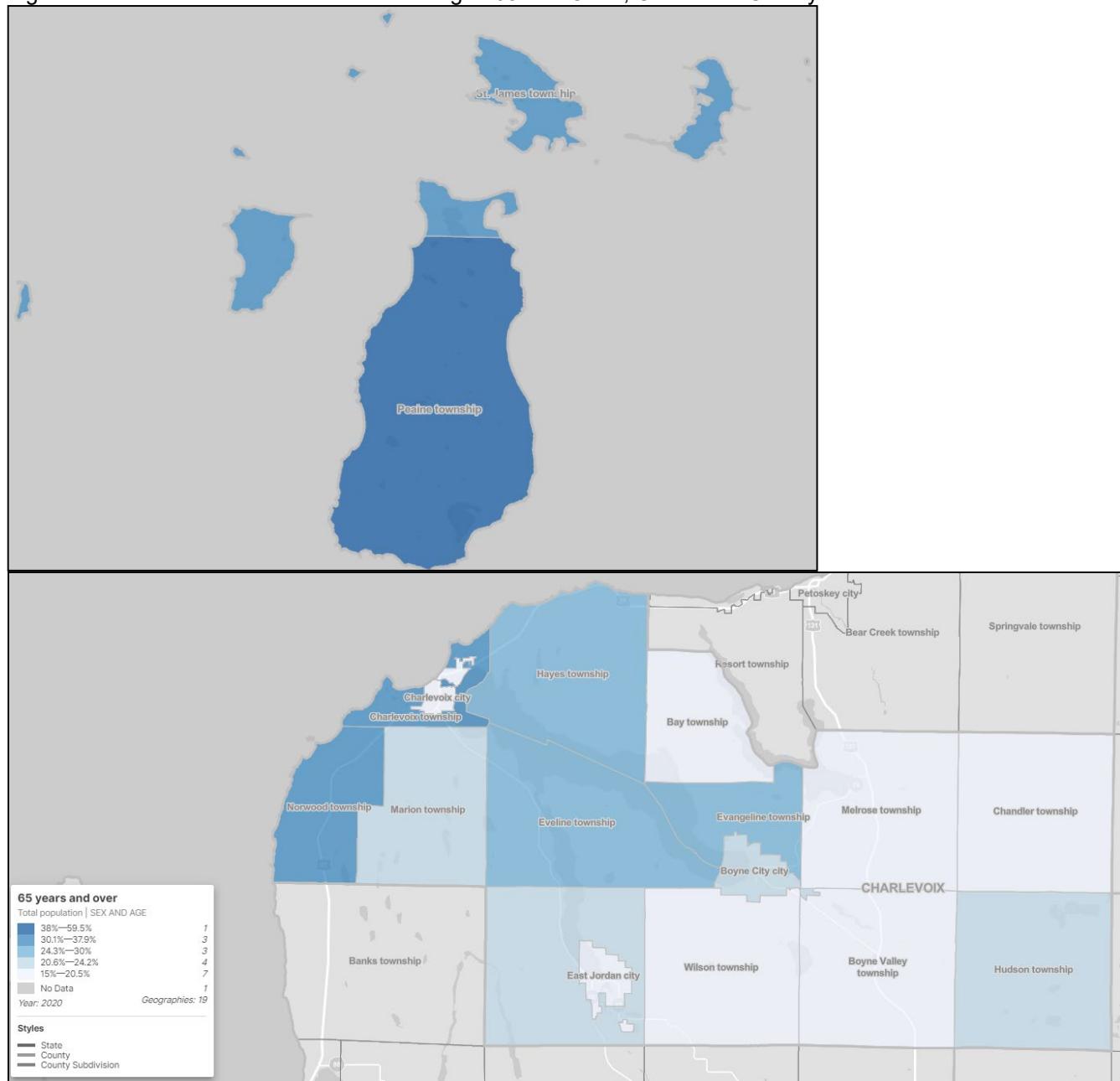
Persons over the age of 65 can be more vulnerable to the effects of natural hazard events, such as power outages, extreme temperatures, and illness outbreaks. An estimated 31% of county residents aged 65 years or older has one or more type of disability (Table 12). Figure 11 and Table 10 indicate that the greatest numbers of this cohort are located in the City of Boyne City, Charlevoix Township, the City of Charlevoix, and Hayes Township. Communities with the greatest percentage of their population who are aged 65 and older are St. James and Peaine Townships on Beaver Island.

Table 10. Estimated Population Over Age 65 by Jurisdiction

Jurisdiction	Est Age 65+	Total Pop Est	% Age 65+
Charlevoix County	6,328	26,197	24.16%
City of Boyne City	885	3,721	23.78%
Charlevoix Township	615	1,780	34.55%
City of Charlevoix	506	2,467	20.51%
Hayes Township	505	1,784	28.31%
South Arm Township	473	2,014	23.49%
Eveline Township	459	1,560	29.42%
Marion Township	429	1,774	24.18%
City of East Jordan	410	2,133	19.22%
Wilson Township	385	2,091	18.41%
Boyne Valley Township	268	1,356	19.76%
Norwood Township	246	737	33.38%
Evangeline Township	233	776	30.03%
Bay Township	212	1,036	20.46%
Melrose Township	211	1,405	15.02%
Hudson Township	166	730	22.74%
Peaine Township (Beaver Island)	154	259	59.46%
St. James Township (Beaver Island)	121	319	37.93%
Chandler Township	50	255	19.61%

Source: U.S. Census Bureau, 2020 ACS 5-Yr Estimates

Figure 11. Estimated Number of Residents Aged 65 and Older, Charlevoix County



Source: US Census, 2020-Year ACS Estimates

As indicated in Table 11, an estimated 15.3% of Charlevoix County residents have one or more type of disability, and an estimated 31% of persons with one or more type of disability are aged 65 years or older. The City of Boyne City has the highest estimated number of persons in their community with a disability (490 persons), followed by Charlevoix Township and the City of East Jordan (Table 12). Hudson Township has the highest estimated percentage of their community population with a disability (29.9%).

Table 11: Persons with a Disability in Charlevoix County, 2020 Estimates

Total Civilian Noninstitutionalized Population	Estimated Persons
With one or more disability	3,966 (15.3%)
Age 0-17 with a disability	272 (5.5% of that age group)
18 to 64 years with a disability	1,814 (12.2% of that age group)
65 years and over with a disability	1,880 (31% of that age group)

Source: US Census, 2020 ACS 5-yr Estimates

Table 12. Persons with a Disability in Charlevoix County Communities, 2020 Estimates

Community	Est. total civilian non-institutionalized population	Est. # with a disability	Est. % with a disability
City of Boyne City	3,721	490	13.20%
Charlevoix Township	2,395	434	18.10%
City of East Jordan	2,133	353	16.50%
Marion Township	1,774	295	16.60%
Hayes Township	1,784	268	15.00%
Wilson Township	2,091	268	12.80%
South Arm Township	1,903	262	13.80%
Boyne Valley Township	1,356	243	17.90%
City of Charlevoix	1,716	240	14.00%
Eveline Township	1,560	237	15.20%
Hudson Township	730	218	29.90%
Melrose Township	1,405	214	15.20%
Norwood Township	737	111	15.10%
Evangeline Township	776	98	12.60%
Bay Township	1,036	92	8.90%
Village of Boyne Falls	343	73	21.30%
St. James Township (Beaver Island)	319	67	21.00%
Peaine Township (Beaver Island)	259	41	15.80%
Chandler Township	255	35	13.70%

Source: US Census Bureau, 2020 ACS 5-Year Estimates; Table S1810

The racial makeup of Charlevoix County is predominantly white (92.3%). 1.6% of the population identifies as Hispanic or Latino (and can identify as any race or a combination of races). 4.8% of the population is of two or more races; 1.5% of the population is American Indian and Alaska Native; 0.6% is of some other race; 0.5% is Asian; 0.3% is Black or African American; and 0.0% is Native Hawaiian or Other Pacific Islander.

Persons of a minority race/ethnic origin are considered socially vulnerable populations in a hazard event scenario. Yellow highlighted entries in Table 13 indicate the largest estimates of persons of non-white race or those of Hispanic or Latino origin by geography. 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.

- Black or African American race alone: City of Charlevoix and Charlevoix Township (11 persons each); City of Boyne City (12 persons)
- American Indian/Alaskan Native alone: City of East Jordan (53 persons); Charlevoix Township (52 persons); Hayes Township (46 persons); Wilson Township (35 persons); South Arm and Eveline Township (31 persons each); City of Boyne City (28 persons); City of Charlevoix (20 persons)
- Asian alone: City of Boyne City (30 persons); Charlevoix Township (20 persons)
- Of two or more races: City of Boyne City (218 persons); City of East Jordan (141 persons); Hayes Township (110 persons); City of Charlevoix (104 persons); South Arm Township (95 persons); Charlevoix Township and Marion Township (71 persons each)
- Of Hispanic or Latino Origin (these survey respondents can identify as any type of race): City of Boyne City (68 persons); City of East Jordan (49 persons); Charlevoix Township (48 persons); South Arm Township (36 persons); Marion Township (35 persons); Eveline Township (31 persons)

Additionally, the 2020 ACS 5-Year Estimates Tables for Charlevoix County estimate that 0.2% of all households (26 households with a margin of error of + or - 19) are limited English-speaking households. This poses a possible communication challenge in providing these households with public notices/warnings prior to or during a hazard event, or during rescue and recovery efforts after a disaster.

Table 13: Race and Hispanic/Latino Origin Population Estimates, Charlevoix County Communities

	Total population	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian & Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino (of any race)
Charlevoix County	26,054	24,052	78	384	124	10	164	1,242	425
	100.00%	92.30%	0.30%	1.50%	0.50%	0.00%	0.60%	4.80%	1.60%
Bay Township	1,142	1,073	0	11	6	0	12	40	9
	100.00%	94.00%	0.00%	1.00%	0.50%	0.00%	1.10%	3.50%	0.80%
Boyne Valley Township	1,425	1,334	3	13	4	0	10	61	24
	100.00%	93.60%	0.20%	0.90%	0.30%	0.00%	0.70%	4.30%	1.70%
Chandler Township	284	270	2	3	2	0	1	6	5
	100.00%	95.10%	0.70%	1.10%	0.70%	0.00%	0.40%	2.10%	1.80%
Charlevoix Township	1,763	1,596	11	52	20	1	12	71	48
	100.00%	90.50%	0.60%	2.90%	1.10%	0.10%	0.70%	4.00%	2.70%
City of Boyne City	3,816	3,500	12	28	30	0	28	218	68
	100.00%	91.70%	0.30%	0.70%	0.80%	0.00%	0.70%	5.70%	1.80%
City of Charlevoix	2,348	2,187	11	20	11	1	14	104	26
	100.00%	93.10%	0.50%	0.90%	0.50%	0.00%	0.60%	4.40%	1.10%
City of East Jordan	2,239	2,024	7	53	0	2	12	141	49
	100.00%	90.40%	0.30%	2.40%	0.00%	0.10%	0.50%	6.30%	2.20%
Evangeline Township	767	699	3	2	5	2	12	44	14
	100.00%	91.10%	0.40%	0.30%	0.70%	0.30%	1.60%	5.70%	1.80%
Eveline Township	1,515	1,396	1	31	7	0	13	67	31
	100.00%	92.10%	0.10%	2.00%	0.50%	0.00%	0.90%	4.40%	2.00%
Hayes Township	2,000	1,815	6	46	9	0	14	110	18
	100.00%	90.80%	0.30%	2.30%	0.50%	0.00%	0.70%	5.50%	0.90%
Hudson Township	671	626	0	8	1	0	2	34	7
	100.00%	93.30%	0.00%	1.20%	0.10%	0.00%	0.30%	5.10%	1.00%
Marion Township	1,657	1,545	8	19	5	0	9	71	35
	100.00%	93.20%	0.50%	1.10%	0.30%	0.00%	0.50%	4.30%	2.10%
Melrose Township	1,405	1,313	0	16	8	1	9	58	15
	100.00%	93.50%	0.00%	1.10%	0.60%	0.10%	0.60%	4.10%	1.10%
Norwood Township	700	660	4	10	0	1	2	23	5
	100.00%	94.30%	0.60%	1.40%	0.00%	0.10%	0.30%	3.30%	0.70%
Peaine Township	266	251	0	1	1	0	0	13	5
	100.00%	94.40%	0.00%	0.40%	0.40%	0.00%	0.00%	4.90%	1.90%
St. James Township	259	238	0	5	0	0	3	13	2
	100.00%	91.90%	0.00%	1.90%	0.00%	0.00%	1.20%	5.00%	0.80%
South Arm Township	1,939	1,797	7	31	3	2	4	95	36
	100.00%	92.70%	0.40%	1.60%	0.20%	0.10%	0.20%	4.90%	1.90%
Village of Boyne Falls	358	330	1	0	0	0	0	27	11
	100.00%	92.20%	0.30%	0.00%	0.00%	0.00%	0.00%	7.50%	3.10%
Wilson Township	1,858	1,728	3	35	12	0	7	73	28
	100.00%	93.00%	0.20%	1.90%	0.60%	0.00%	0.40%	3.90%	1.50%

Source: US Census Bureau, 2020 Decennial Census, DEC Demographic Profile, Table DP1

Housing

The average household size for Charlevoix County residents is 2.21 persons, which is slightly lower than the State's average of 2.45 persons. Locally and at a state-wide level, the average household size has continued to get smaller over the decades of census reporting.

The county had 17,451 housing units in 2020 (Table 14). Of those, there are an estimated 11,765 households, or "occupied housing units". The Census defines a household as all the people who occupy a single housing unit, regardless of their relationship to one another.

Between 2010 and 2020, the county experienced a slight increase in the number of housing units (1.17%, or 202 units). The City of Boyne City has the largest percentage of housing units of all municipalities in the county (13.17%), followed by the City of Charlevoix, Eveline Township and Boyne Valley Township. The community that experienced the greatest growth in housing units between 2010 and 2020 was Boyne Valley Township, gaining 345 housing units. Some communities that experienced a loss in housing units also experienced population loss between 2010 and 2020, as previously presented; those that experienced a population increase, but a decrease in housing units include Marion, Chandler, South Arm and Melrose Townships.

Much of the County's housing stock is over 40 years old, with an estimated 55.6% of the county's residential units built before 1980 (Table 15). An estimated 80.6% of the county's household units are 1-unit, detached structures, which are commonly referred to as single-family homes, and 7% are mobile homes. Table 16 indicates the estimated number of mobile home units by community. The City of Boyne City has the most units (222), followed by Charlevoix Township (207), Hayes Township (175), and Wilson Township (105). The locations of concentrated mobile/manufactured homes in the county are indicated on the Hazard Area Maps in Appendix A.

Table 14. Housing Units by Municipality

Community	2010 Housing Units	2020 Housing Units	% Change	% of 2020 Total Housing Units
Charlevoix County	17,249	17,451	1.17%	
City of Boyne City	2,292	2,298	0.26%	13.17%
City of Charlevoix	2,201	2,148	-2.41%	12.31%
Eveline Township	1,381	1,388	0.51%	7.95%
Boyne Valley Township	833	1,178	41.42%	6.75%
Hayes Township	1,134	1,162	2.47%	6.66%
City of East Jordan	1,189	1,138	-4.29%	6.52%
Charlevoix Township	1,067	1,137	6.56%	6.52%
South Arm Township	1,078	1,046	-2.97%	5.99%
Melrose Township	935	906	-3.10%	5.19%
Wilson Township	876	867	-1.03%	4.97%
Bay Township	847	859	1.42%	4.92%
Marion Township	777	784	0.90%	4.49%
Peaine Township (Beaver Island)	564	529	-6.21%	3.03%
Evangeline Township	504	524	3.97%	3.00%
Hudson Township	549	516	-6.01%	2.96%
St. James Township (Beaver Island)	452	415	-8.19%	2.38%
Norwood Township	412	408	-0.97%	2.34%
Village of Boyne Falls*	178	196	10.11%	1.12%
Chandler Township	158	148	-6.33%	0.85%

Source: US Census Bureau, Decennial Census - 2010 and 2020 DEC Redistricting Data (PL 94-171)

Note: *Village of Boyne Falls' housing unit data is incorporated in the housing unit counts for Boyne Valley Township.

Table 15. Year Built, Charlevoix County Housing Units

Year Structure Built	Estimated Units	% of Total
Built 2014 or later	302	1.70%
Built 2010 to 2013	241	1.36%
Built 2000 to 2009	1,951	10.99%
Built 1990 to 1999	2,764	15.57%
Built 1980 to 1989	2,620	14.76%
Built 1970 to 1979	2,973	16.75%
Built 1960 to 1969	2,095	11.80%
Built 1950 to 1959	1,311	7.38%
Built 1940 to 1949	1,383	7.79%
Built 1939 or earlier	2,113	11.90%
Total	17,753	

Source: US Census, 2020 ACS 5-yr Estimates, DP04 Selected Housing Characteristics

Table 16. Estimated Mobile Home Units, Charlevoix County

Community	Mobile homes	% of Housing Units
Charlevoix County	1,247	7.00%
City of Boyne City	222	9.70%
Charlevoix Township	207	17.90%
Hayes Township	175	15.20%
Wilson Township	105	10.00%
Hudson Township	83	13.70%
City of East Jordan	76	6.40%
Boyne Valley Township	72	8.20%
South Arm Township	59	5.50%
Melrose Township	58	6.40%
Marion Township	38	4.20%
Evangeline Township	35	7.40%
City of Charlevoix	34	1.60%
Peaine Township (Beaver Island)	22	4.00%
Village of Boyne Falls	21	9.70%
Bay Township	17	1.90%
Eveline Township	17	1.20%
Norwood Township	14	2.90%
Chandler Township	10	6.00%
St. James Township (Beaver Island)	3	0.60%

Source: US Census, 2020 ACS 5-yr Estimates, DP04 Selected Housing Characteristics

Housing Tenure, Table 17, summarizes the status of housing units, whether occupied or vacant, as well as the median housing value of owner-occupied units (\$171,000) and the median gross rent (\$782). Of the 17,753 total estimated housing units, (66%) are occupied (indicating physically occupied, principal residence housing units), and 34% are categorized as vacant (this includes seasonally-occupied homes). As described previously, Charlevoix County's combined population (full-time residents, part-time residents and overnight visitors) increases by as much as 72% from the minimum monthly population of in April to the greatest monthly population in July.

Table 17: Housing Tenure Estimates, 2020

Charlevoix County Housing Units	17,753	%
Occupied housing units	11,725	66%
Owner-occupied	9,579	82%
Median Housing Value	\$171,000	
Renter-occupied	2,146	18%
Median Gross Monthly Rent	\$782	
Vacant* housing units	6,028	34%

Source: US Census, 2020 ACS 5-year Estimates, Table DP04 Selected Housing Characteristics

Note: * "Vacant" indicates a non-occupied residence at the time of the survey

Areas of New Development in Charlevoix County

Since the completion of the 2016 Charlevoix County Hazard Mitigation Plan, there have been some areas in the county that have experienced new development or have plans for future new development:

City of East Jordan – sites for redevelopment, per the city's 2020 Master Plan

- The 64.4 acres of land where the East Jordan Ironworks foundry was located is planned for a multi-use development that would include small, medium and large lot residential development, including workforce housing
- The 1.27 acre former public boat launch site – desired future mixed use development with residential units

City of Boyne City

- Fox Run Manufactured Home Community (49 homes completed; planned for up to 140 home sites); construction began in 2021 and is ongoing.

City of Charlevoix – per the city's 2022 Master Plan:

- Promote infill development to "provide a variety of housing options for a range of incomes, ages, family sizes, and needs" (p. 119)

Boyne Valley Township

- As discussed previously in this plan, between 2010 and 2020 the township grew by 230 persons (a 19.25% increase), which is the most of any jurisdiction in Charlevoix County. Note that this number includes an increase of 64 persons within the Village of Boyne Falls. The number of housing units in the Township also increased between 2010 and 2020, with an addition of 345 housing units (a 41.42% increase). Future housing development is expected within Boyne Mountain Resort property.

Lake Michigan and Inland Lakefront Properties

- In general, infill development of vacant lots or replacement of older houses with larger, new houses has occurred near FEMA-designated flood zones along Lake Michigan, Lake Charlevoix or Walloon Lake.

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 18 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 at \$50,971, followed by Grand Traverse County at \$44,562. Charlevoix County has the third highest average annual wage at \$44,558.

Table 18: 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 Charlevoix County is further described in Table 19. The county's industry makeup is divided into 20 different North American Industry Classification Sectors (NAICS) with associated industry job numbers and annual average wages. The average annual wage in 2018 was \$44,558. The industry with the largest number of jobs in 2018 was "manufacturing" with 23.3% of jobs, followed by "accommodation and food services" with 17.3% of jobs, and "health care and social assistance" with 16% of jobs. The industry with the highest annual average wage was "utilities" at \$107,000, followed by "manufacturing" at \$60,866 and "wholesale trade" at \$53,155.

Table 19: Charlevoix County Economic Distribution by Industry, 2018

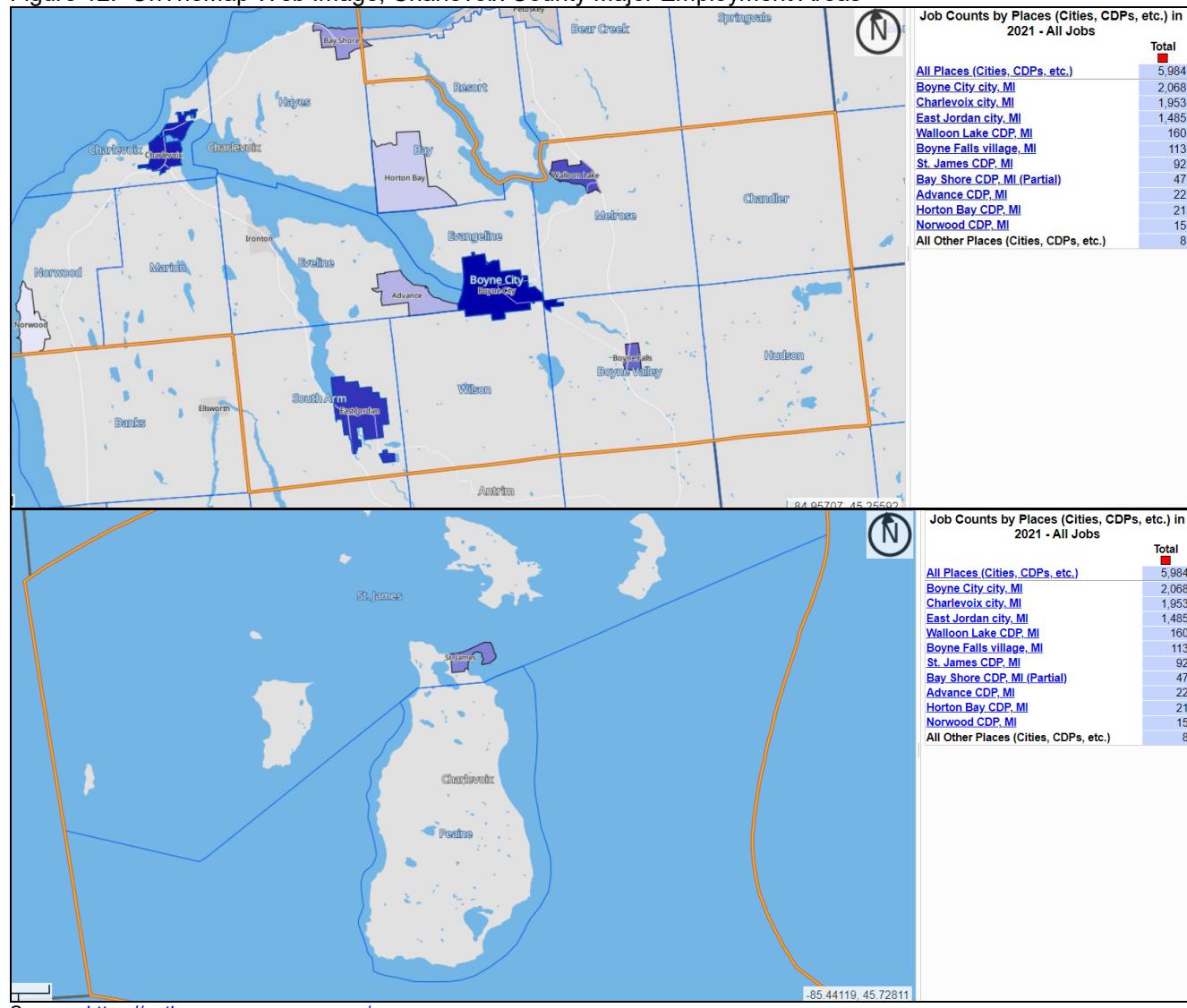
Industry (NAICS)	Establishments	Jobs	% Distribution of Jobs	Annual Average Wage
Total Covered Employment	782	10,527	100.00%	\$44,558
Agri., forestry, hunting	5	D	D	D
Mining	1	D	D	D
Construction	120	646	6.10%	\$43,806
Manufacturing	45	2,451	23.30%	\$60,866
Wholesale trade	16	53	0.50%	\$53,155
Retail trade	114	876	8.30%	\$29,009
Transportation, warehousing	17	129	1.20%	\$42,443
Utilities	4	147	1.40%	\$107,000
Information	13	72	0.70%	\$27,706
Finance and Insurance	29	160	1.50%	\$47,784
Real Estate, rental, leasing	29	184	1.70%	\$27,435
Professional, technical services	44	D	D	D
Administrative, waste services	53	253	2.40%	\$33,625
Educational services	11	648	6.20%	\$51,753
Health care, social assistance	59	1,687	16.00%	\$46,962
Arts, entertainment, recreation	37	266	2.50%	\$31,888
Accommodation and food services	79	1,826	17.30%	\$27,051
Other services, exc. public admin.	76	305	2.90%	\$44,314
Public administration	22	618	5.90%	\$41,886
Other (includes private, management of business, and unallocated)	8	206	2.10%	N/A

Source: 2021 Comprehensive Economic Development Strategy, Networks Northwest

*D means limited industries of a sector that would disclose confidential information

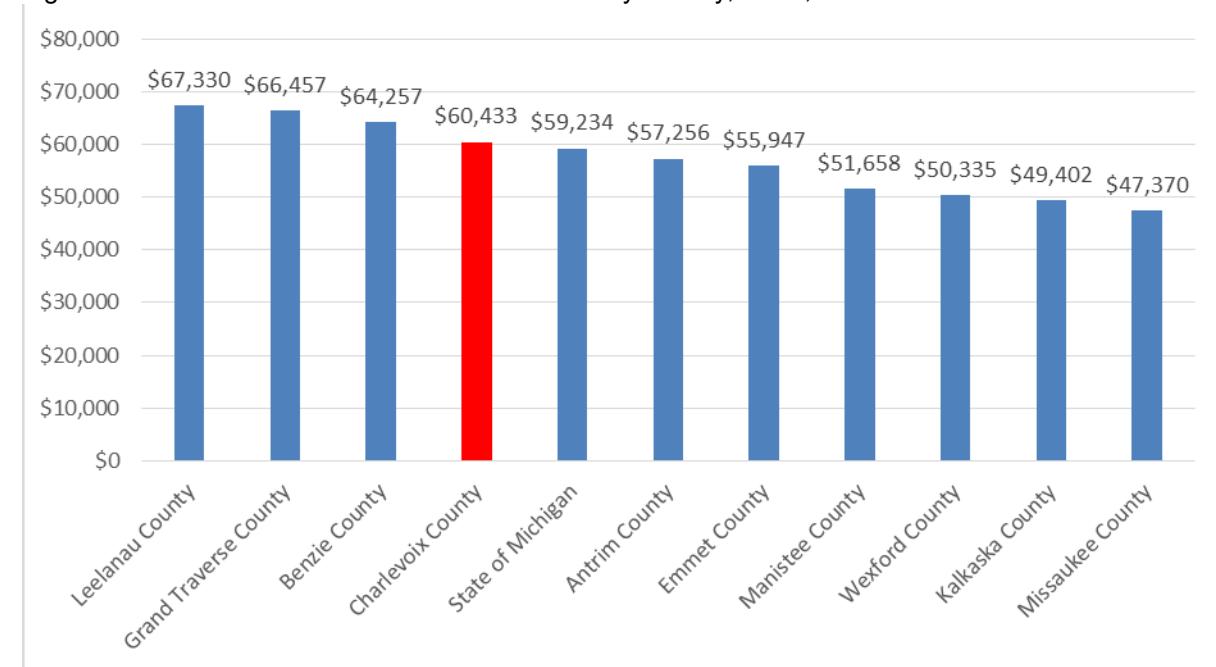
Additionally, OnTheMap, an online interactive tool available from the US Census Bureau, allows for viewing the estimated job density within the county. This website may be useful for emergency preparedness planning as related to response and potential impact to local economic activity areas. It appears the greatest density of jobs are located in the City of Boyne City, City of Charlevoix, City of East Jordan, and the Walloon Lake census-designated place (CDP). The figures below screenshots of the interactive map when completing an area profile analysis for all workers in all jobs in the county in 2021.

Figure 12. OnTheMap Web Image, Charlevoix County Major Employment Areas



Figures 13 and Table 20 present a comparison of the median household income (MHI) across the ten county region, the State of Michigan, and local jurisdictions. Charlevoix County has a median household income of \$60,433, ranking the fourth highest in the region. Leelanau County has the highest median household income at \$67,330. Within Charlevoix County, Eveline Township has the highest MHI at \$76,513, and the City of Charlevoix has the lowest MHI at \$36,341.

Figure 13. Estimated Median Household Income by County, State, 2020



Source: US Census, 2020 ACS 5-yr Estimates, Table S1901

Table 20. Median Household Income (MHI), Charlevoix County, 2020

Jurisdiction	Median Household Income
City of Charlevoix	\$36,341
City of East Jordan	\$46,458
Peaine Township (Beaver Island)	\$52,813
Boyne Valley Township	\$53,438
City of Boyne City	\$55,357
Hudson Township	\$56,250
Chandler Township	\$58,750
CHARLEVOIX COUNTY	\$60,433
Charlevoix Township	\$62,500
Norwood Township	\$63,906
Melrose Township	\$64,643
Evangeline Township	\$68,500
St. James Township (Beaver Island)	\$68,500
Marion Township	\$68,854
South Arm Township	\$68,919
Hayes Township	\$72,250
Bay Township	\$73,869
Wilson Township	\$76,000
Eveline Township	\$76,513

Source: US Census, 2020 ACS 5-year estimates, Table S2503

The following tables describe the population with the lowest incomes. It is estimated that in 2020, 9.7% of people in the county lived at or below the poverty level (Table 21). The City of Charlevoix had the highest estimated number of persons living below the poverty level in the county at 607 persons, followed by the City of East Jordan, South Arm Township, and the City of Boyne City (Table 22). The highest estimated percentage of a community's population estimated to be living in poverty occurs in the City of Charlevoix at 25.4%, followed by the City of East Jordan and the Village of Boyne Falls. 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 23.

Table 21. Poverty Estimates, Charlevoix County and State of Michigan, 2020

Poverty	Charlevoix County	State of Michigan
Families living below the poverty level	491 (6.4%)	232,432 (9.2%)
Families with related children under age 18, in poverty	343 (12.9%)	172,916 (15.6%)
Persons living below the poverty level	2,493 (9.7%)	1,337,256 (13.7%)

Source: US Census, 2020 ACS 5-yr Estimates, Tables S1701 and S1702

Table 22. Poverty Estimates, Charlevoix County Communities, 2020

Community	Est. Total Population for whom poverty status is determined	Est. # below poverty level	Est. % below poverty level
City of Charlevoix	2,389	607	25.40%
City of East Jordan	2,127	445	20.90%
South Arm Township	1,901	202	10.60%
City of Boyne City	3,686	201	5.50%
Marion Township	1,754	158	9.00%
Eveline Township	1,560	122	7.80%
Melrose Township	1,392	115	8.30%
Hudson Township	730	112	15.30%
Charlevoix Township	1,713	107	6.20%
Boyne Valley Township	1,345	101	7.50%
Hayes Township	1,773	88	5.00%
Bay Township	1,027	63	6.10%
Village of Boyne Falls	335	55	16.40%
Evangeline Township	776	55	7.10%
Chandler Township	255	32	12.50%
Wilson Township	2,089	32	1.50%
Peaine Township (Beaver Island)	259	29	11.20%
St. James Township (Beaver Island)	319	13	4.10%
Norwood Township	733	11	1.50%

Source: US Census, 2020 ACS 5-yr Estimates, Table S1701

Table 23. US Census Poverty Thresholds for 2020

Size of family unit	Weighted average thresholds	Related children under 18 years								
		None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person (unrelated individual):	13,171									
Under 65 years.....	13,465	13,465								
65 years and over.....	12,413	12,413								
Two people:	16,733									
Householder under 65 years.....	17,413	17,331	17,839							
Householder 65 years and over.....	15,659	15,644	17,771							
Three people.....	20,591	20,244	20,832	20,852						
Four people.....	26,496	26,695	27,131	26,246	26,338					
Five people.....	31,417	32,193	32,661	31,661	30,887	30,414				
Six people.....	35,499	37,027	37,174	36,408	35,674	34,582	33,935			
Seven people.....	40,406	42,605	42,871	41,954	41,314	40,124	38,734	37,210		
Eight people.....	44,755	47,650	48,071	47,205	46,447	45,371	44,006	42,585	42,224	
Nine people or more.....	53,905	57,319	57,597	56,831	56,188	55,132	53,679	52,366	52,040	50,035

Source: U.S. Census Bureau, 2021. Note: The source of the weighted average thresholds is the 2021 Current Population Survey Annual Social and Economic Supplement (CPS ASEC).

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, 2021). An estimated 27% of all households in the County are considered ALICE, and 9% of households are estimated to live below the poverty level (Table 24). These households likely would not have reserve savings to cover an emergency, such as impacts to their personal property from a hazard event.

Table 24. ALICE and Poverty Households in Charlevoix County

Location	Total Households	Households Below ALICE Threshold	Households in Poverty
St. James Township (Beaver Island)	148	40 (27%)	Census data not available for households
Peaine Township (Beaver Island)	153	61 (40%)	
Evangeline Township	294	94 (32%)	
Norwood Township	365	99 (27%)	
Bay Township	479	115 (24%)	
Hudson Township	293	117 (40%)	
Eveline Township	682	184 (27%)	
South Arm Township	773	209 (27%)	
Melrose Township	656	210 (32%)	
Wilson Township	840	227 (27%)	
Boyne Valley Township	591	230 (39%)	
Hayes Township	752	233 (31%)	
Charlevoix Township	797	239 (30%)	
Marion Township	749	255 (34%)	
City of East Jordan	997	479 (48%)	
City of Boyne City	1,827	713 (39%)	
City of Charlevoix	1,277	753 (59%)	
CHARLEVOIX COUNTY	11,769	27% (state average 26%)	9% (state average 13%)

Data Sources: <https://www.unitedforalice.org/county-reports/michigan>; US Census Bureau 2021 ACS 5-Year Estimates, Table S1701

Note: There is no ALICE data available for Chandler Township

The county's 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. According to the 2023 Housing Needs Assessment (produced by Housing North), the greatest rental housing gaps in the county are for the two lowest housing affordability segments (rents below \$1,669 that are affordable to households earning up to 80% of AMHI). The study also found that the greatest for-sale housing gap in the county is for product priced between \$222,401 and \$333,600, which is affordable to households earning between \$66,721 and \$100,080. Additionally, many renter households are already cost burdened – paying more than 30% of their income toward housing costs (Table 25).

Table 25. Cost Burdened Households in Charlevoix County

Cost Burdened Households – Paying more than 30% of income toward housing costs		Severe Cost Burdened Households – Paying more than 50% of income toward housing costs	
Renter	Owner	Renter	Owner
43.5%	18.6%	17.3%	5.8%

Source: Housing North 2023 Housing Needs Assessment: Charlevoix County Data Summary

IV. Hazard Identification and Assessments

Hazard Analysis Overview

Charlevoix County is vulnerable to a wide range of natural hazards. Hazard events have the potential to impact community residents and visitors, economic drivers in the community, critical infrastructure, the built environment, and the natural environment. Charlevoix County Emergency Management is challenged with managing these threats to protect life and property.

Natural hazard impacts 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 persons of racial/ethnic minority groups, the economically disadvantaged, elderly (particularly those living alone), homeless, and persons with a disability. Those that live unsheltered or in homeless encampments, assisted living facilities, mobile homes, or isolated residences are more susceptible to impacts from hazardous events. Campgrounds are also areas where persons in RVs or tents are more vulnerable to the effects of thunderstorms, high winds, lightning, hail, tornadoes, wildfire and extreme heat.

Locations of mobile/manufactured 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.) The State Equalized Value (SEV) of the approximate area of these properties, based on the US Census Bureau's 2020 ACS 5-year estimates and Charlevoix County Equalization data, is as follows:

- Campgrounds: \$1,639,608.43
- Mobile/Manufactured Homes: \$5,529,641.34

The natural environment is the primary influencing factor for residents choosing to live and vacation in northwest Michigan. Charlevoix County is home to abundant forest lands, inland lakes and streams, unique sand dune areas, Lake Michigan shoreline and all of the wildlife within that are integral to the identity of the community. While natural resources are abundant, they are vulnerable to all types of hazards. Northwest Lower Michigan is also home to many sensitive wildlife populations that require specific climates and habitats to survive. Damaged, destroyed, or changing natural environments may decrease the chances for certain species' survival.

As stated previously, Northwest Michigan receives an influx of seasonal residents in the summer months. According to the 2022 report by Networks Northwest, *Seasonal Population Study for Northwest Lower Michigan*, Charlevoix County's combined population (full-time residents, part-time residents and overnight visitors) increases by as much as 72% (an addition of 24,930 persons) from the minimum monthly population of 34,603 in April to the greatest monthly population of 59,533 in July. In July, the county experiences 33,479 part-time and overnight visitors - a 128% increase from the base population of 26,054. On average, the county's population grows by 61%, or 15,791 people, throughout the year. While the seasonal population changes are integral to the local tourism-based economy, they also create an increased demand for limited public services and can put pressure on existing infrastructure capabilities.

Broadband, or high-speed internet service, has been limited in rural parts of the county, particularly on Beaver Island. In 2023, Peninsula Fiber Network, a telecommunications carrier, was awarded a \$61 million grant to support their "Critical Crossings Project". The plan includes three internet connectivity projects, one of which will be an underwater fiber optic connection between Charlevoix and Beaver Island and into the Upper Peninsula. There are also overland fiber routes to connect Charlevoix to Bellaire and Mancelona (in adjoining Antrim County), Gaylord (in adjoining Otsego County), and continue across the state. The project is expected to be completed before 2028. Currently the only internet connection linking the upper and lower peninsulas of Michigan is located on the Mackinac Bridge, so this new connection will improve local resiliency to ensure reliable communications capabilities.

Infrastructure points (stream crossings, bridge conditions, and dams) and their available condition ratings are shown on the Infrastructure Map in Appendix A. Additionally, locations of critical infrastructure facilities (Table 26) are represented on the Critical Infrastructure Map in Appendix A.

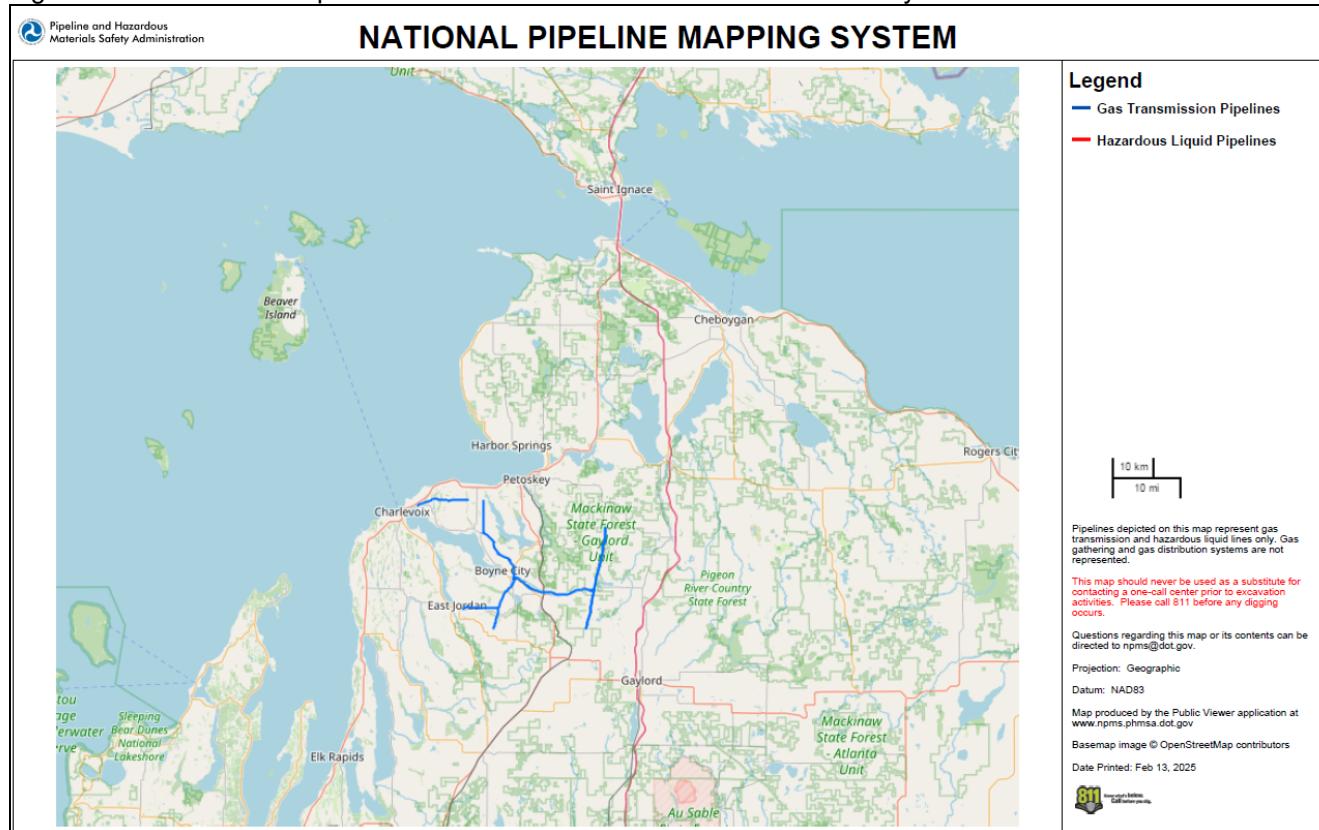
Table 26. Charlevoix County Critical Infrastructure Sites

# of Facilities	FACILITY TYPE
14	Agricultural (farms; food processing, packaging, and production facilities)
23	Communications (towers and related structures)
14	Dams
30	Emergency Services (County Sheriff, County Road Commission, Police, EMS, Fire, Public Works, USCG Station in Charlevoix)
34	Energy (Primarily electric and natural gas utility infrastructure*)
29	Government Facilities (Local Government halls; DPW buildings; County Commission on Aging Service Buildings in East Jordan, Boyne City, Charlevoix Twp. and Beaver I.)
20	Healthcare (Medical care service centers and assisted living facilities)
21	Industry
30	Transportation <ul style="list-style-type: none"> • 6 Airports <ul style="list-style-type: none"> ○ Beaver Island Airport (scheduled to be rehabilitated in spring of 2026; provides nighttime emergency air transport) ○ Welke Airport (Beaver Island) ○ City of Charlevoix Municipal Airport ○ City of Boyne City Municipal Airport ○ Boyne Mountain Airport ○ East Jordan Municipal Airport • 13 Marinas <ul style="list-style-type: none"> ○ Beaver Island Municipal Marina North (St. James Township) ○ Beaver Island Municipal Marina South (St. James Township) ○ City of Charlevoix Marina ○ Northwest Marine Yacht Club (City of Charlevoix) ○ Charlevoix Yacht Club (City of Charlevoix) ○ Harborage Marina (Boyne City) ○ F. Grant Moore Municipal Marina (Boyne City) ○ Somerset Pointe Yacht Club & Marina (Eveline Township) ○ Tommy's (formerly Bay) Marina (Eveline Township) ○ Ironton Cove & Marina (Eveline Township) ○ Bear Cove Marina (Bay Township) ○ City of East Jordan Municipal Marina ○ S. Arm Marina and Gas Docks (South Arm Township) • US-31 bascule bridge in the City of Charlevoix; Three Road Commission buildings (Eveline Twp.; Boyne City; and St. James Twp.); Beaver Island Boat Co. ferry service docks; Charlevoix pier lighthouse; Ironton Ferry and stone dock; County Transit service and Indian Trails bus service.
45	Water and Sewer Infrastructure (municipal water wells, lift stations, water treatment plants, and wastewater treatment plants)

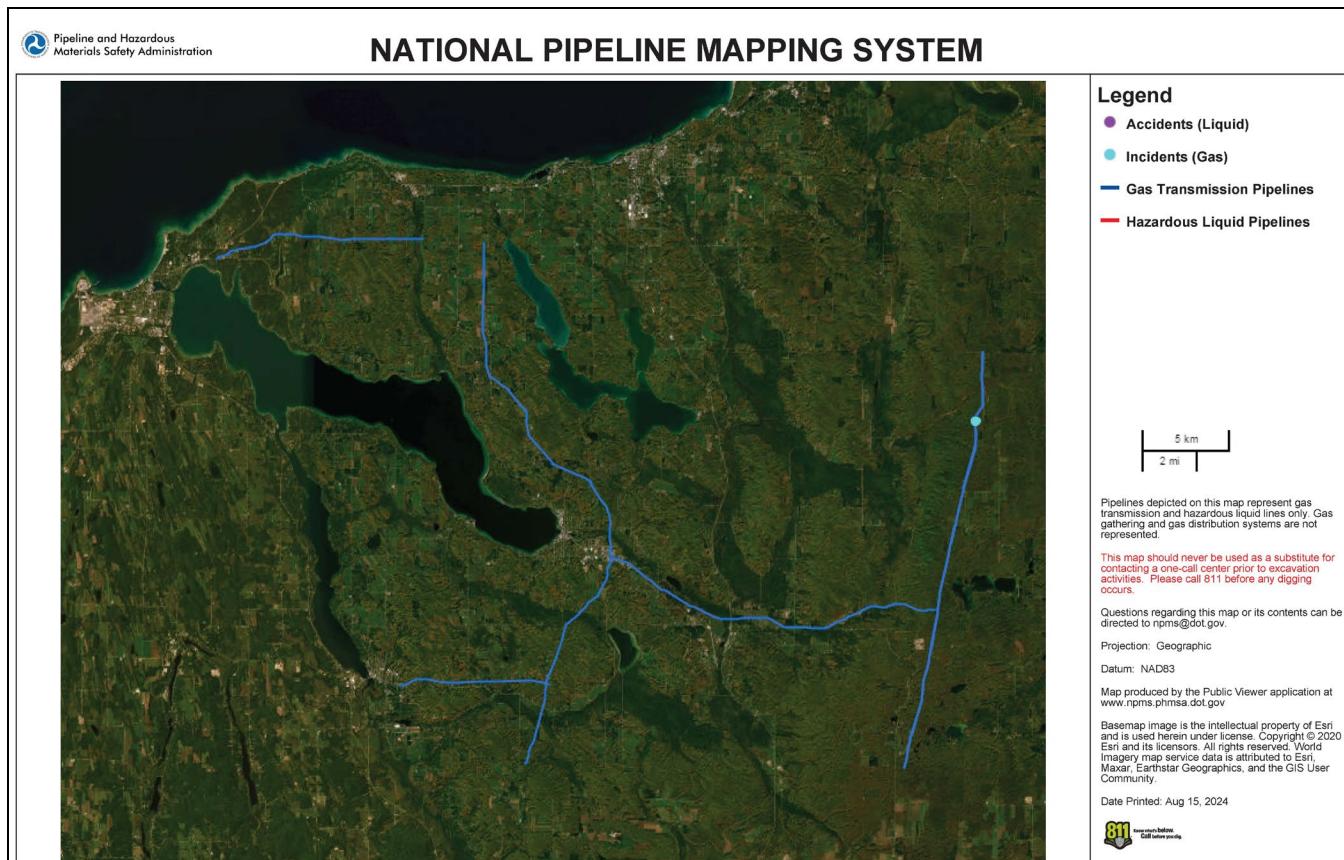
Source: Charlevoix County Emergency Management

*The National Pipeline Mapping System (NPMS) Public Viewer enables the public to view NPMS pipeline, liquefied natural gas (LNG) plant and breakout tank data one county or federal waters area at a time, including attributes and pipeline operator contact information. The user can also view gas transmission and hazardous liquid pipeline accidents and incidents going back to 2002 for the entire US. NPMS pipeline data consists of gas transmission pipelines and hazardous liquid pipelines jurisdictional to PHMSA. It does not contain gas gathering or distribution pipelines, such as lines which deliver gas to a home. Therefore, not all pipelines in an area will be visible in the Public Viewer. Figure 14 is a map created from the NPMS Public Viewer when queried for pipelines and any recorded pipeline incidents within Charlevoix County.

Figure 14. Natural Gas Pipeline and Incident Locations in Charlevoix County



IV. Hazard Identification and Assessments



Source: <https://pvnpms.phmsa.dot.gov/PublicViewer/>

As shown in the NPMS maps above, there are only natural gas transmission pipelines within the mainland of the County. There are no pipelines on Beaver Island. The pipeline that runs north-south through the east side of the County (through Chandler and Hudson Townships) is operated by Great Lakes Gas Transmission Company. The remaining pipelines are operated by DTE Gas Company and are located in parts of the Townships of Hudson, Boyne Valley, Evangeline, Bay, Hayes, Wilson, and South Arm, as well as the City of Boyne City.

There are two records of pipeline incidents which occurred at the Great Lakes Gas Transmission Company's natural gas processing facility at 10339 Great Lakes Road, Boyne Falls (in Chandler Township). Natural gas releases at the facility were reported in April 2011 and January 2024, both due to equipment failure. There were no fatalities or injuries reported with those incidents.

This plan includes a profile for each hazard event the County is likely to face. Each profile includes the location, extent, previous occurrences, probability of future events, and a 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 to estimate the likelihood of future events and predict potential impacts. The extent of historic events may be included when the data is available. 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 based on previous event occurrences 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, and existing community assets to mitigate or respond to the hazard.

Information utilized in the hazard analysis in Charlevoix County was compiled from several different sources, listed below.

- **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 (Table 27).
- **NOAA Online Weather Data** <https://www.weather.gov/wrh/Climate?wfo=apx> – Historical local observed weather data; Climate prediction and variability; local high impact event summaries. The National Weather Service has established five weather reporting stations in Charlevoix County - in the City of Charlevoix, the City of East Jordan, two miles northwest of the City of East Jordan, the Village of Boyne Falls and on Beaver Island. Climate data reported at these locations reflects the various weather conditions and patterns influence by differences in topography, land mass and location relative to Lake Michigan.
- **Michigan State Police's 2019 Michigan Hazard Analysis and 2020 Michigan Hazard Analysis Supplement**
- **Past Severe Weather Events - NOAA Storm Event Database** <https://www.ncdc.noaa.gov/stormevents/> Data available to search beginning in 1950 to within 3 months from present day; however, information for various events is limited and non-consecutive. The database provides local storm reports, damage reports, and recorded event descriptions. The event types researched for Charlevoix 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*)
 - Flooding (*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*)

- **Wildfires** - The [Michigan Hazard Analysis](#), completed by the Michigan State Police in 2019, was referenced to collect data on wildfires that occurred on State-owned land between 1981 and 2018 (as reported by the MDNR).
- **Drought** - Historical local observed drought data was obtained from the [US Drought Monitor](#).
- **Space Weather/Electromagnetic Pulses** - [US Department of Homeland Security](#)
- **Public Health Emergency** – [Health Department of Northwest Michigan](#); [Michigan Department of Health and Human Services Coronavirus Case Data](#)
- **Invasive Species** - [Michigan Invasive Species Program](#); [Midwest Invasive Species Information Network](#); [CAKE-CISMA](#)
- **Shoreline Erosion and Flooding** - [LIAA's Northwest Lower Michigan Coastal Resilience Atlas](#); MI EGLE's [Wetlands Map Viewer](#)
- **Dangerous Currents** - [The National Weather Service's/MI Sea Grant's Great Lakes Beach Hazards Incident Database](#) indicates current-related incidents on the Great Lakes from 2002 to 2020. The NOAA NCEI Storm Events Database also provides information on reported rip current incidents.
- **Dams** - 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.
- **Bridges and Stream Crossing Conditions** - MDOT [Bridge Condition Ratings](#); [Great Lakes Stream Crossing Inventory](#)
- **Pipelines** - [National Pipeline Mapping System Public Viewer](#)
- **Climate Change** – [EPA Climate Change Indicators](#); [Great Lakes Environmental Research Laboratory](#); [GLISA, the Great Lakes Climate Adaptation Partnerships/RISA team](#)

Additional data sources utilized for all types of hazards included: the Charlevoix County Office of Emergency Management; local government planning and zoning documents; local non-profit publications and websites; local newspaper articles; and public/stakeholder input.

The Historical Analysis of hazards in Charlevoix County uses information on impacts and losses from previous hazard events to predict potential impacts and losses during a similar event. There have been seven incidents involving a federal or state declaration of an emergency or disaster affecting Charlevoix County (Table 27; red, bold text). These events (with the exception of the 2005 hurricane evacuation incident) are also included in the hazard analysis for individual event types.

Table 27. Presidential and Governor Declared Disasters or Emergencies for Charlevoix County

Date of Incident	Type of Incident	Affected Area	(P)residential Declaration* / Federal ID Number** or State of Emergency (G)overnor's Declaration***
3/13/2020, 3/27/2020 Ended 5/11/2023	Pandemic	Statewide ; Nationwide	(P) Emergency (3455) (P) Major Disaster (4494) (G) Emergency
1/29/2019	Extreme Cold	Statewide	(G) Emergency
2/13/2014	Deep Frost	Charlevoix , Cheboygan, Chippewa, Delta, Emmet, Gogebic, Luce, Mackinac, and Marquette Co.	(G) Emergency
9/7/2005	Hurricane evacuation	Statewide (resulting from the influx of evacuees to Michigan from states impacted by Hurricane Katrina beginning on August 29, 2005)	(P) Emergency (3225)
9/4/2005			(G) Disaster
12/1993 to 05/1994	Underground Freeze	10 counties: Charlevoix , Cheboygan, Chippewa, Delta, Gogebic, Houghton, Mackinac, Marquette, Ontonagon, and Schoolcraft Co.	(P) Major Disaster (1028)
3/10/94 3/4/94 2/23/94, 2/25/94		Charlevoix , Cheboygan, Chippewa, Delta, Gogebic, Houghton, Mackinac, Marquette, Ontonagon, and Schoolcraft Co.	(G) Emergency
1/26-27/1978	Blizzard, snowstorm	Statewide	(P) Emergency (3057); (G) Disaster
3/2/1977	Drought	44 counties: Alcona, Alger, Alpena, Antrim, Arenac, Baraga, Benzie, Charlevoix , Cheboygan, Chippewa, Clare, Crawford, Delta, Dickinson, Emmet, Gladwin, Gogebic, Grand Traverse, Houghton, Iosco, Iron, Isabella, Kalkaska, Lake, Leelanau, Luce, Mackinac, Manistee, Marquette, Mason, Mecosta, Menominee, Missaukee, Montmorency, Oceana, Ogemaw, Ontonagon, Osceola, Oscoda, Otsego, Presque Isle, Roscommon, Schoolcraft, and Wexford Co.	(P) Emergency (3035)

*Does not include separate Secretary of Agriculture or Small Business Administration (SBA) disaster declarations, which are issued under other authorities. Declarations after 1974 were issued under PL 93-288 (Disaster Relief Act), as amended by the Robert T. Stafford Disaster Relief and Emergency Assistance Act (1988) and the Disaster Mitigation Act (2000).

**Indicates federal declaration number assigned by FEMA or its predecessor agencies

***Declarations since 1977 were issued under 1976 PA 390, as amended (Michigan Emergency Management Act).

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

The NOAA NCEI Storm Events Database is updated on a rolling basis (approximately every three months) and thus is always being added to. The database indicates that 248 events were reported between 01/01/1950 and 8/31/2023 (26,906 days). There were a total of 225 days with an event, 32 days with an event and property damage, and 1 day with an event and crop damage. No injuries or deaths were recorded with these events. Those events as well as the emergency/disaster declaration events are included in the hazard analysis. It is important to note when viewing the data that most of the events on record started in the mid-1990's, even though the available search range dates back to 1950.

Table 28 lists the recorded hazard events for Charlevoix County. Wildfire is the most frequently occurring hazard, followed by severe winter weather; thunderstorm/wind and high winds; hail; extreme temperatures; and tornados.

Table 28: Charlevoix County Hazard Events by Type, Location, and Year

Type of Event	# of Events	Event Location	Years Event Recorded
Wildfire	173	MDNR Lands	1981-2018
Severe Winter Weather (i.e. Ice storm, Heavy Snow, Blizzard)	149	Countywide	*1978, 1996-2019, 2021-2023
Thunderstorm/Wind and High Wind	51	Countywide	1962, 1971, 1982, 1985, 1988, 1991, 1996, 1998-2007, 2009-2011, 2013, 2015-2018, 2020-2021
Hail	34	Countywide	1962, 1963, 1985, 1996-1998, 2000, 2002-2004, 2007, 2008, 2011-2014, 2016, 2017
Extreme Temperatures (Heat / Cold)	2 / 5	Countywide	2001, 2018 / 1994*, 2007, 2014*, 2015, *2019
Tornado	4	Boyne Valley Township, Wilson Township, City of Boyne City	1955, 1977, 1989, 2002
Lakeshore Flood	3	Lake MI Coastal Communities; along the shores of Lake Charlevoix	10/21/2019, 4/13/2020, 11/15/2020
Drought	3	Countywide	*1977, 2007 (2)
Riverine and Urban Flooding (Flash Flood)	1	City of Charlevoix	6/18/2012
Lightning	1	Countywide	2000
Public Health Emergency	1	Statewide/Nationwide	*2020
Dense Fog	0	Countywide	
Lake MI Shoreline Hazards (Waterspout, Seiche, Dangerous Current)	0	Norwood, Charlevoix, Hayes, St. James and Peaine Townships; City of Charlevoix	
Space Weather/EMPs	0	County / Region	
Invasive Species	-	Countywide	Ongoing

Sources: NOAA National Centers for Environmental Information Storm Events Database; MDNR; USFS/USDA; the Emergency Management and Homeland Security Division within the Department of Michigan State Police; FEMA; NWS Great Lakes Beach Hazards Incident Statistics. Note: * indicates a state or federal declaration of an emergency or disaster

Table 29 presents the *reported* deaths, injuries/rescues/illnesses, property damages, and crop damages from hazard events in Charlevoix County from 1950-2023. There have been 76 deaths and 6,091 illnesses, which were related to the COVID-19 pandemic. The economic impact of NOAA-recorded hazard events for Charlevoix County is \$903,000 in property damages and \$7,500,000 in crop damages. It should be noted that many events likely cause numerous small amounts of property damage, but these often go unreported.

Table 29. Extent of Damage by Event Type, Charlevoix County

Event	Deaths	Rescue, Injury/ or Illness	Property Damages	Crop Damages
Severe Winter Weather	0	0	\$295,000	\$7,500,000
Thunderstorm and High Wind	0	0	\$323,000	\$0
Lakeshore Flooding and Erosion	0	0	\$235,000	\$0
Hail	0	0	\$45,000	\$0
Tornado	0	0	\$3,000	\$0
Riverine and Urban Flooding	0	0	\$2,000	\$0
Extreme Temperatures (Heat or Cold)	0	0	\$0	\$0
Lightning	0	0	\$0	\$0
Drought	0	0	\$0	\$0
Wildfire	0	0	\$0	\$0
Waterspout, Seiche, or Dangerous Currents	0	0	\$0	\$0
Dense Fog	0	0	\$0	\$0
Public Health Emergency (COVID-19 Pandemic)	*76	*6,091	N/A	N/A
Space Weather	0	0	\$0	\$0
Invasive Species	N/A	N/A	N/A	N/A
TOTAL	76	6,091	\$903,000	\$7,500,000

Sources: NOAA's National Centers for Environmental Information; NWS Great Lakes Beach Hazards Incident Statistics; *State of Michigan <https://www.michigan.gov/coronavirus/stats> reported confirmed and probable cases and deaths and cases attributed to COVID-19 as of 11/14/2023.

Table 30 provides an overview of each potential hazard's estimated impact on the State Equalized Values (SEV) for real and personal property (residential and commercial). SEV is equal to half the true value of the property. Population data is collected from the US Census Bureau, 2020 Decennial Census. According to the 2022 report, *Seasonal Population Study for Northwest Lower Michigan*, assume a 119% increase to account for the highest estimated annual average seasonal population within the county (which occurs in August). Specific areas of hazard concerns were identified based on GIS mapping capabilities and public input session feedback.

Table 30. Hazard Impacts by Location (referencing Hazard Areas and Vulnerable Population Map in Appendix A)

Hazard Type	Location	Acreage	Estimated State Equalized Value
Severe Winter Weather, Thunderstorm, Hail, Lightning, Tornado, Extreme Temperatures, Dense Fog, Invasive Species, Space Weather, Pandemic, Drought	Countywide – from an estimated 34,603 people in April to 59,533 in July (combined year-round and part-time residents/visitors)	279,460	\$3,973,888,729
Inland Flooding	Jordan River communities (City of East Jordan, South Arm Township); Six Mile Lake area (South Arm Township); Boyne River communities (Boyne Valley Township, Boyne Falls Village City of Boyne City); urbanized areas (City of Boyne City, City of Charlevoix, City of East Jordan); various areas throughout the county where road/water crossings need infrastructure upgrades	119	\$34,359,603
Shoreline Flooding and Erosion	Communities adjoining Lake Michigan, Lake Charlevoix, and Walloon Lake (all communities except Chandler, Hudson, Wilson, and Boyne Valley Townships and Boyne Falls Village)	365	\$59,821,346
Waterspout, Seiche or Dangerous Currents	Hayes, Charlevoix, Norwood, St. James and Peaine Townships; City of Charlevoix	N/A	N/A
Wildfire	Wildfire concern areas: agricultural lands in Norwood, Marion and Eveline Townships; various parts of Peaine Township on Beaver Island	16,478	\$90,431,079
	White and Red Pine forest areas scattered in various areas throughout every community except City of Charlevoix. Jack Pine (the more flammable species) is found in areas within Norwood, Charlevoix, Hayes, Bay, Melrose, Eveline, Evangeline and Marion Townships.	7,573	
Tornado, High Wind, Thunderstorm/Wind, Hail, Lightning, Extreme Temps, Wildfire, Flooding	Campgrounds: City of East Jordan; the Townships of Boyne Valley Township, Marion, Evangeline, Eveline, Norwood, Charlevoix, Chandler, South Arm, St. James, and Peaine.	412	\$1,639,608
Tornado, High Wind, Thunderstorm/Wind, Hail, Heavy Snow	Mobile/Manufactured Home Communities: Charlevoix Township, Hayes Township, City of Boyne City, Village of Boyne Falls, City of East Jordan	179	\$5,529,641
“Snowbelt” concern areas – heavy snow, blowing snow	In Peaine Township, Beaver Island: Along Kings Highway, west of Welke Airport and south of East Side Dr./Barneys Lake Rd; and at Beaver Island Airport area, along Fox Lake Road/Paid Een Ogs Road/West Side Road.	N/A	N/A
Aquatic Invasive Species - specific areas of concern	Inland Lakes: Walloon, Charlevoix, Thumb, Six Mile Lake MI Shoreline areas Jordan River, Boyne River, and Porter Creek (to Lake Charlevoix) Fineout Creek (to Walloon Lake) Bear River (from Walloon Lake)	20,976	\$32,492,958

Sources: Charlevoix County Equalization; 2022 Seasonal Population Study for Northwest Lower Michigan

Severe 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

Severe 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 Charlevoix County is at risk from the occurrence and impacts from extreme winter weather. The coastal communities are more susceptible to lake-effect snow due to proximity to Lake Michigan.

Extent

Snowstorms can be measured based on snowfall accumulations or damages. The average annual snowfall in Charlevoix County varies depending on location according to NOAA's Online Weather data: Beaver Island, 75.1"; City of Charlevoix 88.6"; Village of Boyne Falls, 109.1"; South Arm Township (2 miles north of the City of East Jordan), 117.9"; City of East Jordan, 124.2". Extreme winter weather events in total caused \$295,000 in property damages and \$7,500,000 in crop damages between 1996 and 2023 (Table 31). Extreme winter weather events have the highest amount of monetary damages on record compared to any other hazard event in Charlevoix County.

Table 31. Extreme Winter Weather Events and Impacts, Charlevoix County

Event Type	Number of Events	Property Damage	Crop Damage	Event Year(s)
Winter Weather	1	\$ -	\$ -	2006
Frost/Freeze	1	\$ -	\$ 7,500,000	4/27/2012
Ice Storm	3	\$ -	\$ -	2001, 2005, 2008
Blizzard	7	\$ -	\$ -	1978, 1997-1999, 2002, 2019, 2022
Lake-Effect Snow	22	\$ -	\$ -	2006-2014, 2016
Heavy Snow	50	\$ 250,000 (3/2/2012)	\$ -	1996-2009, 2012, 2014, 2016, 2018
Winter Storm	65	\$ 45,000 (11/27/2007)	\$ -	1996-1998, 2000-2010, 2012-2019, 2021-2023
TOTAL	149	\$ 295,000	\$ 7,500,000	

Source: NOAA: National Centers for Environmental Information; Michigan State Police 2019 *Michigan Hazard Analysis*

Previous Occurrences

Since 1996, there have been 148 extreme winter weather events reported for Charlevoix County, which include heavy snow, ice storms, frost/freeze, blizzard, lake-effect snow winter storm and winter weather events (Table 31). Additionally, in 1978, Charlevoix County, along with the rest of the state of Michigan, received a Presidential Emergency Declaration for a snowstorm and blizzard. In recent years, the more common events are winter storms with moderate snowfall of 5-10 inches. Heavy snow, blizzards, and lake-effect snows 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.

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 event accounts for \$250,000 in reported damages in Charlevoix County.

The frost/freeze event on listed in Table 31 took place on April 27, 2012 across Northwest Lower Michigan. 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. This event accounts for \$1.7 million in crop damage in Charlevoix County.

The winter storm event on November 17, 2007 was the result of a clipper low pressure system that rapidly intensified in northwest Lower Michigan. Lake effect snow and very strong winds developed after a cold front

passed on the morning of the 27th. The City of Charlevoix and the Village of Pellston both measured wind gusts around 60 mph by midday. Some trees and power lines were downed as a result. One building in Boyne City was significantly damaged by a falling tree. Snowfall in the snowbelts was generally two inches or less. However, a narrow band of about four inches fell from Norwood to Grayling. The snow and gusty winds combined to produce near blizzard conditions at times. This event accounts for \$45,000 in property damages in Charlevoix County.

Probability of Future Events and Vulnerability Assessment

Between 1996 and 2023, Charlevoix County has had 148 extreme winter weather events. This averages to about 5.3 events every year. Therefore the probability of an event occurring in future years is 100 percent. Severe winter weather events have the potential of shutting down electric service and transportation routes in towns and businesses for a significant period of time. Air travel (the primary transportation method on and off the island in the winter) to Beaver Island is also limited or impossible during severe winter weather events. Blowing and drifting snow with blizzard conditions cause driving hazards. Damage to shoreline properties may occur when high winds push lake water and ice inland, causing damage to public infrastructure and residential property. The agriculture industry in the county is vulnerable to unseasonable temperature fluctuations and ice storms.

During the public input process as part of this plan, blowing/drifting snow was mentioned as a concern in two specific areas. On Beaver Island, blowing/drifting snow has impacted roads near Beaver Island Airport and Welke Airport, including along Kings Highway, the main north-south connector road. In Melrose Township, temporary snow fences installed at the foot of Walloon Lake have helped mitigate blowing snow/extreme snow drifts over M-32.

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 Charlevoix County. New residents, especially those locating in remote areas, increase the chance of risk to life and property. 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 severe winter weather events, persons most vulnerable in Charlevoix County include elderly persons; persons living at or below the poverty level; members who live in remote rural areas; those with limited access to technology including cellular phone service and broadband internet; and those without access to an emergency power source.

Thunderstorms and Severe 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.

Location

Thunderstorms and severe 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 Charlevoix County is at risk from the occurrence and impacts from thunderstorms and severe winds.

Extent

Thunderstorms can be measured based on wind speed or damages. The average wind speed for thunderstorm/wind and high wind events in Charlevoix County is 50 knots. There is \$323,000 in property damages and no crop damages associated with these events on record with NOAA for Charlevoix County.

Previous Occurrences

Between the years 1962 and 2023, there have been 51 thunderstorm/wind or high wind events reported in Charlevoix County (Table 32). This is the second-most frequently occurring type of severe weather event in the county.

The event narratives on record with NOAA indicate that many of the storm and wind events uprooted trees, caused power outages from damaged power lines, and caused some structural or vehicle damages.

Table 32. Thunderstorm and Wind Events Previous Occurrences, Charlevoix County

Event Type	# of Events	Deaths	Property Damage	Crop Damage	Event Year(s)
Thunderstorm/ Wind	40	0	\$224,000	\$ -	1962, 1971, 1982, 1985, 1988, 1991, 1996, 1998-99, 2001-07, 2011, 2013, 2016-18, 2020-21
High Wind	11	0	\$99,000	\$ -	1998, 2000, 2001, 2003, 2005, 2009, 2010, 2015, 2021
TOTAL	51	0	\$323,000	\$ 0	

Source: NOAA: National Centers for Environmental Information

In addition, while not a NOAA recorded storm event, the St. James Township Supervisor indicated that during a wind storm in November 2022, the overhead electric lines were downed between the Beaver Island GLE electrical distribution station and the landward point of entry of the lines at Lake Michigan. This resulted in a two day power outage of the buried electrical system on the island, and three days outage for the damaged aerial system.

Probability of Future Events and Vulnerability Assessment

Between the years 1982 and 2023¹, there have been 49 thunderstorm/wind or high wind events reported in Charlevoix County. This averages to 1.2 events per year; therefore the probability of an event occurring in a future year is nearly 100 percent. Damage from straight line winds usually affects multiple counties with the loss of electricity from trees/tree limbs downing power lines; widespread property damage; and potentially exposing people to severe injury or fatality due to flying debris. The magnitude of the impact of thunderstorm/wind and high wind events depends on the seasonal population, seasonal activities, and the spread of development.

Beaver Island's electric infrastructure is capable of operating entirely on generated power. In other words, in the case of emergencies, the Island's backup generators will power the Island. Great Lakes Energy (GLE) conducts assessments of its infrastructure every three years to determine where equipment may need to be upgraded. GLE may be making upgrades to the generator plant on the Island in the next five years to ensure that backup generated power is as reliable as possible. This would be a positive improvement for the Island, especially as the number of extreme storms are expected to increase in northern Michigan, increasing the risk for power outages.

The electric service providers in Charlevoix County (Great Lakes Energy, Consumers Energy, and the City of Charlevoix) maintain the vegetation near their power lines by performing regular trimming of vegetation and yearly inspections for dead trees and other hazards. Additionally, GLE has a full-time employee on Beaver Island to provide immediate service. While the west side of the Island has buried electric service lines, the east side of the Island has overhead lines that remain sensitive to disruptions due to high wind and ice storms. Property owners and the townships of Peaine and St. James should work with GLE to bury lines.

Residents and visitors are attracted to both rural, sparsely populated rural areas and urbanized areas (particularly for annual special events; see Table 34. Mobile home communities, and campgrounds, and numerous annual special events that draw a large number of tourists to outdoor recreation areas were identified as specific areas of vulnerability (see Table 33).

Thunderstorms can appear quickly and cause significant damage. Aside from the cities of Boyne City, Charlevoix and East Jordan, the county's population is geographically spread out and notifying them of tornado warnings or watches can be difficult. Severe thunderstorm/high wind alerts are provided to the public via the BeAlert notification system, television and radio announcements. The efficacy of the BeAlert system is limited due to the sign up process, as citizens must request to be added to the alert system.

Table 33. Campgrounds and Mobile Home Communities in Charlevoix County

Community	Campground	Mobile Home Areas
Boyne Valley Township	Boyne Country RV Park and Campground	
	Lost Woods Farm & Forest Eco-Resort	
Chandler Township	Chandler Hill Campground	
Charlevoix Township	Fisherman's Island State Park (north campground – 45 sites)	Charlevoix Estates Northern Cove Estates
City of Boyne City		Lakeview Village Fox Run
City of East Jordan	Tourist Park	“The Evergreens” neighborhood; 3 other areas in the city
Evangeline Township	Young State Park	
Eveline Township	Whiting Park	
Hayes Township		Lake Michigan Heights
Marion Township	Church of God Family Camp	

¹ The events for the years 1962 and 1971 were excluded from the probability analysis due to the large temporal gap between the remaining events on record.

Norwood Township	Fisherman's Island State Park (south campground – 45 sites)	
Peaine Township	Beaver Island Hideaway Campground Beaver Island State Forest Campground Beaver Island Retreat Bill Wagner Memorial Campground	
St. James Township	St. James Twp. Campground Port St. James Stable Campground (in Port of St. James Association)	
South Arm Township	Six Mile Lake Campground Chain of Lakes Camp	
Village of Boyne Falls		Mountain View Estates

Table 34. Annual Major Special Events in Charlevoix County

Location	Event	Typical Dates of Event
Beaver Island	St. Patrick's Day Celebration	The Saturday before March 17
	Bike Festival	Last weekend in June
	Independence Day Parade; Independence weekend fireworks and Boat Parade	4 th of July holiday
	Irish Festival	The Friday/Saturday after Labor Day in September
City of Boyne City	Mushroom Festival	Mid-May
	4 th of July Festival/Fireworks	4 th of July Holiday
	Boyne Thunder Powerboat Poker Run	Second Friday/Saturday in July
Village of Boyne Falls/Boyne Valley Township	Polish Festival	1 st weekend in August
	Boyne USA Events	Year-round
City of Charlevoix, Charlevoix Twp., and Hayes Twp.	Charlevoix Marathon (running race on Little Traverse Wheelway and local roads)	3 rd Saturday in June
City of Boyne City, Wilson Twp., South Arm Twp., City of East Jordan	Michigan Mountain Mayhem (Bicycle Road Race)	3 rd Saturday in June
City of Charlevoix	Boyne Thunder Powerboat Poker Run	Second Friday/Saturday in July
	Venetian Festival	A week in mid-late July
	Art Fair	2 nd Saturday in August
	Apple Fest	2 nd weekend in October
City of East Jordan	Freedom Festival	5 days in mid- to late- June
Melrose Township	Walloon Lake 4 th of July Celebration and Fireworks	Around the 4 th of July
	Northern Michigan Antique Flywheelers Show	4 days- the last weekend in July

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. Most hailstorms occur between May and August; this is when growing crops have the greatest potential to be damaged by hail.

According to the 2012 Michigan Hazard Analysis, the National Weather Service began recording hail activity in Michigan in 1967. 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, destroying an estimated 30,000-35,000 bushels of apples at 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 Charlevoix County is at risk from the occurrence and impacts from hailstorms. According to the National Weather Service, Charlevoix County is in an area of the United States that has on average two days of hailstorm events per year.

Extent

The description of hail is based on its approximate size, as described as follows in Table 35. If a thunderstorm produces hail that is 1 inch in diameter (quarter size) or larger, it is considered to be a severe thunderstorm.

Table 35. 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
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

Hail can damage personal property, and can harm or kill livestock and people. Hailstorms have caused no deaths, injuries, or crop damages in Charlevoix County. The greatest extent hail reported in Charlevoix County was 3 inches on July 8, 2016 in East Jordan with \$45,000 in reported property damages. The NOAA episode and event narratives for that event is as follows:

Powerful thunderstorms developed over Lake Michigan late in morning of the 8th, ahead of an incoming cold front. These storms produced very large hail, and some damaging winds, as they swept across northern Michigan. Approximately 60 percent of the cherry crop in northwest Lower Michigan was damaged by the severe thunderstorms. Some vehicles were damaged by very large hail.

Previous Occurrences

Between 1962 and 2023, Charlevoix County had 34 hail events reported to NOAA (Table 36).

Table 36. Hail Events, Charlevoix County

Place	Date	Magnitude (inches)
	6/30/1962	1.75
	5/8/1963	1.5
	9/7/1985	1.5
EAST JORDAN	7/8/1996	0.75
BOYNE CITY	9/11/1996	1
CHARLEVOIX	7/2/1997	0.75
CHARLEVOIX	6/24/1998	0.75
CHARLEVOIX	6/24/1998	1
IRONTON	5/12/2000	1
EAST JORDAN	8/8/2000	0.75
IRONTON	4/18/2002	1
EAST JORDAN	8/12/2002	0.75
EAST JORDAN	7/31/2003	0.88
BOYNE FALLS	8/9/2004	0.75
EAST JORDAN	3/26/2007	0.75
CHARLEVOIX	10/18/2007	0.75
BOYNE CITY MUNI ARPT	4/25/2008	0.75
CLARION	4/25/2008	0.75
BOYNE FALLS	5/30/2008	1
EAST JORDAN	6/27/2008	0.75
CLARION	5/22/2011	1
EAST JORDAN	6/8/2011	0.75
BIRCH HILLS	6/8/2011	0.75
EAST JORDAN	6/8/2011	0.75
EAST JORDAN	6/8/2011	1
EAST JORDAN	6/8/2011	1.75
BIRCH HILLS	6/8/2011	0.75
BOYNE CITY MUNI ARPT	5/27/2012	0.75
EAST JORDAN ARPT	5/20/2013	1.5
ST JAMES WELKE ARPT	7/22/2014	0.75
EAST JORDAN	7/8/2016	3
EAST JORDAN	10/17/2016	1.5
BOYNE MTN ARPT	10/17/2016	0.88
EAST JORDAN	9/4/2017	0.88

Source: NOAA: National Centers for Environmental Information

Probability of Future Events and Vulnerability Assessment

There have been 31 hail events reported between 1996 and 2023² in Charlevoix County, which equates to an average of 1.1 hail events per year. Therefore, there is a nearly 100% annual chance of a hail storm occurring in the county. All buildings, exposed infrastructure, and populations are at risk from hailstorms since hail causes damage to roofs, brick walls, glass, landscaping, crops, and cars. Mobile homes and campground populations located throughout the county and are more susceptible to impacts from hail. 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.

² The events for the years 1962, 1963, and 1985 were excluded from the probability analysis due to the large temporal gap between the remaining events on record.

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 has created guidelines that describe the approach and terminology used to classify dams, as explained in their *Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams* (April 2004). The dam hazard potential classification system, as shown in Figure 15, was developed by the Interagency Committee on Dam Safety (ICODS) as part of the National Dam Safety Program. The system provides groups who manage dams a common way to understand and talk about the possible negative impacts to people and property downstream in the case a dam fails or is mis-operated. Although the system does not speak to the condition of the dam, it does reflect probable loss of life and impacts on economic, environmental, and lifeline interests.

Figure 15. Dam Hazard Potential Classification System

DAM HAZARD POTENTIAL CLASSIFICATION	LOW HAZARD POTENTIAL	SIGNIFICANT HAZARD POTENTIAL	HIGH HAZARD POTENTIAL
LOSS OF HUMAN LIFE	None Expected	None Expected	Probable
ECONOMIC LOSSES	Low and generally limited to owner	Yes	Yes (but not necessary for this classification)
ENVIRONMENTAL DAMAGES	Low and generally limited to owner	Yes	Yes (but not necessary for this classification)
LIFELINE INTERESTS IMPACTED	No	Yes	Yes (but not necessary for this classification)

Source: *National Inventory of Dams*

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 Infrastructure Map included in Appendix A illustrates the locations of road/stream crossings, bridges and Michigan-regulated dams with their currently available condition rating. It should be noted that data is not available for every infrastructure location.

Areas of urban development (City of Boyne City, City of Charlevoix and City of East Jordan) are more vulnerable to flash flooding than other rural areas of the county due to the concentrations of impervious surfaces in those areas.

Also, seasonally high water tables, often occurring in late winter and the spring, can compromise aging or inadequate septic systems, leading to contamination of local lakes and streams. Seasonal flooding in the spring also affects many road/stream crossings, particularly near wetlands, throughout the county.

Members of the Natural Hazards Task Force identified the Boyne River corridor and Jordan River corridor as areas of riverine flood hazard concern, particularly due to the risk of potential dam failure along those rivers. Additionally, flooding occurred on land around Font Lake in St. James Township and Peaine Township during times of high groundwater tables/Lake Michigan water levels in 2019-2020.

The National Inventory of Dams maintains information for these four dams in the county: The Boyne Falls Dam (State-regulated), East Jordan Dam (State-regulated), Boyne River Dam (Federally regulated), and Walloon Lake CC Dam #14 (not regulated). Refer to *Figure 16* and *Table 37* for details. These dams are also labeled on the Infrastructure Map in Appendix A.

The Boyne Falls Dam in Boyne Valley Township is an earth embankment dam on the Boyne River with two concrete culvert spillways. The dam embankment has a length of approximately 400 feet and a structural height of approximately 23 feet. The dam creates a head of approximately 18 feet and an impoundment with a surface area of approximately 17 acres. The original construction date of the dam is unknown. The upstream and downstream slopes of the earth embankment are approximately 2 horizontal to 1 vertical. The top width of the embankment crest is approximately 40 feet. The crest of the dam serves as the roadway for Michigan Highway M-75. The roadway has an asphalt pavement and guardrail on both sides.

The East Jordan Dam in South Arm Township was constructed primarily of earth in 1900 on Deer Creek, and was originally owned and operated by Consumers Energy to produce electricity. The powerhouse was removed in 1950. The dam has a height of approximately 23 feet and a head of 13 feet. The earth embankment is approximately 315 feet long with an average width of 15 feet at the top. The spillway is made of concrete and is a gravity overflow type with no water level control device for Patricia Lake. The dam was bought by East Jordan Plastics in 1978 and is currently being used as a reservoir for their fire protection system. The size of impoundment is approximately 65 acres with a head of 13 feet.

In addition, the Michigan Dam Inventory indicates there are 13 dams in the county (not counting the federally-regulated Boyne River Dam, owned by Boyne USA, Inc.) (*Figure 17* and *Table 38*). Many of these dams are small, privately owned dams that are not regularly inspected by the State of Michigan.

Figure 16. Locations of Dams in Charlevoix County, per the National Inventory of Dams

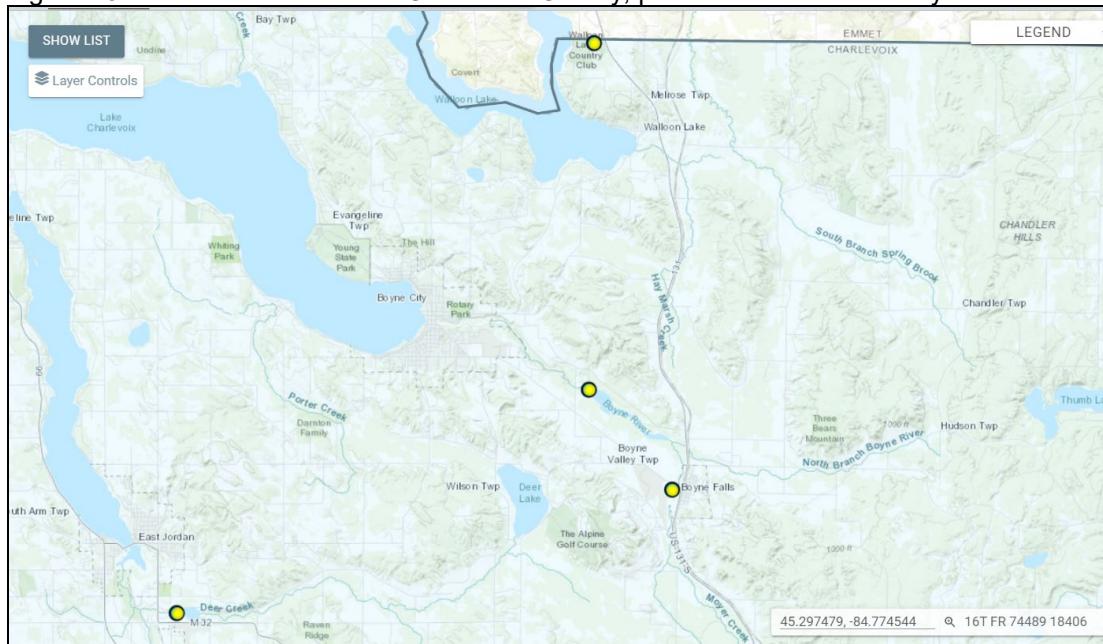


Table 37. Details on Dams in Charlevoix County, per the National Inventory of Dams

Name	Boyne Falls Dam	East Jordan Dam or "Lake Patricia Dam"	Boyne River Dam	Walloon Lake CC Dam #14
Downstream Hazard Potential	Significant	Significant	Low	Significant
Location	Boyne Valley Township at M-75 bridge over the Boyne River, west of US-131	South Arm Township	Boyne Valley Township	Melrose Township
Height (Ft)	23	23	37	16
Storage (Acre Ft)	88	865	1,390	8
Water Body	Boyne River	Jordan River	Boyne River	Tributary to Walloon Lake
Owner	Village of Boyne Falls	East Jordan Plastics	Boyne USA, Inc.	Walloon Lake Country Club
Year Completed	Unknown	1900	1904	1989
Purpose	Recreation; Retired Hydro	Recreation; Retired Hydro	Hydroelectric /Recreation	Recreation /Irrigation
Regulatory Agency	MI EGLE	MI EGLE	FERC	None
Condition Assessment/Date	"Satisfactory" 10/19/2021	"Fair" 5/31/2018	"Poor" 9/9/2022; as of 4/11/2023, operational status is "under remediation"	6/14/1990
Inspection Frequency	Every 4 years	Every 4 Years	Every 3 years	-
Emergency Action Plan Last Revised	12/28/2021	12/31/2006	1/31/22	N/A

Sources: National Inventory of Dams; EGLE Michigan Dam Inventory

Figure 17. Locations of Dams in Charlevoix County per EGLE's Michigan Dam Inventory

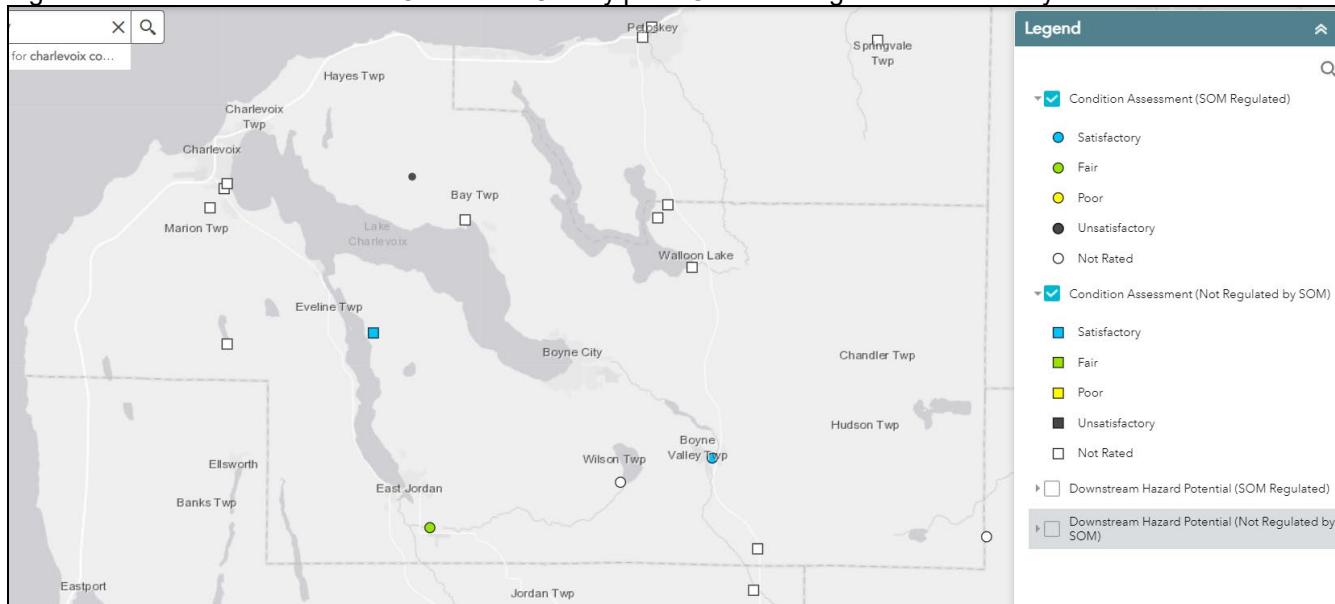


Table 38. Details on Dams in Charlevoix County per EGLE's Michigan Dam Inventory

Dam Name	Boyne Falls Dam	East Jordan Dam	Walloon Lake CC Dam #14	Walloon Lake CC Dam #3	Walloon Lake Dam (Weir)	Lawton Walleye Pond Dam	Charlevoix KMart Retention Basin Dam	Deer Lake Level Control Structure	Belvedere Golf Club Dam	Marion Hills Dam	Stover Creek Dam	Horton Creek Dam	Mooney Dam
Other Dam Names		Lake Patricia Dam	#14 Pond Dam	#3 Pond Dam		DNR Walleye Rearing Pond							Mooyer Creek Trout Ponds
Location	Boyne Valley Twp.	South Arm Twp.	Melrose Twp.	Melrose Twp.	Melrose Twp.	Eveline Twp.	Charlevoix Twp.	Wilson Twp.	Marion Twp.	Marion Twp.	Charlevoix Twp.	Bay Twp.	Boyne Valley Twp.
Downstream Hazard Potential	Significant	Significant	Significant	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Emergency Action Plan	Yes	Yes	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required
EAP Updated	2/2/2021	12/31/2006											
Owner Type	Local Government	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private	Private
Owner Name	Village of Boyne Falls	East Jordan Plastics	Walloon Lake Country Club	Walloon Lake Country Club	Walloon Lake Cottage Owners	Unknown	Agree Development Company	Deer Lake Property Owners Assoc.	Belvedere Golf Club	David L. Campbell	Irish Boat Shop Inc.	Horton Bay Club	Mario Massay
Inspector	Dan DeVaun	Paul Repasky, P.E.	MDNR	MDNR	None	MDEQ Pawloski	MDNR	Lucas C. Porath, P.E.	None	None	None	MDNR	
Regulatory Authority	Part 315	Part 315	Inventory	Inventory	Inventory	Inventory	Inventory	Part 307	Inventory	Inventory	Inventory	Inventory	Inventory
Inspection Date	10/19/2021	6/1/2018	6/14/1990	6/14/1990	1/1/1901	5/23/2001	6/14/1990	12/12/2018	1/1/1901	2/8/1991	1/1/1901	6/15/1989	1/1/1901
Inspection Frequency	4 Years												
Next Inspection	12/31/2025	12/31/2022				12/31/2006		12/31/2021					
Year Completed		1900	1989	1989	1911	1987	1990	1973			1948		
Dam Type	Earth	Earth Gravity	Earth	Earth	Gravity	Earth	Earth	Other	Rockfill	Earth Gravity		Earth	
Purposes	Retired Hydro	Retired Hydro	Recreation Irrigation	Recreation Irrigation	Other	Other	Flood & Stormwater	Recreation	Other	Recreation	Recreation	Recreation	
River	Boyne River	Deer Creek	Tributary to Walloon Lake	Tributary to Walloon Lake	Bear River	Tributary to Lake Charlevoix	Tributary to Lake Charlevoix	Deer Creek	Stover Creek	Marion Creek	Stoner Creek	Horton Creek	Mooyer Creek
Trout Stream			No	No		No	No					Yes	
Fish Passage	No	No	No	No	No	No	No	No	No	No	No	No	No
Lamprey Barrier			No	No		No	No					Yes	
Delegated Authority							County Drain Commissioner						
Report Received		12/20/2018					12/13/2018						
Condition Assessment	Satisfactory	Fair	Not Rated	Not Rated	Not Rated	Satisfactory	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated	Not Rated
Condition Assessment Detail	Meets applicable tolerable risk criteria		Not under state jurisdiction	Not under state jurisdiction	Not under state jurisdiction	Meets applicable tolerable risk criteria	Not under state jurisdiction	Other	Not under state jurisdiction				

IV. Hazard Identification and Assessments - Riverine and Urban Flooding

Extent

The extent of an inland flooding event can be measured by the amount of property damage and accumulation of rainfall. There has been one flash flood event on record with NOAA for Charlevoix County, in the City of Charlevoix, which caused \$2,000 in property damages (Table 39). No crop damages were reported and there have been no deaths or injuries from flooding.

Previous Occurrences

Table 39. Charlevoix County Fluvial and Pluvial Flood Events

LOCATION	DATE	EVENT TYPE	DEATHS / INJURIES	PROPERTY DAMAGE	CROP DAMAGE	FLOOD CAUSE
City of Charlevoix	6/18/2012	Flash Flood	0	\$2,000	0	Heavy Rain
*Boyne Valley Township/Village of Boyne Falls	3/15/2019	Riverine Flooding – S. Branch Boyne River, Boyne Valley Township and Village of Boyne Falls				Dam Failure
*Boyne Valley Township/City of Boyne City	October 2016	Riverine Flooding- Boyne River downstream of Boyne USA dam				Dam mis-operation
TOTAL				\$ 2,000	\$ -	

Sources: NOAA National Centers for Environmental Information Storm Events Database; Michigan State Police's 2019 *Michigan Hazard Analysis*

Notes: * Event not listed in the NOAA Storm Events Database

The NOAA episode and event narratives for the June 18, 2012 flash flood in the City of Charlevoix is provided below:

A warm front allowed warm and moist air to surge north into Northern Michigan. Initial thunderstorms developed in Eastern Upper Michigan in the afternoon; some of these produced large hail. Incoming thunderstorms organized into a line as they crossed Northern Lake Michigan; this squall line produced many reports of 40 to 55 mph winds, but only a few pockets of wind damage, in addition to a single tornado.

High water closed US-31 between Garfield and St Marys in the city of Charlevoix.

The descriptions of the March 15, 2019 and October 2016 flooding incidents on the Boyne River were obtained from <https://truenorthtrout.com>:

Friday evening March 15, 2019, after Thursday's daytime high of 57°, coupled with snowmelt and rain, a [privately-owned, non-regulated] dam located behind Weiss Acres along 131 gave way and washed out. The site was an old grist mill from many decades ago. There are cabin rentals along the river bank where vacationers could kayak up a couple hundred yards in slack water before they ran into two undersized culverts on the former entrance to Boyne Mountain, opposite Cherry Hill Road. This site was also looked at by Tip of the Mitt Watershed but complications and funding delayed removal because of buried utilities.

The amount of sediment washed down stream is yet undetermined. Fish kill and macro invertebrate collateral damage is unknown. Biggest concern is young of the year brown and brook trout that may have little recourse in escaping plume of silt or heavy flows. The DNR, DEQ, and Tip of the Mitt have visited site along with Little Traverse Bay Tribe- who took water samples on Tuesday. A crew of surveyors from Elmer's Construction-general contractors on Maple River and Boardman River dam removals, were also on hand and forecast an involved remediation of river and hope for a quick recovery. The portion upstream is high quality trout stream, below former dam site is the Boyne Falls Mill Pond, which may have acted as a large sand trap. There is also evidence that when the dam broke free, the amount of water and sediment going downstream would have stirred and flushed the still water in the pond- pushing a larger plume of silt downstream. The turbid and murky water was visible for 4-5 days in Boyne City.

The river has been through this before. In October of 2016, while performing routine maintenance on the Boyne Property Dam at Kircher's pond, a log became lodged in the floodgate and most of impounded water was released downstream. Anglers who were in the river fishing for salmon noticed the river suddenly rush from knee deep to over their waists and became very murky. Some actually caught pike and large browns that were residents from the impoundment. Some property owners had to retrieve kayaks that were along their shoreline to be found in the mouth of Boyne at Lake Charlevoix.

The following photos depict the streambank erosion and private property damage resulting from the 2019 flooding incident along the South Branch Boyne River in Boyne Valley Township and the Village of Boyne Falls: (all photos sourced from <https://truenorthtrout.com/2019/03/south-branch-boyne-river-update/0>)





Probability of Future Events and Vulnerability Assessment

Since 2012, Charlevoix County has had 3 inland flooding events, indicating there is a 25% annual chance of a riverine or urban flood event. The magnitude and severity depend on the area of impact's population, seasonal activity, and the spread of development. During the warm or summer months, the population expands to include both the permanent population and visitors to the area. Areas of urban development (City of Boyne City, City of Charlevoix and City of East Jordan) are more vulnerable to flash flooding than other rural areas of the county.

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 sewer lines causing water supply pollution, downed power lines, broken gas lines, fires, and the release of hazardous materials.

Inland flooding will continue to occur at times in Charlevoix County. Years with exceptional snowfall levels will likely result in flooding events from snowmelt. Increasing Lake Michigan water temperatures will create more active storm systems and heavier rainfalls. Fluctuating Lake Michigan water levels will also increase inland flooding events as groundwater tables rise. Increased development, reduction in green space, and subsequent soil erosion can 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. Also, seasonally high water tables, often occurring in late winter and the spring, can compromise aging or inadequate septic systems, leading to contamination of local lakes and streams.

Members of the Natural Hazards Task Force identified the Boyne River corridor and Jordan River corridor and tributaries as areas of riverine flood hazard concern, particularly due to the risk of dam failure along those rivers. Areas around Six Mile Lake in South Arm Township, and other smaller sites of historic inland/flooding are also included in the Hazard Areas Map in Appendix A.

While dams can provide flood protection, recreation, energy supply, and water security, they also pose a significant threat to the environment. Dams block fish from moving along their natural pathways between feeding and spawning grounds (upstream habitat), causing interruptions in their life cycles that limit their abilities to reproduce. Dams can degrade water quality because the water they impound warms up and holds less oxygen, which affects fish and other aquatic animals. Dam failures may cause problems like erosion, which puts properties at risk and accelerates sediment transport downstream. Too much sediment in a river can cover important gravel beds needed for fish and macroinvertebrate habitat, as well as wetlands in the floodplain.

The Boyne River Hydropower Dam in Boyne Valley Township has a "low" hazard potential classification, meaning that the failure or misoperation of the dam is not expected to result in the loss of human life; economic losses and environmental damages are expected to be low and generally limited to the owner; and impact to lifeline interests are not expected. Boyne USA, Inc., as the owner/operator, maintains a current Emergency Action Plan (EAP) for the dam on file with the Federal Energy Regulation Commission (FERC) and Charlevoix County government.

The Boyne Falls Dam and the East Jordan Dam have a "significant" hazard potential classification, meaning that while the failure or misoperation of the dam is not expected to result in the loss of human life, there will be economic losses, environmental damages, and impact to lifeline interests. The owners of the dams are required to maintain an EAP for the dam with MI EGLE and Charlevoix County Emergency Management.

The December 20, 2021 EGLE Dam Safety Inspection Report for the Boyne Falls Dam provides the following conclusions and recommendations:

The Boyne Falls Dam is in Fair condition. No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action. The following recommended actions are listed by priority:

- *The void in the concrete of the primary spillway chute downstream of the retaining wall needs to be cleaned, filled and compacted, then resurfaced by June 30, 2022.*

- Review the dam's Emergency Action Plan (EAP) in coordination with Charlevoix County Emergency Management. Advise the Dam Safety Program of the findings of this review and submit any revisions to the Dam Safety Program and the County Emergency Management Coordinator by December 31, 2022.
- Trees should be removed 10 feet past the toe of the embankment and along the left groin area by December 31, 2022.
- Mow/weed the upstream slope of the embankment periodically.
- The deteriorating concrete in retaining walls both upstream and downstream of M-75 needs to be monitored for further deterioration. Consider resurfacing the areas with hairline cracks to mitigate growth of the cracks.
- Consideration should be given to improve access to the stoplog structures on both the primary and auxiliary spillways. Currently, the only access is from the water with no machinery to assist putting in and taking out the stoplogs.
- Monitor movement in mass concrete section.

The dam's current Significant hazard potential rating remains appropriate.

The East Jordan Dam Inspection Report, dated February 29, 2023, provides the following conclusions and recommendations:

We estimate that the overall condition of the dam is "Fair" as defined by the "Role of Inspection and Condition Assessment in the United States Army Corps of Engineers Civil Works Infrastructure Management" (Uzarski et al. 15). The condition "Fair" indicates that the dam is currently functioning as it should with some observed minor deficiencies that require corrective action. These minor deficiencies include the following:

- Deteriorated concrete spillway and walls
- Trees and brush on the dam
- Bare/exposed soil on the dam
- Minor erosion on the upstream slope
- Low point on the north embankment where overtopping could potentially occur

As indicated in previous inspection reports, the dam appears to originally have had a powerhouse with a concrete spillway and other concrete components. While portions of the powerhouse have been removed, the spillway and some of the walls/foundation elements remain. The concrete spillway is currently functioning as intended. However, there is deteriorated concrete, along both walls on each side of the spillway, especially along the bottom joints.

We cannot predict how much longer the spillway will function, but if the spillway fails, this could potentially lead to a dam failure causing significant damage to the surrounding area. Review of Past Dam Safety Inspection Reports indicate the condition of the concrete spillway is continuing to deteriorate.

We recommend, at a minimum, that the following actions be taken:

1. Continue to monitor the concrete spillway condition during routine maintenance operations on the dam. Contact the Michigan Department of Environment, Great Lakes and Energy (EGLE) with major changes.
2. Monitor groundwater seepage coming out of southwest concrete embankment headwalls during drier summer months.
3. Fill in and repair animal burrow hole behind the south concrete spillway wall on downstream side and other areas as they appear.
4. Remove all trees and brush on the dam.
5. Repair areas of erosion by grading banks to a uniform slope and restore with topsoil, seed, fertilizer, and mulch.
6. Place topsoil on all sandy areas of the dam and seed to promote vegetation growth.
7. Place embankment on the top of the northern earthen dike to a uniform elevation match the top of the spillway.
8. Repair or replace the walls of the spillway. It is recommended that this be completed within one year.

No future studies or investigations appear to be required other than inspections as required by the Dam Safety Act. A permit and plans sealed by a Professional Engineer will be required for any alterations to the spillway. Hazard Potential Classification is HIGH and is appropriate.

The report also provides the following description of residences, buildings or structures that may be threatened by flooding from potential failure of the dam:

- *M-32 Hwy. Bridge Crossing Downstream ½ Mile Downstream of East Jordan Dam: 10 ft. Clearance Height to Stream Level may be exceeded by Flood Wave.*
- *Residences Near the Confluence of Deer Creek and the Jordan River: There are no residences immediately downstream (within 1 mile) of the dam, but some residences upstream may be affected by back-up of Jordan River causing flooding.*

An inspection report was issued in 2021 for the Walloon Lake Weir by a State of Michigan licensed professional engineer. The weir is a water control structure to control the elevation of Walloon Lake (per a court order) and is located just northwest of highway M-75 where the Bear River exits Walloon Lake. Melrose Township is responsible for the operation and maintenance of the weir. The inspection report listed the following recommendations by priority:

A. Short Term Recommendations

1. *Monitor the condition of the weir especially the lower northeast section.*
2. *Seal the concrete walls of the weir with a high-quality concrete sealer to reduce water intrusion and damage from the freeze-thaw cycle.*
3. *Work with county and/or state road commissions to develop a drainage plan to prevent salt laden water runoff from flowing over the concrete wing walls of the weir.*

B. Long Term Recommendations

1. *Work with county and/or state road commissions to develop and implement a repair plan for the weir wing walls*

Recent Flood Hazard Mitigation Efforts

In August 2023, the Tip of the Mitt Watershed Council was awarded a \$323,672 grant from the MI EGLE's Nonpoint Source Fund to conduct work in the Lake Charlevoix Watershed. This 3-year project will allow them to install green stormwater infrastructure (a bioretention area) in downtown East Jordan, to be integrated into the City's new streetscape design. The grant funds will also assist in replacing two undersized road-stream crossings on the Jordan River (in southerly adjoining Antrim County) in partnership with the Conservation Resource Alliance, as well as make updates to the Lake Charlevoix Watershed Management Plan.

The Charlevoix County Road Commission has indicated they will continue to evaluate and inventory the condition of culverts in the county on an ongoing basis, as time permits.

The Village of Boyne Falls was awarded a \$185,000 grant from EGLE's Dam Risk Reduction Program for the 2023-24 funding cycle. The grant will be used to conduct a feasibility study to determine the future management options for the Boyne Falls Dam on the South Branch Boyne River. The increasing cost of maintaining the aging dam has become a burden to the Village. The dam is located at a primary connector road to Boyne City, on M-75 at the intersection of US-131.

NFIP Participation Status

Several Charlevoix County communities received an updated Flood Insurance Study and digital flood maps in 2019. Community input and coordination with FEMA will determine the extent, if any, of future mapped flood areas. Table 41 outlines the NFIP information for local communities.

Boyne Valley Township and Marion Township each had a FIRM issued in within their jurisdictions in 2019; however, they are listed as non-participants in the NFIP as they have not submitted documentation of local adoption of the FIRM(s) to FEMA. During the development of this hazard mitigation plan, inquiries were made with local government officials from these communities as to the reason why they are a non-participant in the NFIP. The Boyne Valley Township Supervisor indicated that the township has inadequate staff to participate in NFIP activities. No response was received from Marion Township officials regarding this inquiry.

Michigan State Police's *2019 Michigan Hazard Analysis* provides the following National Flood Insurance Statistics for Charlevoix County. Six (6) claims have been paid since 1978 (Table 40).

Table 40. National Flood Insurance Program Statistics, Charlevoix County

Policies	Total Coverage	Total Premium	Claims since 1978	Total Paid Since 1978
23	\$6,980,000	\$11,762	6	\$49,308

Source: FEMA NFIP Policy and Claims Report, 5/24/2023 <https://www.michigan.gov/msp/divisions/emhsd/programs-and-publications/mhmp-appendix-5>

An NFIP-insured structure that has had at least two paid flood losses greater than \$1,000 each in any 10-year period since 1978 is considered a "repetitive loss" property by FEMA.³ FEMA provides a public dataset⁴ with information on structures that have had multiple NFIP claims across the history of the program. An online map of this data can be found on FEMA's ArcGIS Online platform:

<https://fema.maps.arcgis.com/home/webmap/viewer.html?webmap=872bbaf7dfbb48cb88d244c7123e4d9d>

The data contains NFIP-insured structures that fall within the four categories of Repetitive Loss and Severe Repetitive Loss that FEMA tracks. There are also fields to show whether a structure is currently NFIP-insured, has been mitigated, and other characteristics. The data includes properties that have since been mitigated or demolished and may no longer considered to be in any of the listed categories. According to this information source (last updated by FEMA on September 5, 2024), there are no repetitive loss properties on record for Charlevoix County.

³ <https://www.fema.gov/glossary/repetitive-loss-structure>

⁴ <https://www.fema.gov/openfema-data-page/nfip-multiple-loss-properties-v1>

Table 41. NFIP Information for Charlevoix County Communities

Municipality	Community ID	NFIP Participant?	Floodplain Management /FIRM Map Adoption*	Current Effective Map Date	Reg- Emerg Date**
Bay Township	26796B	Y	Y	9/15/2022	9/18/1987
City of Boyne City	260056C	Y	Y	5/16/2019	7/19/1982
City of Charlevoix	260057B	Y	Y	9/15/2022	2/11/1983
Charlevoix Township	260790B	Y	Y	9/15/2022	9/18/1987
City of East Jordan	260372C	Y	Y	5/16/2019	7/19/1982
Evangeline Township	260800B	Y	Y	9/15/2022	9/18/1987
Eveline Township	260773B	Y	Y	9/15/2022	9/18/1987
Hayes Township	260778B	Y	Y	9/15/2022	9/18/1987
Melrose Township	261295C	Y	Y	5/16/2019 (M)	8/28/2019
Norwood Township	260769B	Y	Y	9/15/2022	9/18/1987
Peaine Township	261296B	Y	Y	9/15/2022	11/1/2019
South Arm Township	260761C	Y	Y	5/16/2019	3/18/1987
St. James Township	261297B	Y	Y	9/15/2022	8/28/2019
Wilson Charter Township	261298C	Y	Y	NSFHA	11/18/2019
Boyne Valley Township	261292C	N	N	5/16/2019	5/16/2020 (Sanction Date)
Marion Township	260808B	N	N	9/15/2022	5/16/2019 (S) (Sanction Date)

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.

**** How participants implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.

"M" = no elevation determined; all Zone A, C, X

"NSFHA" = no special flood hazard areas; all Zone C

"S" = Suspended community

Data Source: FEMA Community Status Book Report, Accessed 10/8/2023

Table 41 Continued: NFIP Information for Charlevoix County Communities

Municipality	Implementation Method***	Implementation of Damage Provisions****
Bay Township		
City of Boyne City		
City of Charlevoix		
Charlevoix Township		
City of East Jordan		
Evangeline Township		
Eveline Township	The Charlevoix County Building Safety Department is the designated agency to administer, apply, and enforce the floodplain management regulations as contained in the state construction code for these communities. The FIRMs are declared	Per the State of Michigan Building Code, if more than 50% of a building is damaged, it would need to be brought up to current construction code standards.
Hayes Township	to be a part of Section 1612.3 of the Michigan Building Code and provide the content of the "Flood Hazards" section of Table R301.2(1) of the Michigan Residential Code.	
Melrose Township		
Norwood Township		
Peaine Township	Local zoning ordinances regulate development pertaining to flood areas.	
South Arm Township		
St. James Township		
Wilson Charter Township		
Boyne Valley Township	Per the Boyne Valley Township Supervisor, the township has inadequate staff to participate in [NFIP] activities.	
Marion Township	No response received from inquiry to Township officials as to the reason why they do not participate in the NFIP.	

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.

**** How participants implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.

"M" = no elevation determined; all Zone A, C, X

"NSFHA" = no special flood hazard areas; all Zone C

"S" = Suspended community

Data Source: FEMA Community Status Book Report, Accessed 10/8/2023

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 Charlevoix County is at risk from the occurrence and impacts from lightning.

Extent

Lightning can be measured by damages-caused including deaths, injuries, property damages, and/or crop damages. There have been no reports of damages or injuries attributed to lightning in the county.

Previous Occurrences

There has been one lightning incident reported to NOAA for Charlevoix County (Table 42).

Table 42. Lightning Events

LOCATION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE
County/Region	9/1/2000	0	0	\$0
TOTAL		0	0	\$0

Source: NOAA: National Centers for Environmental Information

NOAA's narrative for the 2000 event is as follows:

These storms led to flooding across Leelanau County as well as the northern half of Benzie and Grand Traverse counties. Many secondary roadways across the central and western sections of Leelanau county were washed out. Sections of M-22 running near Suttons Bay received significant damage due to the force of the running water. Several businesses within the town of Glen Arbor were flooded. Many city streets around Traverse City became inundated with as much as 4 feet of standing water. Intense lightning also occurred with these storms. The lightning caused power outages to hundreds of homes and businesses in the Traverse City area.

Lightning associated with these storms and many others that night was nearly continuous. One man was killed by the lightning 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. Emergency crews performed CPR on the father immediately and a police officer arrived quickly with a defibrillator. However, attempts to revive the man failed.

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.

Probability of Future Events and Vulnerability Assessment

There has been one lightning event on record in the last 24 years for Charlevoix County. This indicates there is a 4.2% chance of an impactful lightning strike occurring in a given year. However, it is assumed that not all lightning events have been reported since events with injuries, deaths, and extensive damages tend to be the only ones reported. Therefore, the amount of damages from lightning strikes is likely higher.

Vegetation (especially in dry soils), buildings and infrastructure are at risk from damage 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.

One of the concerns indicated in the community survey for this plan was the possibility of a lightning strike at the location of the former Big Rock Nuclear Plant in Hayes Township, where casks of spent nuclear fuel are stored. However, according to personnel responsible for management of the site, risk of public exposure to any radiation would likely be very minimal in the event of a direct lightning strike to the casks. Lightning rods surround the casks as a preventative measure against lightning strikes, and any damage to the cask would only result in localized radiation at that site. Unlike an active nuclear power plant, the Big Rock site is not required to have protective action guidelines for a mass evacuation scenario (a plume of radioactive material would not be disbursed into the air if the casks were damaged). Areas of developed land are at least 1/3 mile away from the location of the stored nuclear waste.

People that work outside or participate in outdoor recreation activities are at a higher risk to be struck by lightning. Charlevoix County is rich in land and water-based outdoor recreation areas. The total acreage of land in parks and recreation use (27,179.21 acres) represents about 21% of the county's total land area (266,432 acres). Table 43 lists the amounts of acreage for public parks and recreation use in each community in the county.

Table 43. Parks and Recreation Acreage by Unit of Government

Unit of Government	Acreage
St. James Township	92.75
City of East Jordan	110.19
City of Charlevoix	122.88
Eveline Township	400.8
Marion Township	424.3
Charlevoix County	520.1
City of Boyne City	648.87
Charlevoix Township	660.4
South Arm Township	832.5
Hayes Township	906.5
Evangeline Township	1,017.61
Bay Township	1,189.41
Wilson Township	1,304.30
Norwood Township	2,282
Hudson Township	3,441.30
Boyne Valley Township & Village of Boyne Falls	4,946.50
Melrose Township	8,677.80
Peaine Township	12,791
Chandler Township	16,810
TOTAL	57,179.21

Source: Charlevoix County Parks and Recreation Plan, 2020-2024
 Note: Acreage is based on all public land available for recreational use in each municipality within Charlevoix County.

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 1999 and 2019, Michigan has had 314 reported tornado events with 52.9% as EF0 (weak) or EF1 (moderate), 38.9% reported as F0 or F1 (weak), 6.7% as EF2 (significant) or EF3 (severe), and 1.6% as F2 (strong). In Northern Michigan, tornadoes are most likely 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 Charlevoix County is at risk from 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 Hazard Areas Map in Appendix A.

Extent

The Fujita Scale (Table 44) 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, Charlevoix County's most damaging tornado occurred on April 3, 1956 with winds ranging from 210-261 mph. It caused no injuries or deaths, but \$250,000 in property damages.

Table 44. Fujita and Enhanced Fujita Scale Comparison

Fujita Scale		EF Scale	
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

Since 1955, Charlevoix County has had four reported tornadoes, which caused \$3,000 in property damage (Table 45). As a result of these tornadoes, there were no deaths, no injuries, and no reported crop damage.

An F1 tornado occurred in Boyne Valley Township in 1955. It touched down north south of Moyer Creek and northwest of Metros Road and US-131 and headed northeast for 2.3 miles, ending northeast of Springbrook and Thumb Lake Road, near Three Bears Mountain. This tornado caused \$2,500 in property damage.

An F2 tornado occurred on July 31, 1977. It started in Antrim County (Warner Township), traveling 3.8 miles northeast, crossing US-131 and ending in the southern portion of Boyne Valley Township. This tornado caused \$250 in property damage.

An F0 tornado occurred in Wilson Township on August 21, 1989, causing \$250 in property damage. The exact location/trajectory of the tornado is unknown, but it is reported as being one mile long and 110 yards wide.

An F1 tornado occurred in Wilson Township/ Boyne City area in 2002; the exact location/trajectory is unknown. No property damages are reported for this event. The NOAA episode and event narratives for this event are provided below:

Four waves of severe thunderstorms impacted northern Michigan during the morning, afternoon, and evening hours on the 1st. The first wave of severe thunderstorms struck the area during the early morning hours, initially knocking trees down in Tahquamenon Falls State Park. The last of the storms exited northern Michigan into Lake Huron during the evening hours. Three tornadoes were associated with the severe thunderstorms, but none of these crossed county boundaries. Numerous trees down, some onto structures and vehicles. Roof damage to several buildings.

Table 45. Tornado Events in Charlevoix County

LOCATION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE
Boyne Valley Township	6/19/1955	F1	0	0	\$2,500
Boyne Valley Township	7/31/1977	F2	0	0	\$250
Wilson Township	8/21/1989	F0	0	0	\$250
Wilson Township/City of Boyne City	8/1/2002	F1	0	0	0
TOTAL	4		0	0	\$3,000

Source: NOAA - National Centers for Environmental Information

Probability of Future Events and Vulnerability Assessment

Since there have been four tornadoes events reported in the last 69 years, the data shows that there is a 5.8% annual chance a tornado would occur in a future year. While the chance for a tornado is low, if an event occurs, there is potential for a higher magnitude tornado to touch down. All reported historic events have caused significant property damage. The cities of Boyne City, Charlevoix and East Jordan and adjoining communities, where the densities of population and developed lands are highest, would bear the greatest amount of impact from a tornado. Mobile homes are also more at risk from damage from tornadoes than homes built on permanent foundations. Table 46 indicates the estimates of mobile homes in each community in the county. Also, Table 33 in this plan lists the campgrounds and mobile home neighborhoods in each jurisdiction.

Table 46. Mobile Home Estimates, Charlevoix County

Location	Mobile homes	% of Housing Units
Charlevoix County	1,247	7.00%
City of Boyne City	222	9.70%
Charlevoix Township	207	17.90%
Hayes Township	175	15.20%
Wilson Township	105	10.00%
Hudson Township	83	13.70%
City of East Jordan	76	6.40%
Boyne Valley Township	72	8.20%
South Arm Township	59	5.50%
Melrose Township	58	6.40%
Marion Township	38	4.20%

Location	Mobile homes	% of Housing Units
Evangeline Township	35	7.40%
City of Charlevoix	34	1.60%
Peaine Township	22	4.00%
Village of Boyne Falls	21	9.70%
Bay Township	17	1.90%
Eveline Township	17	1.20%
Norwood Township	14	2.90%
Chandler Township	10	6.00%
St. James Township	3	0.60%

Source: US Census, 2020 ACS 5-yr Estimates, DP04 Selected Housing Characteristics

Tornados can appear quickly and cause significant damage. Aside from the three cities, the county population is geographically spread out and notifying them of tornado warnings or watches can be difficult. As mentioned previously, outdoor recreation areas are abundant in every community in the county.

In 2008, the Grand Traverse Band Tribe of Ottawa and Chippewa Indians (GTB) completed construction of six underground severe storm “safe rooms” (shelters) located on their tribal lands. Within their tribal lands in Eveline Township, Charlevoix County, one of these in-ground storm shelters was installed near the playground area at the GTB Charlevoix Community Center (10085 Wa-Ba-Noong Mi-Kun, East Jordan; 45° 12'33N-85° 11'03W). This project was funded in part by a FEMA hazard mitigation project grant awarded to the GTB. Each shelter can accommodate approximately 24 people. That number may be reduced, depending on pets or belongings carried. The shelters were designed and installed for the safety and protection of residents without basements in their homes during severe storms and tornadoes. The GTB also has a basement at the Charlevoix satellite office at this location that can be used as a tornado shelter.

The shelters were prefabricated and lowered into excavated areas. The units were then covered with dirt, graded and planted with grass to stabilize the soil and blend the site into the surrounding landscape. The only noticeable features are the ingress and egress hatch and the ventilation nubs (see Figure 18). For this reason, signs have been installed advising residents of the location and operation of the shelters. Public meetings and instructional sessions were also held by the tribal fire department to advise residents of the locations and operation of the shelters and how to react during periods of severe weather. These public education sessions also stressed the need for each household to have an emergency kit readily available within their home that they could take with them to the designated shelter. This eliminates the need to stock large quantities of supplies within the shelters. The shelters are open during the severe weather months (April 1 to September 30) and are locked for the remainder of the year.

Figure 18. GTB Tribe Underground Storm Shelter Entrance



Source: *Michigan Hazard Mitigation Success Stories – October 2020*, Michigan State Police

Charlevoix County currently uses the BeAlert public notification system, which provides phone alerts describing current emergency situations. However, it is limited in efficacy as citizens must sign up for the service's phone alerts.

Other emergency public notification methods available include:

- 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.
- The FEMA Mobile App: provides real-time weather alerts, locations of emergency shelters, and allows for notifications to be sent to loved ones.
- NOAA Weather Radio All Hazards: a nationwide network of radio stations broadcasting continuous weather information directly from the nearest National Weather Service office. NWR broadcasts official Weather Service warnings, watches, forecasts and other hazard information 24 hours a day, 7 days a week.
- The following communities have manually operated tornado sirens: City of East Jordan (2 sirens), City of Boyne City (1 siren), and the City of Charlevoix (1 siren). The technology to remotely activate the sirens is outdated. As of April 2023, the City of East Jordan has identified funding source(s) to update their tornado sirens to be activated remotely, and the City of Charlevoix is evaluating options to update their siren.

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.

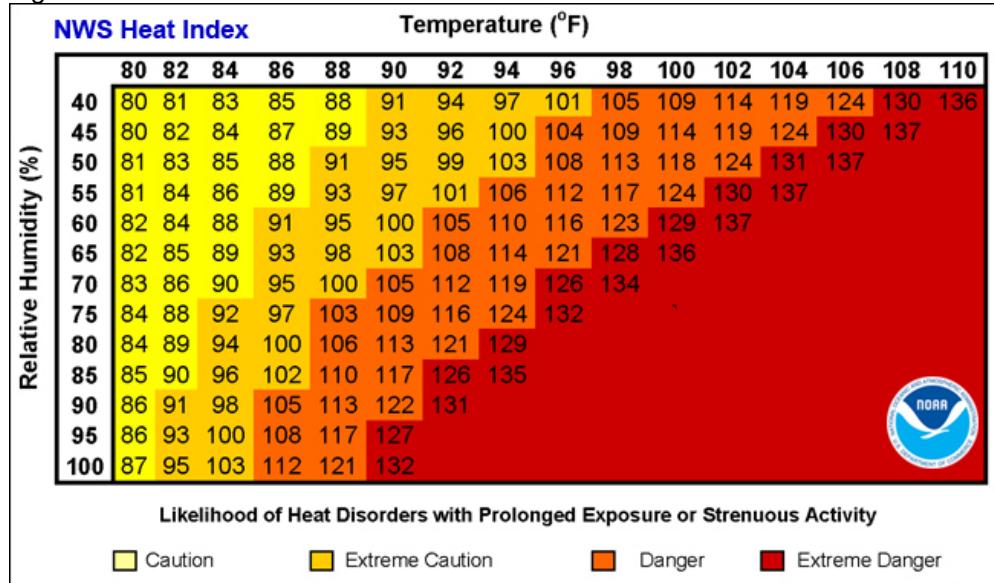
According to the 2019 Michigan Hazard Mitigation Plan, Michigan has 11 average annual extreme heat events with 0.4 average annual deaths and 41 average annual injuries.

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 19). 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.

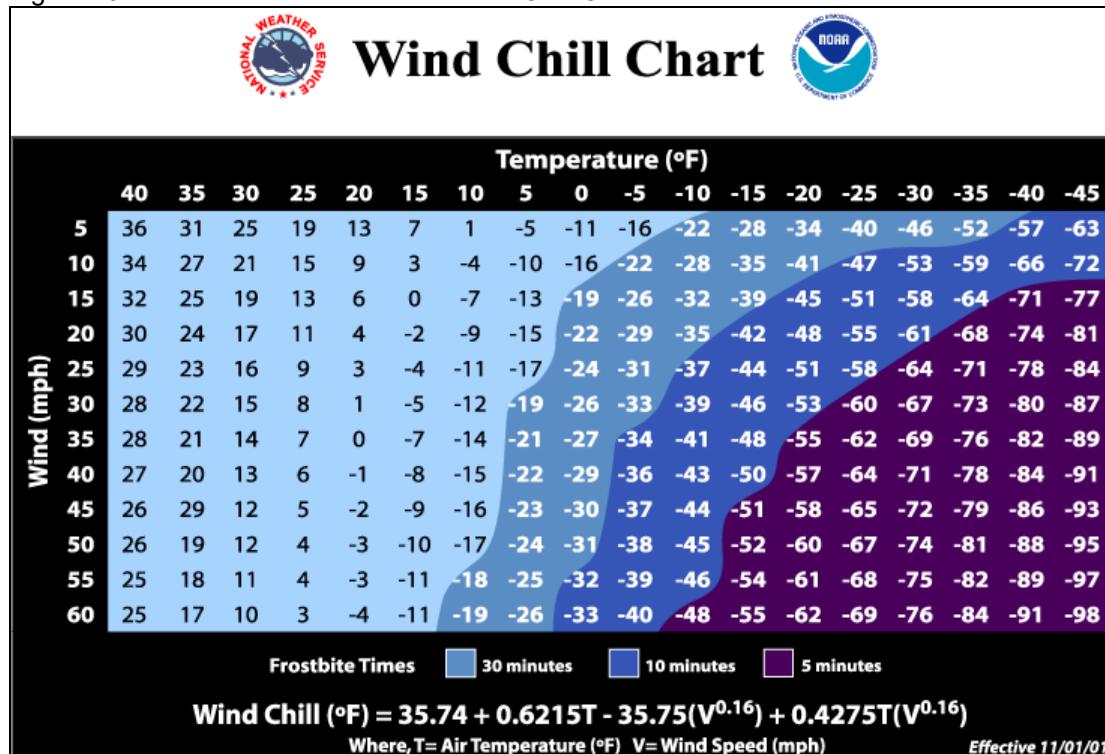
Figure 19. National Weather Service Heat Index



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 19 shows the NOAA Wind Chill Chart as it corresponds to various temperatures and wind speeds.

Figure 19. National Weather Service Wind Chill Chart



Source: National Weather Service

Figures 20 and 21 illustrate the daily observed temperatures at the NOAA weather station at Beaver Island and East Jordan in 2022 (dark blue line) in comparison to daily record maximum temperatures (red line), the daily normals temperature range, and daily record minimum temperatures (light blue line). East Jordan experienced warmer temperatures in the spring and summer months and colder temperatures in the fall and winter months compared to Beaver Island.

Figure 20. Daily Temperature Data Comparison for Beaver Island, 2022

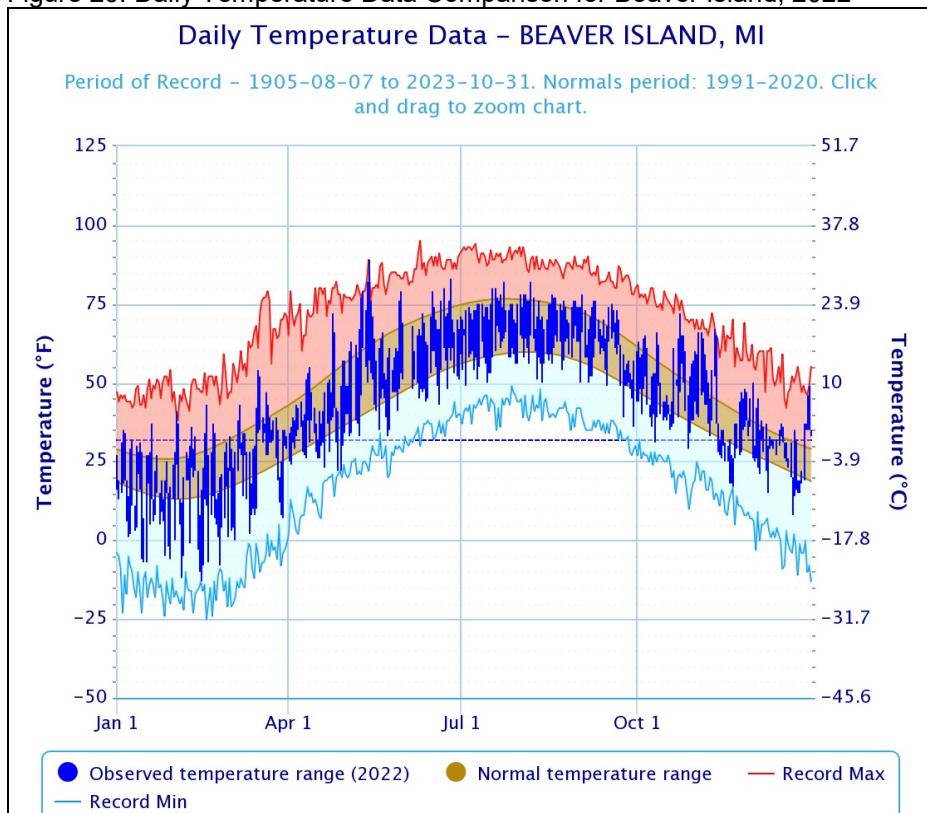
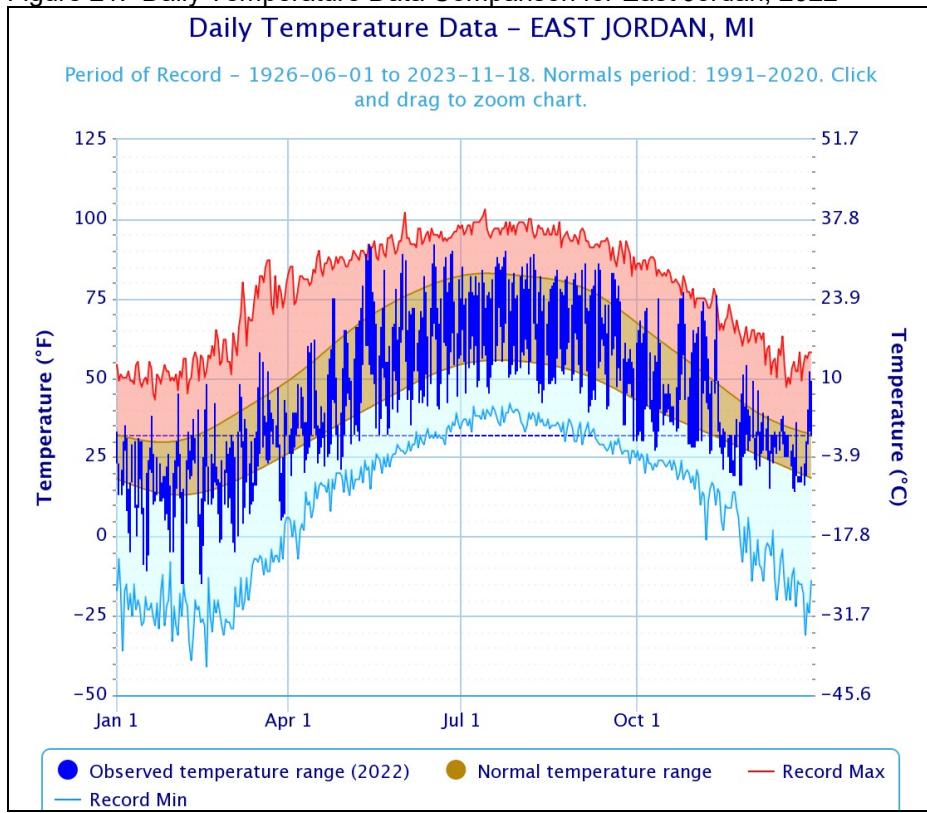


Figure 21. Daily Temperature Data Comparison for East Jordan, 2022



Source: NOAA Climate Data Online <https://www.weather.gov/wrh/Climate?wfo=apx>

Location and Extent

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

Previous Occurrences

Charlevoix County has had two extreme heat events that occurred in the summers of 2001 and 2018 (Table 47). The events were not associated with any reported 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 NOAA episode narratives are provided below:

The first instance of reported excessive heat occurred on August 1, 2001. Excessive Heat was 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.

Table 47. Extreme Heat Events, Charlevoix County

LOCATION	DATE	EVENT TYPE	INJURIES, DEATHS, DAMAGES	EVENT DESCRIPTION
CHARLEVOIX (ZONE)	8/1/2001	Heat	0	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.
CHARLEVOIX (ZONE)	6/30/2018	Excessive Heat	0	Highs were well into the 90s, including 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.

Source: NOAA: National Centers for Environmental Information

There have been four extreme cold events reported for Charlevoix County (in 2007, 2015, and 2019; Table 48). The events were not associated with any deaths, injuries, or property/crop damages. The low temperatures caused schools to close. However, since cold temperatures typically occur during winter months, many events may have gone unrecorded.

A Governor Declared Emergency for extreme cold was enacted in January 2019 for all 83 counties in the state.

Table 48. Extreme Cold Events, Charlevoix County

LOCATION	DATE	EVENT TYPE	INJURIES, DEATHS, DAMAGES	EVENT DESCRIPTION
Charlevoix, Cheboygan, Chippewa, Delta, Gogebic, Houghton, Mackinac, Marquette, Ontonagon, and Schoolcraft Counties	12/1993 through 5/1994	Underground Freeze*	0	Governor Declared Emergency and Presidential Declared Major Disaster (1028)
CHARLEVOIX (ZONE)	2/4/2007	Extreme Cold/wind chill	0	High temperatures on the 4th 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 extreme cold and poor road conditions.
Charlevoix, Cheboygan, Chippewa, Delta, Emmet, Gogebic, Luce, Mackinac, and Marquette Counties	12/13/2014	Deep Frost*	0	Governor Declared Emergency
CHARLEVOIX (ZONE)	2/14/2015	Extreme Cold/wind chill	0	A clipper system passing just north and east of Michigan would bring a multitude of weather hazards. Widespread light snow occurred ahead of the system's cold front, but that snow was enhanced by Lake Michigan into northwest lower Michigan. Snowfall totals of 6 to 8 inches were seen, especially west and southwest of Traverse City, with the highest amounts near Wellston. The coldest air of the winter so far surged in behind the cold front, along with gusty northwest winds and lake effect snow. Considerable snowfall, blowing and drifting snow, and low wind chills were realized in northwest lower Michigan. Across the rest of northern Michigan, away from the temperature-mitigating effects of Lake Michigan, wind chills reached warning criteria. Wind chills reached 30 to 40 below zero in northern lower Michigan, and 40 to 50 below zero in eastern upper, bottoming out at -49 in Dafter early in the morning of the 15th.

STATEWIDE	1/29/2019	Extreme Cold/wind chill	0	Governor Declared Emergency – 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.
-----------	-----------	-------------------------	---	--

Source: NOAA: National Centers for Environmental Information

Notes: * not an event recorded in the NOAA NCEI database; sourced from MSP 2019 *Michigan Hazard Analysis*

Probability of Future Events and Vulnerability Assessment

Since 2001, there have been two extreme heat events in Charlevoix County. This indicates there is an 8.7% annual chance than an extreme heat event would occur in a future year.

Since 1993, there have been five extreme cold events in Charlevoix County. This indicates there is about a 16.7% chance an extreme cold event would occur in a future 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, which means there may have been more extreme cold events in the county.

Extreme heat and cold events are more likely to impact unsheltered populations, such as the urban homeless population and people working or recreating outside. There are several locations that can serve as temporary emergency shelters in the county in the event of an extreme heat/cold emergency. The Charlevoix County Emergency Management Department maintains agreements with public schools, local fire departments/government offices and some churches for use of their buildings as secondary shelter sites.

Anecdotally, emergency personnel see more fatalities during extreme temperature events. Vulnerable populations may not be able to find or access heating or cooling stations or communicate their needs. In addition to human vulnerability to extreme temperatures, because heat is an additive, there are also environmental concerns when heat increases the risk of wildfire and drought.

The *Northwest Lower Michigan Coastal Resilience Atlas* written by the Land Information Access Association completed a Heat Vulnerability Assessment⁵ of coastal communities. A community's vulnerability is their exposure to the hazard (determined by tree canopy and impervious surface coverage) + their sensitivity. Sensitivity is determined by these factors:

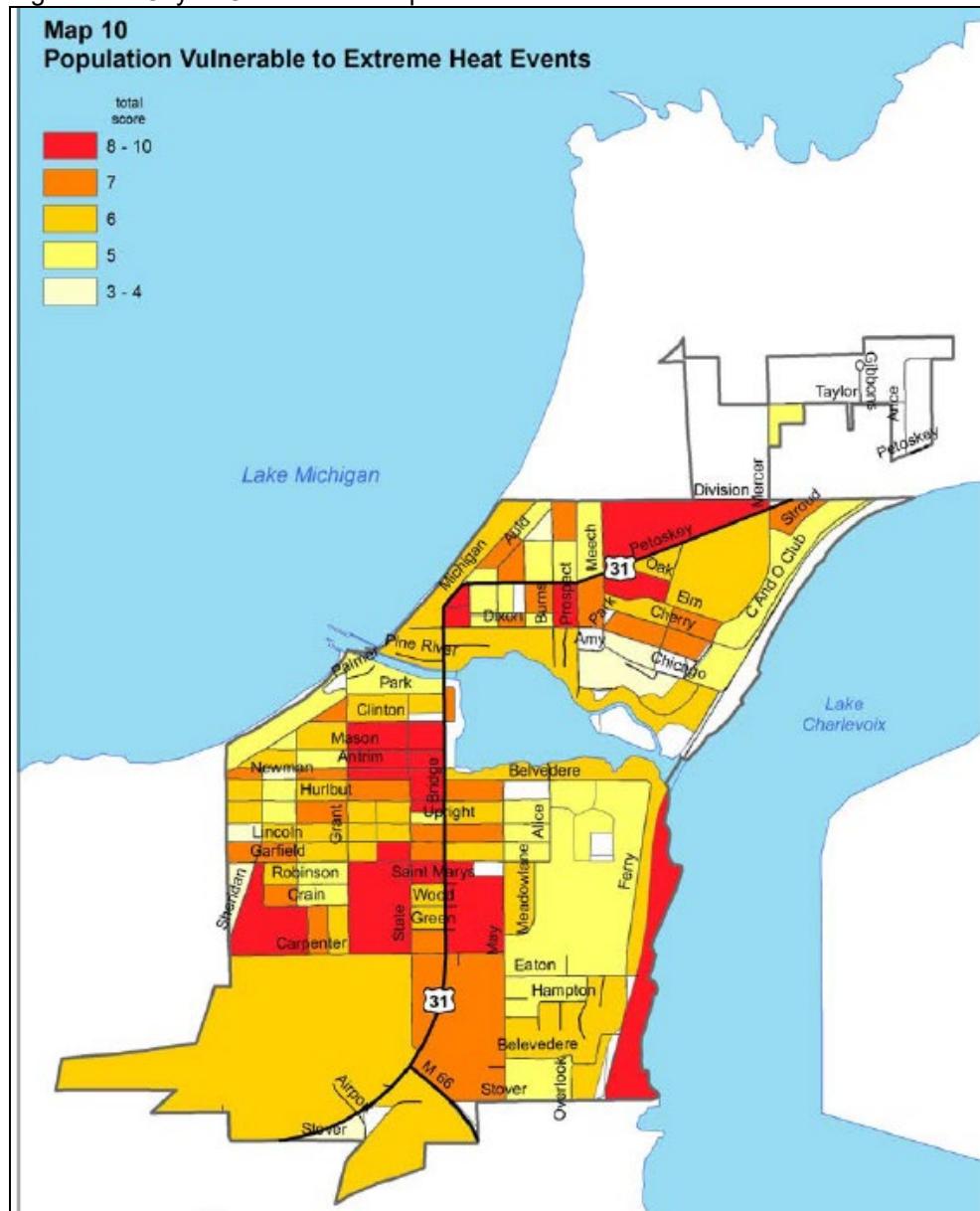
- Persons > 65 years
- Persons living alone
- Minority (non-white) persons
- Persons living below the poverty threshold
- People > age 25 with less than a high school education
- Disability status (i.e., ambulatory difficulty, mental disability)

Considering all of these factors, Figure 22 illustrates the vulnerability of the City of Charlevoix's population to extreme heat events. Similar maps were created in the *Atlas* for Hayes Township, Charlevoix Township, and Norwood Township.

According to US Census data, approximately 24.16% of Charlevoix County residents are over age 65; an estimated 9% of households are in poverty; an estimated 27% are considered "Asset Limited, Income Constrained, and Employed"; and an estimated 15.3% have one or more type of disability. Additionally, an estimated 55.62% of the housing stock in the county is over 40 years old. Many homes do not have air conditioning, which may be needed more often with expected increasingly warmer summers in Michigan.

⁵ Land Information Access Association. (2019). *Northwest Lower Michigan Coastal Resilience Atlas*. http://www.resilientmichigan.org/nw_atlas.asp

Figure 22. City of Charlevoix's Population Vulnerable to Extreme Heat Events



Source: LIAA Northwest Lower Michigan Coastal Resilience Atlas, page 791

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, but losses from drought are as substantial as those from hurricanes, tornadoes and other faster-moving disasters. Drought can cause agricultural loss; affects domestic water supply, energy production, public health, and wildlife; and contributes to wildfire risk.

Location

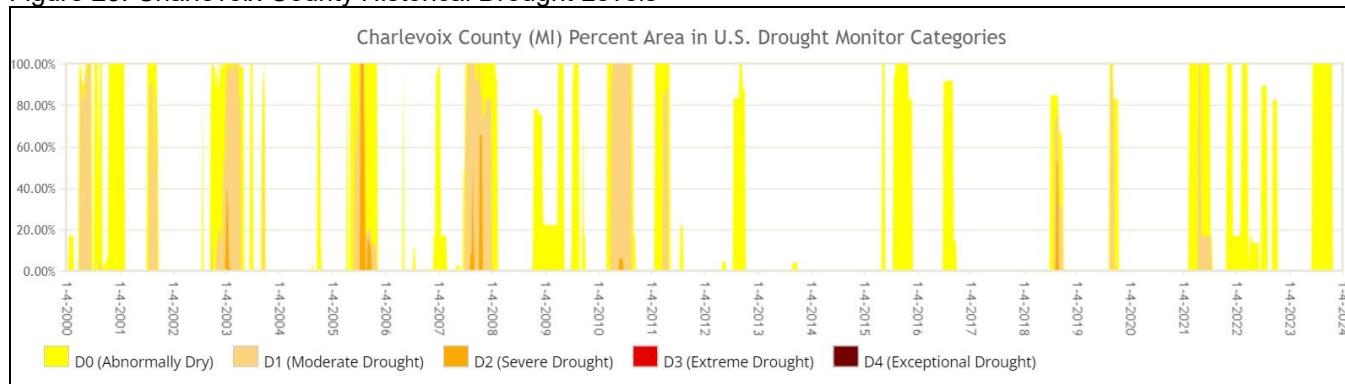
Drought is a regional event that is not confined to geographic boundaries and range in severity across the affected areas. All of Charlevoix County is at risk from the occurrence and impacts from drought.

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 (Figures 23 and 24) 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). Based on the historical data presented, Charlevoix County encountered its worst levels of drought D2 (severe drought) between 2000 and 2023 in the years 2003, 2005, 2007, 2010, and 2018.

Figure 23. Charlevoix County Historical Drought Levels



Source: US Drought Monitor

Figure 24. U.S. Drought Categories and Historically Observed Impacts

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 three major drought events on record for in Charlevoix County (Table 49). There were no reported deaths, injuries, or damages are associated with these events.

Table 49. Major Drought Events in Charlevoix County

LOCATION	DATE	EVENT TYPE	INJURIES, DEATHS, DAMAGES	EVENT DESCRIPTION
Charlevoix County and 43 other counties	3/2/1977	Drought	0	Federally Declared Emergency (3035)
Charlevoix County (Zone)	8/28/2007	Drought	0	Drought conditions (severe, D2) expanded into the tip of Northern Michigan by the end of August. Dry conditions dated as far back as May, when only 1.09 inches of rain fell in Pellston. June rainfall was 1.92 inches. July rainfall was near normal and brought some respite, but August saw just 1.21 inches of rain at Pellston. A ban on burning was issued for most of the state in mid-August, the first such ban since 1998. Golf courses and farmers complained of very high utility bills, due to the need for near-constant irrigation. Corn and bean crops were severely impacted. Rains in September would partially alleviate drought conditions for a spell.
Charlevoix County (Zone)	9/1/2007	Drought	0	Drought conditions (severe, or D2), which carried over from August, eased thanks to wet weather early in the month. Charlevoix County was removed from severe drought when around an inch of rain fell from the 3rd into the 4th.

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

Probability of Future Events and Vulnerability Assessment

There have been four occurrences of a drought incident affecting Charlevoix County since 1977. This indicates an 8.5% annual chance of a future drought event in Charlevoix County. In Northern Michigan's forested regions, drought can adversely impact timber and agricultural production and some tourism and recreational enterprises. This can also cause a drop in income, which impacts other economic sectors.

The biggest problem drought presents, however, is the increased threat of wildfire. Every community in the county has scattered areas of pine trees which are highly vulnerable to wildfire in drought conditions (see the Environmental Features map in Appendix A). Public input sessions for the development of this plan indicated particular concern for orchard areas located in Norwood, Marion and Eveline Townships, as well as areas of cedar trees and juniper shrubs on portions of Beaver Island that local residents indicate are also prone to wildfire. Additionally, many remote areas on Beaver Island, the islands in the Beaver Island archipelago, and on rural areas throughout the mainland portion of the county have limited access (via seasonal, narrow roads, or limited to air or boat transportation) in the event of a wildfire. The local fire departments in the County maintain agreements with some private landowners for water usage as needed for firefighting purposes.

Additionally, the threat to water sources should also be considered. Even drought events in category D1 experience water well level decline. Drought events combined with excessive heat can also have severe impacts on elderly and low income people.

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 are 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 wildfire is from human activities, specifically burning outdoor debris. Recently, only about 4% of all wildfires in Michigan were caused by lightning strikes, and most other causes have been attributed to human activity. Most Michigan wildfires occur close to where people live and/or 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 the affected area or who are using recreational facilities in the area. 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. Occasionally a thunderstorm will roll through and lightning will strike 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 often help 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 in the state of Michigan; an average of 145,000 acres per year. By comparison, it was reported that between 1950 and 1996, the MDNR and U.S. Forest Service 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.

Location

All Charlevoix County communities and developed areas are vulnerable to wildfires since the community centers and rural residential developments interface with the high-fire risk forest types (e.g. Red Pine, Eastern White Pine, and Jack Pine). In terms of tree type and coverage, pine forest composes about 4.5% of the county's total land area. There are 5,221.42 acres of Red Pine (3.1%), 1,227.65 acres of Eastern White Pine (0.73%), and 1,124.21 acres of Jack Pine (0.67%) in Charlevoix County. As shown in the Environmental Features map in Appendix A, Red Pine and Eastern White Pine forest types are scattered throughout the county. Jack Pine, the most flammable forest species in dry conditions, is located in areas of Norwood, Charlevoix, Hayes, Bay, Melrose, Eveline, Evangeline and Marion Townships. Much of the pine forest areas overlap with publicly owned lands.

Extent and Previous Occurrences

Extent can be measured by the number of acres burned and the cost of property damage. According to the Michigan State Police's *2019 Michigan Hazard Analysis*, between 1981 and 2018 there were 173 reported fires on land in Charlevoix County under MDNR jurisdiction. This resulted in 522.2 total acres burned, with an average of 13.7 acres burned and 4.6 wildfires per year. No property damages were recorded.

Probability of Future Events and Vulnerability Assessment

There is a 100% annual chance there will be a wildfire on MDNR lands, and a small chance there will be a wildfire on lands outside of these areas. Red Pine, Eastern White Pine, and Jack Pine forest are scattered throughout the county and are susceptible to wildfires. Jack Pine, the most flammable forest species in dry conditions, is located in areas of Norwood, Charlevoix, Hayes, Bay, Melrose, Eveline, Evangeline and Marion Townships. Much of the pine forest areas overlap with publicly owned lands.

Additional factors that increase fire risk include dead or dying trees as a result of disease/invasive species, invasive species itself, 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 parts of the 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.

Every community in the county has scattered areas of pine trees which are highly vulnerable to wildfire in drought conditions (see the Environmental Features map in Appendix A).

Public input sessions for the development of this plan indicated particular concern for wildfire that could impact the orchard areas located in Norwood, Marion and Eveline Townships. Beaver Island stakeholders indicated that there are areas of cedar trees and juniper shrubs on portions of the island that are also prone to wildfire. Additionally, many remote areas on Beaver Island, including the islands in the Beaver Island archipelago (although only Trout and Squaw/Ojibwe Islands contain residential homes), and rural areas throughout the mainland portion of the county have limited access (via seasonal, narrow roads, or limited to air or boat transportation). Outer islands in the Beaver Island archipelago are subject to wildfires occurring from lightning strikes.

Ensuring proper access to water for emergency firefighting use was also brought up as a concern. In particular, there is a lack of an accessible water drafting capability around Thumb Lake in Hudson Township. The Lake Louise Christian Community summer camp and many residential homes surround Thumb Lake. Representatives from the Melrose Township Volunteer Fire Department and the Lake Louise Christian Community have expressed the need to provide access on Thumb Lake to fire trucks for water intake. It has been suggested by stakeholders to modify the parking lot at Thumb Lake County Park to make it accessible for a fire truck, and/or install a standpipe near the lake that is easily accessible by a fire truck. Currently all the local fire trucks are equipped with portable pumps. The next closest access to fill a tanker truck is a DNR site just over two miles away from Thumb Lake County Park. These improvements would enhance the response times for fire protection on or around Thumb Lake in the east side of the County.

The local fire departments in the County maintain agreements with some private landowners for water usage as needed for firefighting purposes.

Once Beaver Island's "Create a Community Wildfire Protection Plan" (CWPP) is created, local officials intent to apply for related grants to implement the plan. Part of this plan would be to add two buried 30,000 gallon water tanks (in addition to the existing tank at the east side fire hall) at the south and west ends of the Island, to provide water sources for firefighting use.

Dense Fog

Fog forms when water vapor condenses into tiny liquid water droplets that remain suspended in the air just above the Earth's surface, reducing visibility to values equal to or below locally/regionally established values for dense fog (usually 1/4 mile or less) and impacting transportation or commerce.

Two ways that air can become saturated with water are by cooling it to its dew point temperature, or by evaporating moisture into it to increase its water vapor content. Although most fog, by itself, is not generally a hazard because it does not actually apply damaging forces, the interaction between humans and fog can be a dangerous situation, sometimes resulting in disastrous consequences. It must be noted, however, that freezing fog (a hazard for which the National Weather Service issues special statements) can cause direct harm by causing slickness on roadways, walkways, bridges, and highway ramps, and therefore leading to serious transportation accidents.

Fog is not so easy to classify as a severe and high-impact hazard, although it has caused costs and casualties in the transportation sector, sometimes with deadly consequences. Fog has played a contributing role in several multi-vehicle interstate highway pileups during recent years. While statistics suggest that highway accidents and fatalities, in general, have fallen, that trend is not evident with respect to accidents and fatalities caused by fog. The vast majority of automotive accidents are caused by unsafe driving habits and risk-taking behaviors, such as following too closely behind another vehicle, driving too fast for weather and visibility conditions, and distracted driving. Airplanes have their own inherent vulnerabilities when fog develops, making a safe landing more difficult.

Fog can be very dangerous when it reduces visibility. Although some forms of transport can penetrate fog using radar, road vehicles have to travel slowly and use their lights to become visible to each other. Localized fog is dangerous if drivers are surprised by it. At airports, some efforts have been made to develop methods (such as using heating or spraying salt particles) to aid fog dispersal, especially at temperatures near or below freezing.

One severe fog event is estimated to occur in Michigan approximately every two years. Property damage can be significant for vehicles, although real property and structures are usually unaffected. Fog has not yet been identified as one of the most significant hazards in any of Michigan's local hazard mitigation plans.

Location

Dense fog can be a local, regional, or state-wide event that is not confined to geographic boundaries and ranges in severity across the affected areas. All of Charlevoix County is at risk from a dense fog event.

Extent / Previous Occurrences

Dense fog can be measured by damages-caused including deaths, injuries, property damages, and/or crop damages. While there is no record of a dense fog event for Charlevoix County in the NOAA NCEI Storm Events Database, the Supervisor for St. James Township provided a description of recent dense fog events affecting travel to Beaver Island:

"Between January 1 and February 22, 2024, fog over the City of Charlevoix and /or Beaver Island prevented flights and delayed travelers to and from the island. In some cases these delays lasted several days. Medical emergencies on Beaver Island during this period which required evacuation were completed by the Traverse City-based air wing of the USCG. During this time, there were 10 days with zero flights and another 21 days affected by weather resulting in intermittent flying. Weather delays, most of which were fog-based due to unseasonably warm weather, and others were due to our usual winter weather, affected 54% of the first 53 days of 2024.

In addition, the summer of 2023 was the worst on record for summer flying days due to the fog created by forest fires in Canada (as related to climate change)."

Probability of Future Events and Vulnerability Assessment

Dense fog events are likely to occur more frequently, but go unreported to NOAA if there are no injuries, deaths and damages associated with the event. All transportation modes in Charlevoix County - particularly air transportation servicing Beaver Island - are at risk from disruptions caused by dense fog. The continued and increased use of NOAA Weather Radio and mobile alert systems can inform people of hazardous conditions and the appropriate precautions to take (such as limiting travel) during a dense fog event.

Coastal Hazards - 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 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 a while 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.

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

Location

Dangerous currents are coastal events that are not confined to geographic boundaries and may occur anywhere in Lake Michigan waters. All coastal areas in Charlevoix County are at risk from the occurrence and impacts from dangerous currents.

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 currents can be measured by damages-caused including deaths and injuries.

Previous Occurrences

There are no records of dangerous current incidents (deaths/rescues) on record for Charlevoix County. However, it is likely that these events have occurred but gone unreported. There are instances of fatalities from rip currents in nearby coastal counties including Benzie, Emmet, and Leelanau Counties.

Probability of Future Events and Vulnerability Assessment

Dangerous current events are likely to occur, but may go unreported as injuries and deaths do not occur. Strong currents are dangerous to all swimmers, especially those who are unprepared to be swept up in them. Many Lake Michigan beaches do not have a lifeguard on duty who may identify potential hazardous swimming conditions. Swimmers who are caught unaware may panic when caught up in the fast-moving water, tire as they try to swim against the current, and drown. Public beaches with Lake Michigan access in Charlevoix County are located in Charlevoix Township, the City of Charlevoix, Hayes Township, Norwood Township, Peaine Township, and St. James Township.

Coastal Hazards - Seiche

According to the National Weather Service, a seiche is a standing-wave oscillation in any enclosed lake that continues after a forcing mechanism has ceased and results in shoreline flooding and/or damage. In the Great Lakes and large inland lakes, large pressure differences, high winds, or fast-moving squall lines may act as the forcing mechanism. In addition, earthquakes or debris flows can initiate a seiche. When the forcing mechanism ends, the water sloshes back and forth from one end of the lake to the other, causing water level fluctuations of up to several feet before damping out.

A seiche is usually limited to partially or fully enclosed basins, such as Lake Erie. Lake Erie is known for seiches, 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 in Michigan 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 or on large inland lakes. All coastal areas are at risk from the occurrence and impacts from a seiche.

Extent and Previous Occurrences

Seiche events can be measured by damages-caused including deaths, injuries, and property damages. There are no seiche events on record for Charlevoix County in the NOAA Storm Events Database.

However, the [Lake Charlevoix Association's website](#) describes the occurrence of seiche activity on Lake Charlevoix. Because Lake Charlevoix is directly connected to Lake Michigan through the Pine River Channel in Charlevoix, its water level fluctuates with that of Lakes Michigan and Huron. In fact, the Pine River can flow in both directions! Most of the time, water flows out of Lake Charlevoix through the channel, but sometimes the flow is reversed due to a seiche, when the rise in water level at one end of the lake caused is by wind-driven waves; in this case, westerly winds push water up along Lake Michigan's eastern shore, causing the Pine River to flow back into Lake Charlevoix. The current can be quite strong either way.

Probability of Future Events and Vulnerability Assessment

Seiche events have likely occurred along the Lake Michigan coastline in Charlevoix 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 those on Lake Charlevoix and in St. James Harbor), are vulnerable to high waves and temporary high lake levels 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.

Coastal Hazards - Waterspout

NOAA defines a waterspout as a "funnel which contains an intense vortex, sometimes destructive, of small horizontal extent and which occurs over a body of water." Tornadic waterspouts generally begin as true tornadoes over land in association with a thunderstorm, and then move out over the water. They can be large and are capable of considerable destruction, and are often accompanied by high winds and seas, large hail, and frequent dangerous lightning.

Fair weather waterspouts, on the other hand, form only over open water. They develop at the surface of the water and climb skyward in association with warm water temperatures and high humidity in the lowest several thousand feet of the atmosphere. They are usually small, relatively brief, and less dangerous. The fair weather variety of waterspout is much more common than the tornadic.

Waterspouts occur most frequently in northern Michigan during the months of August, September, and October, when the waters of the Great Lakes are near their warmest levels of the year. Waterspout formation typically occurs when cold air moves across the Great Lakes and results in large temperature differences between the warm water and the overriding cold air. They tend to last from about two to twenty minutes, and move along at speeds of 10 to 15 knots.

There are five stages of waterspout formation:

1. Dark spot. A prominent circular, light-colored disk appears on the surface of the water, surrounded by a larger dark area of indeterminate shape and with diffused edges.
2. Spiral pattern. A pattern of light and dark-colored surface bands spiraling out from the dark spot which develops on the water surface.
3. Spray ring. A dense swirling annulus (ring) of sea spray, called a cascade, appears around the dark spot with what appears to be an eye similar to that seen in hurricanes.
4. Mature vortex. The waterspout, now visible from water surface to the overhead cloud mass, achieves maximum organization and intensity. Its funnel often appears hollow, with a surrounding shell of turbulent condensate. The spray vortex can rise to a height of several hundred feet or more and often creates a visible wake and an associated wave train as it moves.
5. Decay. The funnel and spray vortex begin to dissipate as the inflow of warm air into the vortex weakens.

According to NOAA's National Weather Service, the best way to avoid a waterspout is to move at a 90-degree angle to its apparent movement.

Location, Extent and Previous Occurrences

Waterspouts are a common occurrence posing a great threat to marine traffic. According to the MSP's 2019 *Michigan Hazard Analysis*, Michigan waterspouts have been noted by National Climatic Data Center between 1993 and 2001. Many additional events have occurred since, which NCDC has classified according to the corresponding lake location rather than as part of Michigan itself. Waterspouts are less frequent on Lake Superior (8 events since 2001) than on Lakes Huron (23 events) or Michigan (51 events).

There are no Great Lakes waterspout events on record with NOAA's NCEI Storm Event Database for Charlevoix County.

Waterspouts typically last from about two to twenty minutes, and move along at speeds of 10 to 15 knots. They can overturn watercraft and cause damage to bridge structures and According to the MSP's 2019 *Michigan Hazard Analysis*, a waterspout caused \$200,000 in damage to a boat house and storage building at Drummond Island (Lake Huron) on July 3, 1999.

Probability of Future Events and Vulnerability Assessment

Despite the lack of a recorded Lake Michigan waterspout event with the NOAA NCEI Storm Event Database for Charlevoix County, it is likely that waterspouts have occurred in the past, but have not been officially documented.

The National Weather Service (NWS) meteorologists consider forecasting waterspouts during the late summer and fall whenever large, cool air masses overspread the waters of the Great Lakes. Once the NWS has determined that waterspouts are possible, the threat is outlined in the [Nearshore Marine Forecast](#) and [Hazardous Weather Outlook](#). The NWS strives to provide this information to the public 12 to 24 hours prior to waterspout occurrence.

When waterspouts have been detected by Doppler radar or reported by local law enforcement or spotters, the NWS issues a [Special Marine Warning](#). Since it is not uncommon for numerous waterspouts to occur simultaneously over a large area, these warnings tend to cover larger geographic areas than land-based tornado warnings which generally cover a single county.

In most cases, waterspouts which make landfall are much weaker than tornadoes, produce little or no damage, and dissipate quickly. Once on land, they tend not to be a great threat to life and property. In these instances, the NWS issues a [Tornado Warning](#).

A mitigation strategy for marine vessel operators on the Great Lakes includes education and awareness about the prevailing weather conditions, appearance and destructive potential related to waterspouts. When warnings are issued for waterspouts, boaters should be prepared to quickly seek safe harbor, or to find shelter out of the path of the waterspout. The best source for waterspout forecast information is [NOAA Weather Radio \(NWR\)](#). These continuous broadcasts from transmitters scattered around the Great Lakes provide forecasts and warnings 24 hours a day. Mobile emergency alert systems can also be utilized as an informational source for waterspout forecasts and warnings.

Coastal Hazards - Coastal Recessions and Shoreline Flooding

Coastal recession (erosion) 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. Waters of the Great Lakes may cause shoreline hazards to occur, making the entire northwest Michigan coastline susceptible to shoreline hazards. As indicated in Figure 25, 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.

Most of the northwest Michigan coastline is susceptible to coastal recession and shoreline flooding.

Figure 25. Great Lakes Shorelines with High Risk Erosion Areas, 2019

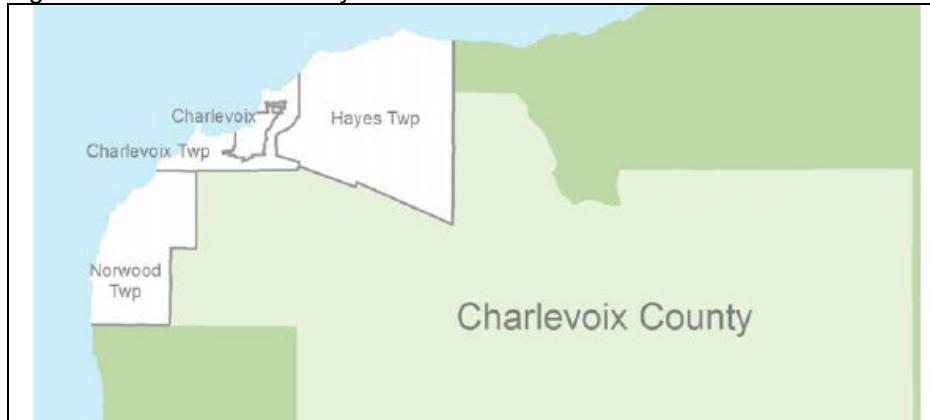


Location

To reference the 2019 *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 Land Information Access Association documented potential shoreline hazards for these communities in Charlevoix County in the *Northwest Lower Michigan Coastal Resilience Atlas*: Hayes Township, Charlevoix Township, the City of Charlevoix, and Norwood Township (Figure 26). This study did not include the Beaver Island townships of Peaine or St. James. Specific areas of shoreline hazards in the county, as identified by stakeholders during the public input process for the development of this plan, are marked as a “shoreline erosion” type of hazard area on the Hazard Area Maps in Appendix A.

Figure 26. Charlevoix County Shoreline Communities in LIAA’s Northwest Lower MI Coastal Resilience Atlas



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:

“Lucky” 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: 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: 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.

Figures 27 and 28 illustrate the potential flooding scenarios in parts of the City of Charlevoix and Hayes Township as examples. “Lucky” scenario flooding is shown in green, “Expected” flooding scenario is shown in yellow, and “Perfect Storm” future scenario is shown in red. Note that parts of US-31 and Round Lake are expected to flood in certain scenarios.

Figure 27. Panel #53 Coastal Flooding Scenario, City of Charlevoix

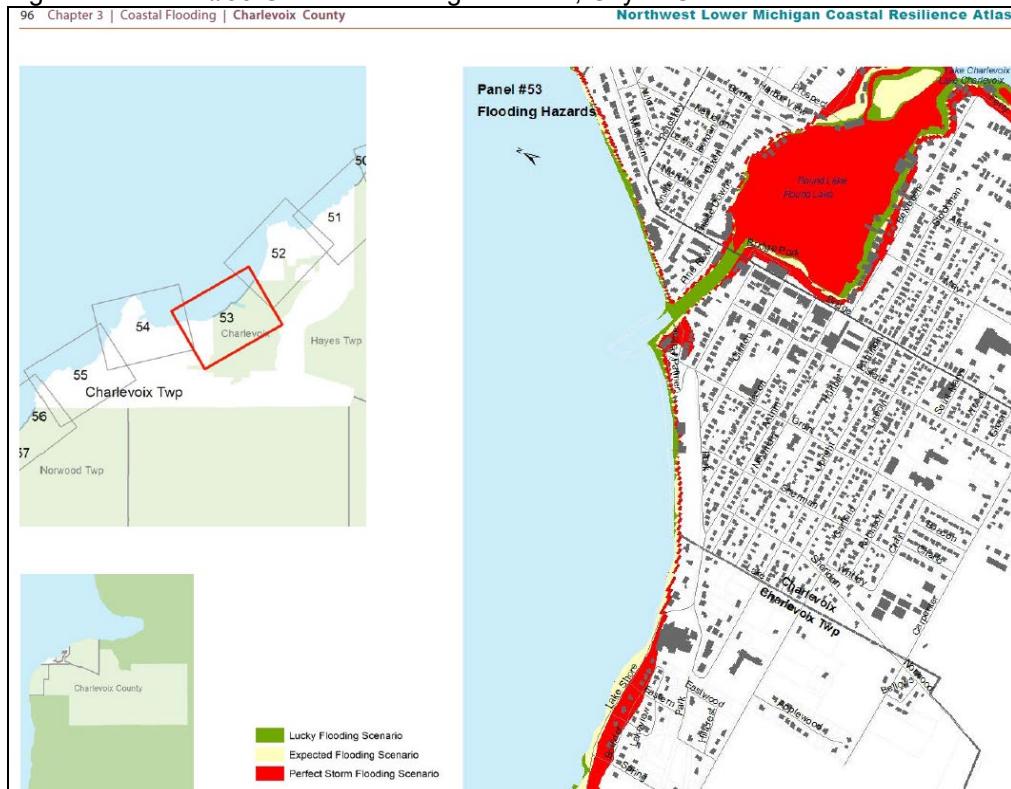
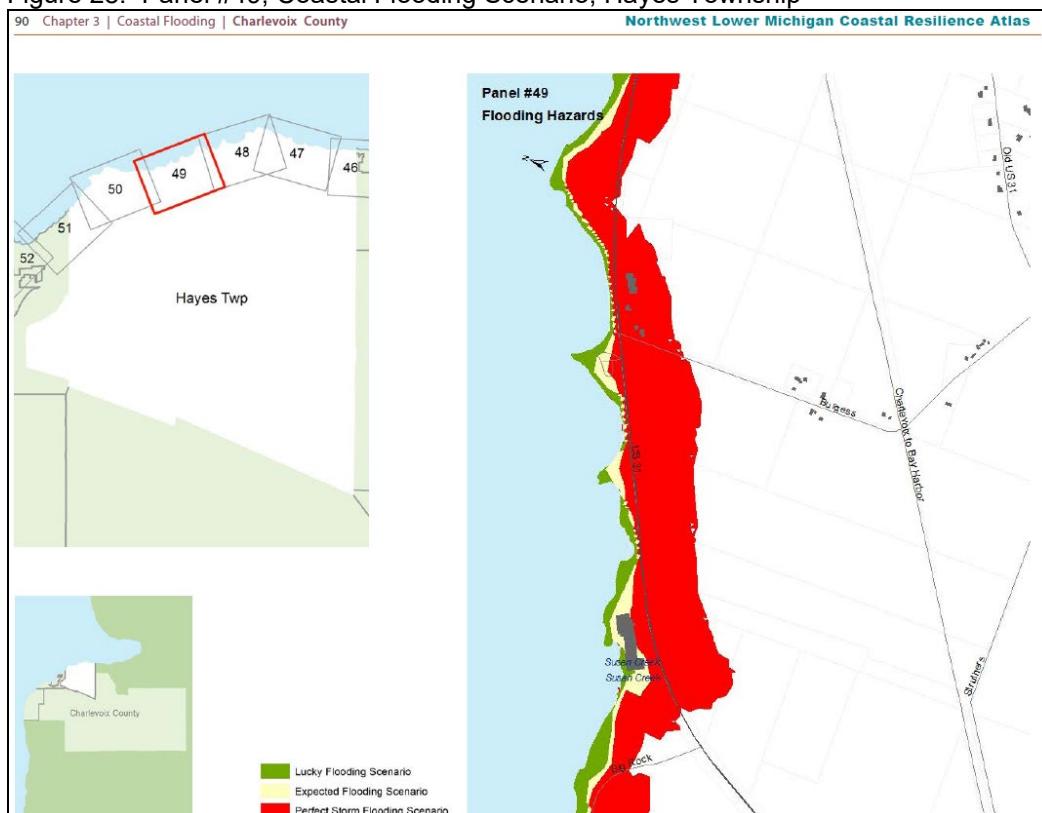
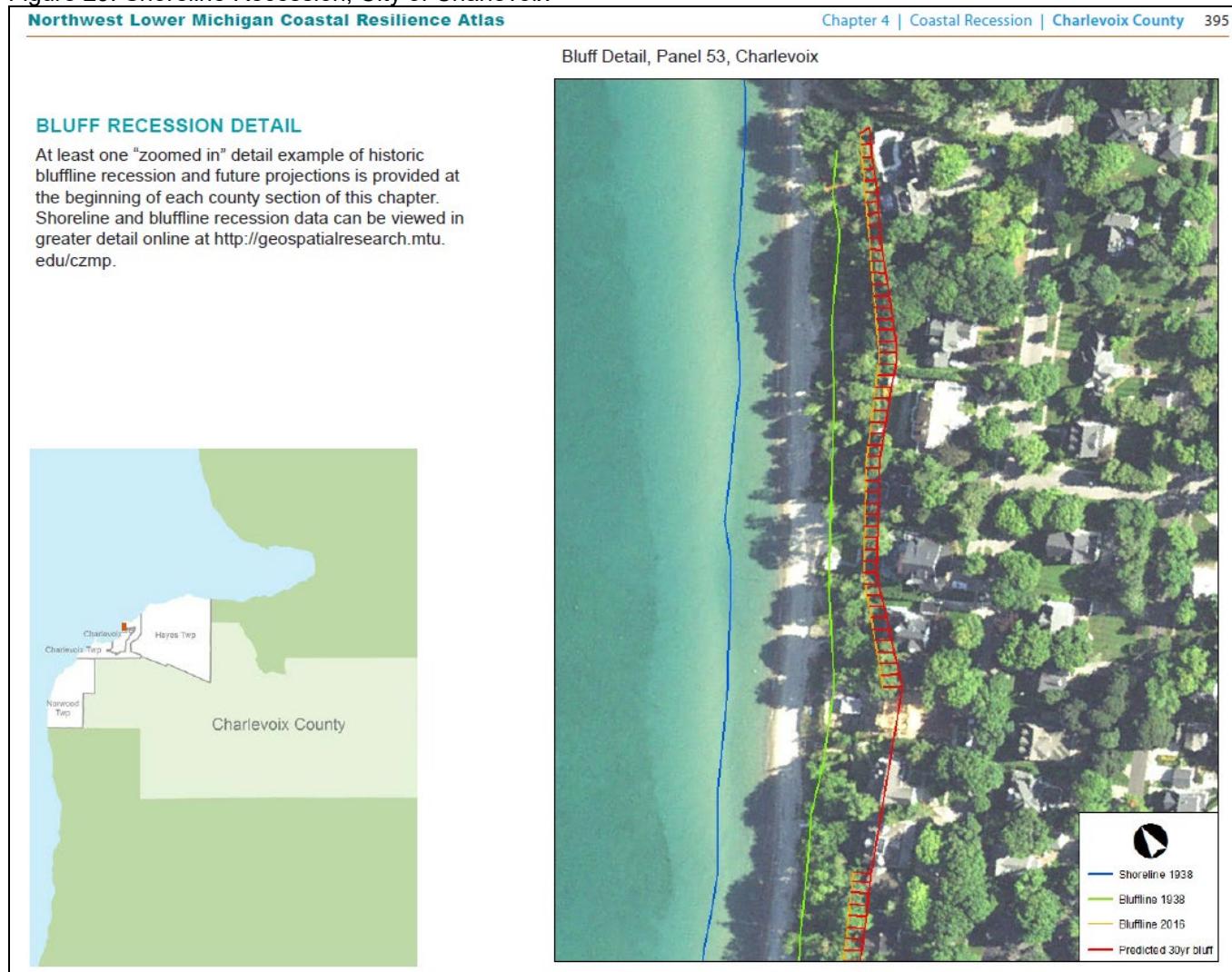


Figure 28. Panel #49, Coastal Flooding Scenario, Hayes Township



Coastal recession, or erosion, to Lake Michigan communities is a constant, but 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 Lake Michigan coastal communities. Chapter 4 of the *Northwest Lower Michigan Coastal Resilience Atlas* describes bluffline recession since the 1938 recorded shoreline location. The colored lines shown on the map in Figure 29 depicts the recession of the bluffline in part of the City of Charlevoix. 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.

Figure 29. Shoreline Recessions, City of Charlevoix



Source: LIAA, Northwest Lower Michigan Coastal Resilience Atlas

The communities of Charlevoix Township, Norwood Township, St. James Township, Peaine Township and small areas within the City of Charlevoix contain State-designated "Critical Dune Areas" (CDAs). CDAs are a combination of coastal barrier dunes, land that has dune-like features, and unique plant communities along a Great Lake 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 (NREPA, Act 451 of 1994). 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. A permit is required 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. Currently EGLE administers Part 353 for all CDAs within the mainland of Charlevoix County, while St. James Township and Peaine Township regulate CDAs within their local zoning ordinances.

The CDAs in Charlevoix County are shown as Figures 30 through 32, as well as on the Environmental Features Map in Appendix A. Detailed maps of CDAs provided by EGLE can be viewed at: <https://www.michigan.gov/egle/about/organization/water-resources/sand-dunes/critical-dunes/maps>.

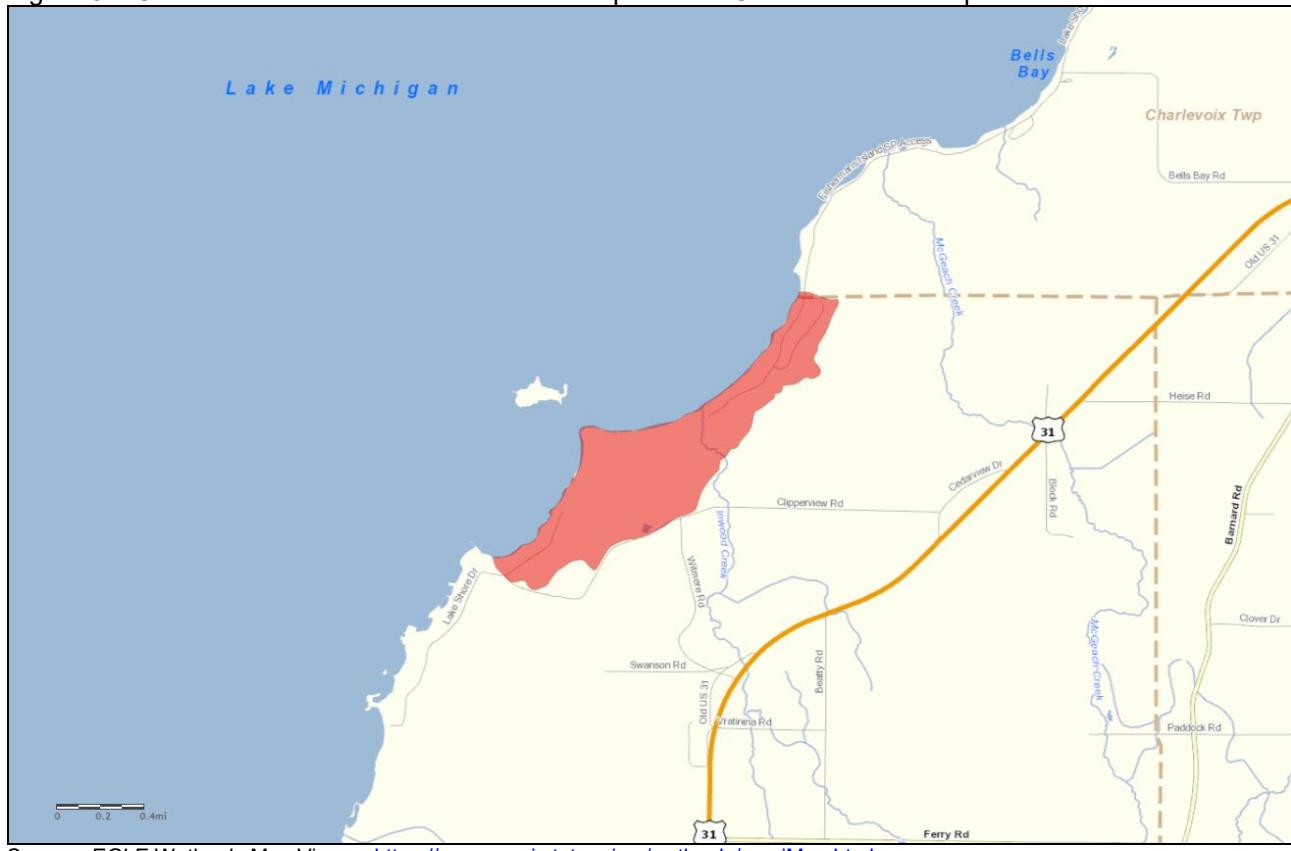
There are no High-Risk Erosion Areas (HREAs) within Charlevoix County. HREAs are shorelines of the Great Lakes where the land is receding at a rate of one foot or more per year for a minimum of 15 years. Recession rates change over time as water levels fluctuate and coastal conditions change. Along these 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 of a structure on any portion of a designated High-Risk Erosion Area 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.

Figure 30. Critical Dune Areas in Charlevoix Township and the City of Charlevoix



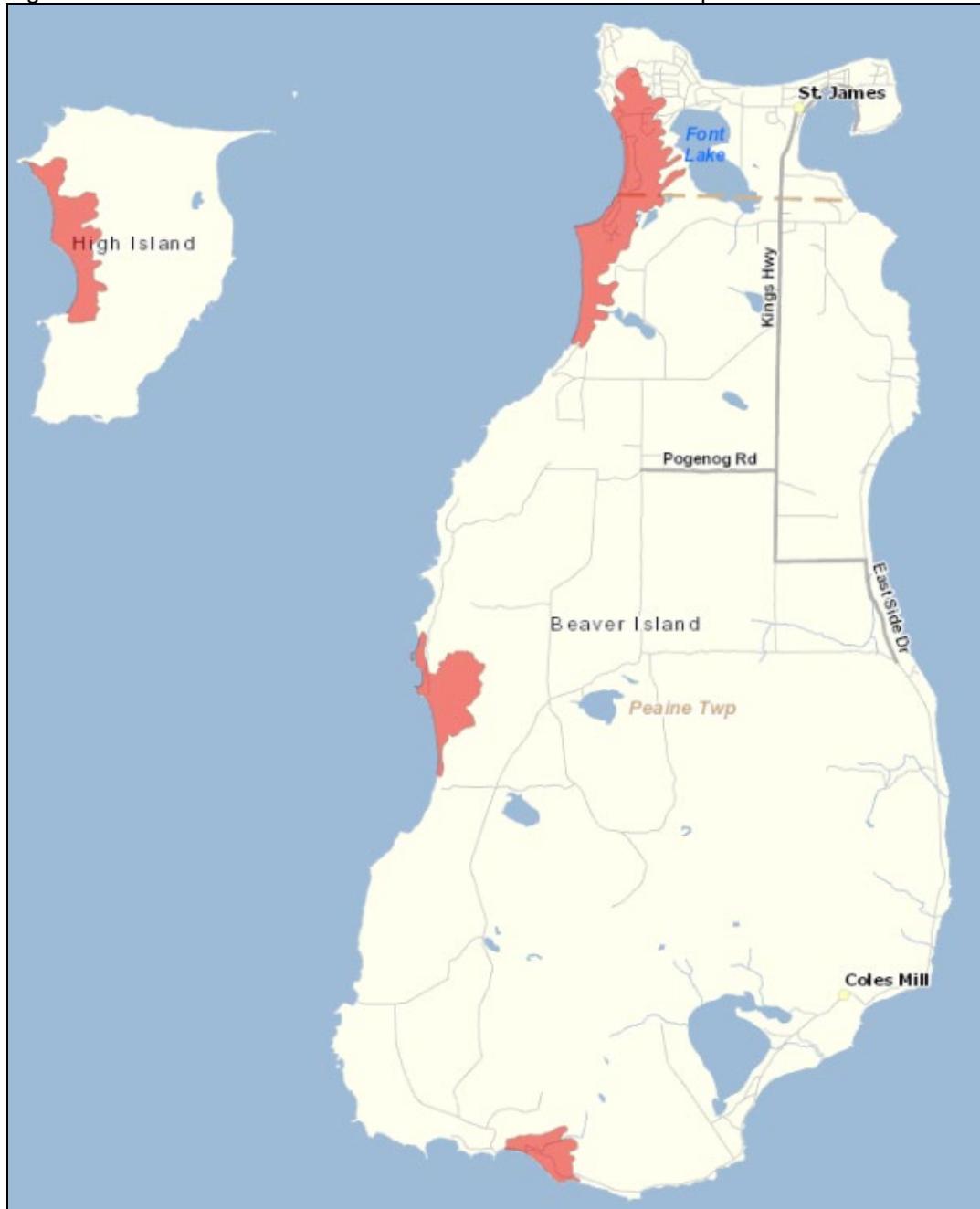
Source: EGLE Wetlands Map Viewer, <https://www.mcgi.state.mi.us/wetlands/mcgiMap.html>

Figure 31. Critical Dune Areas in Norwood Township and the Charlevoix Township



Source: EGLE Wetlands Map Viewer, <https://www.mcg1.state.mi.us/wetlands/mcg1Map.html>

Figure 32. Critical Dune Areas in St. James and Peaine Townships



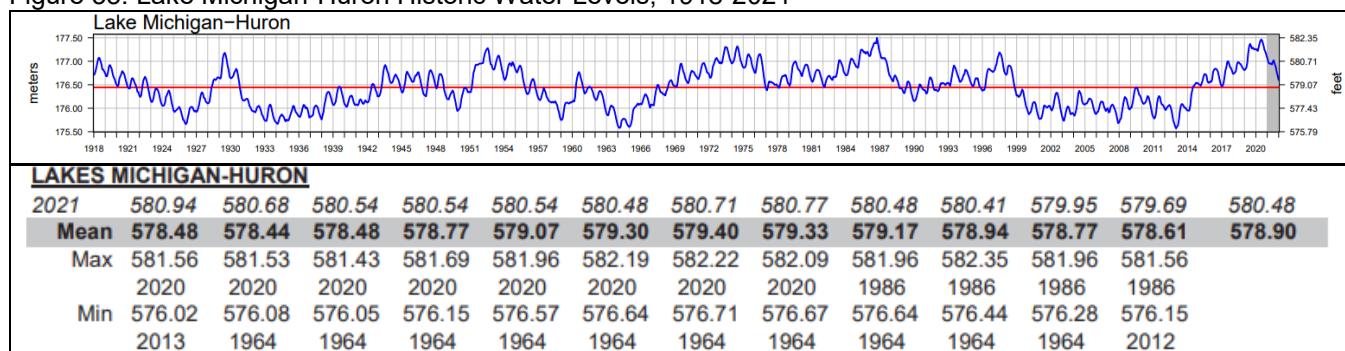
Source: EGLE Wetlands Map Viewer, <https://www.mcqi.state.mi.us/wetlands/mcqimap.html>

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 33), and damages. The three lakeshore flooding events in 2019 and 2020 caused \$235,000 in property damages in Charlevoix County (Table 50).

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 feet, only second to the October 1986 monthly record high of 582.35 feet.

Figure 33. Lake Michigan-Huron Historic Water Levels, 1918-2021



Source: US Army Corps of Engineers

Previous Occurrences

In the past four decades, the Great Lakes experienced record high lake levels in 1985-86, 1997-98, and most recently in 2019-20. Three lakeshore flood incidents are recorded with NOAA for Charlevoix County (Table 50).

Table 50. Shoreline Flooding Events

LOCATION	DATE	EVENT TYPE	DEATHS / INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Charlevoix County	10/21/2019	Lakeshore Flood	0 / 0	\$80,000	\$ -
Charlevoix County	4/13/2020	Lakeshore Flood	0 / 0	\$150,000	\$ -
Charlevoix County	11/15/2020	Lakeshore Flood	0 / 0	\$5,000	\$ -
TOTAL				\$235,000	\$ -

Source: NOAA NCEI Storm Events Database

The episode and event narratives of the October 21, 2019 lakeshore flood event:

Strong northerly to easterly winds resulted in another round of substantial coastal flooding and beach erosion, this time on both Lake Michigan and Lake Huron, for the 21st into the 22nd.

Just west of Bayshore, a portion of the Little Traverse Wheelway Bike Path was destroyed [Hayes Township].

The narrative of the April 13, 2020 lakeshore flood event:

Strong low pressure passed just north of eastern upper Michigan on the morning of the 13th. Gusty west to northwest winds developed during the day, in the wake of the low. Gusts of 40 to 50 mph were common across northern Michigan, especially during the afternoon. The highest measured wind gust was 58 mph at the airport in Gaylord. Some localized power outages resulted. Lakeshore flooding also occurred along portions of the Lake Michigan coastline of northwest lower Michigan. The city boat launch in Frankfort experienced flooding of docks and the parking lot. And severe coastal erosion destroyed a portion of the Little Traverse Wheelway between Petoskey and Charlevoix [in Emmet County].

The episode and event narratives for the November 15, 2020 lakeshore flood event:

Gusty winds increased on the 15th, as strong low pressure moved directly over northern Michigan before departing. Gusts of 50 to 55 mph were common along the Lake Michigan coastline. A peak gust of 59 mph was measured at Grand Traverse Light. Hunting activities were significantly disrupted (the 15th is opening day of the firearms season for deer in Michigan). Lakeshore flooding also developed along portions of Lake Charlevoix.

Boyne City experienced flooding along the shore of Lake Charlevoix. Veterans Park and streets near the park flooded, resulting in a few vehicles being briefly stranded.

Probability of Future Events and Vulnerability Assessment

There have been three lakeshore flooding events in Charlevoix County between 2019 and 2023. These events occurred at the same time as near-record high Great Lakes water levels.

As lake water levels fluctuate and increased storminess occurs, shoreline recession and flooding will continue. In 2021 the level of Lake Michigan began to decline, however, as historic data indicates, the water will begin to rise again. Historic lake level fluctuations have ranged between 3 to 16 year intervals (Figure 58).

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 not a permanent solution.

Shoreline flooding can also result in soil erosion, which carries a risk of loss to shoreline properties. It may necessitate the relocation of homes or other structures 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. Shoreline flooding and erosion is especially relevant to those municipalities that contain residential and commercial development along Lake Michigan that experience seasonal shifts in water levels and possible ice erosion hazards.

In general, infill development of vacant lots or replacement of older houses with larger, new houses continues to occur near FEMA-designated FIRM flood zones along shorelines of the Lake Michigan, Lake Charlevoix or Walloon Lake.

In 2016, the Land Information Access Association (LIAA), a nonprofit community services organization based in Traverse City, Michigan, and the Tip of the Mitt Watershed Council (Watershed Council), a nonprofit committed to watershed protection in the northern portion of the Lower Peninsula of Michigan, worked with the seven townships and three cities around Lake Charlevoix⁶ to develop recommended best zoning standards to protect the water quality of Lake Charlevoix. Zoning changes that assist with shoreline protection efforts were made for specific categories including:

- High water elevation
- Shoreline setbacks
- Greenbelts or vegetated buffer strips
- Engineered stormwater control systems
- Maximum impervious surface lot coverage
- Conditions for issuance of zoning permits
- Formal planning commission site plan review
- Shoreline protection structures
- Keyhole and funneling practices
- Number and use of docks

It was noted that due to existing development patterns (e.g., smaller lot sizes, shallow setbacks, etc.) and the presence of highly disturbed sites within the three cities, the application of some of the recommended shoreline zoning standards is impractical and adjustments could be made to meet each community's specific needs.

In 2022 and 2023, the Lake Charlevoix Association (LCA), a nonprofit that was established to protect the lake for present and future generations, worked with LIAA and the Watershed Council to build upon this work and create a unified vision for the lake. The resulting [2023 Lake Charlevoix Shoreline Protection Report](#) contains three categories of recommendations.

⁶ Portions of seven townships (Bay, Charlevoix, Evangeline, Eveline, Hayes, South Arm, and Wilson) and three cities (Boyne City, City of Charlevoix, and City of East Jordan).

The first is lake-wide recommendations that all local governments around Lake Charlevoix should pursue:

- Shoreline protection education for the public, realtors and contractors working on shoreline projects
- Coordination on permitting amongst local, state and federal governments
 - Local governments should comment on State permit applications
 - Invite State permitting staff to attend a planning commission/board of trustees meeting
 - Require all other relevant permits to be obtained prior to local zoning permit approval
- Ban construction of vertical seawalls
- Ban inland dredging for the creation of boat basins
- Use bonding or specific predetermined fines to ensure conditions of shoreline protection ordinances are met
- Reinvigorate the annual Charlevoix County Planner's Forum
- Attend the Lake Charlevoix Watershed Advisory Council Meetings
- Improve the permit application process
- Local government officials should attend training(s)

The second set of recommendations are zoning and is additional lake-wide consideration options that will require additional discussion, communication and collaboration among all the municipalities.

- Waterfront zoning protections
- Zoning overlay district
- Have an effective non-conforming use ordinance
- Enact a county-wide zoning ordinance/administration
- Contract with a third-party for review and enforcement of shoreline ordinances
- Adjust the Ordinary High Water Mark based on anticipated higher water levels and threats posed by storms due to climate change.
- Enact local short-term rental ordinances to protect against septic system failure

The third category is a list of recommendations tailored generally to cities, townships, and to each jurisdiction.

General City Recommendations:

1. Require greenbelts on all public waterfront properties within city limits
2. Require a greenbelt on newly developed or renovated properties
3. Consider parameters for greenbelt requirements
4. Integrate green stormwater infrastructure with existing gray stormwater infrastructure

City of Boyne City Recommendations:

1. Require formal planning commission site plan review for all waterfront uses
2. Prohibit the construction of vertical seawalls within the zoning ordinance in favor or revetments and engineered natural shorelines, except when there is no other practical alternative.
3. Require greenbelts on all public waterfront properties within city limits.
4. Require a greenbelt on newly developed or renovated properties
5. Consider parameters for greenbelt requirements.
6. Integrate green stormwater infrastructure with existing gray stormwater infrastructure and consider installation of trash capture technologies to address release of debris and plastics from stormwater systems.
7. Conduct a stormwater outfall inventory

City of Charlevoix Recommendations:

1. Redefine the Ordinary High Water Mark
2. Prohibit the construction of vertical seawalls within the zoning ordinance in favor or revetments and engineered natural shorelines, except when there is no other practical alternative.
3. Require greenbelts on all public waterfront properties within city limits.
4. Require a greenbelt on newly developed or renovated properties
5. Consider parameters for greenbelt requirements.
6. Integrate green stormwater infrastructure with existing gray stormwater infrastructure and consider installation of trash capture technologies to address release of debris and plastics from stormwater systems.

City of East Jordan Recommendations:

1. Require formal planning commission site plan review for all waterfront uses.
2. Institute a Waterfront Overlay District for the industrial district land owned by East Jordan Iron Works to ensure shoreline protections prior to development.
3. Require greenbelts on all public waterfront properties within city limits.
4. Require a greenbelt on newly developed or renovated properties
5. Consider parameters for greenbelt requirements.
6. Integrate green stormwater infrastructure with existing gray stormwater infrastructure and consider installation of trash capture technologies to address release of debris and plastics from stormwater systems.

General Recommendations for Townships:

- Need uniform and ubiquitous enforcement across all jurisdictions
- Need dissemination of educational information to contractors, realtors and homeowners.
- Ordinances vary greatly amongst communities; would like to see more universal ordinances but understand there are areas around the lake where that may not be possible; consistency among jurisdictions around the lake would make them easier to enforce.

Bay Township Recommendations:

1. Fulfill the recommendations from the *2016 Enacting Shoreline Zoning Protections around Lake Charlevoix/Charlevoix Watershed* report.
 - Redefine High Water Elevation Mark
 - Prohibit the sanding of beaches
 - Specifically regulate or prohibit keyhole/funnel development
 - Prohibit the alteration of the area between the water's edge and the high water elevation
 - Finalize Article Six, Waterfront Overlay Zoning District, ordinance language
2. Update permit application to coincide with Article six, Waterfront Overlay Zoning District language
3. Develop an online program for permit applications and examples of best management practices
4. Improve stormwater management ordinance requirements in Waterfront Overlay Zoning District (*Township has engaged with TOMWC to work on this effort*)

Charlevoix Township Recommendations:

1. Fulfill the recommendations from the *2016 Enacting Shoreline Zoning Protections around Lake Charlevoix/Charlevoix Watershed* report.
 - Require formal planning commission site plan review for all waterfront uses.
 - Redefine high water elevation
 - Specifically regulate number of docks allowed
 - Modify impervious surface coverage standards for waterfront lots
 - Prohibit the sanding of beaches
2. Regulate septic systems in the short-term rental ordinance

Evangeline Township Recommendations:

1. Fulfill recommendations from the *2016 Enacting Shoreline Zoning Protections around Lake Charlevoix/Charlevoix Watershed* report.
 - Prohibit the alteration of the area between the water's edge and the high water elevation
2. Pursue a pilot project to promote the use of bioengineering to restore critical shoreline functions
3. Add greenbelt requirements to the short-term rental ordinance
4. Prohibit placement of docks in greenbelts and wetlands

Eveline Township Recommendations:

1. Fulfill the recommendations from the *2016 Enacting Shoreline Zoning Protections around Lake Charlevoix/Charlevoix Watershed* report.
 - Require formal planning commission site plan review for all waterfront uses.
 - Modify impervious surface coverage standards for waterfront lots
 - Prohibit the sanding of beaches
2. Expand conditions in which greenbelts are required
3. Regulate greenbelts in the short-term rental license
4. Grant final permits/variances only after greenbelt is verified compliant

Hayes Township Recommendations:

1. Fulfill the recommendations from the *2016 Enacting Shoreline Zoning Protections around Lake Charlevoix/Charlevoix Watershed* report.
 - Specific prohibition of lawn in greenbelt
 - Require that new low-growing plantings be spaced for complete ground coverage in two years
 - Require that all county, state and federal permits be obtained prior to zoning permit approval
 - Require formal planning commission site plan review for all waterfront uses.
2. Prohibit reclamation of property lost to erosion/high water
3. Pursue a pilot project to promote the use of bioengineering for shoreline restoration

Regarding water quality and shoreline preservation efforts for Walloon Lake, Goal #4 of Walloon Lake Association & Conservancy's 2023-2027 Strategic Plan states: "Coordinate with agencies of the five townships, two counties and other concerned stakeholders on government policy to protect Walloon Lake and its watershed." This goal refers to the idea of forming an intergovernmental body that would unify the Walloon Lake communities with common zoning ordinances to solve issues around the lake. Within Charlevoix County, this would include the townships of Melrose, Evangeline, and Bay.

Space Weather and Electromagnetic Pulses

Space weather is a naturally occurring phenomenon in which the sun releases solar flares, energetic particles and/or coronal mass ejections (CME). These events are known as solar storms. In particular, if a CME is directed towards Earth, it can interact with the Earth's magnetic field and cause geomagnetic storms. Under these circumstances extra currents, known as geo-magnetically induced currents (GIC), are created in the ground which can impact the electric grid. These GICs can cause widespread outages in two ways: First, they can cause permanent damage of critical grid components, such as high-voltage power transformers. This is of particular concern as high voltage transformers are not easily replaceable. Second, the GICs can cause voltage instability in the grid and cause the system voltage to collapse, resulting in a widespread but temporary outage.

An increase in ions (charged particles) that interact with the Earth's magnetosphere and then strike our upper atmosphere can cause a glow within the evening skies (which, in the northern hemisphere, includes the famous aurora borealis). Such "northern lights" become increasingly prominent, and extend farther to the south, during the most active solar storms. Government agencies actively monitor space weather, but for those who have not heard any government reports, their warning of solar storm activity may come from noticing these brighter glows in the night sky—especially in most Michigan locations where such "northern lights" are not normally seen.

An electromagnetic pulse (EMP) is a burst of electromagnetic energy produced by a nuclear explosion in the atmosphere, considered capable of widespread damage to power lines, telecommunications, and electronic equipment. EMPs are associated with intentional attacks using high-altitude nuclear detonations, specialized conventional munitions, or non-nuclear directed energy devices. Effects vary in scale from highly local to regional to continental, depending upon the specific characteristics of the weapon and the attack profile. High-altitude electromagnetic pulse attacks (HEMP) using nuclear weapons are of most concern because they may permanently damage or disable large sections of the national electric grid and other critical infrastructure control systems.

According to the U.S. Department of Homeland Security, Science and Technology Directorate's 2022 report [Electromagnetic Pulse Shielding Mitigations: Best Practices for Protection of Mission Critical Equipment](#), the civilian Critical Infrastructure (CI) within the United States faces threats from natural EMPs caused by major solar storms, as well as from manmade EMP attacks. As described in Executive Order (EO) 13865, Coordinating National Resilience to Electromagnetic Pulses (March 26, 2019). "An EMP event has the potential to disrupt, degrade, and damage technology and critical infrastructure systems."

Public awareness of manmade EMPs began on July 9, 1962 following the Starfish Prime test, during which the U.S. detonated a 1.4-megaton thermonuclear weapon 250 miles above Johnston Island in the mid-Pacific. On the Hawaiian Islands, 900 miles away, burglar alarms were triggered, circuit breakers opened, and over 300 streetlights in Honolulu failed nearly simultaneously. A few months later, to better understand EMP effects, the Soviet Union conducted a series of high-altitude nuclear tests over Southwestern Siberia, inadvertently demonstrating the weaponization potential of high-altitude EMP (HEMP), as revealed to U.S. scientists in 1995.

Location

Space weather and EMPs are not confined to geographic boundaries and can be a regional, national or international event. Since space weather occurs more often during solar maximums, however, it is impossible to predict where space weather will occur and how severe it will be. All electric and communications infrastructure in Charlevoix County is at risk from a space weather or EMP event.

Extent

Three space weather scales are in use by NOAA/NWS to summarize the intensity and estimated potential impacts of three different types of space weather effects. Each uses a 5-category classification scheme, and the three scales denote (1) geomagnetic storm intensity (G-scale), (2) solar radiation storms (S-scale), and (3) radio blackouts (R-scale). Weaker events are given a number of 1 on the scale, and extreme events are rated as a 5. In this document, selected material is summarized below. For more detailed information, refer to <https://www.swpc.noaa.gov/noaa-scales-explanation>

Previous Occurrences

Space weather is a term that denotes the impacts of the Sun's activity upon the bodies within this heliosphere (the volume of space inside the heliopause areas), including our own Earth. As is observable with ordinary weather on Earth, there are some clear patterns that are exhibited by space weather. More turbulent space weather is produced during times when more sunspots are present (called a solar maximum), and space weather is calm during times when sunspots are rare and small (or not even detectable at all, called a solar minimum). A sunspot cycle exists, in which sunspot activity periodically shifts between a minimum and maximum level. As with our Earthly seasons, however, it cannot be known in advance exactly how turbulent or calm things will be at a given moment during the sunspot cycle—only that calmer periods regularly give way to more turbulent periods. As to the regularity of the sunspot cycle itself, although it has been found that the average amount of time between a solar minimum and a solar maximum is about 11 years, the actual length varies quite a bit within each cycle. Within the documented cycles so far, the time interval between a minimum and maximum has been as long as 14 years and as short as 8 years.

In addition, it has been observed that long periods can occur with little or no apparent sunspot activity. The “Maunder minimum,” which occurred between the years 1645 and 1715, is the primary example of such long-term variation from the normal cycle, but it is not yet known what caused it, or when it might recur.

The following is a list of significant solar weather events. While no specific impacts occurring in Michigan were mentioned, the events were either international or regional in their effects.

August 28 to September 2, 1859 – International, “Carrington Event”

After a couple days of visibly expanded auroras in the sky, telegraph disruptions were also noted in diverse parts of the world. On September 1, a large solar flare was briefly observed by astronomer Richard Carrington, and also independently recorded by Richard Hodgson. Just before dawn of the next day, however, brilliant auroras were visible in skies around the world, telegraph systems severely malfunctioned, and various damages (and minor injuries) resulted from sparks and equipment failures. This was the first solar flare observation and it was also clearly seen that the phenomenon was connected with malfunctions in electronic communications systems on Earth. No solar flare of this magnitude has been seen in the 150 years since this occurred. Based upon evidence from arctic ice, it was estimated that the 1859 solar geomagnetic storm was the most intense in the past 500 years, nearly twice as much as the second-largest event. (Even though certain intensities have since been matched, no storm since has been able to simultaneously match this one, on all types of intensity measures.) Were such an event to happen again today, it has been estimated that tens of billions of dollars in damage would be done to more than 1,000 satellites that orbit the Earth. These satellites are essential for the safe and smooth operation of airlines, spacecraft, and various communications systems.

May 16, 1921 – International, “Great Storm”

An extremely strong geomagnetic storm occurred—the strongest such storm since 1859. According to one study, if a storm of this magnitude were to occur today, it could result in large-scale electrical blackouts that would affect more than 130 million persons across the northwestern U.S. (including Michigan) and the Pacific Northwest. These figures were based upon estimates of regions susceptible to power grid collapse, and the 1921 storm was considered to be about 10 times as strong as the one that did cause power failures in 1989. Extra-high-voltage transformers were considered to be a particular vulnerability in these projected blackout areas, with places like New Hampshire, New Jersey, and Pennsylvania at particularly high risk in the interconnected grid. This has been estimated as a level of event that has a 1% annual chance of occurring in an average year.

August 4, 1972 – Illinois

A huge solar flare ended up causing the failure of long-distance telephone communications across Illinois. AT&T redesigned its power system for transatlantic cables as a result of this event. Electric grid disturbances were also reported in widespread locations around North America. This event involved the fastest “transit time” of ejected solar material that had been measured. Recently, a paper reported that these storms had an effect upon U.S. military operations, including the unintended detonation of many of its DST mines within the wartime Southeast Asian operational area (Knipp, Fraser, Shea, and Smart, 2018). In some ways, this may have been the most severe event seen during the space age. Had astronauts been in space at the time, it would have been dangerous for them.

March 13, 1989 – Canada and Eastern United States

Geomagnetic storms caused by a huge solar flare involved various disruptions in the transmission of electrical power, causing a widespread blackout across most of Quebec and affecting 6 million persons for a period of up to 9 hours. Specifically, when five transmission lines went down, the system was unable to withstand the loss of their 21,350-megawatt load, and collapsed within the subsequent 90 seconds. The blackout closed schools and businesses, shut down the Montreal Metro Airport, and delayed flights from other airports. Street traffic backups took place, since traffic signals and traffic control systems no longer functioned smoothly. Workers in downtown Montreal were stranded in dark offices, stairwells, and elevators. Elsewhere, power surges caused by the geomagnetic storm (geomagnetically induced currents, or GICs) caused power transformers in New Jersey to be overloaded and damaged. The functioning of long-distance telephone cables were also affected by auroral currents, major power substations experienced voltage swings, generators went offline, and the U.S. Air Force temporarily lost its ability to track satellites. Costs from the loss of power exceeded \$100 million, including stalled production processes, idled workers, and spoiled products. This was considered to be the strongest geomagnetic storm of the space age, and it has been reported that the broader power grid covering the Northeastern and Midwestern U.S. was “within seconds of collapse.”

January 11, 1997 – International

A satellite that had cost \$200 million was incapacitated by the impact of a coronal mass ejection. After efforts to restore the satellite's function failed, it was officially decommissioned.

April-May, 1998 – International

The failure of the attitude control system of an expensive Galaxy IV satellite (the cost of such satellites is usually on the order of \$200 to \$250 million) disrupted the function of about 45 million electronic paging devices. Various other satellite problems were noted, and researchers eventually concluded that these problems were "caused, or at least exacerbated by" the impacts of geomagnetic conditions originating from "highly disturbed" solar conditions. Although the satellite problems occurred in May, weeks of problematic space weather that had started back in April was considered to have eventually led up to May's events.

October 19 to November 7, 2003 – International, "Halloween Storms"

Geomagnetic storms took place in late October and November, and although power grid operators had learned from the March 1989 event and were better able to withstand the storms' effects, there were some heavy impacts upon the aviation sector from this event. The Federal Aviation Administration had implemented a WAAS (Wide Area Augmentation System) to better guide navigation and aviation system control, and a part of what WAAS supports is the ability of air traffic to maintain safe distances from each other. The vertical navigation component of WAAS was disabled for approximately 30 hours across most of the United States during the late October storms. These "Halloween storms" interrupted GPS function, blocked high-frequency radio, damaged power transformers in South Africa, and forced emergency procedures to be implemented at nuclear plants in Canada and the northeastern United States.

January 2005 – International

Space weather at this time included solar radiation storms. In addition to the loss of HF radio communications, such storms can cause elevated radiation exposure to persons in aircraft flying at high latitudes (e.g. across polar regions). The use of polar routes has increased dramatically since the 1990s, since such routes can reduce travel time and fuel costs (by avoiding strong wintertime headwinds). Aircraft must divert to lower-latitude routes during such radiation events, resulting in delays, increased flight times, missed connections, higher costs, and greater fuel consumption.

December 2005 – International

A geomagnetic storm caused the disruption of satellite-to-ground communications and GPS (Global Positioning System) navigational signals. Although this disruption only lasted about 10 minutes, it threatened the safety of commercial air flights and marine traffic during that time.

December 6, 2006 – International

A burst of solar radio wave energy caused a disruption in the function of GPS units across the entire sunlit side of the Earth (the Western hemisphere in this case). Some users of navigation systems found their capacities disrupted for many minutes, which was of particular significance for military aircraft.

July 23, 2012 – International

The STEREO solar observatory detected and measured one of the largest solar storms ever recorded. The trajectory of the emissions were fortunately not directed at Earth during the time of the event, or it would have resulted in the type of extreme storm that has here been estimated as a "worst-case scenario." It has been calculated that if the solar eruption had taken place just one week earlier, then the Earth would have been aligned to receive the impacts, and the results would have been equivalent to another "Carrington Event" (see 1859 entry, above) but with far more extensive electronic systems and investments at risk than had been true in the past.

Probability of Future Events and Vulnerability Assessment

The Earth's atmosphere serves as a shield for us against many types of particles and radiation zipping across space, and Earth is also surrounded by a magnetosphere that similarly provides protection against most of the charged particles traveling through space. There are some weak spots in the Earth's magnetic field, however, that exist near its two magnetic poles and allow many ions to penetrate, where they collide with atoms in the Earth's upper atmosphere and glow to produce the beautiful auroras in the skies of the arctic regions of the north and south. In addition, the Earth is surrounded by "belts" of charged particles (called Van Allen belts) which are hazardous to spacecraft and astronauts. These are known and predictable conditions of calm space weather, however, and the actual hazard is the turbulence generated by large solar flares, causing problems with radio communications, damage to satellites, and even disruptions in power delivery networks on the Earth.

This hazard is considered fairly likely in the near term to cause notable disruptive effects, large economic impacts, and even some direct health risks to persons who are flying in aircraft in the far northern or southern areas of the planet, where the exposure to charged particles occurs in greater quantities.

In September 2022, the Department of Homeland Security (DHS) released a report titled [Electromagnetic Pulse Shielding Mitigations](#). The report describes operational approaches to protect the National Public Warning System from an EMP, as well as best practices and design principles that can be implemented by critical infrastructure owners and operators who seek to secure their assets against EMP in a similar manner to the NPWS equipment.

The report is a collaborative effort between the DHS Science and Technology Directorate (S&T), the Federal Emergency Management Agency (FEMA) Integrated Public Alert and Warning System (IPAWS) Program, and the Cybersecurity & Infrastructure Security Agency (CISA). Content of the S&T press⁷ release pertaining to this report is as follows:

“Electromagnetic pulses, whether caused by an intentional EMP attack or a naturally occurring geomagnetic disturbance from severe space weather, could disrupt critical infrastructure such as the electrical grid, communications equipment, water and wastewater systems, and transportation modes,” said Kathryn Coulter Mitchell, DHS Senior Official Performing the Duties of the Under Secretary for Science and Technology. “This could impact millions of people over large parts of the country. It is critical to protect against the potential damage an EMP event could cause.”

The [National Public Warning System](#) ensures the President of the United States can communicate with Americans in the event of a national emergency. The FEMA IPAWS Program equips 77 private sector radio broadcast stations with EMP-protected backup transmitters, communications equipment, and power generators that would enable the station to broadcast national emergency information to the public in the event of an EMP event. “These stations represent a key public-private sector partnership and serve as the primary sources for a national emergency broadcast during a catastrophic disaster,” said Antwane Johnson, FEMA IPAWS Program Director. The stations are located across the country providing radio broadcast coverage to more than 90 percent of U.S. population.

As part of a broader DHS effort to ensure critical infrastructure and emergency response systems are protected against EMPs, FEMA conducted high-altitude electromagnetic pulse (HEMP) testing on the NPWS equipment to evaluate its operational resiliency. The testing confirmed the effectiveness of protection for NPWS stations, showing they could withstand the effects of an EMP in accordance with military specifications. “Protecting critical assets from EMP is part of a larger DHS effort to assess and mitigate EMP risk in both the public and private sector,” said Acting CISA Assistant Director Mona Harrington. “CISA remains committed to working with our partners to implement requirements outlined in the Executive Order on Coordinating National Resilience to Electromagnetic Pulses, which strengthens our nation’s preparedness from EMP.”

⁷ <https://www.dhs.gov/science-and-technology/news/2022/09/06/dhs-releases-recommendations-protect-national-public-warning-system-emps>

Public Health Emergency

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).

There are a variety of sources that contribute bacteria (such as *Escherichia coli*, or *E. coli*) and other pathogens to the surface water. These sources include illicit waste connections to storm sewers or roadside ditches, septic systems, combined and sanitary sewer overflows, storm (rain) runoff, wild or domestic animal waste, and agriculture runoff. Most strains of the *E. coli* bacteria are not dangerous, but they can indicate the presence of other disease-causing bacteria. *E. coli* bacteria do not survive long in water. Factors such as wind and wave action, as well as ultraviolet light from the sun help to reduce the level of bacteria. The amount of time needed to reduce bacteria levels can be unpredictable, however it usually takes less than 48 hours. Additionally, bacteria contamination originates from conditions or factors present on or near the shore. Two beaches on opposite ends of a lake that have different on-shore conditions will not have the same bacteria levels.

Location

A 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 persons in Charlevoix County are at risk from the occurrence and impacts from an infectious disease. Depending on the type of disease, different populations are more susceptible.

The beaches along Lake Michigan and many inland lakes are essential to Charlevoix County's summer tourism economy. The Health Department of Northwest Michigan (HDNW) conducts a beach monitoring program that has been successful in protecting public health and supporting the economic benefits of having clean, safe swimming areas. County health departments are required by law to take a minimum of three samples each time a beach area is monitored. The daily geometric mean of these three samples must be below 300 *E. coli* per 100 milliliters (ml) of water for the water to be considered safe for swimming. During the summer months, the HDNW sends out public beach advisories if a sample comes back with bacteria higher than is safe for partial or full body contact. Updates are also provided when a sample shows the bacteria level has returned to a safe level. The HDNW provides beach monitoring for 15 beaches in Charlevoix County (Table 51).

Table 51. HDNW Public Beach Monitoring Sites in Charlevoix County

Beach Name	Waterbody	Location
Young State Park	Lake Charlevoix	Evangeline Twp.
Whiting Park	Lake Charlevoix	Eveline Twp.
Depot Beach	Lake Charlevoix	City of Charlevoix
Ferry Beach	Lake Charlevoix	City of Charlevoix
Glenwood Beach	Lake Charlevoix	Evangeline Twp.
Eastern Ave. Beach	Lake Charlevoix	Charlevoix Twp.
Washington St. Beach	Lake Charlevoix	Eveline Twp.
Fisherman's Island	Lake Michigan	Norwood Twp./Charlevoix Twp.
Michigan Beach Park	Lake Michigan	City of Charlevoix
N. Michigan Ave. Beach	Lake Michigan	Charlevoix Twp.
Norwood Park	Lake Michigan	Norwood Twp.
Elm Point Beach	South Arm of Lake Charlevoix	South Arm Twp.
East Jordan Tourist Park	South Arm of Lake Charlevoix	City of East Jordan
Thumb Lake Beach	Thumb Lake	Hudson Twp.
Melrose Township Park	Walloon Lake	Melrose Twp.

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 Charlevoix County, the Health Department of Northwest Michigan works with local, state, and federal agencies to prepare for and respond to public health threats. The Michigan Department of Health and Human Services (MDHHS) reports⁸ that between March 1, 2020 and November 14, 2023, there were 6,091 cases and 76 deaths attributed to COVID-19. This includes confirmed and probable cases and deaths.⁹ The Michigan statewide case fatality rate is 1.4%.

Of the reported deaths attributed to COVID-19 in Charlevoix County, the majority were of persons aged 80 years and older, followed by those in the 70-79 year old age group, and then the 60-69 year old group. All of the deaths reported in the county were of persons aged 60 years and older.

The Health Department of Northwest Michigan conducts weekly beach monitoring studies at public beaches in Emmet County, usually from the last week in June through the end of August each year. Table 52 indicates the recommended limits of body contact with the water in relation to the detected levels of E. coli bacteria.

Table 52. Water Quality Index for Beach Monitoring

Water Quality Index	Body Contact Limits	E. coli/100ml (Single Event)	E. coli/100ml (30 day geo-mean)
Level 1	E. coli levels meet EGLE swimming standard for full body contact.	0-300	0-130
Level 2	E. coli levels meet EGLE standard for wading, fishing, and paddling. Contact above the waist not advised.	301-1000	131-1000
Level 3	E. coli levels exceed EGLE standards, no body contact advised.	>1000	>1000
Level 4	Health alert. E. coli levels and/or known gross contamination of beach waters. Avoid contact with beach waters.	>1000 E. coli/gross contamination	>1000 E. coli/gross contamination

Source: Health Department of Northwest Michigan, Environmental Health Division

The extent of a public health emergency can also be measured in economic terms, such as expenditures related to disease preparation, response and prevention, as well as potential loss of income and jobs within industries that cannot solely operate on remote workers, such as hospitality, personal services, construction, manufacturing, and brick and mortar retailers.

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 in March 2020, federal/state disaster/emergency declarations were enacted in response to the international COVID-19 Pandemic. The U.S. Department of Health and Human Services ended the COVID-19

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

⁹ MDHHS classification: Confirmed cases are those individuals who have had a positive diagnostic laboratory test for COVID-19. Probable cases include individuals who have a positive presumptive laboratory test for COVID-19. Confirmed deaths include individuals who had a confirmed COVID-19 infection AND are either classified as deceased during the case investigation OR have COVID-19 indicated as a cause of death on their death certificate. Similarly, probable deaths include individuals who had a presumptive COVID-19 infection AND are either classified as deceased during the case investigation OR have COVID-19 indicated as a cause of death on their death certificate.

public health emergency (PHE) May 11, 2023. Variants of the coronavirus are still being found years after the initial spread; vaccinations are available to limit the reaction from exposure and limit the spread of the disease.

The HDNW's 2023 Beach Monitoring Report indicates that no sample sites in Charlevoix County had water quality index levels of two (2) or greater.

Probability of Future Events and Vulnerability Assessment

Pandemics will continue to result in widespread precautions around the world. The Michigan Department of Health and Human Services created a Pandemic Response Plan (Annex 12 of the MDHHS Emergency Operations Plan, June 2023) to respond to a large-scale outbreak of influenza and other highly infectious respiratory diseases. The elderly, immune-compromised, and low income populations are most vulnerable to public health emergencies.

The Health Department of Northwest Michigan and the Little Traverse Bay Band of Odawa Indians successfully administered COVID-19 vaccination services to the public and tribal citizens beginning in 2021, and can utilize their knowledge of this experience in a future scenario where vaccinations are needed to mitigate the effects of a pandemic. Additionally, strides continue to be made in the advancement of broadband internet installation throughout the rural areas of northern lower Michigan. Access to broadband internet is an essential tool that allows for remote work, schooling, commerce and communications to continue during a public health emergency.

The HDNW performs a site evaluation and issues a permit before a resident or business installs a drinking water well, as well as do a final review once the well is installed. The HDNW also offers test kits for many types of water sampling, including the two most common: bacteriological and partial chemical.

The HDNW beach monitoring program will continue to protect public health and support the economic benefits of having clean, safe swimming areas through their beach monitoring program. Additionally, the Tip of the Mitt Watershed Council (TOMWC) has recently secured a grant to fund the use of a beach cleaning robot that sifts through beach sand to collect plastic and debris. While plastics themselves are not considered hazardous substances, microplastics can bind to compounds containing toxic metals, such as mercury and dioxins. The zero-emissions, beach cleaning robot provided by TOMWC will be utilized by the following beach management entities within Charlevoix County in 2024:

- Fisherman's Island State Park in Norwood Township and Charlevoix Township
- Young State Park in Evangeline Township

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 Charlevoix 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.

The Midwest Invasive Species Information 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 <https://www.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 reported invasive species in Michigan are:

- Phragmites (Invasive): 65,135
- Garlic mustard: 18,462
- Autumn olive: 17,120
- Spotted knapweed: 15,734
- Brown marmorated stink bug: 13,300
- Japanese knotweed: 12,922
- Purple loosestrife: 11,058
- Common buckthorn: 8,735
- Japanese barberry: 8,161
- Bush honeysuckle: 7,451

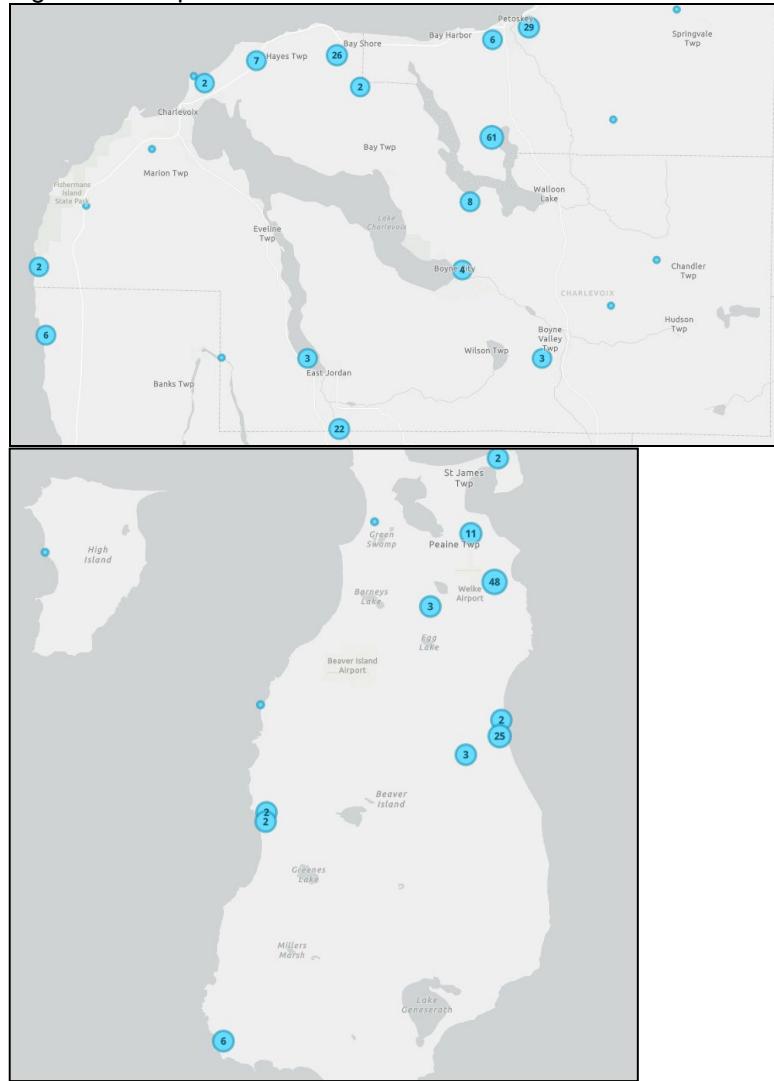
¹⁰ The Welland Canal is a ship canal in Ontario, Canada, connecting Lake Ontario and Lake Erie.

Location

Invasive species pose a significant threat to the County's lakes, wetlands, and forests. These non-native, introduced species outcompete native species; impact food chains and fish and wildlife habitat; reduce property values; impact water-based recreation and navigation; and among the many other environmental and economic problems, invasive species are costly to control and manage. Certain high profile species, such as phragmites and Eurasian watermilfoil, have been especially prolific, disruptive, and costly.

Terrestrial and aquatic invasive species threaten sensitive ecosystems and may be present in Charlevoix 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, 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 website provides species observation maps of invasive animals, plants and diseases that can be created by selecting a species' common name, scientific name or family type. Figure 34 is an example of a map generated when querying invasive species observations in Charlevoix County; in this case, for Autumn olive.

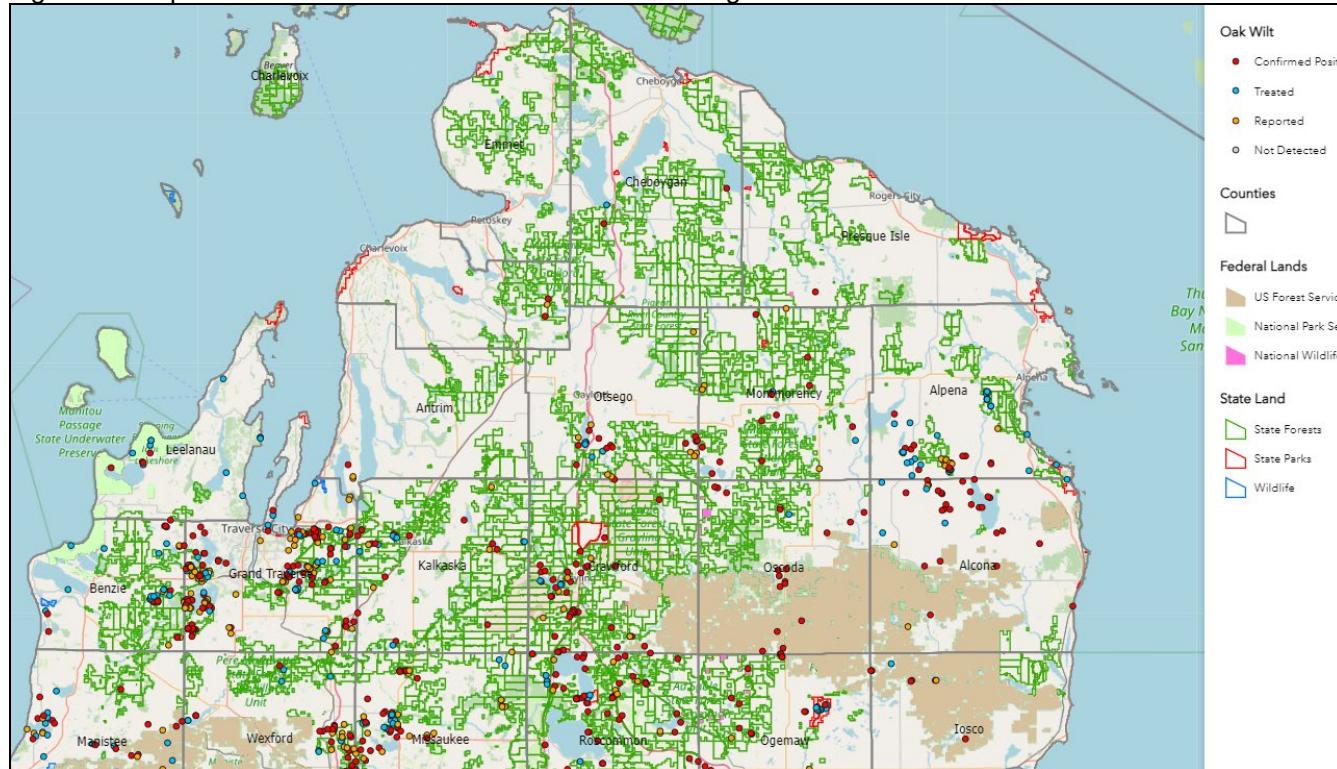
Figure 34. Reported Cases of Autumn Olive in Charlevoix County



Source: <https://www.misin.msu.edu/distribution/?project=misin/> accessed 11/18/2023

Figure 35 is from the MDNR interactive mapping resource “Look for Oak Wilt,” which allows users to view an interactive map to see the known extent of oak wilt throughout Michigan and report a possible infection location. Charlevoix County has two confirmed positive locations (in 2012 in Chandler and Hudson Townships) and one reported case (in 2015 in Chandler Township). Other counties south of Charlevoix County have several reported, tested, and confirmed positive cases of Oak Wilt.

Figure 35. Reported Oak Wilt Cases in Northern Lower Michigan



Source: <https://www.michigan.gov/invasives/id-report/disease/oak-wilt> Accessed 11/18/2023

Extent

Invasive species impact 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.

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.

The estimated annual costs for some local invasive species management efforts:

- Beaver Island spends \$30,000 to \$50,000 per year on identifying and treating invasive species. Peaine and St. James Townships in total provide nearly \$30,000 for this program and the additional funds are based on grant sources, as available, including potential grants or staff from CAKE CISMA, MDNR, USFWS, the Little Traverse Bay Bands of Odawa Indians and the Grand Traverse Band of Ottawa and Chippewa Indians performing monitoring and/or eradication.
- Little Traverse Bay Bands of Odawa Indians is scheduled to treat invasive species on the outer islands of the Beaver Island archipelago in 2024/2025.

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.

On a regional level, 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.
- 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.

On a regional level, 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 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 reaches 3-10 feet or more in length. Grows in ponds, lakes, and low-energy zones in rivers and streams.
- 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 in Charlevoix County. However, the list of all invasive species impacting the county and region 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.

It is important to note that Beaver Island and the Archipelago Islands act as a refuge for native plants and animals, as invasive pests and diseases have more difficulty accessing these locations. The Emerald Ash Borer (EAB) is one example. This pest has eradicated many if not all of the ash trees in the Lower Peninsula of Michigan. EAB was first detected on Beaver Island in 2017 after a decade of monitoring. Islanders have worked with the USDA's Animal and Plant Health Inspection Service (APHIS) to release EAB parasitoids on Beaver and Garden Islands as a bio-control effort to preserve the ash trees on the islands.

The Charlevoix, Antrim, Kalkaska, and Emmet counties Cooperative Invasive Species Management Area (CAKE CISMA) current Strategic Plan (updated April 2023) contains a priority list for aquatic, terrestrial, and invertebrate invasive species in the service area. The list is sorted into aggregate tiers (indicated below) intended to be used as a framework to guide management decisions. Rankings are subject to change at a county level, depending on the spatial distribution of certain species within each county. The list also indicates which species are present in the CAKE area. The list is a living document and is reviewed and updated annually by CAKE CISMA staff to be approved by a majority vote from the CAKE CISMA steering committee.

- Tier 1- Prevention/Early Detection: These species are not yet present in the service area. They pose a great ecological threat to the region if introduced. Tier 1 species are a high priority to the State of Michigan and are either very limited in their presence or not yet detected in Michigan. Management actions for these species include detection surveys, rapid response, and eradication if effective tools exist. Prevention, education, and outreach are important for Tier 1 species.
- Tier 2- Eradication - Rapid Response: Species that are not yet present in the service area or confined to a limited area. Small, localized populations make eradication possible for these species. Management actions for Tier 2 species are delimitation, containment, and eradication where feasible.
- Tier 3: Containment Species that are rapidly increasing in distribution throughout the CISMA region. Managed on a site-by-site basis based on ecological importance. Management actions for Tier 3 species are determined through project-based planning with the objective to slow spread and improving existing habitat function.

- Tier 4: Local Control/ Asset Protection Species that are widespread throughout the State of Michigan and can no longer be eradicated. As such, these species are managed by CISMA only on sites of high ecological value and where partnerships exist. CISMA will assist the public with Tier 4 species through education and outreach.

CAKE CISMA prioritizes invasive species management based on the ecosystem and management feasibility. Some species, like spotted knapweed (*Centaurea stoebe*) or Autumn olive (*Elaeagnus umbellata*), are so widespread that it is no longer feasible to eradicate them. That means that when CAKE CISMA does manage those species, efforts are focused on areas of high ecological importance - like a fen or a dune community, or the Beaver Island archipelago, which doesn't have the same variety of invasive species as are present on the mainland. Initiatives such as not allowing mainland firewood on the island have helped maintain pristine habitats throughout the archipelago. Because there are fewer invasives and more endangered/rare species, the invasives they do have are a higher priority on the island than on the mainland. For example, CAKE CISMA often treats Autumn Olive on the island, a species far beyond control on the mainland.

Invasive species that are not yet widespread or recently detected in the service area are the highest management priority for CAKE CISMA. Special consideration is also given to "satellite" populations of more established species, as they are easier to control than large source populations (and treatment prevents them from turning into source populations themselves!). In these cases, no-cost treatment for public and private landowners is offered.

Throughout 2024, CAKE CISMA will be targeting 1,000 acres of Fresh Water Dune Swales, Fens, and Rich Conifer Swamps for restoration. These natural communities identified by the Michigan Natural Features Inventory are significant in maintaining resiliency to the changing climate.

Probability of Future Events and Vulnerability Assessment

The services and collaborative efforts of CAKE-CISMA, Charlevoix Conservation District, Tip of the Mitt Watershed Council, Little Traverse Conservancy, Little Traverse Bay Bands of Odawa Indians, Grand Traverse Bay Band of Ottawa and Chippewa Indians, MDNR and other land and water management agencies are crucial to make progress on invasive species management and prevention in Charlevoix County for established invasive species, as well as for the monitoring of "watchlist" species.

Invasive species on Michigan's "Invasive Species Watchlist" are priority species that have been identified as posing an immediate and significant threat to Michigan's natural resources. These species have either never 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. Species are listed below by category. This list is reviewed and updated periodically, and the most current list is available at www.michigan.gov/invasives. Potential impact from the species listed on watch list could be catastrophic for Charlevoix County's natural resources, agriculture, recreation, tourism, and economy.

Insects and Tree Diseases (Tree diseases list the scientific name for the pathogen or fungus associated with the disease)

- Asian longhorned beetle (*Anoplophora glabripennis*)
- Balsam woolly adelgid (*Adelges piceae*)
- Hemlock woolly adelgid (*Adelges tsugae*) (*description of local monitoring efforts on the following page)
- Thousand cankers disease (*Geosmithia morbida*)
- Beech leaf disease (*Litylenchus crenatae* and potential associates)
- Spotted lanternfly (*Lycorma delicatula*)

Mammals

- Nutria (*Myocastor coypus*)

Terrestrial Plants

- Asiatic sand sedge (*Carex kobomugi* Ohwi)
- Chinese yam (*Dioscorea oppositifolia* L.)
- Himalayan balsam (*Impatiens glandulifera*)
- Japanese stiltgrass (*Microstegium vimineum* (Trin.) A. Camus)
- Kudzu (*Pueraria montana* var. *lobata*)
- Mile-a-minute weed (*Persicaria perfoliata*)
- Japanese chaff flower (*Achyranthes japonica*)

Aquatic Plants

- Parrot feather (*Myriophyllum aquaticum*)
- Yellow floating heart (*Nymphoides peltata*)
- European frog-bit (*Hydrocharis morsus-ranae*)
- European water-clover (*Marsilea quadrifolia*) – This species is currently allowable for sale and possession. Please contact EGLE if these plants are observed outside of cultivation.
- Brazilian elodea (*Egeria densa*)
- Hydrilla (*Hydrilla verticillata*)
- Water chestnut (*Trapa natans*)
- Water hyacinth (*Eichhornia crassipes*) – This species is currently allowable for sale and possession. Please contact EGLE if these plants are observed outside of cultivation.
- Water lettuce (*Pistia stratiotes*) – This species is currently allowable for sale and possession. Please contact EGLE if these plants are observed outside of cultivation.
- Water soldier (*Stratiotes aloides*)

Fish and other Aquatic Animals

- Invasive carps
 - Silver carp (*Hypophthalmichthys molitrix*)
 - Bighead carp (*Hypophthalmichthys nobilis*)
 - Grass carp (*Ctenopharyngodon idella*)
 - Black carp (*Mylopharyngodon piceus*)
- Northern snakehead (*Channa argus*)
- Marbled crayfish (*Procambarus virginalis*)
- Red swamp crayfish (*Procambarus clarkii*)
- New Zealand mud snail (*Potamopyrgus antipodarum*)

One of the “watchlist” species that CAKE CISMA is currently monitoring for is the hemlock woolly adelgid (HWA) (*Adelges tsugae*), which affects eastern hemlock trees (*Tsuga canadensis*). HWA have specialized mouthparts that enable it to pierce the base of a needle, then suck out nutrients from cells in the shoots of their host tree. A host tree can die in as little as four years. HWA decimated stands of native hemlock in the eastern United States, particularly in the Great Smokey Mountains National Park.

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. It is estimated that Michigan is home to 170 million eastern hemlock trees. Areas near the Lake Michigan shoreline are the most probable for new infestations, as the adelgids tend to favor the temperatures and conditions found near the lake.

In the winter of 2024, the Michigan Department of Agriculture and Rural Development (MDARD) verified a new detection of invasive hemlock woolly adelgid (HWA) near Torch Lake in western Antrim County. An extensive survey of the surrounding area is underway. With this new detection, Antrim becomes the eighth county in the state with an active hemlock woolly adelgid infestation, joining Allegan, Benzie, Mason, Muskegon, Oceana, Ottawa, and Washtenaw counties.

CAKE CISMA offers free surveys of hemlock trees for HWA. Property owners within 5 miles of Lake Michigan can fill out the survey request form on CAKE CISMA’s website. Surveys will be conducted in the winter and property owners will be notified prior to the survey.

Known aquatic invasive species in Lake Charlevoix include Curly-leaf pondweed, Eurasian watermilfoil, Invasive phragmites, Purple loosestrife, Round goby, Sea lamprey, Zebra mussels and Quagga mussels. The open connection with Lake Michigan allows any invasive species present in Lake Michigan to enter Lake Charlevoix unimpeded. The Lake Charlevoix Association, Charlevoix County Conservation District, and Tip of the Mitt Watershed Council have worked diligently to educate residents about invasive species, as well as document and control specific invasives. In particular, watershed partners have focused much of their work on mapping and treating invasive Phragmites. The invasive Phragmites control efforts, which began in 2008, have been successful in preventing the spread and dominance of this aggressive invader along the Lake Charlevoix and Lake Michigan shorelines.

In 2008, Peaine Township and St. James Township adopted phragmites control ordinances, which provide procedures intended to comply with federal and state due process requirements so that all property along the Lake Michigan shoreline with a phragmites infestation can be included in a phragmites eradication zone and can receive effective treatment. In 2020, both Townships replaced this ordinance with a “terrestrial invasive species control” ordinance.

Hayes Township also has a Phragmites Ordinance applicable to the properties in the township along the Lake Michigan and Lake Charlevoix shorelines. Norwood Township and Eveline Township adopted their phragmites ordinances in 2009.

The following communities' local ordinances require that native vegetation be placed in greenbelt areas: the townships of Bay, Charlevoix, Evangeline, Eveline, Hayes, Marion, Peaine, St. James, and South Arm.

The Friends of the Boyne River has made progress with Purple loosestrife control efforts by purchasing and releasing beetles that eat the invasive plant along the river. In 2023 the group's efforts eliminated the loosestrife along Spring Street in Riverside Park, Boyne City.

Public use of boat wash stations removes plant and animal particles from boats, thereby reducing the chance of spreading or transporting invasive species in and out of lakes. Four (4) permanent boat wash stations have been installed to-date on Walloon Lake, two of which are located within Charlevoix County: the Melrose Township Boat Launch and the Sumner Road Boat Launch in Bay Township. Additionally, the Tip of the Mitt Watershed Council's (TOMWC) Mobile Boat Washing Station (MOBO) Program was started in Northern Michigan in 2020. TOMWC volunteers visit various Northern Michigan lake landings and wash boats for free throughout the summer, using heated, pressurized water.

TOMWC staff conducts surveys on inland lakes to document current aquatic plant species and communities, with a particular emphasis on documenting the presence of Eurasian watermilfoil, phragmites, or other invasive aquatic plant species.

The following organizations in Charlevoix County work with TOMWC, CAKE-CISMA, and other partners to monitor, treat and eradicate aquatic invasive species and improve water quality:

- Walloon Lake Association and Conservancy (Melrose, Evangeline and Bay Townships within Charlevoix County; Bear Creek and Resort Townships within Emmet County)
- Lake Charlevoix Association (Hayes, Charlevoix, Marion, Eveline, South Arm, Evangeline, and Bay Townships; Cities of Boyne City, East Jordan and Charlevoix)
- Lake Louise Christian Community (Thumb Lake in Hudson Township)
- Beaver Island Association (Peaine and St. James Townships)
- The Beaver Island Archipelago Terrestrial Invasive Species program
- Friends of the Jordan River (South Arm, Wilson, and Boyne Valley Townships; City of East Jordan)
- Friends of the Boyne River (Boyne Valley Township, Village of Boyne Falls, City of Boyne City, Evangeline Township)

Local government master plans and recreation plans have included goals and objectives related to invasive species management and protection (Appendix F).

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

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>

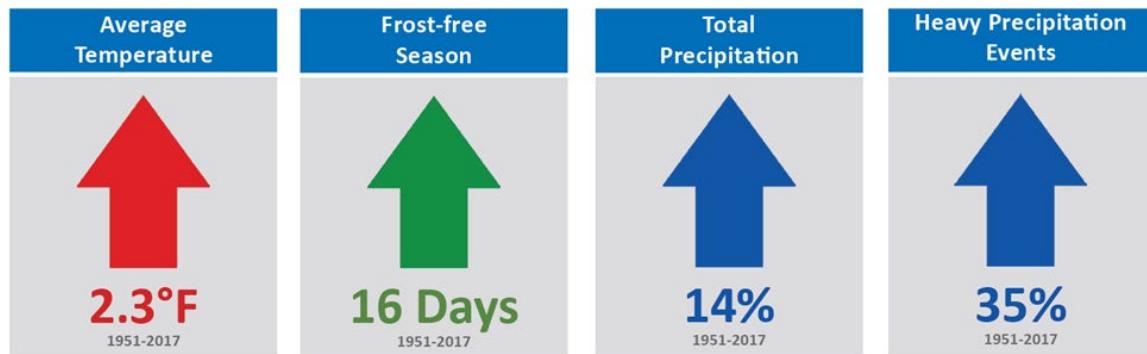
¹³ (2019, February 14). Retrieved from Climate Change in the Great Lakes Region: <https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Pager.pdf>

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/J0N29V45](https://doi.org/10.7930/J0N29V45).

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).

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.

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.

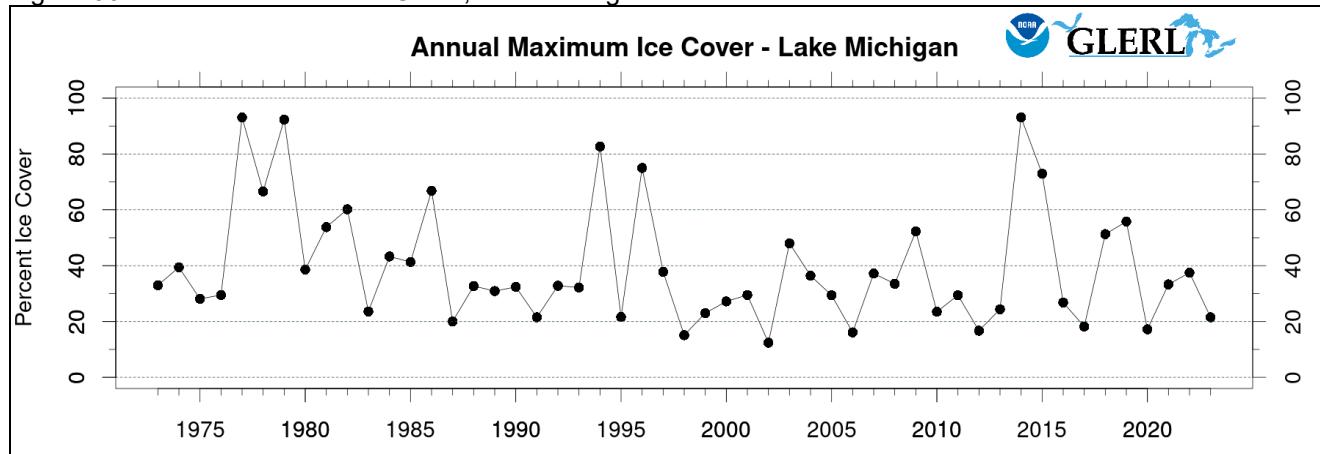


Snow, Ice Cover, Lake Temperature, and Lake Levels

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.

Lake Michigan has experienced seven winter seasons where the maximum ice coverage was sixty percent or greater since 1973 (Figure 36). The last major freeze of the lake occurred in the 2013-14 winter season. This freeze over reduced the ability to transport people, goods and services via ferry and fuel barges between Charlevoix and Beaver Island.

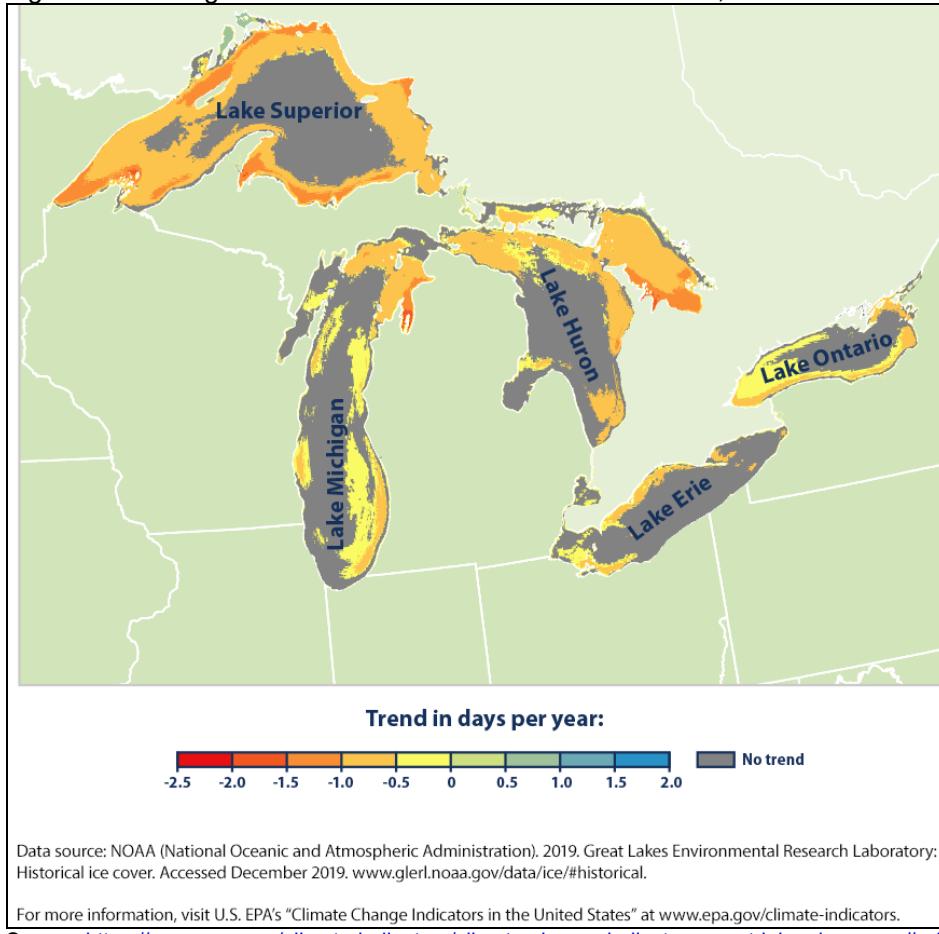
Figure 36. Annual Maximum Ice Cover, Lake Michigan



Source: <https://www.glerl.noaa.gov/data/ice/#historical>

Figure 37 shows that many areas of the Great Lakes have experienced significant decreases in ice cover duration, but other parts of the lakes have not changed significantly. Duration has decreased the most in areas near the shore, such as the area of Lake Michigan between the Beaver Island archipelago and the mainland of Charlevoix County.

Figure 37. Change in Ice Cover Duration in the Great Lakes, 1973-2019



Current information from the GLISA's *Sustained Assessment of the Great Lakes*¹⁶:

Changes in regional climate have affected the patterns of Great Lakes precipitation, runoff, evaporation, and lake ice, and will continue to drive changes in the future. The following observational trends affect the water supply of the Great Lakes and water levels:

- Since 1951, there has been an 14% increase in region-total precipitation as well as a 35% increase in the amount of precipitation falling in the heaviest 1% of storms.
- Annual average air temperatures have increased by 2.3°F in the U.S. Great Lakes region since 1951, with lake temperatures increasing even faster.
- Annual average ice cover on the Great Lakes underwent a shift 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.
- The timing of spring snowmelt is changing. During the period of 1960-2000, observed snow depths in the late winter and early spring decreased, implying an earlier onset of spring thaw.

¹⁶ <https://glisa.umich.edu/sustained-assessment/lake-ice/>

Changes in lake levels are the result of these different competing physical processes. For example, warming temperatures enhance evaporation over the lakes and in the drainage basin, and can lead to more years with low lake ice cover. Increases in evapotranspiration coupled with reduced ice cover duration can subsequently lead to lower water levels. Warmer temperatures can also reduce snowpack and soil moisture contributing to weaker runoff and lower water levels. Conversely, increases in precipitation frequency and intensity could lead to rising water levels. Any water level changes will depend on how one or more of these processes will dominate another in the future.

The future may hold another shift in ice cover but not necessarily in the downward direction. There is still the possibility of years with very high ice cover, as experienced in the 2013-2014 season. Practitioners should prepare for increased variability – high ice cover years followed by low ice cover years, and vice versa. Most certainly, ice will continue to form first where it always has, in protected areas near the shore, but it may not persist for as long.

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.

According to the NCA *Fourth National Climate Assessment Volume II: Impacts Risks, and Adaptation in the United States*, “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).

Climate Change Vulnerability Assessment

The report [Climate Change in the Great Lakes Region](https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Pager.pdf) by GLISA at <https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Pager.pdf> lists key challenges in the Great Lakes Region from climate change:

Public Health

- Increased risk of extreme heat and 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.

Community Services and Local Economy

- Despite a general warming climate trend, it is likely that the area of Lake Michigan between Beaver Island and the mainland of northern lower Michigan will still experience future episodes of significant ice cover. According to input from a Beaver Island resident/local official as part of this plan development, past instances of major ice coverage have resulted in significant issues with maritime transportation logistics between the island and the mainland. Effective planning and coordination amongst transportation entities and safety personnel will be needed to mitigate logistical issues in a future Lake Michigan freeze event.

GLISA has partnered with Great Lakes city adaptation practitioners to produce a set of plausible climate scenarios to aid in city and local planning. These scenarios can also be used at larger spatial scales (e.g., county) and are intended to be transferable across cities or communities, meaning the basic scenario details are relevant for any city in the Great Lakes region with the option to customize them further. While the scenarios are informed by climate model projections, they provide much greater detail than what models alone tell us; although still backed by models and projections, GLISA's scenarios make it easier to understand what projected climate changes could look like in reality. This combination of model data and real-world experience represents a holistic and practitioner-driven approach to scenario development.

Each scenario consists of a narrative description of weather conditions or events with details about sector-specific community impacts (e.g., city transportation, emergency response, etc.). Communities can customize the impacts described in the scenarios based on their own vulnerabilities and planning priorities to make the scenarios more relevant for their planning needs. Example customizations are provided with each scenario and this scenario planning workbook also helps guide these customizations. The scenarios can be used as a starting point for thinking about a future that may look different than the past and to develop ideas, recommendations, and plans to better prepare for that future.

For additional background information about GLISA's scenarios and access to the scenarios: <https://glisa.umich.edu/climate-data/climate-scenarios/>

For a list of GLISA's past scenario planning projects and examples: <https://glisa.umich.edu/engagement/scenario-planning/#examples>

V. Community Vulnerabilities and Capabilities

The tables on the following pages summarize much of the information presented in Sections III (Community Profile) and IV (Hazard Identification and Assessments) as it pertains to hazard vulnerabilities and mitigation capabilities for each community in Charlevoix 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 and assets regarding 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 in Appendix A.

The following resources are available to Charlevoix County to assist in hazard awareness, mitigation and response efforts.

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 Systems

- If there is a major emergency, or if a Local State of Emergency is declared, community notifications will be conducted utilizing the "Be Alert" emergency notification system, which is an electronic, high-speed, outbound notification service available at no charge to the general public. The system notifies a participant via their mobile phone, land-line phone and/or email address.
- The FEMA Mobile App is also a publicly available mobile warning system providing real-time weather alerts, locations of emergency shelters, and allows for notifications to be sent to loved ones.
- 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 users within signal of a cellular tower.

Radio Warning Systems

- Charlevoix County uses radio channels 580 AM and 103.5 WTCM for emergency alerts.
- NOAA Weather Radio All Hazards is a nationwide network of radio stations broadcasting continuous weather information directly from the nearest National Weather Service office. NWR broadcasts official Weather Service warnings, watches, forecasts and other hazard information 24 hours a day, 7 days a week.

Tornado/Severe Weather Warning Systems

- Alert sirens are located at:
 - City of Boyne City (at City Hall)
 - City of Charlevoix (at City Hall)
 - City of East Jordan (Behind EJ Fire Department and at Sportsmen's Club Park)

Flood Warning Systems

- For dam failures that would result in downstream flooding, the dam owners would immediately notify the County Emergency Manager, who would then post a notification on the BeAlert Emergency Communications Network.

Website and Social Media Platforms

- Charlevoix County 911/Dispatch Department posts emergency preparedness information or emergency alerts on their website or via social media.
- Local police and the county Sheriff's Department, in coordination with the County Emergency Manager, post information on emergency events and preparedness on the county Sheriff's Department Facebook page.

Shelter Sites

Table 53. Temporary Shelter Sites in Charlevoix County

Name	Address	Type	Capacity (Schools only list capacity in Gym)	Use	Features
Peaine Twp. Hall	Beaver Island	Other		Warming/ Cooling Center	Handicap Accessible, Power, Air Conditioning, Heat, Water, Lavatories, Back-up Generator, Kitchen Accessible
Boyne City Hall	319 North Lake Street, Boyne City	Other	150	Warming/ Cooling Center	Handicap Accessible, Power, Air Conditioning, Heat, Water, Medical, Lavatories, Back-up Generator, Kitchen Accessible
Boyne City Veterans Park Pavilion	211 North Lake Street, Boyne City	Other	50	Warming/ Cooling Center	Pet Friendly, Handicap Accessible, Power, Air Conditioning, Heat, Water, Lavatories, Kitchen Accessible
St. Matthews Catholic Church	1303 Boyne Ave., Boyne City	Church	300	Warming Center	Handicap Accessible, Power, Heat, Water, Lavatories, Kitchen Accessible
Community Reformed Church	109 Elm St. Charlevoix	Church	400+	Warming Center	Handicap Accessible, Power, Heat, Water, Lavatories, Kitchen Accessible, Counselor(s)
St. Joseph's Catholic Church	207 Nicholls St. East Jordan	Church	250	Warming Center	Handicap Accessible, Power, Water, Lavatories, Kitchen Accessible
East Jordan Emergency Services Building	555 Maple St East Jordan	Fire/EMS Station	30 in Conference Room only	Warming/ Cooling Center	Handicap Accessible, Power, Air Conditioning, Heat, Water, Medical, Lavatories, Back-up Generator, Kitchen Accessible
Lighthouse Missionary Church	7824 Rogers Rd, East Jordan	Church	200	Warming/ Cooling Center	Handicap Accessible, Power, Air Conditioning, Heat, Water, Lavatories, Kitchen Accessible, Shower facilities, Counselor(s), Medical (EMT's)

Source: Charlevoix County Office of Emergency Management

The American Red Cross' Northern Michigan Chapter can provide assistance to create a long-term emergency shelter if needed.

Additionally, the Grand Traverse Band Tribe of Ottawa and Chippewa Indians (GTB) has one in-ground storm shelter, installed near the playground area at the GTB Charlevoix Community Center (10085 Wa-Ba-Noong Mi-Kun, East Jordan; 45° 12'33N-085° 11"03W). This project was funded in part by a FEMA hazard mitigation project grant awarded to the GTB Tribe. The shelter can accommodate approximately 24 people. That number may be reduced, depending on pets or belongings carried. The shelters were designed and installed for the safety and protection of residents without basements in their homes during severe storms and tornadoes. The GTB also has a basement at the Charlevoix satellite office at this location that can be used as a tornado shelter.

River and Lake Access Sites for Emergency Use (such as for water withdrawal or rescue access)

Table 54. River and Lake Access Sites in Charlevoix County

Jurisdiction	Description	Water Body	Owner
Bay Township	Lake Charlevoix Access Site (Lake S.)	Lake Charlevoix	Charlevoix County Road Commission
	Walloon Lake Access Site (Wildwood Dr.)	Walloon Lake	
	Walloon Lake Access Site (Stolt Road)	Walloon Lake	
	Sumner Road	Walloon Lake	
	Walloon Lake (Lily Pad Bay) Access Site (Eagle Island Road)	Walloon Lake	
Boyne Falls Township	Deer Lake Access Site	Deer Lake	State of MI
Charlevoix Township	South Point Boat Launch (Lake Shore Dr.)	Lake Michigan	Township
	Pine Point Boat Launch	Lake Charlevoix	Township
City of Boyne City	Lake Charlevoix Access Site (Lakeview Drive)	Lake Charlevoix	City
	Veteran's Park (small boat launch)	Lake Charlevoix	City
City of Charlevoix	Ferry Avenue Boat Launch	Lake Charlevoix	City
	US Coast Guard Station	Round Lake/Lake Charlevoix	US Coast Guard
City of East Jordan	Tourist Park Boat Launch	S. Arm of Lake Charlevoix	City
Eveline Township	Whiting Park Boat Launch	Lake Charlevoix	County
	Ironton Boat Launch off of 5th St	Lake Charlevoix	State of MI
Hayes Township	Kennedy Park (Burgess Road)	Lake Michigan	State of MI
	Nine Mile Point Boating Access Site	Lake Michigan	State of MI
	John W. Keschick Sr. Access Site	Lake Michigan	Little Traverse Bay Bands of Odawa Indians
	Hayes Township Park (Camp Sea-Gull)	Lake Charlevoix	Township
	Susan Lake Access (Shrigley Road)	Susan Lake	State of MI
Marion Township	Adams Lake Access site off of Pops Road	Adams Lake	State of MI
	Nowland Lake Access site off Nowland Lake Trail	Nowland Lake	State of MI
South Arm Township	Dutchman's Bay Boat Ramp	Lake Charlevoix	State of MI
	Six Mile Lake Access off of Miles Road	Six Mile Lake	State of MI
	Jordan River access at Rogers Road and Old Point Ridge Road (carry-in boats only)	Jordan River	State of MI
	Jordan River access at Alba Road	Jordan River	State of MI
Hudson Township	Thumb Lake Access Site (West End, off of Thumb Lake Rd)	Thumb Lake	Privately owned but leased to the State of MI
	Bows Lake Access Site	Bows Lake	Township
	Huffman Lake Access Site	Huffman Lake	Township
Melrose Township	Melrose Township Boat Launch	Walloon Lake	Township
Peaine Township	Lake Geneserath Access Site	Lake Geneserath	State of MI
	Fox Lake Access Site	Fox Lake	Township
St. James Township	Font Lake Access Site	Font Lake	Road Commission and Township
	Boat Launch at Gallagher Ave. & Main St.	St. James Harbor (Lake MI)	Road Commission
	Main St. near Bay St. at Marina North	St. James Harbor (Lake MI)	Township

Data sources: Charlevoix County Parks and Recreation Plan, 2020-2024; MDNR; Local Officials

Charlevoix County Community Capabilities

Charlevoix County Community Capabilities

	Bay Township	Boyne Valley Township	Chandler Township	Charlevoix Township	City of Boyne City	City of Charlevoix	City of East Jordan	Evangeline Township	Eveline Township	Hayes Township	Hudson Township	Marion Township	Melrose Township	Norwood Township	Peaine Township	St. James Township	South Arm Township	Wilson Township	Village of Boyne Falls
Population (2020 Decennial Census)	1,142	1,425	284	1,763	3,816	2,348	2,239	767	1,515	2,000	671	1,657	1,405	700	266	259	1,939	1,858	358
State Construction Codes (enforced/permited by County Building Dept.)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Watershed Management Plans (WMP)	TOMWC's Lake Charlevoix WMP; Little Traverse Bay WMP	TOMWC's Lake Charlevoix WMP; Little Traverse Bay WMP	TOMWC's Lake Charlevoix WMP; Little Traverse Bay WMP	TOMWC's Lake Charlevoix WMP	TOMWC's Lake Charlevoix WMP	TOMWC's Lake Charlevoix WMP	TOMWC's Lake Charlevoix WMP	TOMWC's Lake Charlevoix WMP	TOMWC's Lake Charlevoix WMP	TOMWC's Lake Charlevoix WMP; Little Traverse Bay WMP	TOMWC's Lake Charlevoix WMP; Little Traverse Bay WMP	TOMWC's Lake Charlevoix WMP; Little Traverse Bay WMP	TOMWC's Lake Charlevoix WMP; Six Mile Lake - part of TOMWC's Elk River Chain of Lakes WMP	TOMWC's Lake Charlevoix WMP	TOMWC's Lake Charlevoix WMP	TOMWC's Lake Charlevoix WMP			
Waterfront greenbelt requirement in Zoning Ordinance	X	X		X		X		X	X	X		X	(Shoreline Protection Overlay District - 40' veg. buffer)	X	Shoreline Protection Zoning Ordinance	X			
Local Floodplain Management Ordinance (NFIP participant)	X		NSFHA	X	X	X	X	X	X	X	X	NSFHA		X	X	X	X	No Special Flood Hazard Areas ID'd in 2019 Flood	
Zoning Ordinance includes structural setbacks from Ordinary High Water Mark of Lake MI				50 feet		50 feet in districts R1 and R4							50 feet in Lake MI Shores District; otherwise 100 feet			50 feet			
State Designated Critical Dunes Areas - permits issued by State of MI EGLE or Local Government				X		X									X	X	X		
Zoning Ordinance includes development restrictions in Critical Dune Areas				X												X	X		
Critical Sand Dune Permit Manual																X	X		
Outdoor Burning Regulations	MDNR's website https://www2.dnr.state.mi.us/burnpermits/ indicates if open burning is permitted in a county without a permit, or if there are burn permit restrictions in effect.														Beaver Island Fire Chief issues burn permits	www2.dnr.state.mi.us/burnpermits/			
Lake and Stream Management Associations	Walloon Lake Assn. & Conservancy	Friends of the Jordan River; Friends of the Boyne River		Lake Charlevoix Assn.	Lake Charlevoix Assn.; Friends of the Boyne River	Lake Charlevoix Association	Lake Charlevoix Assn.; Friends of the Jordan River	Walloon Lake Assn. & Cons.; Friends of the Boyne River	Lake Charlevoix Assn.	Lake Charlevoix Assn.	Lake Louise Christian Community	Lake Charlevoix Assn.	Walloon Lake Assn. & Conservancy	Beaver Island Association	Lake Charlevoix Assn.; Friends of the Jordan River	Friends of the Jordan River	Friends of the Boyne River		

Charlevoix County Community Capabilities

Charlevoix County Community Vulnerabilities																				
	Bay Township	Boyne Valley Township	Chandler Township	Charlevoix Township	City of Boyne City	City of Charlevoix	City of East Jordan	Evangeline Township	Eveline Township	Hayes Township	Hudson Township	Marion Township	Melrose Township	Norwood Township	Peaine Township	St. James Township	South Arm Township	Wilson Township	Village of Boyne Falls	
Population (2020 Decennial Census)	1,142	1,425	284	1,763	3,816	2,348	2,239	767	1,515	2,000	671	1,657	1,405	700	266	259	1,939	1,858	358	
Severe Winter Weather and Extreme Temperature Vulnerabilities																				
Blowing/Drifting Snow Concerns													M-75 at foot of Walloon Lake		Kings Hwy. and Fox Lake Rd. areas					
Est. number of residents > age 65	212	268	50	615	885	506	410	233	459	505	166	429	211	246	154	121	473	385	74	
Estimated number of residents with a disability	92	243	35	434	490	240	353	98	237	268	218	295	214	111	41	67	262	268	73	
Est. # of jurisdiction residents that are of a minority race	69	91	14	167	316	161	215	68	119	185	45	112	92	40	15	21	142	130	28	
Est. # of residents that are of Hispanic or Latino origin	9	24	5	48	68	26	49	14	31	18	7	35	15	5	5	2	36	28	11	
Est. # of residents that are in poverty	63	101	32	107	201	607	445	55	122	88	112	158	115	11	29	13	202	32	55	
Est. % of households that are ALICE	24%	39%	No Data Available	30%	39%	59%	48%	32%	27%	31%	40%	34%	32%	27%	40%	27%	27%	27%	No Data Available	
Recreation Land Acreage	1,189	4,947	16,810	660	649	123	110	1,018	401	907	3,441	424	8,678	2,282	12,791	93	833	1,304	(acreage included in Boyne Valley Township)	
Thunderstorm, High Winds, Hail, Tornado Vulnerabilities																				
Previous Tornadoes		2																	2	
Mobile Homes (Census Estimates)	17	72	10	207	222	34	76	35	17	175	83	38	58	14	22	3	59	105	21	
Campgrounds		2	1	1			1	1	1			1		1	3	2	2			
Recreation Land Acreage	1,189	4,947	16,810	660	649	123	110	1,018	401	907	3,441	424	8,678	2,282	12,791	93	833	1,304	(acreage included in Boyne Valley Township)	
Communications Critical Infrastructure (CI): Towers/Structures		1	1	4	2	3	2	1	1		1	1	1		2	1	1	1		
Energy CI: Elect/Natl Gas)		3	1	2	2	1	1	1	2	4	1	1	2		2		3	7		
Est. number of residents > age 65	212	268	50	615	885	506	410	233	459	505	166	429	211	246	154	121	473	385	74	
Estimated number of residents with a disability	92	243	35	434	490	240	353	98	237	268	218	295	214	111	41	67	262	268	73	
Est. # of jurisdiction residents that are of a minority race	69	91	14	167	316	161	215	68	119	185	45	112	92	40	15	21	142	130	28	
Est. # of residents that are of Hispanic or Latino origin	9	24	5	48	68	26	49	14	31	18	7	35	15	5	5	2	36	28	11	
Est. # of residents that are in poverty	63	101	32	107	201	607	445	55	122	88	112	158	115	11	29	13	202	32	55	
Est. % of households that are ALICE	24%	39%	No Data Available	30%	39%	59%	48%	32%	27%	31%	40%	34%	32%	27%	40%	27%	27%	No Data Available		

Charlevoix County Community Vulnerabilities																				
	Bay Township	Boyne Valley Township	Chandler Township	Charlevoix Township	City of Boyne City	City of Charlevoix	City of East Jordan	Evangeline Township	Eveline Township	Hayes Township	Hudson Township	Marion Township	Melrose Township	Norwood Township	Peaine Township	St. James Township	South Arm Township	Wilson Township	Village of Boyne Falls	
Population (2020 Decennial Census)	1,142	1,425	284	1,763	3,816	2,348	2,239	767	1,515	2,000	671	1,657	1,405	700	266	259	1,939	1,858	358	
Lightning and Space Weather Vulnerabilities																				
Campgrounds		2	1	1			1	1	1			1			1	3	2	2		
Communications Critical Infrastructure (CI): Towers/Structures		1	1	4	2	3	2	1	1		1	1	1		2	1	1	1		
Energy CI: Elect/Natl Gas)		3	1	2	2	1	1	1	2	4	1	1	2		2		3	7		
Site of Former Big Rock Nuclear Power Plant										x										
Airports (CI)		1		1	1	1	1								2		1			
Municipal Water and Wastewater Infr. Sites				8	6	11	15					1	3			1	1			
Recreation Land Acreage	1,189	4,947	16,810	660	649	123	110	1,018	401	907	3,441	424	8,678	2,282	12,791	93	833	1,304	(acreage included in Boyne Valley Township)	
Lake Shoreline Hazards																				
Shoreline Flooding Issues	x			x	x	x	x	x	x	x	x			x	x	x	x			
Shoreline Erosion Issues				x	x	x			x	x				x	x	x				
Critical Dunes				x		x								x	x	x				
High Risk Erosion Areas																				
Lake MI Public Beach Access				x		x				x				x	x	x				
Marinas connected to Lake MI					2	3	1		3								2	1		
FEMA FIRMS issued - adjoining Lake MI				x		x				x				x	x	x				
FEMA FIRMS issued - Lake Charlevoix connection to Lake MI	x			x	x	x	x	x	x	x	x	x				x				

Charlevoix County Community Vulnerabilities																				
	Bay Township	Boyne Valley Township	Chandler Township	Charlevoix Township	City of Boyne City	City of Charlevoix	City of East Jordan	Evangeline Township	Eveline Township	Hayes Township	Hudson Township	Marion Township	Melrose Township	Norwood Township	Peaine Township	St. James Township	South Arm Township	Wilson Township	Village of Boyne Falls	
Population (2020 Decennial Census)	1,142	1,425	284	1,763	3,816	2,348	2,239	767	1,515	2,000	671	1,657	1,405	700	266	259	1,939	1,858	358	
Inland Flooding Vulnerabilities																				
FEMA FIRM issued, NFIP participant	X		NSFHA	X	X	X	X	X	X	X	NSFHA		X	X	X	X	X	X	No Special Flood Hazard Areas ID'd in 2019 Flood	
FEMA FIRM issued, not in NFIP		X										X								
Dams (including available hazard potential rating)	Horton Creek Dam (Low)	Boyne Falls Dam (Significant), Boyne River Dam (Low), Massey Dam (Low)	Stover Creek Dam (Low); Charlevoix Kmart Retention Basin Dam (Low)						Lawton Valley Pond Dam (Low)			Belvedere Golf Club (Low); Marion Hills Dam (Low)	Walloon Lake CC Dams #3 (Low) and #14 (Significant); Walloon Lake Weir at Bear River (Low)				East Jordan Dam (Significant)	Deer Lake Level Control Structure (Low)		
Prior Inland Flood Incidents		X			X	X		X												X
Road/Stream Flooding Problems			X					X			X		X		X	X	X	X		
# of Road/Stream Crossings with a Moderate to Severe Rating	1	31	18	1	1		6	3		1	6	1	22				Data will be available later in 2024	27	24	1
# of Bridges with Poor, Serious, Critical or Closed Ratings						US-31 Bridge (Poor) *(Bridge rehabilitation complete in Spring 2024)					Iron Bridge Road Bridge (Closed)		Eastwood Road Bridge (Poor)							
Est. number of residents > age 65	212	268	50	615	885	506	410	233	459	505	166	429	211	246	154	121	473	385	74	
Estimated number of residents with a disability	92	243	35	434	490	240	353	98	237	268	218	295	214	111	41	67	262	268	73	
Est. # of jurisdiction residents that are of a minority race	69	91	14	167	316	161	215	68	119	185	45	112	92	40	15	21	142	130	28	
Est. # of residents that are of Hispanic or Latino origin	9	24	5	48	68	26	49	14	31	18	7	35	15	5	5	2	36	28	11	
Est. # of residents that are in poverty	63	101	32	107	201	607	445	55	122	88	112	158	115	11	29	13	202	32	55	
Est. % of households that are ALICE	24%	39%	No Data Available	30%	39%	59%	48%	32%	27%	31%	40%	34%	32%	27%	40%	27%	27%	27%	No Data Available	

Charlevoix County Community Vulnerabilities																				
	Bay Township	Boyne Valley Township	Chandler Township	Charlevoix Township	City of Boyne City	City of Charlevoix	City of East Jordan	Evangeline Township	Eveline Township	Hayes Township	Hudson Township	Marion Township	Melrose Township	Norwood Township	Peaine Township	St. James Township	South Arm Township	Wilson Township	Village of Boyne Falls	
Population (2020 Decennial Census)	1,142	1,425	284	1,763	3,816	2,348	2,239	767	1,515	2,000	671	1,657	1,405	700	266	259	1,939	1,858	358	
Wildfire Vulnerabilities																				
Eastern Pine and Red Pine Forest	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Jack Pine Forest	X			X				X	X	X		X	X	X						
Campgrounds		2	1	1			1	1	1			1		1	3	2	2			
Fire Hazard Concern Areas	X			X					X			X	X	X						
Est. number of residents > age 65	212	268	50	615	885	506	410	233	459	505	166	429	211	246	154	121	473	385	74	
Estimated number of residents with a disability	92	243	35	434	490	240	353	98	237	268	218	295	214	111	41	67	262	268	73	
Est. # of jurisdiction residents that are of a minority race	69	91	14	167	316	161	215	68	119	185	45	112	92	40	15	21	142	130	28	
Est. # of jurisdiction residents that are of Hispanic or Latino origin	9	24	5	48	68	26	49	14	31	18	7	35	15	5	5	2	36	28	11	
Est. # of residents that are in poverty	63	101	32	107	201	607	445	55	122	88	112	158	115	11	29	13	202	32	55	
Est. % of households that are ALICE	24%	39%	No Data Available	30%	39%	59%	48%	32%	27%	31%	40%	34%	32%	27%	40%	27%	27%	27%	No Data Available	
Drought Vulnerability																				
Recreation Land Acreage	1,189	4,947	16,810	660	649	123	110	1,018	401	907	3,441	424	8,678	2,282	12,791	93	833	1,304	(acreage included in Boyne Valley Township)	
Municipal Water Systems					X	X	X						X						X	
Agriculture Processing, Packaging & Production Facilities (Cl)							1		3			8					2			

Charlevoix County Community Vulnerabilities																				
	Bay Township	Boyne Valley Township	Chandler Township	Charlevoix Township	City of Boyne City	City of Charlevoix	City of East Jordan	Evangeline Township	Eveline Township	Hayes Township	Hudson Township	Marion Township	Melrose Township	Norwood Township	Peaine Township	St. James Township	South Arm Township	Wilson Township	Village of Boyne Falls	
Population (2020 Decennial Census)	1,142	1,425	284	1,763	3,816	2,348	2,239	767	1,515	2,000	671	1,657	1,405	700	266	259	1,939	1,858	358	
Invasive Species Concerns																				
Areas mapped as a locations of particular concern		Boyne River			Boyne River		Jordan River	Boyne River	Porter and Dyer Creeks		Thumb Lake (EWM)		Boyne River; tributaries to Walloon Lake ; Bear River; Shoreline along foot of the lake	Lakeshore Drive along Lake MI (phragmites)	AIS along MI shoreline and in inland lakes on the island.	6 Mile Lake (EWM); Jordan River				
Public Health Emergency Vulnerabilities																				
Assisted Living or Adult Foster Care Facility (CI)	1				4	2	1				2		1	1			1			
Est. number of residents > age 65	212	268	50	615	885	506	410	233	459	505	166	429	211	246	154	121	473	385	74	
Estimated number of residents with a disability	92	243	35	434	490	240	353	98	237	268	218	295	214	111	41	67	262	268	73	
Est. # of jurisdiction residents that are of a minority race	69	91	14	167	316	161	215	68	119	185	45	112	92	40	15	21	142	130	28	
Est. # of jurisdiction residents that are of Hispanic or Latino origin	9	24	5	48	68	26	49	14	31	18	7	35	15	5	5	2	36	28	11	
Est. # of residents that are in poverty	63	101	32	107	201	607	445	55	122	88	112	158	115	11	29	13	202	32	55	
Est. % of households that are ALICE	24%	39%	No Data Available	30%	39%	59%	48%	32%	27%	31%	40%	34%	32%	27%	40%	27%	27%	27%	No Data Available	

VI. Goals and Objectives

The mission of the Charlevoix 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, liability issues, a breakdown in vital services like transportation and infrastructure, economic slumps, and tourism loss. 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

Objectives:

- A. Encourage cooperation and communication between planning and emergency management officials
- B. Encourage additional local governmental agencies to participate in the natural hazards mitigation process
- C. Encourage public and private organizations to participate in the natural hazards mitigation process

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

Objectives:

- A. Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures; and into the county's comprehensive master plan
- B. Incorporate natural hazards mitigation into basic land use regulation mechanisms
- C. Update or create zoning ordinances to reflect any new building codes, shoreline protection rules, etc.
- D. Incorporate natural hazard area classifications into standard zoning classifications
- E. Improve community education efforts about hazard preparedness and prevention
- F. Increase public awareness and use of available emergency warning systems
- G. Strengthen the role of the Local Emergency Planning Committee in land development processes
- H. Integrate hazard mitigation into the capital improvement planning process so that public infrastructure does not lead to development in hazard areas
- I. Encourage county agencies to review local roads, bridges, dams, and related transportation infrastructure for natural hazards vulnerability

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

Objectives:

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

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

Objectives:

- A. Encourage public and business involvement in natural hazards mitigation projects

VII. Mitigation Strategies

Types of Mitigation Actions

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 Efforts

Furthermore, a set of evaluation criteria was developed to determine which mitigation strategies were best suited to address the identified problems in Charlevoix 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. Appendix A can assist with determining future problem areas.

Mitigation Strategies

Strategies were developed based on discussions amongst the Task Force, local officials and a review of FEMA best practices for hazard mitigation. A list of alternative strategies considered is included as Appendix E. The strategies table is grouped according to purpose. Purpose types include: Awareness & Preparation, Shelters, Buildings & Development, 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 this plan update. Note that the 2016 mitigation strategies were not assigned a priority level of "high", "medium", or "low", as they are in this plan; they were simply categorized within the following top five natural hazard priority areas:

1. *Potential of severe thunderstorms, high winds and severe winter storms: Concerns about transportation and utilities at a countywide level and also specifically at the US-31 Bridge in the City of Charlevoix*
2. *Boyne River and East Jordan areas: Potential flooding if dams were to fail*
3. *Eastern portion of the county: Potential wildfire and the possibility of tornadoes near a natural gas transmission facility in Chandler Township [located north of Great Lakes Road and west of Magee Road].*
4. *Wildfires in the rural areas of the County, specifically at Beaver Island and other small islands in the archipelago; Near Thumb Lake Road/Lake Louise Christian summer camp (lots of pine forest) in Hudson Township; and in the Huffman Lake area in Hudson Township, which is growing in population.*
5. *Festival events at seasonal population centers throughout the County: Potential severe thunderstorms, high winds, and tornadoes.*

Rationale for Prioritization of the Mitigation Strategies

The Charlevoix County Emergency Manager and Local Emergency Planning Committee 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:

PRIORITY LEVEL	RATIONALE
HIGH	High priority strategies are considered critical to preserve life and property, and will have the largest benefit for the community. High priority strategies often address human health, community safety, and protection of property and critical infrastructure. Many of these strategies have an enforcement standard and financing in place; a high level of need and/or anticipated economic benefit; or a high probability of immediate benefit public health or safety if the hazard event were to occur.
MEDIUM	Medium priority strategies address hazards that do not appear to have immediate benefits to public health or safety, and may have benefits to specific residents or visitors. Many of these strategies consist of ongoing practices, education or planning efforts. If the action item's responsibility pertained to a party that was not available for discussion, we defaulted to "Medium" to respect that they may have a different interpretation of the priority which could not be identified at the time this plan was written.
LOW	Low priority strategies are considered to be long-term mitigation efforts that will be worked on as resources (such as staff or financing) become available. The impact of these strategies is generally not considered to be absolutely critical to preserving life or property. Regarding foreseeable short- or long-term health and safety benefits (which may change within 5 years), the word "consider" was used in the action item. The probability of an event occurring in the geographic area is low, but not impossible, so it should be considered. The strategy's priority level may also change over time as new situations arise.

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

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE							STRATEGY TYPE						
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection
Awareness and Preparation	1 Incorporate the County Hazard Mitigation Plan's strategies into elements of county and local planning documents .	Countywide	County Planning Commission; All local jurisdictions	J, K	Ongoing	High	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	1a Annually review and update the Annex to Charlevoix County's Emergency Operations Plan for Beaver Island, and adjust Capital Improvement Plans so they align with the EOP.	Peaine and St. James Townships	Peaine and St. James Township Officials, Beaver Island Emergency Services Authority (EMS/Fire), and County EM.	J, K	Annual	High	X	X	X	X	X	X	X	X	X	X	X	X	X	
	2 Continue to pursue interdepartmental cooperation and coordination of police, fire, rescue and EMS services to maintain community-wide service coverage.	Countywide	See below		Ongoing	High	X	X	X	X	X	X	X	X	X	X	X	X	X	
	2a Ensure there is coordinated communication amongst flight and ferry service providers and BIEMS during the Beaver Island Airport reconstruction.	Peaine and St. James Townships	County EM, Township Supervisors, Airport Managers, USCG	J, K, N	2 years (est. completion in 2026)	High	X	X	X	X	X		X	X	X	X	X	X	X	
	2b Create a Community Wildfire Protection Plan for the Beaver Island Archipelago. Consider doing so with other inhabited islands in FEMA's Region 5.	St. James Township and Peaine Township	Peaine and St. James Townships, Beaver Island Fire Dept., Northern Lake MI Island Collaborative (MDNR); County EM	K, F, P2	3 years	High			X			X				X	X	X	X	
	2c Create an emergency plan that addresses emergency access to the outer islands . Focus on access between the outer islands and Beaver Island and the mainland, and trail development rescue/evacuation. The plan should conform with the appendix for Beaver Island in the County EOP.	St. James Township	Northern Lake MI Island Collaborative (MDNR), Beaver Island First Responders, St. James and Peaine Townships, County EM	J, K, N	2 years	High		X	X		X		X		X	X	X	X		

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE						STRATEGY TYPE								
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
Awareness and Preparation	2d Continue to conduct annual emergency scenario planning drills regarding possible issues with the US-31 bridge or the former Big Rock Nuclear Power Plant site.	City of Charlevoix; Hayes Township; Charlevoix Township	County EM	J, K, N	Annual; ongoing	High	X	X	X	X	X	X	X	X	X	X	X	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
	2e Maintain the relationship between the MDNR Forest Resources Division and the Local Fire Chief's organization; collaborate to utilize fire towers, fire spotters and aerial support as needed for fire prevention and response.	Countywide	Local Fire Chiefs; County EM; MDNR;	N	Ongoing	High			X				X							X	X
	3 Continue to increase participation in the BeAlert mass electronic notification system.	Countywide	County EM	J, K, N	Ongoing	Medium	X	X	X	X	X	X	X	X	X	X	X	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
	4 Inform the public about emergency events and shelter sites via utilization and promotion of the BeAlert mass notification systems, NOAA Weather Radio, and websites/social media (County website and FB).	Countywide	County EM	J	Ongoing	High	X	X	X	X	X	X	X	X	X	X	X	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
	5 Continue Charlevoix County Commission on Aging's practice of maintaining a list of elderly residents that receive "reassurance calls" during emergencies/power outages.	Countywide	Charlevoix County Commission on Aging; Beaver Island Rural Health Center; local EMS; Area Agency on Aging	O	Ongoing; COA has this as part of their process and create an updated call list quickly.	Medium	X	X	X	X	X	X	X	X	X	X	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts	
	6 Continue to develop Emergency Action Plans as needed for large public events.	Countywide	County EM	J, N	Ongoing	Medium	X	X	X	X	X	X	X	X	X	X	X	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
	7 Post MDNR Fire Danger Status via BeAlert messaging and social media (Facebook).	Countywide	Local Fire Depts, Bellaire MDNR Fire office; County EM	J, N	Ongoing	Medium			X									1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
	8 Support the identified needs of local fire agencies to effectively conduct their jobs.	Countywide					X	X	X	X	X	X	X	X	X	X	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts	

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE						STRATEGY TYPE									
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts	
Awareness and Preparation	8a Ensure there is at least one accessible standpipe for fire trucks to draft water from Thumb Lake	Hudson Township	Hudson Township/Local Fire Dept.	K, N	5-10 years	Medium	X		X			X						X	X	X		
	8b Establish proper fire access zone to access the three standpipes within the St. James harbor area.	Beaver Island (St. James Township)	Beaver Island Fire Department	K, N	Ongoing	High	X		X			X						X	X			
	8c Work to secure funding to construct two buried 30,000-gallon water tanks at the south and west ends of Beaver Island as water sources for fire fighting.	Beaver Island (Peaine and St. James Townships)	Beaver Island Fire Department , Townships, MDNR	F, I, K, N	3 Years	High	X		X			X						X	X			
	8d Maintain access locations to two inland lakes as water sources for the Beaver Island Fire Department.	Beaver Island (Peaine Township)	Beaver Island Fire Department , Township, MDNR	K, N	Ongoing	High	X		X			X						X				
	8e Upgrade Beaver Island's emergency radio communication system to overcome terrain/landscape interference with radios between 911 Dispatch and EMS/Fire Dept. users.	Peaine and St. James Townships	Charlevoix County OEM/Sheriff	J, K	3 Years	High	X	X	X	X	X	X	X	X	X	X		X				
	8f Develop additional fire stations where needed.	Countywide	Local governments, fire departments	I, K, N	As needed	Low			X				X						X	X		
	9 Provide information on fire safety prevention to guests at parks and campgrounds	MDNR campgrounds; Whiting Park campground; county and local parks	MDNR, County and Local Parks and Rec Depts.	J, N	Ongoing	Low			X				X							X	X	
	10 Work with campground managers to ensure they are aware of evacuation plans/routes and areas of refuge. Ensure routes are accessible to people with mobility, sight or hearing impairments.	Countywide	MDNR , local fire departments, private/local government campgrounds	J, N	Ongoing	Low		X	X	X	X	X	X	X	X	X	X	X	X		X	
	11 Provide information on fire safety and prevention to residents.	Countywide		J, N					X				X			X						

Theme	Charlevoix County Hazard Mitigation Strategies	Where - Affected Locations or Groups	Who - Responsible Parties (Lead entities are in Bold font)	How - Resources	When - Timeframe (Years)	Priority Type (High, Med, or Low)	Hazard Type					Strategy Type									
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
Awareness and Preparation	11a Promote awareness of vegetation/fuel management for fire prevention around homes and other structures.	Countywide	Local Fire Depts.; MDNR via radio and social media	J, N	Ongoing	Low			X			X						X	X		
	11b Encourage safe disposal of yard and organic waste (i.e., recycling or composting) rather than through open burning.	Countywide		J, N					X			X						X	X		
	11c Remind residents to check the MDNR's burn permit website to determine if a permit is needed or if there are restrictions in effect.	Countywide		J, N					X			X					X	X	X	X	
	12 Stay informed about any changes pertaining to the operation and management of the Boyne River Dam, Boyne Falls Dam, or East Jordan Dam, and Deer Lake Level Control Structure.	Boyne City, Village of Boyne Falls, Boyne Valley Township, City of East Jordan, South Arm Township, Wilson Township	County EM, local governments, DEGLE	J, K	Ongoing	Medium			X								X	X	X	X	
	13 Utilize the Elk River Chain-of-Lakes (ERCOL) hydrology study tool completed in 2022 by the USACE to evaluate and prepare for potential impacts to the watershed in various scenarios. (This is strategy #59 in Antrim County's 2023 Hazard Mitigation Plan.)	Six Mile Lake in South Arm Township	Charlevoix County Drain Commissioner, Antrim County Drain Commissioner, South Arm Township, EGLE	J, K, B2, O2	Ongoing	High			X									X	X	X	X
	14 Continue the preparedness practice of conducting the annual statewide tornado drill .	Countywide	County EM	J	Annual; ongoing	Medium		X									X			X	
	15 Investigate the feasibility of upgrading the three existing manual tornado sirens (in the 3 cities) to the 800mHz operating system. This would allow for automatic tornado warning messages to be sent to all communities in the county via the BeAlert notification system.	City of East Jordan has purchased upgrade equipment; City of Boyne City and City of Charlevoix to identify funding	County EM	B, H, J, K	0-3 Years	Medium		X									X	X	X	X	

Theme	Charlevoix County Hazard Mitigation Strategies	Where - Affected Locations or Groups	Who - Responsible Parties (Lead entities are in Bold font)	How - Resources	When - Timeframe (Years)	Priority Type (High, Med, or Low)	Hazard Type					Strategy Type									
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
Awareness and Preparation	21a Continue to provide and promote the Charlevoix County Commission on Aging's home meal delivery and senior center meal programs	Senior Centers in Charlevoix, Beaver Island, Boyne City and East Jordan; home-delivered meals available to any county resident age 60+	Charlevoix County Commission on Aging	J, O	Ongoing; COA has contingency plans in place for meal services during severe weather and public health emergencies	Medium	X	X							X	X					
	21b Maintain existing and add additional community gardens in shared open spaces and/or school locations to promote learning about growing local food, native pollinating plants, and provide access to fresh produce.	Countywide		I, K-M, U1, Y1, D2, E2, L2	Ongoing; 5-10 years	Low							X	X	X			X	X		X
	21c Continue to provide and improve food assistance programs and emergency food programs to help communities prepare for unanticipated emergencies, but also increase regular food accessibility.	Countywide	Food pantries; NMCAA; COA; school districts (school meal programs)	I, R, F2	Ongoing	Low									X	X					X
	22 Continue programs and services offered by the Health Dept. of Northwest Michigan that support disease prevention such as immunization services and E. coli monitoring at public beaches.	Countywide	HDNM, County EM	P	Ongoing	High									X	X					X
	23 Continue to rely on the MDHHS for guidance via the State Pandemic Plan and information about new or emerging disease threats.	Countywide	HDNM, County Medical Care Facility, Assisted Living Facilities, Munson Hospital, County EM	P	Ongoing	High									X	X					X
	24 Maintain proper levels of PPE for healthcare workers and first responders, with additional supplies for long-term care facilities.	Countywide	County EM; local fire/EMS; senior living facilities	F, H-K, N	As Needed	Medium									X	X					

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE						STRATEGY TYPE							
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection
Awareness and Preparation	25 Identify structures on properties that have been impacted by flooding; consider applying for FEMA hazard mitigation assistance grants related to flood mitigation , such as innovative stormwater management solutions; property acquisition; structure demolition, elevation, relocation or retrofitting; dry flood proofing; or project scoping	Countywide	County EM, Local Governments, Drain Commissioner, MI EGLE	A, B, C, H	As Needed; Ongoing	Low				X	X						X	X	X	
	26 Document where flooding and erosion has impacted or may impact areas of verified cultural assets on Beaver Island, and create a work plan for necessary site protection.	Beaver Island (Peaine and St. James Townships)	Local governments, Beaver Island Historical Society, Grand Traverse Band of Ottawa & Chippewa Indians; Amik Circle Society	A, B, C, H, K, L, N2	Ongoing	Low				X	X						X			X
	27 Continue to maintain existing agreements between local fire depts. and landowners (and municipal water suppliers where applicable) for secondary water sources in a drought.	Countywide	Charlevoix Conservation District, USDA-NRCS , MSUE, Local Fire Chiefs, Local Officials	N, W, X, X1, Z1	Ongoing	Medium						X					X			X
	28 Continue the USDA - NRCS's provision of free 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 disaster.	Countywide	USDA-NRCS , MDNR, Charlevoix Conservation District	X1, Z1	Ongoing	Low	X	X	X	X		X	X	X	X	X		X	X	X

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE						STRATEGY TYPE							
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection
Shelters	29 Maintain an accurate inventory of emergency shelter sites and their capabilities; review annually, update as needed.	Countywide	County EM ; American Red Cross	J	Ongoing; annually	Medium	X	X	X	X	X	X	X	X	X	X	X	X		
	30 Provide and publicize designated heating and cooling centers, targeting vulnerable populations such as elderly citizens.	Countywide	County EM ; Senior Centers	J	Ongoing	Medium	X					X			X		X	X	X	X
	31 Research funding sources for backup power generators to enhance capabilities of fire/EMS stations and shelters.	Countywide	County EM ; Local Fire Depts.; Senior Centers; Municipal Offices	B - E, H, I	1-2 years	Medium	X	X	X	X	X	X			X	X		X	X	X
	32 Evaluate the Senior Citizens Center in East Jordan as a preferred shelter site instead of the East Jordan Middle/High School; would need a generator.	City of East Jordan	County EM , East Jordan Public Schools, City of East Jordan, COA, Am. Red Cross	B - D, H, I	1-5 years	Medium	X	X	X	X	X	X			X	X		X	X	
	33 Evaluate the Shirley Roloff Center (serves as the Senior Center & County Offices) as a shelter site due to its size and resources; generator needed.	Charlevoix Township	Charlevoix County , County EM, City of Charlevoix, Charlevoix Township, COA	B - D, H, I	1-5 years	Medium	X	X	X	X	X	X			X	X		X	X	
	34 Continue to evaluate potential warming/cooling centers on Beaver Island for needed updates as guided by the ETIPP/ERCP project.	Peaine and St. James Townships	Beaver Island ETIPP Team , County EM, American Red Cross	B - D, H, I	Underway; evaluating buildings where the ARC could establish a MOU for use as a shelter	Medium	X	X	X	X	X	X			X	X		X	X	
	35 Create signage in public parks/beaches that illustrate the nearest emergency shelter.	Countywide	County and local governments; MDNR	J, K, N1, E2	5 years	Low		X		X	X									X
	36 Maintain best practices/ procedures for adequate quarantine areas in group living quarters, such as shelters, hospitals and assisted living facilities.	Countywide	County Medical Care Facility ; County Jail; Munson Hospital; assisted living/ adult foster care sites	P	Ongoing	Medium										X				X

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE						STRATEGY TYPE						
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects
Buildings, Transportation & Dams	37 Continue enforcement of building codes, stormwater management ordinance, soil erosion/sedimentation control, Critical Dune permits and EGLE permitting requirements relative to new construction or site modification.	Countywide; Critical Dunes are in Charlevoix Twp., Norwood Twp., St. James Twp., Peaine Twp., and City of Charlevoix.	County Building Dept.; Peaine Twp. and St. James Twp. for Critical Dune Permits on Beaver Island; EGLE	J, K, K1	Ongoing	Medium	X	X	X	X	X	X		X	X	X	X	X	X
	38 Continue to promote the availability of low-cost residential weatherization and home improvement programs.	Countywide	Charlevoix County operates the Emergency Home Repair Program ; Charlevoix County Commission on Aging, County EM, NMCAA	J - M, O, R, S, T	Ongoing	Medium	X	X	X	X		X			X	X	X	X	X
	39 Consider allocating county funds to develop a reduced-cost program to install air conditioning in the homes of low-income senior citizens.	Countywide	Charlevoix County Board of Commissioners; Commission on Aging, County EM	J, U	1-3 years	Low			X			X			X	X	X	X	X
	40 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.	Countywide	Charlevoix County OEM, Charlevoix County Brownfield Redevelopment Authority; Local Governments	J, K	Ongoing; In 2024 the County Sheriff's Office, County OEM and County of Charlevoix received grant funds towards blight and brownfield cleanup efforts	Medium		X	X	X	X				X	X	X	X	

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE						STRATEGY TYPE							
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection
Buildings, Transportation & Dams	41 Pursue available funding opportunities from the MI EGLE Dam Risk Reduction (DRR) Grant Program for the East Jordan Dam and Boyne Falls Dam	South Arm Township and City of East Jordan; Village of Boyne Falls and Boyne Valley Township	East Jordan Plastics Co., Village of Boyne Falls (County Road Commission/MDOT coordination in event of removal)	K, Q1, A2	0 - 5 years; Village of Boyne Falls received a DRR Grant in 2024 to conduct a feasibility study	High			X								X	X		
	42 Evaluate options for developing additional Lake Michigan access points (e.g., boat launches or strategically stored inflatable boat(s) on trailer(s)) for emergency use on Beaver Island. Current access points are in St. James Harbor & Bill Wagner Memorial Campground.	Peaine and St. James Townships	Peaine and St. James Twps., MIEGLE, MDNR, USACE, USCG	F, I, K, E2	2 years	High		X	X	X	X	X	X	X	X	X	X	X	X	
	43 Evaluate options for an emergency route that would function as an alternative for the section of King's Highway that currently has no alternative route. This section of road is near the GLE electric distribution site, a gas station, and stored LP tanks. Consider "Buddy Martin's Trail".	Peaine Township	Peaine Township, County Road Commission	K	2 years	High	X	X	X	X	X	X	X	X	X	X	X	X	X	
	44 Install snow fences along Kings Highway, including the roads near Beaver Island Airport and Welke Airport.	Peaine Township	Peaine Township, County Road Commission	K	3 Years	High	X												X	
	45 Ensure that St. James and Peaine Townships site plan review processes include appropriate driveway width/clearance standards to accommodate emergency vehicle access (minimum 12-15').	Peaine and St. James Townships	Planning Commissions and Planning Administrator of Peaine and St. James Townships, County Road Commission, Beaver Island Fire Dept.	K, N	Ongoing	Low	X	X	X	X		X	X				X			

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE					STRATEGY TYPE									
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
Buildings, Transportation & Dams	46	Inventory and prioritize improvements for flood/erosion prone locations in the County's infrastructure. (i.e., upgrading aging stormwater abatement structures, or replacing undersized/failing catch basins, culverts and bridges.)	Countywide	County Road Commission, MDOT, local governments County Drain Commissioner, public land management organizations	Ongoing	High	X	X	X						X	X					
	46a	Complete an inventory of Beaver Island's culverts, documenting their conditions and establishing short/long-term replacement plans, including the Cable Creek crossing.	Beaver Island (Peaine and St. James Townships)	County Road Commission, Townships, Tip of the Mitt Watershed Council, Conservation Resource Alliance, USFWS		Medium	X	X	X						X	X	X				
	46b	Continue to maintain the impoundment on Font Lake which functions as an emergency drainage point when the lake floods.	Beaver Island (Peaine and St. James Townships)	St. James Township		Medium		X							X	X	X				
	46c	During times of high Lake Michigan water, Gull Harbor Dr. and sometimes South End Rd. are closed by the County Road Commission. When South End Rd. experiences coastal erosion, repair is required. High water inland, related to beaver dams, can close Hannigan's Road. Consider phrasing road signage as "total closure at _ ft. ahead", instead of a simple warning of "high water ahead".	St. James Township	Charlevoix County Road Commission		Medium			X									X			
	46d	Flooding at Hetrick Road over Schoolhouse Creek	Boyne Valley Township	Charlevoix County Road Commission, local township governments		Medium			X	X								X	X		
	46e	Matz Road stream crossings - beaver dam activity floods near the road; water saturates the road bed. Contract with land owner to fix.	Chandler Township			Low			X									X	X		
	46f	Beaver dam activity impacting East Shadow Trail	Evangeline Township			Low			X									X	X		

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE				STRATEGY TYPE									
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection
Buildings, Transportation & Dams	46g	Address water runoff/erosion issues from roads on steep slopes in the Springwater Beach subdivision and near Hemingway Point Club Assn. homes along Pine Lake Rd.	Evangeline Township	B, J-M, A2-C2	0-5 years	Low			X									X	X	
	46g1	Consider adoption of a special assessment district to fund road drainage improvements.	Evangeline Township		0-5 years	Low			X									X	X	
	46g2	Consider installing rain gardens/bioswales to reduce runoff.	Evangeline Township		0-5 years	Low			X			X						X	X	
	46h	Flooding issues at Woodin Road stream crossing north of Huffman Lake Rd., on the county line	Hudson Township		Monitoring is ongoing	Low			X									X	X	
	46i	Narrow road crossings over the West Branch Sturgeon River on Bingham and Iron Bridge Roads due to beaver dam activity	Hudson Township		Monitoring is ongoing	Low			X									X	X	
	46j	Two culverts on Bauman Road over creeks need to be 15 feet longer. Culverts are very short and the road jogs; lots of beaver dam activity in the area.	Melrose Township		Monitoring is ongoing	Low			X									X	X	
	46k	Springvale Road has 3 culverts over the Bear River; two are failing. Very old. Classified as a bridge as it meets the minimum 20' span width. Springvale Road is an E-W primary road. Want to turn it into a free span bridge and open up the creek to increase creek flow and improve riparian habitat.	Melrose Township		Monitoring is ongoing	Medium			X									X	X	
	46l	Seasonal water issues at stream crossings at 4 locations on M-75, including Walloon Lake Dam over Bear River.	Melrose Township		0-5 years	Low			X									X	X	

Theme	Charlevoix County Hazard Mitigation Strategies	Where - Affected Locations or Groups	Who - Responsible Parties (Lead entities are in Bold font)	How - Resources	When - Timeframe (Years)	Priority Type (High, Med, or Low)	Hazard Type						Strategy Type							
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection
Utilities & Technology	46m Shadow Trail (near South Arm shoreline of Walloon Lake) was repaved in 2016-2017, but water still flows over the road at times around Fineout Creek. (due to beaver dam activity)	Melrose Township	Charlevoix County Road Commission, local government		Monitoring is ongoing	Low			X									X	X	
	46n Flooding near Six Mile Lake	South Arm Township			Monitoring is ongoing	Low			X									X	X	
	46o Flooding has occurred near the Raven Hill Discovery Center due to undersized culverts at Bergman Rd., Fuller Rd. and Marvon Rd. over Deer Creek.	Wilson Township			2024-2025	High			X									X	X	
	47 Continue regular trimming of vegetation (particularly diseased or dead trees) along various road and utility right-of-ways to minimize power outages and road blockages from storm damage.	Countywide	County Road Commission (utilizes a contractor), Cities/Villages, MDOT, Consumers Energy, Great Lakes Energy	K, A1, B1	Ongoing	High	X	X	X			X	X				X		X	
	48 Continue to maintain effective communications practices between electric utility companies regarding power restoration. (County EM to share electrical outage utility maps on social media.)	Countywide	County EM, Consumers Energy, Great Lakes Energy, City of Charlevoix	J, A1, B1	Ongoing	Medium	X	X	X			X								X
	49 Place electric and communication utility lines underground, such as during new construction, new utility connection work, or in areas regularly prone to power outages.	Countywide	Local governments with zoning; property owners; Consumers Energy, Great Lakes Energy, City of Charlevoix	B, H, K, A1, B1	Ongoing	Medium	X	X	X			X	X				X	X		
	49a Priority area to evaluate for Beaver Island: Bury electric lines between the GLE electric distribution station and the landward point of entry from Lake Michigan.	Peaine Township	Peaine Township, Great Lakes Energy		5-10 Years	Medium	X	X	X			X	X					X		

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE					STRATEGY TYPE							
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects
Utilities & Technology	49b Priority area to evaluate for Beaver Island: Bury electric lines on the east side of the island where there is a high density of development	Peaine Township	Property Owners, Great Lakes Energy		5-10 Years	Medium	X	X	X			X	X				X	X	
	50 Promote the use of small-scale renewable energy sources for homes, businesses and governmental facilities	Countywide	County/Local Governments, Consumers Energy, Great Lakes Energy		Ongoing	Medium	X	X				X					X	X	
	50a Continue to work with the ETIPP/ECRP project which is assessing the Beaver Island energy grid to propose sustainable energy recommendations and take action where possible.	Beaver Island (Peaine and St. James Townships)	Beaver Island ETIPP Team	E1 - H1, M2	Ongoing	Medium	X	X				X					X	X	
	51 Continue to maintain community sewer systems at acceptable regulated operating standards.	Cities of Charlevoix, Boyne City, East Jordan; Melrose Township; St. James Twp.;	Cities of Charlevoix, Boyne City, East Jordan; Melrose Township; St. James Twp.;	K	Ongoing	Medium				X	X					X	X	X	X
	51a Most of East Jordan's stormwater infrastructure is separate from the sewer system, although a small amount flows into the sanitary sewer. Stormwater from the community's southwest side still flows too rapidly into the sewer at times, and so the City may need to identify those problem areas.	City of East Jordan	City of East Jordan	F	Separation completed in 2024	High		X	X							X	X	X	X

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE						STRATEGY TYPE								
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
Utilities & Technology	52 Continue to maintain community water systems at acceptable regulated operating standards.	Municipal water service is provided by the cities of Boyne, Charlevoix and East Jordan, the Village of Boyne Falls, and Charlevoix Township. The unincorporated village of Walloon in Melrose Twp. is serviced by a privately owned water supply system.	Cities of Boyne, Charlevoix and East Jordan; Village of Boyne Falls; Charlevoix Township; Walloon Lake Water System Inc.	K	Ongoing	Medium		X		X X			X X	X X	X X	X X	X X	1. Local Planning & Regulations	2. Building & Infrastructure Projects	3. Natural Systems Protection	4. Education & Awareness Efforts
	53 Identify the locations of where backup generators may be needed for wastewater pump chambers or water storage towers to service issues in the event of a power outage, and apply for funding.	Cities of Charlevoix, Boyne City, East Jordan; Melrose Township; Charlevoix Township; Village of Boyne Falls	Cities of Charlevoix, Boyne City, East Jordan; Melrose Township; Charlevoix Township; Village of Boyne Falls; Walloon Lake Water System Inc.	B, C, E, H, K	1-5 years	Medium	X	X							X X	X X	X X	X X	X X	X X	X X
	53a Utilize the ETIPP/ERCP project to install a permanent generator to keep St. James Twp. sewer system pumps operative in a power outage	St. James Township	St. James Township		1 year	Medium	X	X X X							X X	X X	X X	X X	X X	X X	X X
	54 Continue to connect infill development and older homes on private septic systems to the existing City of Boyne City's water/sewer infrastructure system. (It is cost prohibitive for the City to extend water/sewer to development further outside of the existing system.)	City of Boyne City	City of Boyne City	K	Ongoing	Medium		X X							X X	X X	X X	X X	X X	X X	X X

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE						STRATEGY TYPE						
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects
Utilities & Technology	55 Maintain Continuity of Operations plans and alternative remote work schedules.	County, Local & Tribal Government Agencies; Schools	County, Local & Tribal Government Agencies; Schools	J - M	Ongoing	Low							X	X	X	X	X		
	56 Continue collaboration amongst local governments and utility providers to increase the availability of broadband service.	Rural areas of the county outside of cities and villages	Charlevoix County BOC; local governments; service providers; Connected Nation MI	I - K, C1, D1	Ongoing	Medium		X	X	X	X	X	X	X	X	X	X	X	
	57 Understand local utility/ transportation providers' practices and preparations to minimize disruptions from space weather and EMP events. Refer them to FEMA's Best Practices on EMP mitigation.	Countywide	Charlevoix County OEM, Airports, Ferries, MDOT, Communications & Energy Service Providers	Z	1-2 years	Medium							X		X	X	X	X	X
Environment & Natural Resources	58 Continue the <u>monitoring, treatment and removal</u> efforts for aquatic invasive species (AIS) and terrestrial invasive species (TIS)	Countywide	CAKE-CISMA, county and local governments, TOMWC, lake and stream management organizations, Charlevoix Conservation District, MDNR, Little Traverse Conservancy, Walloon Lake Association & Conservancy											X				X	
	58a AIS in the Jordan River	South Arm Township and City of East Jordan	Local governments, TOMWC, lake and stream management organizations, Charlevoix											X				X	
	58b AIS in Porter and Dyer Creeks (tributaries to Lake Charlevoix)	Eveline Township	Charlevoix Conservation District, MDNR, Little Traverse Conservancy, Walloon Lake Association & Conservancy										X				X		
	58c AIS in several tributaries on the south side of Walloon Lake; coastline along the foot of the lake (North Shore Dr., M-75 and S. Shore Drive); Bear River	Melrose Township	Charlevoix Conservation District, MDNR, Little Traverse Conservancy, Walloon Lake Association & Conservancy										X				X		

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE					STRATEGY TYPE							
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects
Environment & Natural Resources	59	Continue to provide <u>public education/outreach</u> regarding aquatic and terrestrial invasive species management.	Countywide	CAKE-CISMA, county and local governments, TOMWC, lake and stream management organizations, Charlevoix Conservation District, MDNR, Little Traverse Conservancy, Walloon Lake Association & Conservancy	T1 - W1, Y1, Z1, B2, D2, E2, G2 - L2	Ongoing	Medium					X						X	X
	59a	Consider participating in EGLE's annual Great Lakes Aquatic Invasive Species "Landing Blitz" event at public boat launches , emphasizing the need to Clean, Drain, Dry boats whenever they come out of the water, and Dispose of unwanted bait in the trash.	Countywide	CAKE-CISMA, county and local governments, TOMWC, lake and stream management organizations, Charlevoix Conservation District, MDNR, LTC		1 - 5 Years	Low						X					X	X
	59b	Consider applying for grant funding through MSUE's "Clean Boats, Clean Waters" comprehensive aquatic invasive species boater outreach program to communicate aquatic invasive species prevention information through outreach materials and demonstrations to boaters.	Countywide	Local or tribal units of government; Lake associations/watershed protection groups; Non-profit 501(c)(3) organizations		1 - 5 Years	Low						X					X	X
	59c	Continue TOMWC's Mobile Boat Washing Station (MOBO) Program, where volunteers use high-pressure, heated water to wash invasive plants and animals off boats and trailers. Visits are made to various Northern MI lake landings and wash boats for free throughout the summer.	Countywide	Tip of the Mitt Watershed Council		Ongoing	Medium						X					X	X

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE					STRATEGY TYPE							
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects
Environment & Natural Resources	59d Promote EGLE's "NotMISpecies" webinars and resources on invasives control and management best practices	Countywide	CAKE-CISMA, county and local governments, TOMWC, lake and stream management organizations, Charlevoix Conservation District		1 - 5 years	Low			X		X		X		X		X	X	
	59e Discuss amongst land managers/stakeholders the practice of conducting controlled burns on Beaver Island to reduce wildfire risk and manage invasive species.	Beaver Island (Peaine and St. James Townships)	Peaine and St. James Townships, tribal entities (LTBBOI, GTB), MDNR, Beaver Island Fire Captain		1 - 2 Years	Medium		X					X		X		X	X	
	59f Work with the Beaver Island transportation entities (boat and barge companies and airports) to address minimizing the spread of invasive species.	Beaver Island (Peaine and St. James Townships)	Peaine and St. James Townships, CAKE-CISMA, Beaver Island Boat Co., Beaver Island Airport, Welke Airport		1 - 2 Years	Medium							X		X		X	X	
	59g Investigate alternative, effective and cheaper invasive species control measures, such as livestock grazing.	Countywide	CAKE-CISMA, MSU Extension		1 - 10 years	Low							X				X	X	
	60 Consider updating zoning ordinances to mitigate lakeshore erosion and improve water quality, such as prohibiting shoreline armoring or requiring native vegetation in a greenbelt along a waterfront to prevent erosion.	Townships of Boyne Valley, Hudson, Marion, Melrose, Norwood, Peaine, St. James, South Arm, and Wilson; Cities of Boyne City, Charlevoix and East Jordan		K, J1 - M1, B2, G2, H2	1 - 5 years	Medium			X	X			X		X		X	X	
	60a Consider implementation of the zoning change and project recommendations provided in the <i>2023 Lake Charlevoix Shoreline Protection Report</i> prepared by LIAA and TOMWC	Townships of Bay, Charlevoix, Evangeline, Eveline, Hayes, Melrose, and South Arm; Cities of Boyne City, East Jordan, Charlevoix	Townships of Bay, Charlevoix, Evangeline, Eveline, Hayes, Melrose, and South Arm; Cities of Boyne City, Charlevoix and East Jordan	K, H2	1 - 5 years	Medium			X	X		X	X		X		X	X	

THEME	CHARLEVOIX COUNTY HAZARD MITIGATION STRATEGIES	WHERE - Affected Locations or Groups	WHO - Responsible Parties (Lead entities are in Bold font)	HOW - Resources	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Med, or Low)	HAZARD TYPE					STRATEGY TYPE							
							Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Coastal Hazards: Flooding, Erosion, Currents, Seiche, Waterspout	Extreme Temperatures	Drought	Dense Fog	Invasive Species	Space Weather & EMPs	Public Health Emergency	1. Local Planning & Regulations	2. Building & Infrastructure Projects
Environment & Natural Resources	60b Per the Walloon Lake Association & Conservancy's 2023-2027 Strategic Plan, Goal #4: Coordinate with agencies of the five townships, two counties and other concerned stakeholders on government policy to protect the lake and watershed. This requires forming an intergovernmental body to unify these communities with common ordinances.	Townships of Melrose, Evangeline, and Bay within Charlevoix County; and Resort and Bear Creek Townships within Emmet County	Walloon Lake Association & Conservancy (WLAC); Townships of Melrose, Evangeline, Bay, Resort, and Bear Creek; Emmet County; Charlevoix County	K, G2	1 - 5 Years	Medium			X	X			X	X	X			X	X
	61 Consider installing permanent boat wash stations at lake access points and boot cleaning stations at trail access points.	Countywide	MDNR, Local and County Government recreation providers	K, S1, T1, B2, D2, E2, G2, H2, L2	1 - 5 years	Low							X					X	X
	62 Continue to identify and prioritize sites for open space protection/preservation and green infrastructure, especially in areas prone to flooding or erosion.	Countywide	Little Traverse Conservancy; WLAC; County/Local governments; TOMWC	A, J - M, P1, D2, G2, L2	Ongoing	Medium			X	X	X		X				X	X	
	63 Incorporate green infrastructure-related goals and objectives in the county and local community plans.	Countywide	Charlevoix County Planning Commission; All local jurisdictions	J, K	Ongoing	Medium			X	X			X	X	X			X	
	64 Continue to provide information to educate and inform lakeshore residents about 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.	All communities except Chandler Township and the Village of Boyne Falls.	TOMWC, Local Governments, Charlevoix Conservation District, Lake Associations	K, I1 - M1, Y1, Z1, B2, E2, G2, H2, L2	1 - 5 years	Medium			X	X			X				X	X	
	65 Continue efforts to clean up river and lake debris.	Countywide	River & Lake Associations; TOMWC, LTC	A2, B2, D2, E2, G2 - J2, L2	Ongoing	Low			X	X								X	X
	66 Continue to regularly clean out culverts (due to sediment deposits, beaver activity, invasive species)	Countywide	Roadway owners/operators: Road Commission; MDOT; Cities; Villages	J, K, C2	Ongoing	Medium	X	X	X				X				X	X	

Key	Resource	Description	Website	Hazard Type
A	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.	https://www.fema.gov/grants/mitigation/floods	Flooding
B	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.	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities	All hazards
C	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.	https://www.fema.gov/grants/mitigation/hazard-mitigation	All hazards
D	FEMA Fact Sheet: Mitigating the Risk of Extreme Temperatures with Hazard Mitigation Assistance Funds	FEMA's Hazard Mitigation Assistance (HMA) grant programs provide funding for eligible mitigation measures that build climate resilience. These funds can be used to plan for and mitigate risks posed by natural hazards, including extreme temperatures. This fact sheet identifies opportunities for hazard mitigation assistance, provides an overview of considerations and identifies other available FEMA mitigation assistance. Potential projects include, but are not limited to, backup power for heating or cooling centers, hospitals, or publicly-owned multifamily residential structures; hardened power lines against high winds and winter storm hazards; climate smart building materials, and nature-based infrastructure solutions.	https://www.fema.gov/sites/default/files/documents/fema_extreme-heat-fact-sheet_102022.pdf	Extreme Temps, Severe Winter Weather, Thunderstorms/High Wind
E	FEMA HMGP Post-Fire Assistance (PFA) grant program	This FEMA 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.	https://www.fema.gov/grants/mitigation/post-fire	Wildfire, Drought
F	FEMA's Assistance to Firefighters (AFG) Grants Program	Fire safety grants fund critically needed resources to equip and train emergency personnel, enhance efficiencies and support community resilience. The primary goal of the Assistance to Firefighters Grant (AFG) is to meet the firefighting and emergency response needs of fire departments and non-affiliated emergency medical service organizations. Eligible applicants include fire departments, nonaffiliated Emergency Medical Services (EMS), state fire training academies, and non-federal airport and/or port authority fire or EMS organizations.	https://www.fema.gov/grants/preparedness/firefighters	Wildfire, Drought, Public Health Emergency
G	State of MI Bureau of Fire Services Fire Fighter Training Division	"SMOKE" - System Maintenance of Knowledge and Education - offers funding for local firefighter training.	https://www.michigan.gov/lara/bureau-list/bfs/fire-fighter-training-div#Overview	Wildfire
H	Michigan Hazard Mitigation Revolving Loan Fund Program	The Michigan State Police, Emergency Management and Homeland Security Division is developing an application for FEMA's Safeguarding Tomorrow Revolving Loan Fund Program. If successful in receiving a capitalization grant, Michigan would utilize the funds to supplement a revolving loan fund to provide hazard mitigation assistance loans for local governments to reduce risks from natural hazards and disasters. In accordance with application requirements, Michigan has developed an Intended Use Plan for the revolving loan fund and a Project Proposal List. Project proposals for the FY2024 application were sought from February 23, 2024, through April 12, 2024. New project proposals will be sought annually.	https://www.michigan.gov/msp/divisions/emhsd	Extreme temperatures; severe storms; wildfires; Flooding, including the construction, repair, or replacement of a nonfederal levee or other flood control structure; Shoreline erosion; High water levels
		This program promotes funding to disadvantaged communities through encouraging applicants to develop revolving loan funds that target those areas. Additionally, the revolving fund should provide at least 40% of its loans to underserved communities.	https://www.fema.gov/grants/mitigation/storm-rif	
		This program provides maximum flexibility for the funding of mitigation projects, allowing local communities to use their own criteria for project prioritization. FEMA does not require the submission of a benefit-cost analysis for capitalization grants or loans to be used.	https://www.fema.gov/grants/mitigation/storm-rif	
		Eligible project types under this program include activities that mitigate the impact of natural hazards, zoning and land use planning changes, and building code enforcement.	https://www.fema.gov/grants/mitigation/storm-rif	
I	USDA Community Facilities Direct Loan & Grant Program	Non-Federal Cost Share: Loans may be used by local governments to satisfy a local government's non-federal cost-share requirement for other FEMA Hazard Mitigation Assistance (HMA) grant programs, such as the Hazard Mitigation Grant Program, Hazard Mitigation Grant Program Post Fire, Building Resilient Infrastructure and Communities and Flood Mitigation Assistance grant programs.	https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-direct-loan-grant-program	All Hazards
		The Direct Loan & Grant program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings. Funds can be used to purchase, construct, and / or improve essential community facilities, purchase equipment and pay related project expenses. Examples of essential community facilities include:	https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-direct-loan-grant-program	
J	Charlevoix County Government	County staff including Emergency Management	https://www.charlevoixcounty.org/	All hazards
K	Local government staff	All local units of government - employees, elected and appointed officials	https://www.charlevoixcounty.org/	All hazards
L	Grand Traverse Band of Ottawa Indians	Tribal staff and members including Emergency Manager	https://www.gtbidians.org/	All hazards
M	Little Traverse Bay Bands of Odawa Indians	Tribal staff and members including Emergency Manager	https://ltbodawa-nsn.gov/	All hazards
N	Local Emergency Services and Fire Departments	Local units of government; MDNR	https://www.michigan.gov/dnr/managing-resources/forestry/fire	All hazards
O	Charlevoix County Commission on Aging	Provides programs and services to assist seniors with health and well-being: Senior Project FRESH; Senior Center Food Pantry, Senior Nutrition Program, Senior Dining Out Program, Senior Services Reimbursement Program (for transportation, lawn care, snow removal and light housekeeping).	https://www.charlevoixcounty.org/Commission_on_Aging/	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning, Flooding; Extreme Temperatures; Public Health Emergency
P	Health Department of Northwest Michigan	Provide programs and services such as: immunizations; infectious disease education and prevention; community clinics; school health services; permitting processes for proper location and installation of water wells and septic systems; beach monitoring for E.coli bacteria levels; education about cleaning, monitoring and maintaining septic systems; septic or well repair financial assistance, and the inspection and licensing of food service establishments.	https://nwhealth.org/	Public Health Emergency
Q	Septic Replacement Loan Program	The Septic Replacement Loan Program (SRLP), created in partnership with the Michigan Department of Environment, Great Lakes, and Energy (EGLE), provides low-interest financing to Michigan homeowners for the replacement of failing or near-failing septic systems. EGLE contracted Michigan Saves to develop and manage the program. Eligibility: Single-family homes, owner-occupied or rental property; Sites with documented failing, near-failing, nonexistent, or similarly inadequate septic system (as determined and documented by your local health department); Eligible costs include evaluation of the system, design, pumping, and installation; All systems funded through this program must meet SRLP program minimum standards.	https://michigansaves.org/septic/	Flooding; Public Health Emergency
R	Northern Michigan Community Action Agency (NMCAA) Nutrition Programs	COMMODITY SUPPLEMENTAL FOOD PROGRAM (CSFP) - a USDA funded program providing nutritionally balanced food supplements to senior citizens 60 & over. Must meet income guidelines. CSFP pickups held at the Boyne City Senior Center the 1st Thursday of the month from 9-10 am. THE EMERGENCY FOOD ASSISTANCE PROGRAM (TEFAP) - A USDA funded program providing federally purchased surplus food to low-income families. No age requirement but must meet the income guidelines. TEFAP distribution occurs at the Charlevoix Harvest Barn Church 210 S. Lake Street, East Jordan, MI 49727 Wed. of November, March, June, September 12:00 pm – 1:00 pm .	https://www.nmcaa.net/tefap.asp	Public Health Emergency

Key	Resource	Description	Website	Hazard Type
S	NCMCAA Emergency Home Repair Program	Charlevoix County works in conjunction with Northern Michigan Community Action Agency (NMCAA) to provide funding for emergency home repairs for homeowners. Repairs include structural or mechanical improvements necessary to alleviate a health or safety concern or a repair which is necessary to prevent additional damage to the home. Examples include, but are not necessarily limited to, issues related to furnaces, wells, septic systems, water heaters, and leaking roofs. Funding provided is a no interest, no monthly payment loan repaid upon future sale or transfer of the home or when the home is no longer occupied by the borrower. To qualify, homeowners must: <input type="checkbox"/> Own and live in the home for at least 1 year. <input type="checkbox"/> Property taxes paid. <input type="checkbox"/> Homeowners insurance paid. <input type="checkbox"/> Available home equity to secure the deferred mortgage. Household income at or below the 80% AMI 2023 limit, based on family size.	https://www.charlevoixcounty.org/Emergency%20Home%20Repair%20Program.pdf	Extreme Temperatures, Severe Winter Weather, Thunderstorms/Wind, Public Health Emergency
T	NCMCAA Weatherization Assistance Program	The Weatherization Assistance Program is funded by the Federal Department of Energy (DOE) and administered by the Michigan Department of Health and Human Services (DHHS). The program provides free energy conservation services for eligible low-income households. DHHS contracts with Northwest Michigan Community Action Agency (NMCAA) to operate the program in our service area. The Agency determines applicant eligibility, performs the necessary inspections and weatherization and contracts with mechanical contractors to complete mechanical work. Services may include: Home Energy Audit Weather-stripping, caulkng, general air sealing Window/door repair Attic, foundation, wall, or sill box insulation Programmable thermostat installation Furnace, water heater, refrigerator tune-up or replacement	https://www.nmccaa.net/energy.asp	Extreme Temperatures, Severe Winter Weather, Thunderstorms/Wind, Public Health Emergency
U	"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.	www.michigan.gov/mi-hope	Severe winter weather: Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency
V	"Senior Cool Care Program", Virginia Dept. for Aging and Rehabilitative Services	A potential model program for Charlevoix County/ Commission on Aging: Senior Cool Care is a public-private partnership sponsored by Dominion Energy and administered by the Virginia Department for Aging and Rehabilitative Services that helps low-income older citizens in Virginia keep cool during summer months. The program runs May 1 through the last working day in October. The program provides single room fans, window air conditioners and now portable air conditioners to elderly Virginians who live within Dominion Energy's service area and who meet eligibility requirements. Seniors must be 60 or older, be at or below 150% of the poverty level, and need additional cooling at home. Local Area Agencies on Aging administer Senior Cool Care by screening applicants and distributing air conditioners, fans, or portable air conditioners. The program does not cover the cost of installation or bill payment assistance.	https://www.vda.virginia.gov/seniorcoolcare.htm	Extreme Heat
W	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.	https://www.climatehubs.usda.gov/hubs/midwest/to(pic/midwest-agriculture-climate-team-mac-t	Drought, Extreme Temperatures, Flooding, Severe Winter Weather, High Winds, Hail
X	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).	https://www.cpc.ncep.noaa.gov/products/Drought/	Drought
Y	National Weather Service Skywarn Storm Spotter Program	To obtain critical weather information, the National Weather Service (NWS) established SKYWARN® with partner organizations. SKYWARN® volunteers help keep their local communities safe by providing timely and accurate reports of severe weather to the National Weather Service. Although SKYWARN® spotters provide essential information for all types of weather hazards, the focus is reporting on severe local thunderstorms.	https://www.weather.gov/skywarn	Severe Thunderstorms, Lightning, Hail, Tornados, Flash Flooding
Z	Electromagnetic Pulse Shielding Mitigations Best Practice	The report, published on 9/6/2022, is a collaborative effort between the Department of Homeland Security (DHS) Science and Technology Directorate (S&T), the Federal Emergency Management Agency (FEMA) Integrated Public Alert and Warning System (IPAWS) Program, and the Cybersecurity and Infrastructure Security Agency (CISA) that summarizes recommendations that federal, state, and local agencies and private sector critical infrastructure owners and operators can employ to protect against the effects of an EMP event.	https://www.dhs.gov/science-and-technology/publication/electromagnetic-pulse-shielding-mitigations-best-practice	EMPs
A1	Consumer's Energy Utility Service	Consumers Energy electrical and natural gas utility service. Energy through renewable energy sources is available. A power outage map is available to track outage locations.	https://www.consumerenergy.com/outagemap	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Wildfire
B1	Great Lakes Energy Cooperative Outage Center	Report an outage, check outage status, power outage preparation & safety tips	https://www.gtlakes.com/power-outages/	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Wildfire
C1	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.	https://connectednation.org/michigan/	All hazards
D1	Rural Digital Opportunity Fund - Spectrum Internet	The Rural Digital Opportunity Fund (RDOF) is a Federal Communications Commission initiative focused on bridging the digital divide to efficiently fund the deployment of broadband networks in rural America. This includes many unserved and underserved rural communities that do not have Internet service with speeds of at least 25/3 Mbps.	https://www.spectrum.com/cp/build	All hazards
E1	Energy Zones Mapping Tool	The Energy Zones Mapping Tool is a free online mapping tool to identify potential energy resource areas and energy corridors in the US. The website provides background on the energy resources: Biomass, Coal, Geothermal, Natural Gas, Nuclear, Solar, Storage, Water, and Wind; flexible modeling of power plant and corridor siting factors such as slope and land protections; and tools to generate and analyze potential corridor routes.	https://ezmt.anl.gov/	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures
F1	CBS Solar	Various solar information/funding resources	https://www.cbsolar.com/resources	Extreme Temps, Severe Winter Weather, Thunderstorms/High Wind
G1	MSUE Planning and Zoning Guide for Solar Energy Systems	For local officials and landowners	https://www.canr.msu.edu/resources/planning-zoning-for-solar-energy-systems-a-guide-for-michigan-local-governments	Extreme Temps, Severe Winter Weather, Thunderstorms/High Wind
H1	MI EGLE's Catalyst Communities Initiative	The Catalyst Communities Initiative is a comprehensive program to provide education, training, planning and technical resources to local governments as they work toward their sustainability goals. This program offers an array of resources on various environmental, social, and economic topics to help communities across Michigan make a just transition to decarbonization. The Initiative aims to provide a range of options to meet communities wherever they are, regardless of geography, population size, or pre-existing knowledge.	https://www.michigan.gov/egle/outreach/catalyst-communities	Extreme Temps, Severe Winter Weather, Thunderstorms/High Wind, Drought, Coastal Flooding, Inland Flooding
I1	Great Lakes Shoreviewer Tool	View aerial imagery of Lake MI shoreline and associated risk levels for coastline, infrastructure/roads, and buildings.	http://www.greatlakesshoreviewer.org/	Shoreline flooding and erosion
J1	LIAA's Northwest Lower MI Coastal Resilience Atlas	LIAA supports community resiliency and natural resource preservation, and provides community assistance. Their Coastal Resilience Atlas provides maps of coastal flooding and coastal erosion based on three future climate scenarios for communities adjoining Lake MI; and areas of the shoreline population, by census tract, that are most vulnerable to extreme heat events.	http://www.resilientmichigan.org/nw_atlas.asp	Shoreline flooding and erosion, Extreme Heat

Key	Resource	Description	Website	Hazard Type
K1	EGLE's Critical Dune Areas (CDAs) program and maps	Critical Dune Areas represent a diverse cross-section of dune shapes, height, and vegetation along Lake Michigan's shoreline. 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 NREPA. 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.	https://www.michigan.gov/egle/about/organization/water-resources/sand-dunes/critical-dunes	Shoreline erosion
L1	LIAA's Planning for Resilient Communities Program	Planning for Resilient Communities is a community engagement and technical services program developed by LIAA with numerous statewide partners. The program is helping citizens, local leaders and public officials plan communities that are more resilient to global challenges such as climate variability, extreme weather events and economic challenges. In collaboration with Michigan's Coastal Management Program, LIAA can help your master plan enhance coastal and community-wide resilience. Coastal Community Resilience Matching Grants are available. LIAA has also compiled a reference library for coastal resilience zoning using 5 key measures.	http://www.resilientmichigan.org/	Shoreline flooding and erosion
M1	MI EGLE's Coastal Management Program	A plethora of resources to improve coastal and climate resiliency through both planning and best management projects.	https://www.michigan.gov/egle/about/organization/water-resources/coastal-management	Shoreline flooding and erosion
N1	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.	https://www.greatlakeswatersafety.org/	Dangerous Coastal Currents
O1	Great Lakes Beach Hazards and Forecast	Know before you go! Great Lakes Beach Forecasts & Statements are issued seasonally for the U.S. side of Lake Erie, Lake Huron, Lake Michigan, Lake Ontario, and Lake Superior from roughly Memorial Day weekend through Labor Day weekend (weather dependent). Beach forecasts contain a daily swim risk, which is based on that day's threat of high waves and dangerous currents. Beach hazard statements provide additional details on high swim risk days.	https://www.weather.gov/greatlakes/beachhazards	Dangerous Coastal Currents
P1	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.	https://www.mcg1.state.mi.us/wetlands/mcg1Map.html	Flooding, drought, extreme temperatures
Q1	EGLE Dam Risk Reduction Grant Program	EGLE's Dam Risk Reduction Grant Program aims to provide private owners with the needed resources for proper management of existing dams and reduce the overall risk of dam failure in Michigan. Entities that own or operate a dam in the state of Michigan are eligible to apply. The applicant should be the entity that will hold the vendor contracts, if applicable. Federally regulated hydropower dams are ineligible for grant funding. Applicants must demonstrate that their project will reduce or eliminate risk associated with the dam. Applicants must be in compliance with the safety requirements of Part 315 and Part 307 of the NREPA. If not in compliance, the proposed project must be part of an approvable compliance plan provided EGLE. Eligible activities under the grant may include, but are not limited to: • Planning, feasibility studies, or design, of projects that reduce or eliminate risk of dam failure. • Repair, alteration, or removal of dams. • Post project monitoring and corrective actions.	https://www.michigan.gov/egle/about/organization/water-resources/dam-safety	Inland Flooding
R1	State of MI: Resources and Best Practices to prevent and manage invasive species	Prevention tips and action steps to control or remove invasive species.	https://www.michigan.gov/invasives/take-action	Invasive Species
S1	Michigan Invasive Species Grant Program	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. Tribal units of government are eligible to apply. Projects must support the overall goals of the MISGP: Prevent new invasive species introductions. Strengthen statewide invasive species early detection and response network. Limit the dispersal of recently confirmed invasive species. Manage and control widespread, long-established invasive species.	www.michigan.gov/invasives/grants/misgp	Invasive Species
T1	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 ¹ 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.	www.canr.msu.edu/clean_boats_clean_waters/index	Invasive Species
U1	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.	https://www.michigan.gov/invasives/take-action	Invasive Species
V1	Michigan State University Extension (MSUE)	Resources available for: training elected and appointed officials, agriculture and food support programs, and natural resources protection.	https://www.canr.msu.edu/outreach/	Inland flooding, shoreline erosion; Invasive Species; Public Health Emergency
W1	MSU 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.	https://www.canr.msu.edu/michiganlakes/convetion/	Inland flooding, shoreline erosion; Invasive Species
X1	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.	https://www.nrcs.usda.gov/	Drought; Extreme Temperatures; Invasive Species; Public Health Emergency
Y1	Charlevoix, Antrim, Kalkaska and Emmet Cooperative Invasive Species Management Area (CAKE CISMA)	CAKE CISMA is a cooperative organization dedicated to collaborative invasive species management throughout Northern Michigan. Their mission is to protect the environment, economy, and human health of Northern Lower Michigan through collaborative management of invasive species. They focus on education, outreach and restoration. They host educational events at schools, conduct invasive species treatment days with local non-profits, and treat high priority invasive species throughout their 4 county area. Most often they work with terrestrial invasive species, but occasionally work with aquatic invasive species as well.	https://www.cakecisma.org/	Invasive Species, Flooding, Coastal Hazards, Drought
Z1	Charlevoix Conservation District	The Charlevoix Conservation District provides the public with a point of access to the routine aspects of natural resource management. The delivery of these services allows citizens to manage their lands for a cleaner, healthier Charlevoix County. District projects include: Shoreline Considerations • Michigan Agriculture Environmental Assurance Program (MAEAP) Certification • Invasive Species Awareness • Qualified Forest Program • County Recycling Program • Soil & Water Stewardship • Backyard Conservation• County Plat Books • Native Plant Sale	https://www.charlevoixcounty.org/conservation_district/	Flooding, Coastal Hazards, Invasive Species, Extreme Temperatures, Public Health Emergency
A2	Conservation Resource Alliance (10-county northwest MI region, along with the southerly adjoining counties of Mason, Lake, Osceola, Oceana and Newaygo.)	Current projects include: Wild Roots, a cost-share program offering native plants to property owners at a greatly reduced rate; and The River Care Program, which ensures that natural resource professionals maintain a consistent and prioritized action plan for each river in the organization's region. River Care professionals not only find and repair physical problems before they become worse, they also team with local agencies, residents, and interest group representatives for fact-based conversations. These cross-functional teams can speak openly and affect change in an agile, efficient and transparent way.	https://www.rivercare.org/	Flooding & Erosion; Invasive Species; Drought; Extreme Heat; Public Health Emergency
B2	Tip of the Mitt Watershed Council	TOMWC is dedicated to protecting Northern Michigan's lakes, streams, wetlands, and groundwater through respected advocacy, innovative education (such as their mobile boat washing program), technically sound water quality monitoring, thorough research, and restoration actions. Technical services include Watershed Management Planning; Water Resource Inventories & Surveys; Monitoring Programs; Shoreline and Streambank Restoration; Wetland Determination; Project & Site Plan Review; Stormwater Studies & Management; Septic Evaluations for Shoreline Properties; Greenbelt Assessments and Design; and GIS, Mapping & Natural Resource Inventories.	https://watershedcouncil.org/	Flooding & Erosion; Invasive Species; Drought; Extreme Heat; Public Health Emergency
C2	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.	https://great-lakes-stream-crossing-inventory.michigan.hub.arcgis.com/	Flooding & Erosion

Key	Resource	Description	Website	Hazard Type
D2	Little Traverse Conservancy	<p>The mission of the Little Traverse Conservancy is to protect the natural diversity and beauty of northern Michigan by preserving significant land and scenic areas, and fostering appreciation and understanding of the environment. Their service area includes Chippewa, Mackinac, Emmet, Cheboygan, and Charlevoix counties. LTC achievements of June, 2023:</p> <p>More than 330 private properties have been given permanent protection with conservation easements. Almost 400 nature preserves and 38 working forest reserves are open to the public with more than 100 miles of trails available.</p> <p>Several partnerships with local units of government have protected additional lands now open to the public.</p>	https://landtrust.org/	Flooding & Erosion; Invasive Species; Drought; Extreme Heat; Public Health Emergency
E2	Charlevoix County Community Foundation	<p>The Charlevoix County Community Foundation is a charitable organization that's dedicated to improving and enriching life for all who live in our area. With assistance from a team of financial managers, the gifts received from donors are carefully invested to create a permanent endowment. Earnings from this endowment are used to make annual grants that support a wide variety of community programs that encourage environmental stewardship, artistic talent, and economic growth, health and wellness, youth initiatives, recreation, education, and more.</p> <p>In March of 2024, grants were awarded to these organizations/efforts, among others:</p> <p>Tip of the Mitt Watershed Council will use their grant to restore the Stover Creek stream channel profile, create instream habitat, and provide for more natural flow of water, sediment, and wildlife in Lake Charlevoix. Walloon Lake Association and Conservancy will purchase a vehicle for their staff to use in their work around the watershed. On Beaver Island, Tara's Meadow will conduct workshops on soil regeneration, organic waste management, and local food production, and will bring a monarch butterfly expert to lead in native plantings and butterfly protection efforts. St. James Township will use their grant to protect, educate, and improve access at the Gull Harbor Natural Area.</p> <p>Invasive species present an enormous threat to Michigan's biodiversity. Removing invasives and replacing them with native species, or simply planting more native species, is a highly effective way to address this issue. Three organizations will be using grant funds in related efforts: CAKE CISMA, through the Antrim Conservation District, Camp Daggett, and the Little Traverse Conservancy. Finally, funds granted to the Conservation Resource Alliance will help them to complete a multi-year project to replace aging infrastructure at road crossings on the Jordan River and Deer Creek, in the Jordan River Watershed.</p>	https://www.c3f.org/	Flooding & Erosion; Invasive Species; Drought; Extreme Heat; Public Health Emergency
F2	Groundwork Center for Resilient Communities	<p>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.</p>	https://www.groundworkcenter.org/food-farming/	Public Health Emergency
G2	Walloon Lake Association and Conservancy	<p>The mission of WLAC is to deliver Walloon Lake, a place where people and nature thrive, to the next generations through the power of conservation. The two environmental guardians — Walloon Lake Association with its lake monitoring and the Walloon Lake Trust and Conservancy with its conservation efforts — consolidated into one organization in 2019 that is now known as the Walloon Lake Association and Conservancy (WLAC). Today, the WLAC continues this tradition of stewardship through water testing, shoreline surveys, invasive species monitoring, safety lessons, and overall lake management. WLAC also educates neighbors and visitors, offering hiking trails, and promoting environmental research and initiatives. They steward over 2,300 acres, including 54 preserves and 20 conservation easements, uniting more than 1,000 members across two counties and five townships, all in an effort to protect Walloon Lake and its watershed.</p>	https://www.walloon.org/	Invasive Species; Flooding & Erosion, Public Health Emergency
H2	Lake Charlevoix Association	<p>LCA Mission Protect the natural quality and beauty of Lake Charlevoix Promote understanding and support for safe, shared use Advocate sensible and sustainable practices for lake use and development</p> <p>LCA Goals To educate the public on existing rules, regulations and good lake practices. To be the organization that Lake Charlevoix users and property owners turn to when questions come up concerning lake issues. To provide a comprehensive website and informative newsletters to members. To collaboratively make specific lake improvements, e.g. shoreline reconstruction, invasive species control. To provide a forum to discuss and address instances where beneficial lake behaviors are not being followed. To advocate sensible and sustainable positive actions on the lake. To cultivate members who can identify and help correct harmful activities on the lake.</p>	https://www.lakecharlevoix.org/	Invasive Species; Shoreline Erosion, Public Health Emergency
I2	Friends of the Boyne River	<p>The Friends of the Boyne River strives to improve and conserve the environmental health and recreational quality of the Boyne River and its tributaries in the 63-mile watershed. Work efforts include stream "health" monitoring, river sweeps, environmental speakers, controlling invasive purple loosestrife, membership events that promote camaraderie, and scholarships for students studying environmental fields.</p>	https://boyneriver.org/	Invasive Species; Flooding & Erosion, Public Health Emergency
J2	Friends of the Jordan River Watershed	<p>FJR's mission is to conserve the natural resources and protect the environmental quality of the Jordan River and its watershed.</p>	https://friendsofthejordan.org/	Invasive Species; Flooding & Erosion, Public Health Emergency
K2	Beaver Island Archipelago Terrestrial Invasive Species Program	<p>The Beaver Island Archipelago Terrestrial Invasive Species program is a joint effort between St. James and Peaine townships to control and eliminate the spread of invasive species in the Beaver Island Archipelago. CAKE CISMA partners with the Beaver Island Archipelago TIS Program regarding invasive management work and grants relating to the island. Managing invasive species in the archipelago is unique compared to the mainland and requires a different approach. Beaver Island is home to several rare/endangered species' many of which have been extirpated or have severely diminished available habitat on the mainland. Management work on Beaver Island focuses heavily on the protection of these species.</p> <p>Initiatives such as not allowing mainland firewood on the island have helped maintain pristine habitats throughout the archipelago. Because there are fewer invasives and more endangered/rare species, the invasives they do have are a higher priority on the island than on the mainland. For example, CAKE CISMA often treats Autumn Olive, a species far beyond control on the mainland, when they visit the island.</p>	https://www.cakecisma.org/beaver-island/#~text=The%20Beaver%20Island%20Archipelago%20Terrestrial,in%20the%20Beaver%20Island%20Archipelago	Invasive Species; Flooding & Erosion
L2	Beaver Island Association	<p>BIA focuses on issues that affect the fundamental character and beauty of Beaver Island. They:</p> <ul style="list-style-type: none"> Work with local governments to support property owners' views, concerns and investments by: Providing a forum for discussion of island governance and property taxes Representing membership concerns through township government liaison <p>Support preservation and wise use of natural resources, plants, and wildlife of Beaver Island by:</p> <ul style="list-style-type: none"> Collaborating with tribes, environmental organizations, schools, and government agencies Proposing environmental conservation policies and / or methods Sponsoring environmental education programs and public lectures and presentations Publishing a semi-annual newsletter and a continuously updated website Monitoring and controlling invasive species Cleaning up beaches and campgrounds, and Helping with forest fire prevention 	https://www.beaverislandassociation.org/	Invasive Species, Flooding & Erosion, Wildfires
M2	Beaver Island Sustainability Initiative	<p>Beaver Island Sustainability Initiative (BISI) means to establish Beaver Island as a regional model of sustainability and community resilience. Efforts focus on planning and action steps that engage broad segments of the local population, as well as civic leaders, township officials, Odawa tribal members, nonprofit organizations, universities, and other entities on and off the island to achieve goals within three main pillars: Smart, Clean Energy; Local Food Systems; and Ecological and Cultural Resilience.</p> <p>In 2022, Tara's Meadow and the BISI Smart Energy Team received an Energy Transitions Initiative Partnership Project (ETIPP) Technical Assistance Grant from the US Department of Energy. Through this multi-year, technical assistance project, ETIPP partners work alongside remote and island communities seeking to transform their energy systems and increase energy resilience.</p>	https://www.tarasmeadow.org/sustainability	Severe Winter Weather, Thunderstorm/High Winds, Hail, Intense Extreme Temperatures

Key	Resource	Description	Website	Hazard Type
N2	Beaver Island Sustainability Initiative	In 2023, Tara's Meadow and the BISI Smart Energy Team was one of 67 national winners of a U.S. Department of Energy Office of Clean Energy Demonstrations Energizing Rural Communities Prize. The Energy Prize is intended to incentivize communities in rural or remote areas to take the first steps necessary in developing a clean energy project. The Energy Prize will enable Beaver Island to pursue these goals with a short term Clean Energy Project, and to continue toward long term clean energy strategies and transitions. The first step will be the identification of essential island structures for complete energy audits and energy efficiency remediation. This will dovetail with the on-going, longer range strategies for Beaver Island energy sustainability and reliability that are currently being pursued through the BI Master Plan and through the ETIPP Technical Assistance Program.	https://www.energy.gov/eere/oecd/energizing-rural-communities-prize	Lightning, Extreme Temperatures, Dense Fog, Public Health Emergency
N2	Amik Circle Society	The group works to understand and protect the many stone circles, mounds and burial sites found in the Beaver Island Archipelago. They are a 501(c)3 non-profit organization formed for scientific and educational purposes.	https://amikcircle.com/	Flooding; erosion on Beaver Island
O2	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.	https://gtbay.org/elk-river-chain-of-lakes-watershed-implementation-team/	Inland flooding and erosion along Six Mile Lake in South Arm Township
P2	U.S. Fire Administration	Resources available to create a a Community Wildfire Protection Plan (CWPP). A CWPP can help to strategically document local risk and create an action plan and it will help everyone understand how making improvements to their home and the area around their home can create a more favorable outcome.	https://www.usfa.fema.gov/wui/communities/assess-risk.html	Wildfire, Drought

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 natural and technological 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.

Resources to Assist with Implementing the Strategies

To assist with the funding and/or enacting of the proposed natural hazards mitigation strategies, the Resources Table on the previous pages lists multiple resources that can help fund, staff or otherwise support the implementation of hazard mitigation strategies. Each potential entity or program is assigned a letter code, listed in the "Resources" column of the strategies table.

The following is a general list of some of the financial assistance entities to help fund strategic actions of the Plan.

- Federal Emergency Management Administration – Hazard Mitigation Grant and Building Resilient Infrastructure and Communities Programs
- U.S. Environmental Protection Agency
- U.S. Department of Agriculture Natural Resources Conservation Service
- U.S. Department of Agriculture Rural Development: Rural broadband opportunity – high speed telecommunication funding from Public Telecommunications Facilities Planning and Construction grants
- U.S. Department of Housing and Urban Development
- Michigan Department of Environment, Great Lakes, and Energy
- Michigan Department of Natural Resources
- National Oceanic and Atmospheric Administration
- Community, Regional Foundations
- Businesses

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 Management Coordinator and the Administration. The Local Emergency Planning Committee (LEPC) is an inter-agency partnership led by the county's Emergency Management Coordinator 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 Charlevoix County Emergency Management Coordinator and will coordinate with the County Board of Commissioners.

The Natural Hazards Task Force will perform an annual review of the Charlevoix 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 will be encouraged to actively participate in revising, updating, and maintaining the plan.

- Charlevoix County Government Staff
- Charlevoix County Road Commission
- Townships and Villages (elected and appointed officials)
- Little Traverse Bay Bands of Odawa Indians
- Grand Traverse Band of Ottawa and Chippewa Indians
- Charlevoix Conservation District
- Charlevoix, Antrim, Kalkaska and Emmet Coordinated Invasive Species Management Area

- Little Traverse Conservancy
- Tip of the Mitt Watershed Council
- Walloon Lake Association and Conservancy
- Lake Charlevoix Association
- Beaver Island Association
- Friends of the Jordan River
- Munson Hospital – Charlevoix
- Charlevoix Chamber of Commerce
- Networks Northwest
- Health Department of Northwest Michigan
- Michigan State University Extension
- Michigan Department of Environment, Great Lakes, and Energy
- Michigan Department of Natural Resources
- The Emergency Management and Homeland Security Division within the Department of Michigan State Police
- U.S. Environmental Protection Agency
- U.S. Coast Guard
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture Natural Resources Conservation Service
- American Red Cross
- National Weather Service (Gaylord)
- Insurance and real estate companies

In addition, the townships, cities and village within the county have indicated to the county emergency manager that they will follow the county's lead in identifying hazard 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 (all communities except for the Village of Boyne Falls). Professional planners assist the individual 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, soil erosion permits, and storm water permits are issued for applicable construction projects in all Charlevoix County communities by the County's Department of Building Safety. Permits related to water well and septic systems are issued by the Health Department of Northwest Michigan. Permits related to State-designated Critical Dune Areas are issued by the Michigan Department of Environment, Great Lakes, & Energy (EGLE) for all communities except for Peaine and St. James Townships on Beaver Island (they issue their own CDA permits though the enforcement of their local zoning ordinances).

Plan Integration

All communities, local and state agencies in Charlevoix County will consider integrating information from the hazard mitigation plan into their comprehensive and operations plans. As part of the education and outreach aspect of the hazard mitigation effort, the local communities will be encouraged to adopt zoning regulations to minimize the risk and impact from 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

Peaine and St. James Townships in the Beaver Island archipelago have indicated in their 2023 Beaver Island Master Plan that a “very high priority” action item pertaining to social services and leadership is to consolidate the two townships into one township government.

Five Year Plan Review and Update

The Stafford Act, as amended by the Disaster Mitigation Act of 2000, requires the County’s 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 completion, the updated 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 Charlevoix County Board of Commissioners, along with individual local units of government that participated in the plan’s development, can formally adopt the plan. In order to properly update the plan in the future, Charlevoix County will need to seek funding from appropriate state and/or federal agencies.

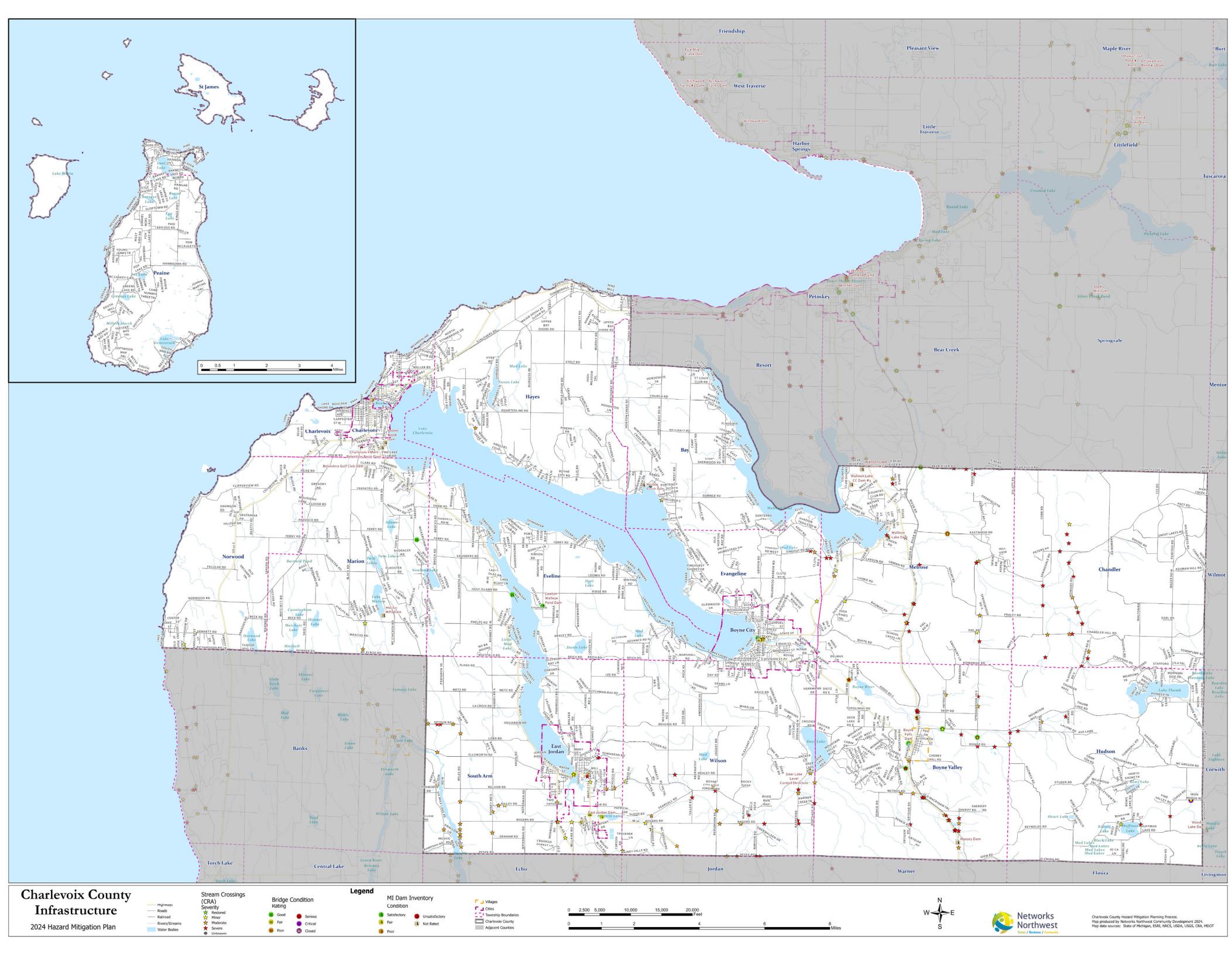
Continued Public Involvement

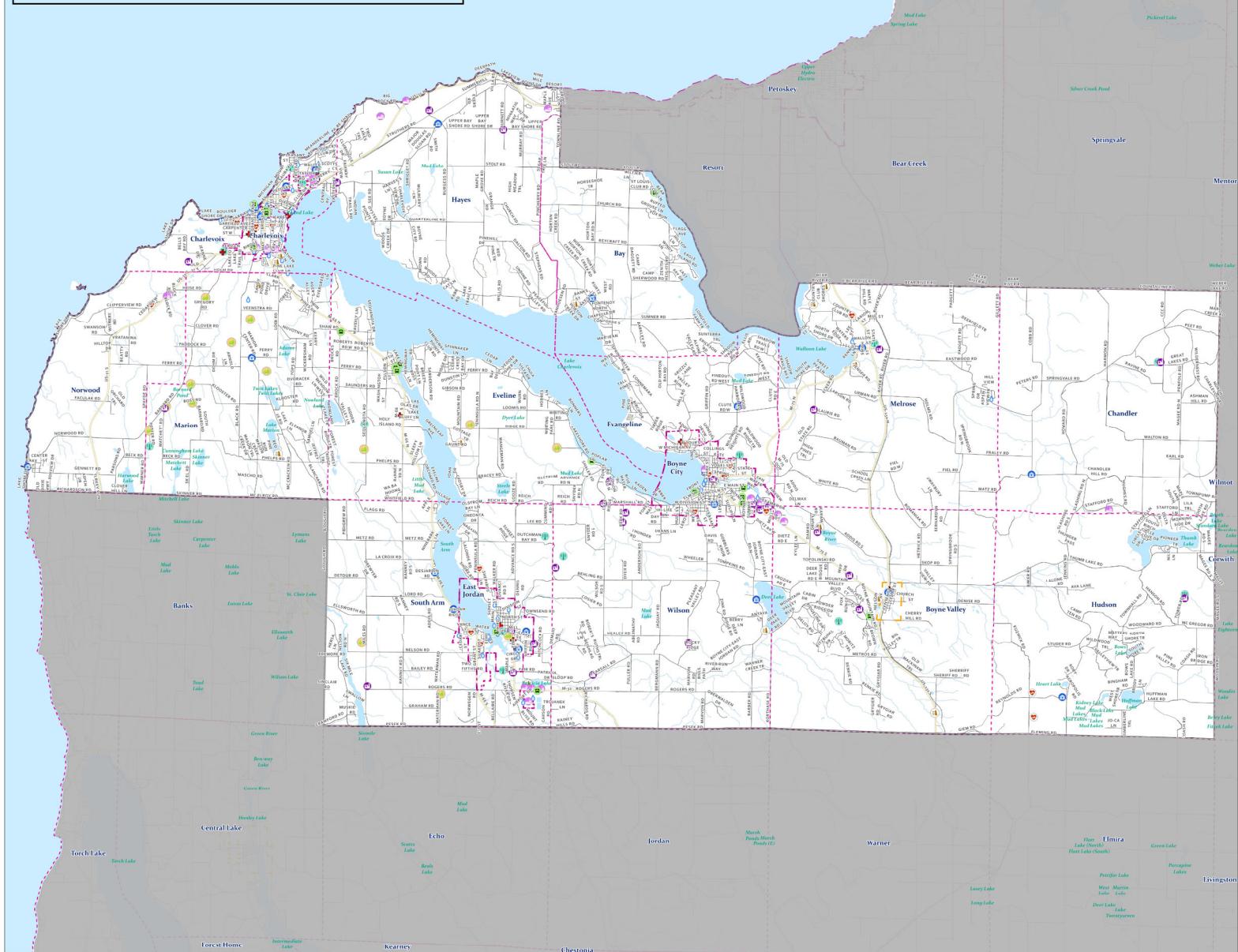
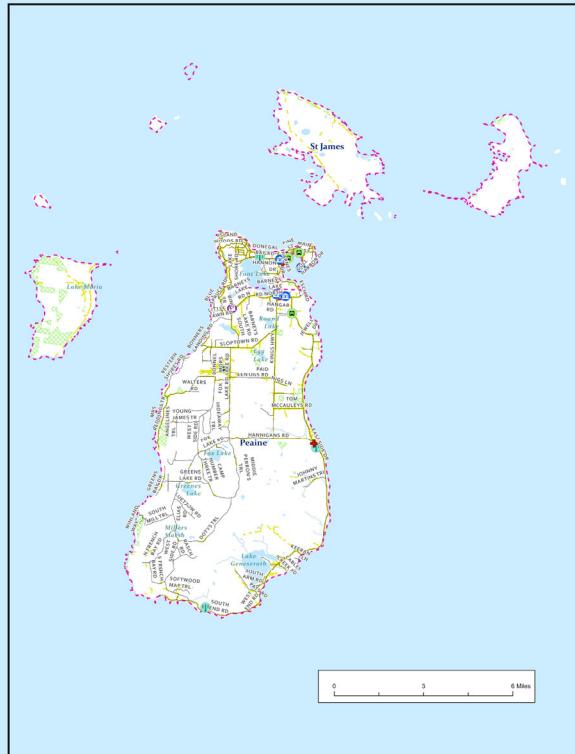
Charlevoix County is committed to keeping the public involved in the implementation and update of the Hazard Mitigation Plan. Copies of the plan will be available at the county libraries, county clerk’s office, and all township offices, and will be posted on the community websites and/or regional planning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

APPENDIX A: MAPS

Map images are provided on the following pages and can also be viewed in greater detail by clicking on the hyperlinked map names listed below.

1. [Environmental Features](#)
2. [Infrastructure](#)
3. [Critical Infrastructure](#)
4. [Hazard Areas](#)
5. [Critical Infrastructure and Hazard Areas](#)
6. [Vulnerable Populations and Hazard Areas](#)





Charlevoix County Critical Infrastructure Points

2024 Hazard Mitigation Plan

Legend

Sector	Symbol
Highways	Yellow line
Railroad	Red line
Rivers/Streams	Blue line
Water Bodies	Blue polygon
Villages	Yellow square
Agribusiness	Green square
Communications	Blue square
Emergency Services	Red square
Healthcare	Pink square
Industry	Orange square
Energy	Yellow square
Water Utilities	Blue circle
Government Facilities	Green circle
Others	Yellow circle
Emergency Boundaries	Yellow dashed line
Adjacent Counties	Light blue shaded area
Water Bodies	Blue polygon

0 3,000 6,000 12,000 18,000 24,000 Feet

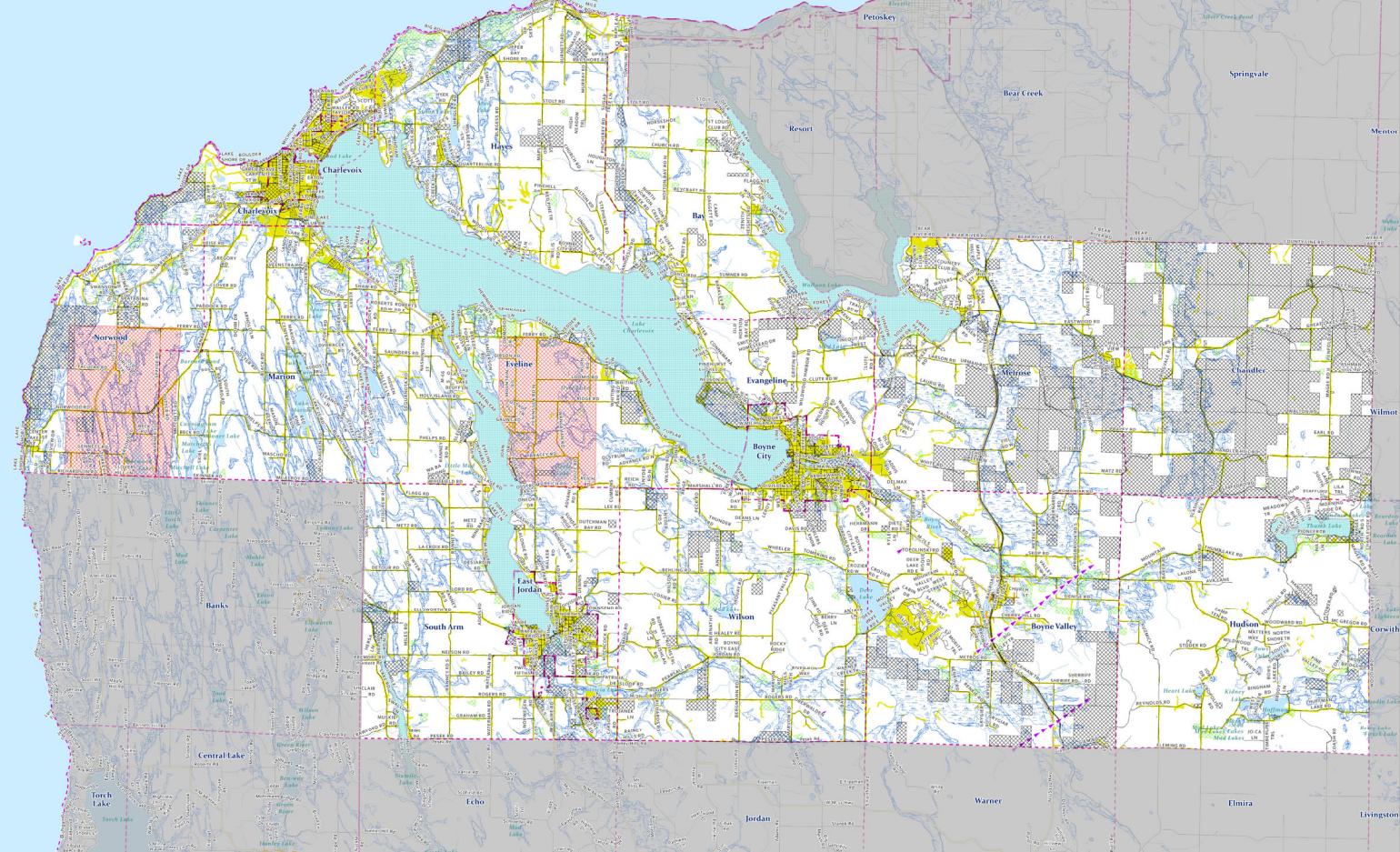
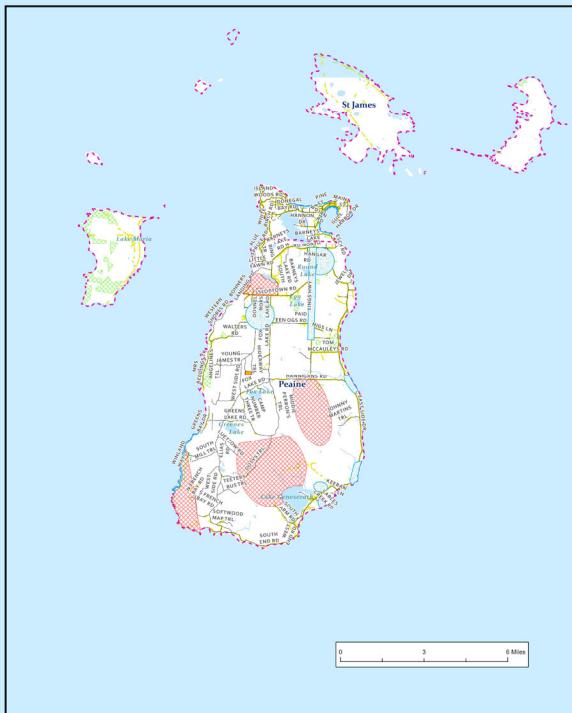
0 0.5 1.25 1.88 2.5 Miles

Charlevoix County Hazard Mitigation Planning Process
Map produced by Networks Northwest Community Development 2024.
Map data sources: State of Michigan, ESRI, NALC, USGS, ODA, USGS, OIA, MDOT,
Charlevoix County Emergency Management



Networks Northwest

Community Development

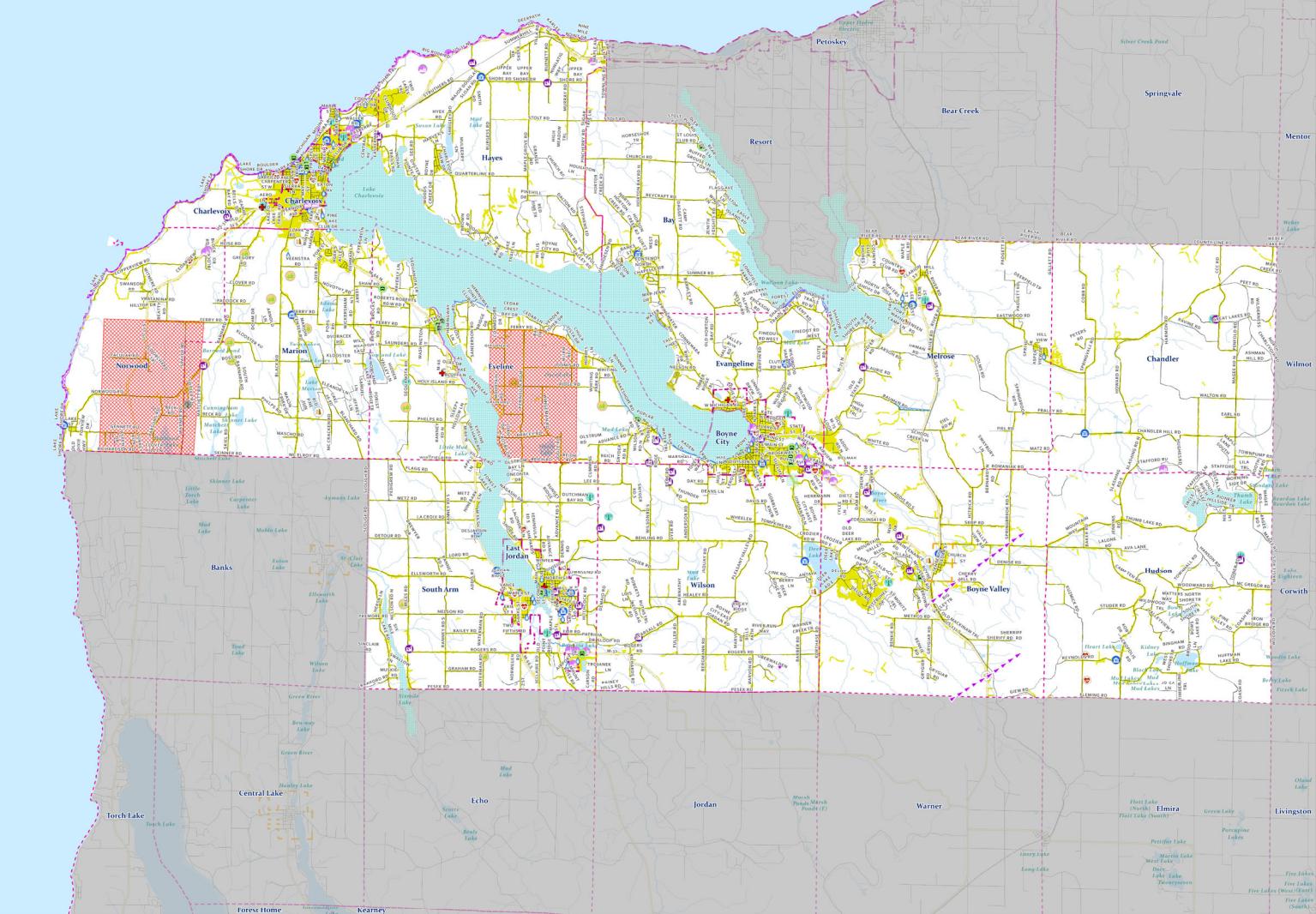
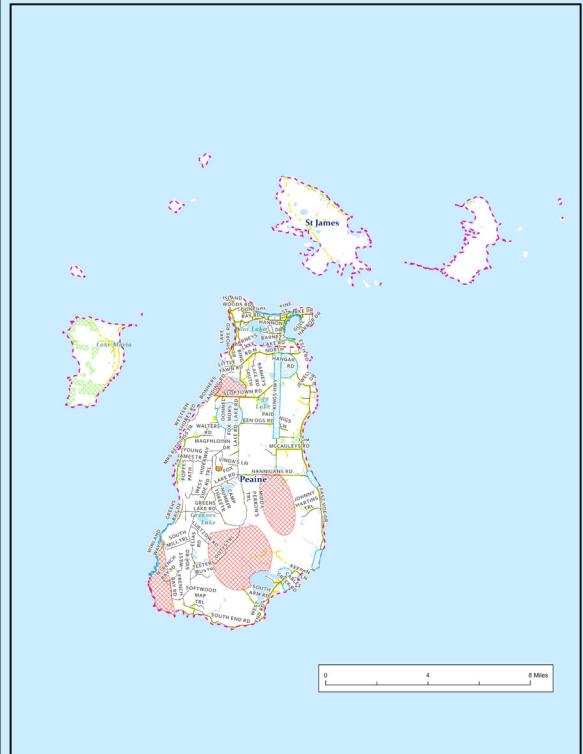


Charlevoix County Hazard Areas

2034 Hazard Mitigation Plan

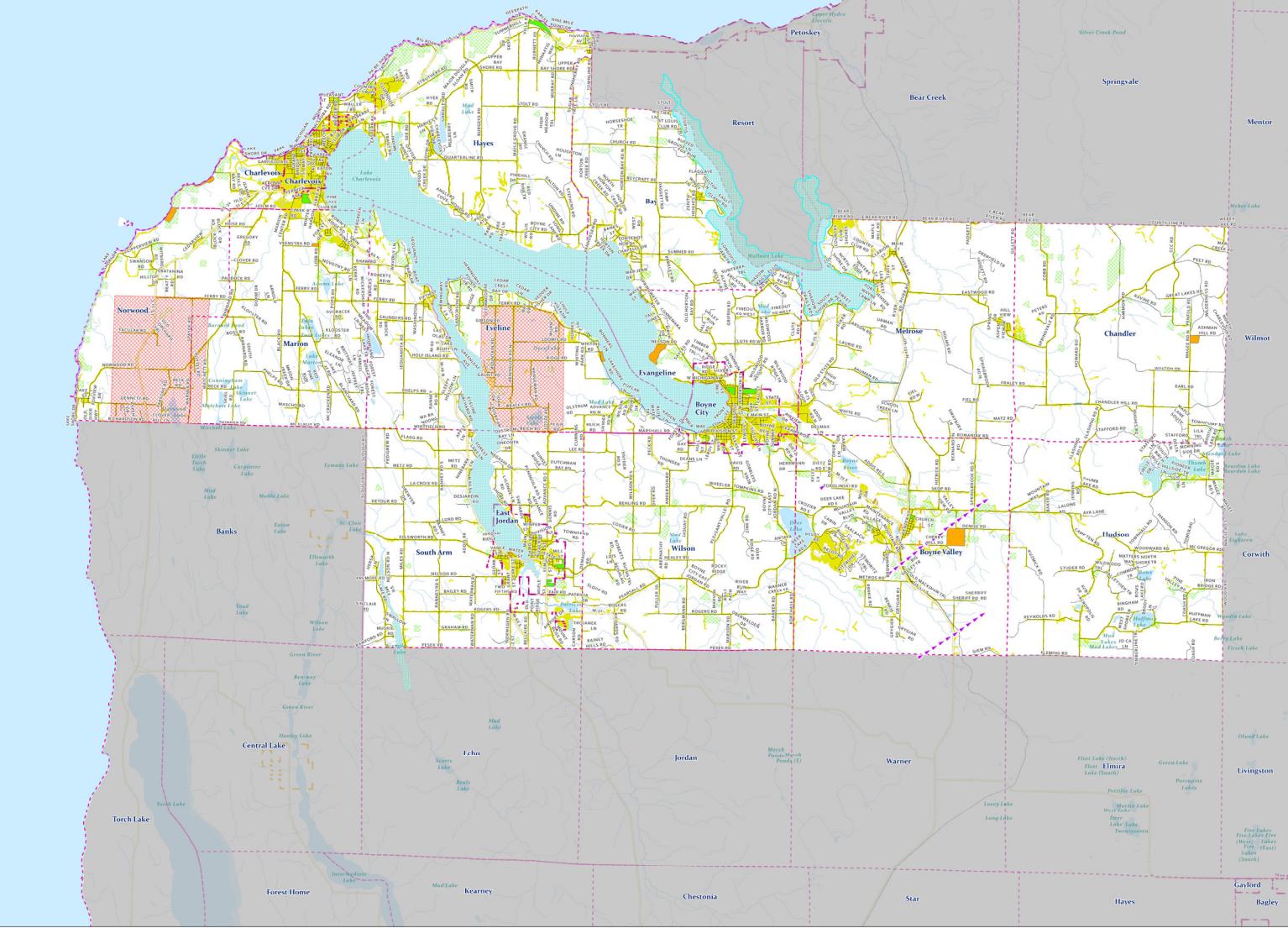
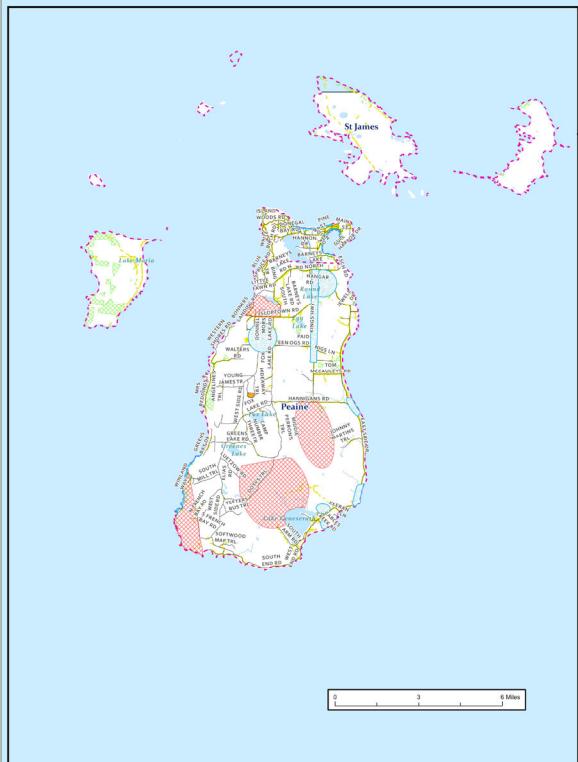


Charlevoix County Hazard Mitigation Planning Process.
Map produced by Networks Northwest, Community Development 2024.
Map data sources: State of Michigan, ESRI, NRCS, USDA, USGS,
Charlevoix County Emergency Management



Charlevoix County Hazard Mitigation Planning Process
Map produced by Networks Northwest, Esri, NRCIS, USDA, USGS, CBA, MDOT, Charlevoix County Emergency Management





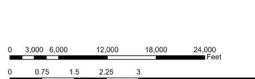
Charlevoix County Hazard Areas & Vulnerable Populations

2024 Hazard Mitigation Plan

Legend

Legend for the map:

- Corporation
- Fire
- Adjacent Counties
- Villages
- Mobile/Manufactured Homes
- Invasive Species
- Pine Forest
- Cities
- Hazards Areas
- Shoreline Erosion
- Snow Belt
- Tornadoes
- Highways
- Flooding
- Developed Land
- Railroad
- Township Boundaries
- Rivers/Streams



Charlevoix County Hazard Mitigation Planning Process.
Map produced by Networks Northwest Community Development 2024.
Map data sources: State of Michigan, ESRI, NRCS, USDA, USGS, CRA, MDOT
Charlevoix County Emergency Management





Networks Northwest
Talent | Business | Community

APPENDIX B: COMMUNITY SURVEY RESULTS

Default Report

Charlevoix County Hazard Mitigation Community Survey

August 28, 2023 3:06 PM MDT

Q1 - Charlevoix County and Networks Northwest are currently working on Phase I of the process to update to the Charlevoix County Hazard Mitigation Plan. Hazard mitigation planning reduces loss of life and property by minimizing the impact of natural disasters. This phase of the update includes data collection and community input from all local jurisdictions in Charlevoix County. Your participation in this survey is vital to the success of the planning process. We are seeking input on past projects, hazard events in your community, and potential strategies you would like to see considered in the plan. Your participation is also voluntary. You may choose not to answer certain questions, to discontinue your participation at any time, or not to participate at all, without consequences. Local officials should note their name, organization, and title will be used in the final plan to indicate participation from an agency representative - a requirement of the approval agency, FEMA. If you have any questions or concerns about this project, please contact Jennifer Neal, (231-709-3204; jennifer.neal@networksnorthwest.org).

Q2 - Please identify the jurisdiction you represent in Charlevoix County (choose all that apply).

#	Field	Choice Count
1	Charlevoix County Government	20.83% 15
2	City of Boyne City	5.56% 4
3	Village of Boyne Falls	1.39% 1
4	City of Charlevoix	16.67% 12
5	City of East Jordan	4.17% 3
7	Bay Township	4.17% 3
8	Boyne Valley Township	4.17% 3
9	Chandler Township	1.39% 1
10	Charlevoix Township	2.78% 2
11	Evangeline Township	1.39% 1
12	Eveline Township	4.17% 3
13	Hayes Township	1.39% 1
14	Hudson Township	0.00% 0
15	Marion Township	2.78% 2
16	Melrose Township	1.39% 1
17	Norwood Township	2.78% 2
18	Peaine Township	1.39% 1
19	South Arm Township	4.17% 3
20	St. James Township	9.72% 7
21	Wilson Township	2.78% 2
22	Other	6.94% 5

Showing rows 1 - 22 of 22

Q3 - What is your role/organizational representation within Charlevoix County (i.e. resident, local government employee, elected official, business or property owner, etc.)?

What is your role/organizational representation within Charlevoix County (i...

Elected official

Cheboygan County Emergency Management

N/A

City of Charlevoix full time resident, Planning Commission

resident

Resident, local government employee

Resident, appointed official

Resident

Permanent resident

Property owner, multiple

Resident

Business and Property Owner

Property owner

county government employee and county resident

resident

Elected District 5 County Commissioner

elected official

Chair, Shade Tree and Parks Commission, City of Charlevoix

Elected Official

Resident

What is your role/organizational representation within Charlevoix County (i...

Township Clerk

Elected official: Supervisor of St James Township

Resident/Long Term Care Emergency Preparedness

Hospital Employee/Emergency Management

resident

EMS Director

Supervisor

elected official

Planning Commission

Planning Commissioner

Planning Commission Member

Resident, Local Government Employee

St James Planning Commission

resident

Charlevoix County Planning Commissioner and resident of Peaine Township

Resident

Resident

resident

Tip of the Mitt Watershed Council

resident

City Administrator

local government employee

Elected Official

Property owner

What is your role/organizational representation within Charlevoix County (i...

Grand Traverse Band Tribal Historic Preservation Officer

Melrose Township Supervisor

elected official

Resident and government employee

Clerk

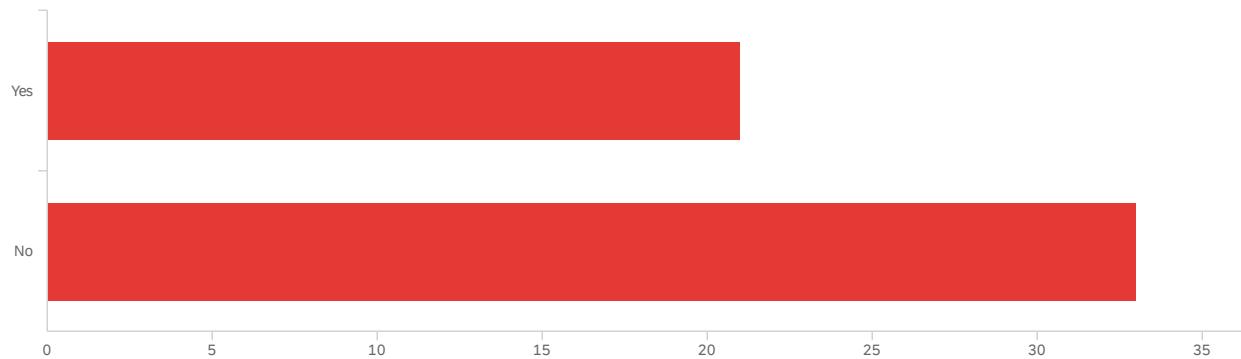
City Manager

local government employee

Neighboring County Employee

local government employee

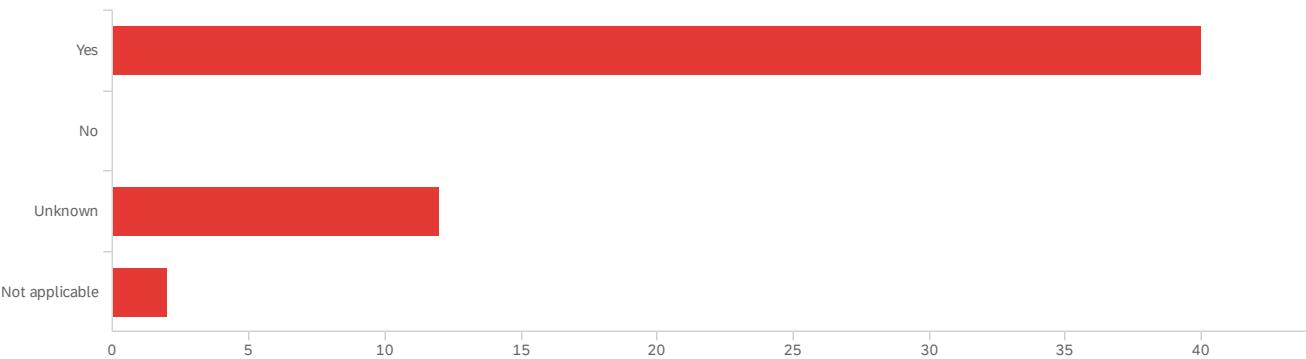
Q4 - Are you familiar with the county's Natural Hazard Mitigation Plan?



#	Field	Choice Count
1	Yes	38.89% 21
11	No	61.11% 33
54		

Showing rows 1 - 3 of 3

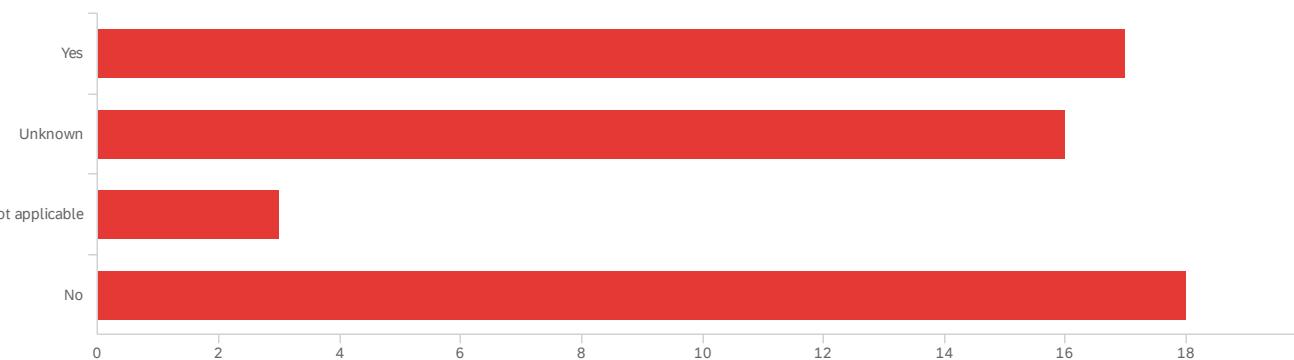
Q5 - Does the community you represent have an adopted Master Plan?



#	Field	Choice Count
4	Yes	74.07% 40
5	No	0.00% 0
6	Unknown	22.22% 12
7	Not applicable	3.70% 2
		54

Showing rows 1 - 5 of 5

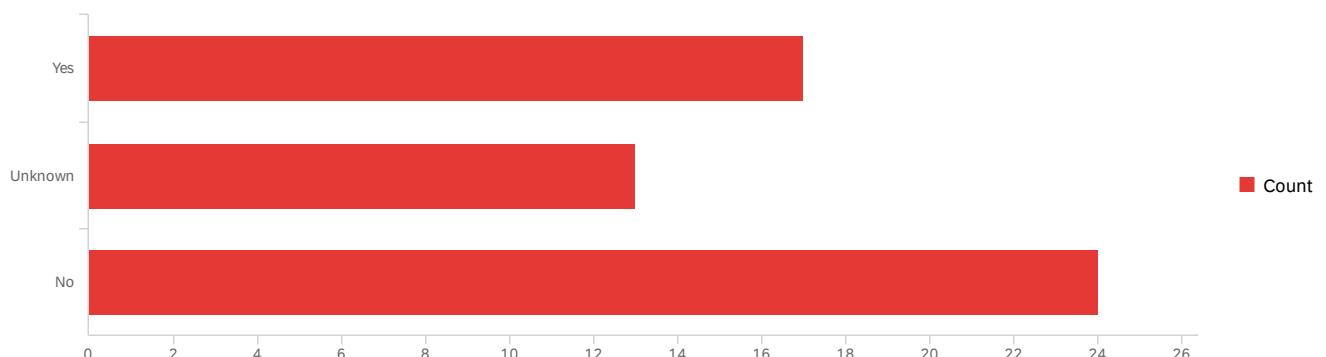
Q6 - Does the community you represent have an adopted Capital Improvements Plan?



#	Field	Choice Count
1	Yes	31.48% 17
3	Unknown	29.63% 16
11	Not applicable	5.56% 3
13	No	33.33% 18
		54

Showing rows 1 - 5 of 5

Q7 - Has the community you represent experienced a significant natural hazard event within the last ten years?



#	Field	Choice Count
1	Yes	31.48% 17
3	Unknown	24.07% 13
5	No	44.44% 24
		54

Showing rows 1 - 4 of 4

Q8 - If so, what was the nature of the event?

If so, what was the nature of the event?

TORNADO -STRAIGHT LINE WINDS - WINTER WEATHER

Blizzard

Covid-19

BOYNE CITY Tornado in recent past

Wind Storm

High water erosion

flooding

High Lake Michigan levels and high winds combined for shore erosion and damage to homes/property.

Heavy snowfall, strong winds

Extreme Winter Weather

Power Outage

Ice storm,wind.

High Water, Erosion

What is significant? We had some houses that were being threatened by high water, storm driven events.

High water/flooding/erosion

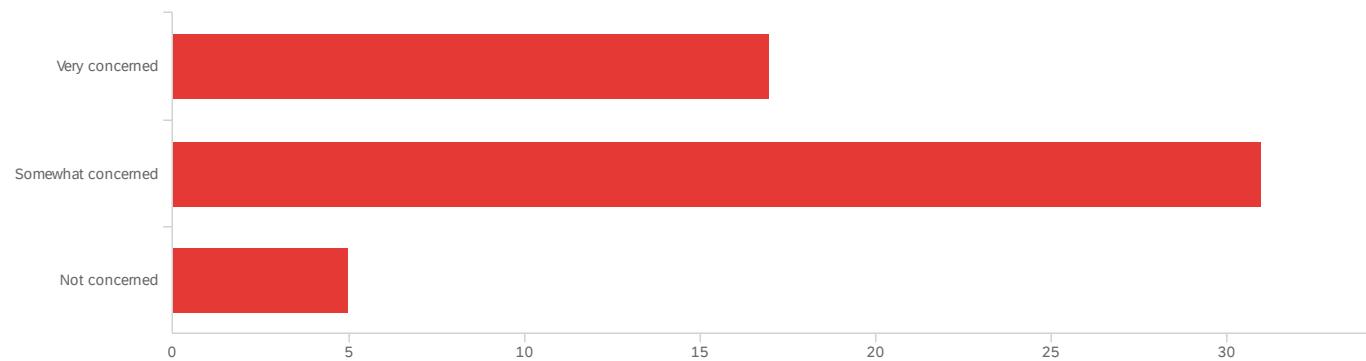
Flooding of public areas, parks and infrastructure. Over capacity of wastewater system with stormwater

N/A

Tornado and Straight Line Winds

High wind storms- Dec 2021; High water levels 2018-2019

Q9 - How concerned are you about future natural hazard events impacting your community?



#	Field	Choice Count
1	Very concerned	32.08% 17
2	Somewhat concerned	58.49% 31
3	Not concerned	9.43% 5
		53

Showing rows 1 - 4 of 4

Q10 - What type of natural hazard events are likely to have the largest impact of your community (i.e. flood, winter storm, thunderstorm/wind, drought, illness outbreak, etc.)?

What type of natural hazard events are likely to have the largest impact of...

Winter storm and flooding

Winter Storm/Wind/Tornado

WINTER STORMS WINDS TORNADO

Wind, no matter what season, shore erosion due to waves has no season here.

winter storm

Flood, winter storm and wind storms

winter storm and thunderstorms & winds

Wind, drought, winter storm

Flooding, shoreline erosion, illness outbreak, winds, soil contamination, extreme overuse of gas powered boats and HUGE races on the lake, waterfowl habitat being disturbed, trash dumped off shore and boats into the lake...

Floods and Winter Storms

Winter storm tornado

winter storm, thunderstorm/wind

winter storm,illness outbreak

Illness outbreak, Erosion issues at lakeshores, power outages due to high winds

All

Winter storm

flood, winter storm, thunderstorm/wind, drought

High Winds, high water, winter storms, illness outbreak

all of the above

High winds and/or high water causing damage and/or long term lost of power during cold periods

What type of natural hazard events are likely to have the largest impact of...

winter storms/power outages, wind, infectious disease outbreak

Winter Storm or extended power outage

Winter storm, power outage, wind storm, water level issues

Radiation Leak Big Rock caused by lightening strike

Dam washing out, winter storm

flood, winter storm, wind, illness

Illness utbreak

Flood, winter storm,illness outbreak.

winter storm

High Water, Winter Storm, Thunderstorm/Wind, Illness Outbreak, Fire, Flooding

Flooding, wind and drought

all of the above

High water-wind driven events, forest fires, ice storms impacting power lines

Illness outbreak or wind storm

wind, tornado, winter storm

flood, high lake levels/groundwater, increased storms

Flooding, winter storms, high winds, power outages

flood/wind/thunderstorm/winter storm

Winter storm and thunderstorms and high winds

damage caused by a large wind event

winter storm or wind

Flood, winter storm

winter storm, thunderstorm/wind/hail

drought, lakeside erosion, straightline winds

What type of natural hazard events are likely to have the largest impact of...

Flood and Wind Storms

winter storm, thunder/wind Storms, soil erosion

Q11 - Does your community have concerns about infrastructure (dams, bridges, utilities, etc.) withstanding a natural hazard event in the future? Please describe.

Does your community have concerns about infrastructure (dams, bridges, util...

Yes

Dam failure and Mackinaw Bridge

N/A

I do not have that information.

Water waste, water supply

Our bridge is very old and in need of replacement so a hazard event could have a high impact

possible bridge or utilities

Our Community does, our "management" in Boyne City doesn't - their actions are contradictory to their words, and our residents are taking a back seat to KEEPING up and taking care of our infrastructure...

No

shoreline infrastructure damage from soil erosion due to high lake levels

bridge,dams

Dam situation on Deer Lake, power outages due to high winds/storms

unknown

utility issues would most affect our residents

Utilities - power outages

The Township has a water system that should be able to withstand any natural hazard events

Utility damage with power lines down and/or lack of Generator operations during cold periods for buried power lines

Yes, they are currently evaluating dams, culverts, and bridges.

utilities are above ground wires that are open to damage by wind, trees downed, etc.

Draw Bridge common outages / Power

Does your community have concerns about infrastructure (dams, bridges, util...

dams, bridge on M 75

dams

Electric outages

Yes. Dams,Charlevoix Bridge,utilities,erosion from high lake levels.

Concerns for our island utilities in the providing of and repair times, concern for our water/sewer infrastructure in the event of heavy precipitation or freezing

Yes, fragile road beds and cultural assets.

Unknown

utilities, mainly water and sewer services

Infrastructure's could use some help

No

No

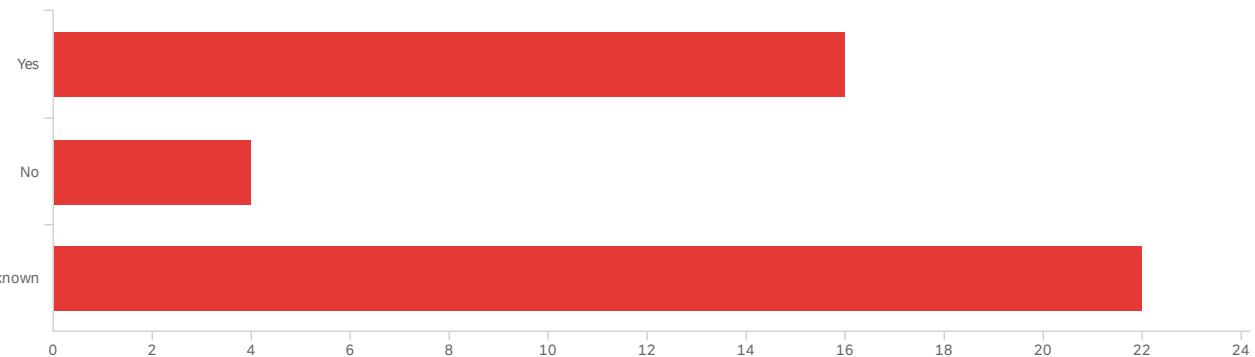
Water infrastructure can be challenging in extreme cold

Yes. A local road tax doesn't address the road and culvert needs throughout the Township

Yes - improvements are always underway or in the planning process to protect infrastructure

Dams (Boyne Mt. and Boyne Falls m-75); phone/internet service on Beaver Island; high water levels in the next 15-20yrs could be worse then what area had in the past couple years.

Q12 - Has your community considered mitigation strategies for potential or current hazards?



#	Field	Choice Count
4	Yes	38.10% 16
5	No	9.52% 4
6	Unknown	52.38% 22
42		

Showing rows 1 - 4 of 4

Q44 - If so, please identify potential strategies you would like to explore in the future.

If so, please identify potential strategies you would like to explore in th...

N/A

No - not that i'm aware of but I could be wrong.

Updates to power grid

Shoreline erosion

Island Emergency Management team that can facilitate public response to emergencies

The Beaver Island Emergency Operations Plan needs updating, assistance in this regard would be helpful. We have identified recent power issues as part of a long term blackout) and need for warming centers, so need assistance to determine public and personal generator needs to make warming centers work or if any reliance on the GLE island-based generator is more valuable.

Bridge Outages and Big Rock Planning Drills Yearly

unknown what to do to prevent event

upgraded power grid,back up power.

Evacuation plans, CIP,

Identifying high risk erosion areas where building codes should be strengthened. Usually it is buyer beware.

The Watershed Council has encourage climate mitigation strategies for coastal communities.

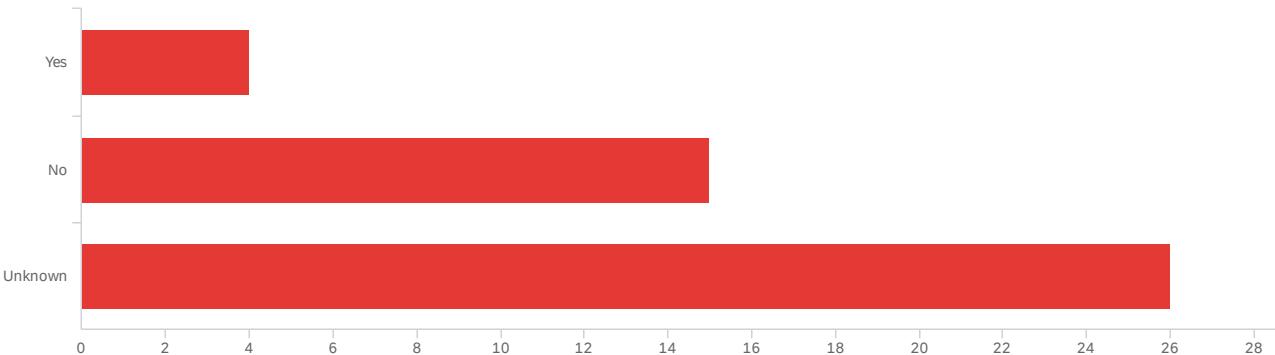
Collaborative efforts between jurisdictions, shared services, emergency response with private utility companies

Revising infrastructure as possible

Culvert Improvements and utilization of the new County Hyrdology Model

Q13 - Has your community requested assistance for mitigation projects in the past?

Whether from FEMA or other partner agencies.



#	Field	Choice Count
1	Yes	8.89% 4
3	No	33.33% 15
11	Unknown	57.78% 26
		45

Showing rows 1 - 4 of 4

Q14 - If so, was your request granted and what type of project did the request include?

If so, was your request granted and what type of project did the request in...

Floodplain Management Provisions - FEMA

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

Is there any additional information you would like us to consider as we upd...

Not at this time.

Placing power lines underground....

Yes - ANY mitigation plan needs to be made VERY known - as if it were an election time - posted, advertising, snail mail, television, public notice postings...

Flooding in Six Mile Lake

The Island needs local team to aid in emergencies, especially when off-island emergency personnel are not available and/or power, internet and phone services are disrupted

no

Our current master plan is being updated. A review in regard to Hazard Mitigation is warranted including the shoreline protection measures and harbor operations. As mentioned, please assist with updating the emergency operation plan (which covers resources and accessibility)..

Power outage for an island community is a very serious issue with many people losing a whole winter's food supply in the freezer and refrigerator

Yup staffing levels FIRE POLICE and EMS / Lack of

Not at this time

I think we had a practice on this once. Always good to be prepared. Glad we are updating.

keep island logistics in mind

Nothing I can think of.

End of Report

APPENDIX C: PUBLIC INPUT SESSIONS FEEDBACK

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

Summary of 2/3/2023 discussion with Charlevoix County Road Commission:

ROAD INFRASTRUCTURE ISSUES	RECENT IMPROVEMENTS
Norwood Township	
Phragmites south of Clipperview Road and west of US-31	
Charlevoix Township	
	Shoreline by St. Mary's cement plant - installed riprap to combat lakeshore erosion in 2020-21
South Arm Township	
The bridge beams are starting to fail on M-32 (Rogers Road) over the Jordan River. Truck traffic weight restrictions currently in place. This impacts the operations of a nearby trucking company (H & H Trucking) at M-66 and M-32. [NOTE: THIS BRIDGE IS SCHEDULED FOR RECONSTRUCTION IN 2024].	MDOT recently completed repairs on M-66, south of Monroe Creek. The M-66 detour caused issues in Ellsworth as no truck traffic was allowed through there.
Eveline Township	
	End of Holy Island Road at S. Arm of Lake Charlevoix - 120' of new rip rap added to combat lakeshore erosion in 2020-21.
Wilson Township	
Flooding near Raven Hill Discovery Center. Fuller Road over Deer Creek is undersized. A 200' wide span of road was flooded; no other alternate route. Working with CRA on funding. Have design and engineering done but waiting on construction crews. Est. cost is \$1 million. No way to travel around in the winter. Rogers Road is seasonal; residents plow what they can.	Deer Lake levels are controlled by a weir. Had a small breach in it in 2022 and was repaired because lake levels were dropping.
Bergman Rd and Marvon Road over Deer Creek are also undersized.	In 2016, new 18' wide box culverts were installed on Korthase Road, south of Deer Lake Road, and on Deer Lake Road, at the crossing of Deer Creek.
Giant knotweed on Boyne City-East Jordan Road just south of Boyne City limits.	
Boyne Valley Township	
Flooding issues at Hetrick Road over Schoolhouse Creek	Completed in 2005: Thumb Lake Road culvert restructuring with post-disaster HMGP funds available under Federal Disaster declaration 1346-DR-MI.
Hudson Township	
Narrow road crossings over the West Branch Sturgeon River on Bingham and Iron Bridge Roads due to beaver dam activity	
Iron Bridge Road is a seasonal road with weight restrictions	
Woodin Road stream crossing north of Huffman Lake Road, on county line, has flooding issues	

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

ROAD INFRASTRUCTURE ISSUES	RECENT IMPROVEMENTS
Chandler Township	
Matz Road stream crossings - beaver dam activity floods near the road; water saturates the road bed. Contract with land owner to fix.	
Melrose Township	
Two culverts on Bauman Road over creeks need to be 15 feet longer. Culverts are very short and the road jogs; lots of beaver dam activity in the area.	3 culverts replaced on Romaniak Road, over Hay Marsh Creek
Springvale Road has 3 culverts over the Bear River; two are failing. Very old. Classified as a bridge as it meets the minimum 20' span width. Springvale Road is an east-west primary road. Want to turn it into a free span bridge and open up the creek to increase creek flow and improve riparian habitat. Will apply for local bridge funding.	Replaced Holms Road culvert over Hay Marsh Creek
M-75 (MDOT road) water issues at stream crossings at 4 locations, including Walloon Lake Dam over Bear River.	
Shadow Trail (near South Arm shoreline of Walloon Lake) was repaved in 2016-2017, but water still flows over the road at times around Fineout Creek. Beaver dam activity in the area. Walloon Lake Conservancy (Shadow Trails Nature Area) land adjoins the road on either side. RC requested the Conservancy try to remove the beavers but no action taken.	
Evangeline Township	
Giant knotweed impacting East Shadow Trail; also beaver dam activity along the road	
Peaine Township	
East Side Drive, over the stream connecting Lake Geneserath to Lake Michigan. Culvert is too small; road almost flooded.	
Townships of Evangeline, Bay, Hayes, Marion, Eveline, and South Arm	In 2020, with high lake levels on Lake Charlevoix, the CCRC completed many erosion repairs along shoreline roads by installing rip-rap. Now water levels are down 20 inches.
Countywide	
Autumn olive is also an issue to educate RC mow staff about. Participated in a Tip of the Mitt Watershed Council training many years ago about invasive species management best practices.	
Tracking for beaver to eliminate dams takes many hours	

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

January 2023 Stakeholder Meeting:

Hazard	Specific Concerns	Location
All terrestrial and aquatic invasive species (i.e., EAB, Phragmites, Autumn olive, Giant knotweed)	Degradation of high quality natural resources that sustains the recreational/tourism economy	Countywide
Aquatic Invasive Species (in general)	Jordan River	South Arm Twp. and City of East Jordan
	Porter and Dyer Creeks as tributaries to Lake Charlevoix	Eveline Twp.
	Boyne River	Boyne Valley Twp., Melrose Twp., City of Boyne City
	Several tributaries on the south side of Walloon Lake; coastline along the foot of the lake (North Shore Dr., M-75 and S. Shore Drive); Bear River	Melrose Township
	All of Lake Charlevoix	Hayes, Bay, Evangeline, Wilson, Eveline, South Arm, Marion, Charlevoix and Hayes Townships; Cities of Charlevoix and Boyne City.
Emerald Ash Borer	EAB was first detected in 2017 after a decade of monitoring.	Beaver Island
Phragmites	Along Lake MI Shoreline	Norwood Township
	At various areas along Lake MI on Beaver Island	Peaine Township
Eurasian Watermilfoil impacts boating, fishing, swimming	Thumb Lake	Hudson Township
	Six Mile Lake	South Arm Township
Public Illness Outbreak	Failing septic systems	Countywide
	Waiting on PPE supply replenishment from the State	Countywide
Thunderstorm/Tornado/Winter Storm; Dense fog can reduce visibility for air and marine traffic around Beaver Island and Charlevoix	Awareness and preparedness for hazard events	Countywide
	Tornado awareness	Cities of Charlevoix, East Jordan, & Boyne City
	Power outages	Countywide
	Power outages and transportation route blockages	Countywide
Seiche	Seiche in 1980's impacted Beaver Island. No major damage but water flooded into the power plant. [NOTE: the power plant has since relocated further inland from the harbor and is much less vulnerable to rising Lake MI levels.	Beaver Island

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

Hazard	Specific Concerns	Location
Power Outages	Power outages on Beaver Island - generator not running in winter due to diesel unable to warm up. No backup GLE personnel to fix. Communications power outage impacted public safety.	Beaver Island
Vulnerable populations - elderly persons living independently; disabled persons	Can be more affected by extreme heat/cold, power outages, winter storms, public health emergencies	Countywide
Drought, Extreme Heat	Crop damage	Countywide
	Lack of winter snowfall impacts recreational economy and agriculture; increases spring wildfire risk	Countywide
Extreme cold or extreme heat occurring at wrong time of the year	Crop damage; wildlife impacts; tourism impacts	Countywide
Severe Winter Weather	"Snowbelt" in the communities south and east of Lake Charlevoix and Walloon Lake	Townships of Marion, Banks, South Arm, Wilson, Boyne Valley, Hudson, Melrose and Chandler; City of East Jordan
	Drifting snow along Kings Hwy, Welke Rd, and Pogenog Road	Peaine Township
Wildfire	Orchards at risk	Eveline, Marion, and Norwood Townships
	Forest concerns	Chandler and Melrose Townships
	Wildfire concerns in various areas of Beaver Island with cedar trees and juniper plants; areas of concern have limited road access	Peaine Township
	Outer islands subject to fires from lightning strikes; Mostly MDNR property, no private homes other than Trout & Squaw Islands.	Outer islands in St. James Township: Gull, High, Squaw, Whisky, Trout, Hog, Pismire, Hat, Shoe, Horseshoe, Little
Inland Shoreline Flooding/Erosion	Lake Charlevoix	Along Lake Shore Dr., Front St., Lake St., and Boyne City-Charlevoix Road in Boyne City and Eveline Twp.; Evangeline and Bay Townships
	Along the west shoreline of the South Arm of Lake Charlevoix, from Ironton to Holy Island Road	Eveline Twp.
	Shoreline near the Hemingway Pointe Club Association and homes along Pine Lake Rd.	Eveline Twp.
	South Arm of Lake Charlevoix	Along M-66 in South Arm Township
	Flooding along east/NE side of Font Lake	St. James Township

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

Hazard	Specific Concerns	Location
Lake MI Shoreline Flooding/Recession	Along bike path/US-31	Hayes Township
	Along sections of Lake Shore Drive - residences and Norwood Township Park	Norwood Township
	Entire Lake MI Coastline	Norwood, Charlevoix, Hayes Townships and City of Charlevoix
	Flooding from high Lake MI Levels along roads adjoining St. James Harbor and Gull Harbor Natural Area	St. James Township
	Coastal erosion/recession along South End Road between Iron Ore Bay and Cable Bay; along part of East Side Drive, east of Martins Pit Rd.; and along the northern coast of Beaver Island	Peaine/ St. James Townships

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

10/9/2023 Zoom Meeting with Beaver Island Stakeholders/Residents

Suggested Mitigation Actions	Comments from Bobbi Welke (red) and Shelby Harris (blue)
<p>Identify resources to assist with updating the Beaver Island Emergency Operations Plan. The plan should include evacuation plans; a plan for warming centers in the event of a long-term power outage; and identify public and private need for generators in comparison to reliance on the GLE island-based generator.</p>	<p>My number one concerns extending into the BI Emergency Operations Plan are: <u>Access to Lake Michigan</u> - currently there are only 2 legal boat access launches on the island with both being within St. James Harbor ~1,000ft from each other. There needs to be easy boat access for emergencies on all directions of the island and each end. <u>Fire Lanes</u> are another concern especially within the southern part of the island. The island's trails/roads/forest accesses need to be properly established, labeled and managed.</p> <p>I will share information pertaining to the DOE ETIPP Grant and the ERCP where data collection and model creations are underway to help determine critical buildings for best fit as emergency/warming centers and how to follow through on projects to update these buildings to ones powered by sustainable and/or reliable power sources and be emergency ready.</p> <p>See my comments below under extreme cold or hot conditions.</p>
<p>Utilize Capital Improvement Plans St. James Township has a detailed CIP; Peaine Township is working on developing a CIP) that align with the needs of the Beaver Island Emergency Operations Plan</p>	<p>St James Township has a detailed CIP; Peaine Township is working to create a CIP. Please remove "Prepare and"</p>
<p>Work with CCRC to consider an alternative route to King's Highway in the area north of East Side Drive in case of its closure due to a hazard event.</p>	<p>This section of road is surrounded by GLE's substation, power plant, and Island Energy's gas station with LP storage tanks both east and west of this roadway. A hazard issue associated with any of these locations could cause the closure of this single road that connects the island. Therefore, suggest this additional mitigation action given the vulnerable single road to access the south and north parts of the island.</p> <p>The owner of the land that includes "Buddy Martin's Trail" has interest in Peaine Township (or the road commission) owning the trail which can be developed into an alternative N/S road.</p>
<p>Install a permanent generator for sewer system to keep pump going</p>	<p>"pumps" not pump</p>
<p>Install snow fences</p>	<p>Change the locations to "along Kings Highway, including the roads near the Beaver Island and Welke Airports" (remove "Welke Rd"). The Pogenog Rd is "Paid Een-Ogs Rd".</p>
<p>Currently manual sirens at Town fire station. Consider utilizing 800 mhz system to create automatic siren activation. BeAlert and IPAWS would provide site specific warnings.</p>	<p>800 MHz system has limited functionality. It fails to work with the elevation changes (due to bluffs) and the Island's tree cover. Suggest you add at the appropriate location, "The state of Michigan needs to assist Charlevoix County in updating the Island' 800 MHz system."</p>
<p>Coordinate with utility companies to continue vegetation management along power lines</p>	<p>Work to establish renewable energy sources/grids to decrease reliance on off-island resources such as fuel and utility company personnel</p>
<p>Bury power lines, especially on the east side of the island where power lines are above ground</p>	<p>These are the same issue. Please combine. Further, consider something like, "During future fiber to the home projects, work to bury powerlines. A high priority burial location would be where the underwater electrical cable comes ashore and moves aerial to the GLE Distribution Station as this is the most vulnerable area for operating the existing buried system." (These wires came down in a wind storm in Nov 2022, which was the cause of the two day outage of power of the buried electrical system on the Island. The damaged aerial system took three days to repair.)</p>
<p>Relocate existing power lines underground - especially on east side of island where there is high density of development</p>	
<p>A police officer will check on elderly residents; need to create a "call list" of elderly population and create a brochure with assistance from Council on Aging</p>	<p>Our BIRHC is a source collecting this call list.</p>
<p>Complete culvert improvements (replace/upsized) at East Side Drive, over the stream connecting Lake Geneserath to Lake Michigan. Partner with TOMWC?</p>	<p>This issue is throughout the island, suggest "Work to complete the Island's culvert inventory and then identify culverts condition followed by establishing a short-term/long-term replacement plan.</p>

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

Suggested Mitigation Actions	Comments from Bobbi Welke (red) and Shelby Harris (blue)
Promote shoreline erosion best management practices and incorporate into local zoning codes; Utilize the climate mitigation strategies for coastal communities as provided by Tip of the Mitt Watershed Council and EGLE's Michigan Coastal Zone Management Program.	<p>The Font Lake flooding in the past was within Peaine and St James Townships, suggest this be set for "Beaver Island". A mitigation action is for "St James Township should continue to maintain the impoundment which functions as an emergency drain for Font Lake when it floods.</p> <p>This flooding in St James Twp. should also consider Gull Harbor flooding. While there could be some shoreline erosion practices, there needs to be "Suggest a formal road closure consideration when necessary". I suggest this language because the CCRC puts out road closure signs - as they should - but then works to improve portions of this road to let people onto this road which still has closed areas- this causes access confusion and needs to be resolved.</p>
Seiche in 1980's impacted Beaver Island (but this is not on record with NOAA Storm Events Database). No major damage but water flooded into the power plant	<p>The power plant is no longer located on the harbor. It is located inland and if far less vulnerable.</p>
Wildfire concerns in various areas of Beaver Island with cedar trees and juniper plants; areas of concern have limited road access	<p>Need to establish official, managed and labeled fire lanes along with completing an Emergency Operation Plan of action for this event and an island-wide evacuation plan. Perhaps can begin discussions about controlled burns as well with the MDNR, Bureau of Indian Affairs or other tribal entities.</p> <p>Peaine Township will soon apply for a grant to "Create a Community Wildfire Protection Plan (CWPP)" for the archipelago (to include those outer islands under St James Twp. jurisdiction). Consider adding "Once the CWPP is in place, apply for the related grants to implement the plan." Part of this plan would be to add two buried 30,000 gal tanks at the south and west end of the island which would be filled with water and act as water sources for the fire department along with the existing tank at the East Side Fire Hall. This would add to the existing plan to keep locations for access to Lake Michigan and two inland lakes as water sources sites for the fire department during the winter.</p>
Outer islands subject to fires from lightning strikes; Mostly MDNR property, no private homes other than Trout & Squaw Islands.	<p>*Squaw is now Ojibwe Island Creating a plan of action within the BI Emergency Operations Plan and/or the Northern Lake Michigan Island Collaborative and management of the outer island trail systems for fire control access and evacuation routes</p> <p>Note: The owner of Squaw/Ojibwe Island is protesting this name change as it is a private island, the federal govt may not have had the right to make this change and if they did, they did not consult the owner. Suggest you use "Squaw/Ojibwe" Island.</p>
Increase education and awareness of invasive species prevention and management	<p>Work with transportation entities such as the Boat Co. and Airports to increase educational outreach and awareness along with establishing laws/rules/ordinances to better manage the shipment of materials, vehicles of all kinds, boats and equipment</p>
Pursue stable funding source for increased invasive species management	<p>Work with CAKE CISMA and the Charlevoix Conservation District on the expansion of "Go Beyond Beauty" and regulation of invasive/exotic/non-native species</p>
Crop damage; wildlife impacts; tourism impacts	<p>Beaver Island needs warming/cooling centers. There is some on-going consideration for considering this need, possibly implementing a generator plan for the School and Community Center to be added to the other two buildings currently having generators - BIRHC and Peaine Township Hall.</p>

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

Feedback from In-Person Public Input Sessions in East Jordan, Charlevoix Township and Boyne City, October 2023

Location	Comments
East Jordan Dam (South Arm Twp.)	<p>East Jordan Plastics, Inc. owns it and utilizes it as a water source for fire suppression needs. If the City of East Jordan completes its plan to extend city water service to the business within the next few years, they will no longer have a use for the dam. Benefits: Lake Patricia currently serves a recreational purpose to local residents and the dam serves as a lamprey barrier to Lake Charlevoix. Issues: It is very old and will require constant maintenance to maintain it. Lake Patricia is filled with 3-4 of sediment. If dam were to fail it would impact few residences downstream but have a major impact to the M-32 bridge over the Jordan River downstream. Conservation Resource Alliance has expressed interest in assisting with removal of the dam.</p>
City of East Jordan	<p>Planned Unit Development for future mixed use development at the location of the former East Jordan Ironworks facility. City upgraded their wastewater treatment plan and added a new water well since 2016. The city has the capacity to serve new growth with water and sewer services. Looking to expand water line to East Jordan Plastics.</p> <p>There is an on-site generator for the city's main water well in case of a power outage.</p> <p>The city is working to update their sewer line through the city and currently looking for funding. Main priority is under the Lake and then from the main lift station down to Rogers Road (highest concerns for sewage capacity.)</p>
City of East Jordan and South Arm Twp.	<p>MDOT will reconstruct M-32 in 2024 (downstream from the dam)</p> <p>Interest in installing tornado sirens at the hills around the City of East Jordan. Would cost about \$1,500 to install a new electronic control at the CCE 911 dispatch center to electronically link all the tornado sirens in the county.</p>
City of East Jordan	<p>Current Recreation Plan calls for boat washes to be installed at boat launches. In the past Tip of the Mitt Watershed Council has brought their mobile boat washes to the area. City pays to treat Eurasian water milfoil two times per year. CAKE CISMA provided effective assistance with Phragmites treatment/removal about 10 years ago. Want to keep invasive species out of all natural areas.</p> <p>American Red Cross and EJ School District have an agreement to use the school as an emergency community shelter, but the school does not have a generator. The Mill Street campus would be a better location for a shelter and has a generator.</p> <p>City would like to continue cooperating with surrounding local communities to fund infrastructure needs that benefit all.</p> <p>Consider leasing out generators as needed to local residents in a power outage.</p> <p>In 2020 with the high Lake Charlevoix water levels, there was an issue with standing water in a low area in the Tourist Park (City Park/Beach/Campground).</p>
Village of Boyne Falls	<p>Village would like to remove the Boyne Falls Dam, as it's too expensive to maintain. Looked to the Army Corps of Engineers for a feasibility study to remove that dam, which was estimated to cost \$400,000. Lack of funding to move forward.</p>
Charlevoix Township	<p>Interest in creating a shoreline erosion ordinance to prevent armoring of the shoreline. A potential option for protecting shorelines that may be allowed would be installing a temporary barrier that is removed when lake levels recede.</p> <p>The fire station in the north side of the Township has a generator. Volunteers will be needed if used as a shelter.</p> <p>Shirley Roloff Center could be used as a shelter but needs a generator.</p> <p>County maintains an MOU with schools for shelter use.</p> <p>EMS staffing remains an issue.</p> <p>Fire staffing and volunteers levels are sufficient/steady.</p> <p>Interest in installation of a tornado siren at north and south fire stations. County can pursue grant money if more communities want to upgrade to the 800mHZ connected siren system.</p>

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

Melrose Township	<p>Many people spread out in the community – low density, rural homes, can take time to access in an emergency. Many households still rely on phone landlines, but the addition of Truestream internet/VOIP phone service is improving communication capabilities.</p> <p>Walloon Lake Weir has recently been inspected and is in good condition, but the M-75 bridge over the Bear River has crumbling retaining walls – MDOT to address.</p> <p>Walloon Lake Association is trying to get an overlay ordinance in place in the watershed to require the Townships in the watershed to assist with payment for invasive species management.</p> <p>They have generators installed for the Fire Dept. and Township Hall (for their septic system); Fire Dept. can be a temporary shelter; they provide volunteers with training for operating the shelter.</p> <p>Solar-powered mobile boat wash station installed at Walloon Lake boat launch (at the foot of the lake) in May 2023. Jones Landing on Walloon Lake (in Emmet County) also has a mobile boat wash station.</p> <p>Township is building a new sewer lagoon system to handle increased capacity of sewer system/tanks with new development at the foot of Walloon Lake.</p> <p>Temporary snow fences installed at the foot of the lake have helped to prevent blowing snow/extreme snow drifts over M-32.</p> <p>Fire/EMS staffing remains an issue.</p> <p>Interest expressed in installing a tornado siren.</p> <p>Beaver dams a constant issue in flooding of local roads.</p> <p>Culvert replaced on Fineout Creek crossing around 2020. Traffic rerouted for about 2 months around Walloon Lake and Lake Charlevoix.</p>
Hudson Township	<p>Charlevoix County has contributed to paying for part of the cost to treat Eurasian water milfoil on Lake Louise (the County has a park adjoining the lake).</p> <p>Need to install a standpipe to draft water from Thumb Lake for fire truck access. Only specific trucks are equipped to draft water. Need clearly marked and accessible location at the water access point(s). MDNR parking lot may not be plowed of snow or full with parked cars. Other surrounding Townships and Otsego County may also use this water source.</p>
Bay Township	<p>Area of diseased trees around Camp Daggett Road, need to confirm location.</p>
Countywide	<p>Threat from Electromagnetic Pulses – something needs to be in place in case the grid goes down. Can affect all devices with computer chips, including water and sewer system functions.</p> <p>If there were a catastrophic event, what plans are in place to take care of (refrigerate/store) large amounts of human remains? Inventory capacity of private funeral homes?</p> <p>Need to update old county map of fire suppression water sources (includes standpipes/dry hydrants and underground tanks). Maintain list/map and make sure County EM and Fire Stations have access to this information.</p> <p>Consider noting the locations of all boat ramps in the Hazard Mitigation Plan, as they are critical for water and rescue access for first responders. (Whiting's Park in Eveline Township will get a new boat launch in 2024).</p> <p>Boyne City EMS contracts with Boyne Falls EMS – competitive with staffing; issue to attract, train and retain EMS and Fire first responders. Housing and pay levels are an issue. Lake Charlevoix EMS is a new EMS authority to better serve the area. Can rely on the MDNR in Bellaire (Antrim County) if there is a high fire danger. MDNR parks a rig in East Jordan.</p>

Input from Meetings with Stakeholders and the General Public for Charlevoix County Hazard Mitigation Plan

Feedback from Networks NW Presentation on HM Plan at Charlevoix County Planner's Forum at Charlevoix District Library on November 29, 2023

Session attendees: representatives from Wilson, Eveline, Hayes, St. James Twp., City of Charlevoix, Charlevoix County

Are power outages an issue due to high winds/storms?

- Wilson Twp. – not an issue
- Eveline Twp. – rarely; GLE buried the power line by her house
- Hayes Twp. – have a backup generator at the EMS/Fire Station (ambulances need to always be plugged into aux. power)
- Beaver Island – their power goes out often during storms. They are doing a study to evaluate gaps in back-up power sources on the Island to target improvements. Their EMS/Fire Dept. building does not have a generator, nor does the St. James Twp. office building. Runway lights at the airport will also not work if there is a power outage. Their Medical Center is the only place with a large generator.

Seiche was observed by Hayes Township rep./resident on September 10, 2014. Removed several 20-25' long docks. Others have happened occasionally since then; recall a seiche in Little Traverse Bay around 2019 that caused damage to boats/docks.

Dense Fog is an issue for aircraft operations at the airports on Beaver Island; no visual landing target ability. Often get dense fog in the fall and spring. The ferry boat only runs 2-3 times a day in the spring, which limits accessibility to the island from the mainland.

The Nine Mile Point Homeowner's Association in Hayes Township – new FEMA FIRMs adopted recently; now many homeowners along the coast are located within the 100-year floodplain. During high Lake MI levels in 2019-20, no structures were lost, but stairways down to the beach were lost due to bluff erosion. Also a portion of the Little Traverse Wheelway close to Lake MI was temporarily closed due to shoreline flooding.

With the high lake MI levels in 2019-20, Beaver Island also experienced high groundwater levels, causing many homeowner's basements to flood. (Possible FEMA mitigation grant project?)

In the years when Lake MI has frozen over, it is a precursor to high lake levels the next year, as there is lack of evaporation over the lake's surface in the winter.

APPENDIX D: CURRENT STATUS OF 2016 PLAN STRATEGIES

2016 Charlevoix County Natural Hazard Mitigation Plan Action Strategies and 2024 Status

<p>1. Fire Hazards: Structural Fire Mitigation Strategies</p>		<p>Structural Fires, a Technological Hazard, was not included in the scope of the 2024 Charlevoix County Natural Hazards Mitigation Plan. Some of the 2016 strategies are included in the 2024 plan as applied to wildfire and first responder-related mitigation strategies.</p>
2016 Hazard Mitigation Plan Strategies	2024 Status	Related Strategies in the 2024 Plan and Priority Level
a. Education and enforcement of building and zoning codes	Ongoing; rely on County Building Safety department to enforce building/zoning codes	#37 (Medium); #45 (Low)
b. Education for developers, realtors, business owners, architects, and engineers	No progress.	Not a feasible strategy; not included in the current plan.
c. Public education and school programs, which encourage the development of a Site Emergency Plan for public buildings, a Family Disaster Plan for private households, and the preparation of a Disaster Supplies Kit	Ongoing; have fire prevention open houses for public and visit schools.	Not included as a strategy in the current plan; focus is on wildfire danger not structural fires.
d. Encourage first responder education of methods and training on a regular basis.	Ongoing; Regular training is scheduled within departments and other trainings are promoted to firefighters	#8a (Medium)
e. Seek funding and grants to improve services and training in the rural areas of the county, where services are not adequate to provide minimal fire protection.	Ongoing; County Fire Officer's Association receives funding from State to fund needed training for our county firefighters. Other firefighter agencies send invites on training events they host as well.	Related strategies do not specify focus on rural areas, rather countywide: #8a - #8f, (Low to High)
f. Review existing publicly owned facilities and identify their potential need for retrofitting with generators and other services to bring them up to a minimum standard.	Being addressed currently; evaluating sites on Beaver Island, East Jordan, and Charlevoix Township.	#31-34 (Medium)

2. Fire Hazards: Wildfire Mitigation Strategies		
2016 Hazard Mitigation Plan Strategies	2024 Status	Related Strategies in the 2024 Plan and Priority Level
a. Educate and encourage the proper maintenance of property in or near wildlands, to include the introduction of defensible buffer zones, short grass, thinning trees, and sweeping and cleaning dead or dry leaves and needles, from roofs, decks, eaves, porches, and yards.	Unknown; the current Charlevoix County Emergency Management Coordinator is not aware what was done/discussed for this strategy prior to starting the position in 2022.	#11a, c (Low)
b. Encourage safe disposal of yard and house waste (Recycle or Compost programs) rather than open burning.	The county recycling department operates six drop-off recycling sites and hosts two annual household hazardous waste collection days. Boyne City, East Jordan and Charlevoix have yard waste pick-up dates (usually spring and fall) for residents.	#11b (Low)
c. Construct fire towers, and use fire spotters and planes	Changed “construct” to “utilize” in the updated strategy. Ongoing. MDNR flies their fire spotter planes daily after the end of each winter when fire danger is highest.	#2d (High)
d. Encourage programs on arson prevention activities, including the reduction of blight. (Partnership between Police and Fire)	No programs currently offered; County EM/Sheriff's office have received funding in 2024 to help assist with some blight cleanup.	#40 (Medium)
e. Public education on smoking hazards and recreational fires	Ongoing, Fire agencies share information via social media	#9, 11, 11c (Low)
f. Communication with media for broadcasting weather and fire warning		#4 (High), #7 (Medium)
g. Maintain the relationship that exists now between MDEQ Forest Resources Division and the Local Fire Chief's organizations	Ongoing with Local Fire Chief's meetings	#2d (High)

3. Both Structural and Wildfire Mitigation Strategies		
2016 Hazard Mitigation Plan Strategies	2024 Status	Related Strategies in the 2024 Plan and Priority Level
a. Introduce an ordinance which encourages proper road and driveway construction for vehicle and fire equipment access. Especially areas that close down for the winter months and do not maintain Fire Department Access Routes.	Currently no ordinance in place. Has been basic education to homeowners. Boyne City FD states there is a need for an ordinance at the city/twp. levels at least.	Not a feasible strategy; not included in the current plan.
b. Educate and establish programs which encourage the safe use and maintenance of fireplaces and chimneys.	Ongoing public education via social media posts/radio broadcasts from the MDNR.	Not included as a strategy in the current plan; focus is on wildfire hazards, not structural fires.
c. Have adequate water supplies for emergency firefighting. Pre incident plan to identify areas that have no supply. Install water supply lines and hydrants for drafting from lakes and other sources of water.	Water point locations have been located/mark with signs. Still some areas on the east side that need to be discussed (Thumb Lake area)	#8a-f (Low to Medium) #27 (Medium)
d. Maintain roads and develop connector roads to reduce fire response time	Unknown; the current Charlevoix County Emergency Management Coordinator is not aware what was done/discussed for this strategy prior to starting the position in 2022.	Not identified as a relevant strategy in current plan.
e. Develop additional fire stations where needed	A new fire station was built in Charlevoix Township at Martin and Waller Roads.	#8f (Low)
f. Identify and/or construct prearranged shelters	Ongoing, Fire stations have been identified as secondary shelters if available (not impacted by incident/disaster and volunteers available).	#29-35 (Medium to Low)
4. Severe Winter Weather Mitigation Strategies		
2016 Hazard Mitigation Plan Strategies	2024 Status	Related Strategies in the 2024 Plan and Priority Level
a. Encourage the use of Be Alert and IPAWS for the protection of county residents and vacationers.	Ongoing, advertise of BeAlert enrollment. No need to enroll in IPAWS, just encourage cell devices have setting on.	#3 (Medium)
b. Public education and awareness	Ongoing via County EM social media posts	#4 (High)
c. Identify, improve, and/or construct shelter capacity.	Ongoing. No new shelters created; currently looking to identify new shelter sites.	#29 – 35 (Low to Medium)
d. Promote community response for snow removal activities such as using community services to assist the elderly.	Ongoing; promotion through COA's/public outreach, social media	#19 (Low)
e. Encourage elderly residents to call if help is needed. Such as their heat is out, they need help with snow removal, out of food, etc.	Ongoing; promotion through COA's/public outreach, social media	Not specifically included as a current strategy; related strategy is #19 (Low) and #21a (Medium)
f. Enforcement of building code snow and wind load requirements.	Ongoing via County Building Safety permits issued	#37 (Medium)

5. Severe Thunderstorms, High Winds, and Tornado Mitigation Strategies		
2016 Hazard Mitigation Plan Strategies	2024 Status	Related Strategies in the 2024 Plan and Priority Level
a. Encourage the use of IPAWS and the Everbridge Be Alert applications that are available through Tri-County Emergency Management.	Ongoing; promotion of BeAlert system enrollment. No need to enroll in IPAWS, just encourage cell devices have setting on.	#3 (Medium)
b. Address the practice of placing utilities underground for new construction	Ongoing, depends on funding	#49, 49 a-b (Medium)
c. Education and enforcement of building codes for such activities as bracing elevated platforms, and anchoring and tie downs	Per the Charlevoix County Dept. of Building Safety Permit Requirements for HUD/Double wide homes, the application must be accompanied by a "recommended foundation plan with tie downs" and a floor plan from the contractor or person actually doing the work.	#37 (Medium)
d. Tree management coordination	Ongoing; Road Commission working with contractors to assist with tree clearing on county roads. Utility companies contract out for regular tree trimming	#47 (High)
e. Public education	Ongoing via social media posts from County EM	#3 (Medium) #4 (High)
6. Tornado Mitigation Strategies		
2016 Hazard Mitigation Plan Strategies	2024 Status	Related Strategies in the 2024 Plan and Priority Level
a. Seek funding for a countywide siren alert system or a NOAA alert stations are needed for the protection of county residents and vacationers. Mostly needed in urban areas and cities. No system currently exists.	Ongoing, Currently 3 cities with sirens, more locations possibly coming on board.	#15 (Medium); #16 (Low)
b. Consistent weather event warnings	Ongoing, Social Media/NWS Text Alerts	#4 (High)
c. Public awareness and education	Ongoing via County Emergency Management Facebook posts	

7. Flooding Strategies – for areas around lakes, streams and wetlands		
2016 Hazard Mitigation Plan Strategies	2024 Status	Related Strategies in the 2024 Plan and Priority Level
a. Assessment of flood threat and dam inspections results	Ongoing; Emergency Action Plans and regular dam inspection reports provided to County EM	#12 (Medium); #13 (High); #25-26 (Low); #41 (High)
b. Drainage improvements	Cities/Twps; Ongoing monitoring and improvements as funding allows by Charlevoix County Road Commission	#46a-o (Low to High)
c. Enforcement of storm water management ordinance	Ongoing; enforced by County Building Safety Department; Peaine and St. James Townships; and cities of Charlevoix, Boyne City and East Jordan	#37 (Medium)
d. Enforcement of building and zoning codes	Ongoing; County Building Safety Dept. and local governments (each jurisdiction, except for the Village of Boyne Falls, has their own zoning).	
e. Open space designations: acquisition or conservation easements by land conservancies, county and townships	Ongoing via work by Little Traverse Conservancy. Between 2021 and 2023: 160 acre new forest reserve in Hayes Twp; 107 acre new nature preserve in Norwood Twp; and a 56 acre new nature preserve with ¼ mile of Lake MI shoreline in Hayes Twp. 340.5 additional acres in private conservation easements. 7 additions to existing nature preserves in Peaine, South Arm, Boyne Valley, Norwood, Banks Townships and the City of East Jordan.	#62 (Medium)
f. Public education	Ongoing	#63-64 (Medium)
8. Shoreline and Steep Slope Erosion Mitigation Strategies for areas along Lake Michigan		
a. Enforcement of the Storm Water Management Ordinance and the Soil Erosion and Sedimentation Control Ordinance: slide areas, drainage control, grading, debris flow measures, vegetation (native species) placement	Ongoing; enforced by County Building Safety Department; Peaine and St. James Townships; and cities of Charlevoix, Boyne City and East Jordan	#37 (Medium)
b. Utilize the Critical Dunes Overlay	Ongoing; via site plan review in local jurisdictions with Critical Dunes in their jurisdictions; County Building Safety Dept. and Peaine/St. James Twps. evaluate as part of their permitting processes	
c. Education and enforcement of building and zoning codes: setbacks, lot sizes, driveways, relocation of structures, Lake Michigan coastal zoning ordinances – U.S. Army Corps of Engineers and MDEQ	Ongoing; local planning and zoning permit requirements and county issued Building Safety Dept. permit requirements	
d. Building code enforcement through the permit process. (Building Officials in all three Counties)	Ongoing; County Building Safety Dept.	
e. Open space designations: acquisition or conservation easements by land conservancies, state, county, or townships.	Ongoing via work by Little Traverse Conservancy. In 2023, a 56 acre new nature preserve with ¼ mile of Lake MI shoreline in was established in Hayes Twp.	#62 (Medium)

APPENDIX E: CONSIDERATION OF ALTERNATIVE MITIGATION STRATEGIES

Hazard Mitigation Alternatives Considered for Charlevoix County – 2024 HM Plan

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, Dense Fog, 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.
	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 Considered for Charlevoix County – 2024 HM Plan

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 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 Considered for Charlevoix County – 2024 HM Plan

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 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.
✓	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

Hazard Mitigation Alternatives Considered for Charlevoix County – 2024 HM Plan

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 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.
✓	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.)

Hazard Mitigation Alternatives Considered for Charlevoix County – 2024 HM Plan

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*

✓	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).
	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.
✓	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.

Hazard Mitigation Alternatives Considered for Charlevoix County – 2024 HM Plan

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 Shoreline Flooding and Erosion	
✓	Floodplain/coastal zone management – planning acceptable uses for areas prone to flooding (comprehensive planning, zoning, open space requirements, subdivision regulations, land use and capital improvements planning).
✓	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.
✓	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 in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
✓	Enforcement of basic building code requirements related to flood mitigation.
	Joining the National Flood Insurance Program, obtaining insurance, and participating in the Community Rating System (CRS).
✓	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, dike setbacks, flood gates and pumps, wetlands protection and restoration).
	Elevating mechanical and utility devices above expected flood levels.
	Flood warning systems.
	Monitoring of water levels with stream gauges and trained monitors.
	Anchoring of manufactured homes to a permanent foundation in flood areas, but preferably these structures would be permanently relocated outside of flood-prone areas and erosion areas.
	Control and securing of debris, yard items, or stored objects in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs.
	Increased coverage and use of NOAA Weather Radio.
✓	Locating structures and infrastructure landward of the established setbacks.

Hazard Mitigation Alternatives Considered for Charlevoix County – 2024 HM Plan

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 Space Weather and EMPs	
✓	Awareness campaigns for industries and systems involving satellite communications, GPS, or radio communications that could be disrupted by space weather events and EMPs. In addition to the use of GPS for navigation, aviation, and military applications, that technology is also important for offshore drilling operations, precision farming, transportation, and mapping and surveying.
✓	Operating procedures that include back-up systems allowing complex systems (e.g. air traffic control) to continue to function when key technological systems (e.g. GPS, radio communications, satellites) malfunction. For example, some "legacy" systems might be retained as a back-up, new GPS signals and codes could be used to remove ranging errors, and protective and back-up components could be installed in vulnerable systems.
✓	The use of special procedures, equipment, and redundancies by utility systems (e.g. electrical power and pipeline systems) to minimize the potential for geomagnetic effects to cause inappropriate shutdowns, impaired or lost functionality, and system damage. For example: the provision of reserve system capacity may offset the effects of geomagnetic storms; or the temporary disconnection of vulnerable components for their own protection.
	Additional back-up satellites, for communications and navigation, may be needed to limit the damaging effects of a major solar storm, which may put current satellite equipment out of action and require their rapid replacements. The importance and cost of satellite systems may not be well-known to the general public. As of 2009, the existing fleet of 250 commercial satellites constituted a total investment of about \$75 billion, and involved an annual revenue stream estimated at over \$250 billion.
✓	Consistent use of computer data back-up systems with secure offsite storage as appropriate.
✓	Use of uninterruptible battery supplies (UBS) and/or generators.

APPENDIX F: PARTICIPATION TABLE

Agency/Jurisdiction	Representative	Title	Completed Survey	Participation											
				LEPC Meeting 8/15/2022	LEPC Meeting 11/21/2022	HM Public Input Meeting 01/23/2023	Meeting w/CCRC 02/03/23	LEPC Meeting 04/17/2023	LEPC Meeting 08/21/2023	County Equalization Data Collection 8/22/2023	PI Session via Zoom - Beaver Island 10/9/2023	PI Session East Jordan 10/11/2023	PI Session Charlevoix 10/18/2023	PI Session Boyne City 10/25/2023	LEPC Meeting 11/20/2023
Charlevoix County	Robert Jess	Commissioner, District 1				X									
Charlevoix County	Chris Christensen	Commissioner, District 2			X										
Charlevoix County	Tim Kenney	Commissioner, District 3													
Charlevoix County	Joshua Chamberlain	Commissioner, District 4													
Charlevoix County	Scott Hankins	BOC Chair, District 5	X			X			X						
Charlevoix County	Annemarie Conway	Commissioner, District 6													
Charlevoix County	Sienna Wenz	Emergency Management Coordinator	X	X	X	X	X	X	X		X	X	X	X	X
Charlevoix County	Kevin Shepard	Administrator		X		X									
Charlevoix County	Julia Drost	Clerk		X	X	X		X	X						X
Charlevoix County	Becki King	Finance Director		X		X									
Charlevoix County	Emily Selph	Equalization								X					
Charlevoix County	Kiersten Stark	Planning Director		X	X	X			X		X	X	X		X
Charlevoix County	Pam Grassmick	Planning Commissioner	X		X						X				
Charlevoix County	Nancy Ferguson	Planning Commissioner				X									
Charlevoix County	Michael Ritter	Planning Commissioner													
Charlevoix County	David Skornia	Planning Commissioner													
Charlevoix County	Larry Levengood	Former Planning Commissioner/ Member of Lake Charlevoix Assn.	X		X										
Charlevoix County Medical Care Facility (Grandvue)	Andrea Seese	Corporate Compliance Officer		X	X	X		X	X						X
Charlevoix County Sheriff's Office	Chuck Vondra	Sheriff		X											
Charlevoix County Sheriff's Office	William Church	Lieutenant			X			X	X						X
CCE 911 Central Dispatch	Chris Heckman	Deputy Director			X	X				X					X
CCE 911 Central Dispatch	Pamela Woodbury	Executive Director				X				X					
Charlevoix County Road Commission	Patrick Weeks	Manager			X		X								X
Charlevoix County Road Commission	James Vanek	Staff Engineer					X								
City of Charlevoix	Mary Millington	Planning Commissioner	X												
City of Charlevoix	Perry Irish Hodgson	Chair, Shade Tree & Parks Commission	X												
City of Charlevoix	Rob Sholey	Deputy Chief of Police			X										
City of Charlevoix	Jill McDonnell	Police Chief							X						X
City of Charlevoix	Gerard Doan	Police Chief (former)		X											
City of Charlevoix	Jonathan Scheel	Zoning Administrator/Code Enforcement Official													
City of Boyne City	Michael Cain	City Manager													X
City of Boyne City	Kevin Spate	Police Chief													X
City of Boyne City	Mary Shaffer	Resident	X												
City of East Jordan	Tom Cannon	Administrator	X									X			
City of East Jordan	Mark Penzien	Mayor										X			
City of East Jordan	Cheltzi Wilson	Clerk													
Bay Township	Xavier Gaudard	Supervisor			X										
Boyne Valley Township	Sue Hobbs	Supervisor	X												
Chandler Township	Myron Matz	Clerk													
Charlevoix Township	Sandra Witherspoon	Clerk	X												
Charlevoix Township	J.B. Hoyt	Trustee										X			X

APPENDIX G: PARTICIPATION DOCUMENTATION

**Charlevoix County
Local Emergency Planning Committee**

**August 15th, 2022
12:00pm**

**Charlevoix County
Shirley Roloff Center-Committee Room
13513 Division St.
Charlevoix, MI 49720**

- I. Call Meeting to Order: 12:03PM**
 - a. PRESENT: Andrea Seese; Grandvue, Chloe Capaldi; HDNW, Gerard Doan; CXPD, Julia Drost; County Clerk, Chuck Vondra; Sheriff, John McDonald; Munson Chx, Kevin Shepard; County Administrator, Sienna Wenz; County EM
 - b. GUESTS: Jennifer Neal; Networks Northwest, Kiersten Stark; County Planning, Matt Blythe; Emmet EM, Sandi Whiteford; Eveline Twp Clerk, Becki King; County Finance
- II. Approve agenda**
 - a. Motioned By: Andrea Seese; Seconded By: Kevin Shepard
 - b. Passed: unanimously
- III. Approve minutes: April 11th, 2022**
 - a. Motioned By: Julia Drost; Seconded By: Andrea Seese
 - b. Passed: unanimously
- IV. Old Business**
 - a. COVID update:
 - i. HDNW- currently still have 1 testing site (Krist gas station North of town) in the county once a week. Brainstorming other ideas to see if able to increase testing within the next couple months. Will keep posted
 - ii. Munson Charlevoix Hospital- Currently still testing patients. Current Pandemic Level Status- **Blue**. Almost back to **Green** status.
- V. New Business**
 - a. Hazard Mitigation Planning
 - i. Networks Northwest- Jennifer Neal
 - 1. Presentation on beginning planning process
 - 2. Community Survey will be sent out and encourage all (Residents, Stakeholders, etc) to complete. Pending responses, could have overall survey results for next meeting (November 2022).
 - 3. If there is anyone that should be attending these meetings and unsure if they were invited, please let Sienna know.
 - 4. All that participate in these meetings need to fill out the "In-Kind Local Match Supporting Document"- Sienna has copies.
 - ii. MSP- Mike Sobocinski (via ZOOM)
 - 1. Discussed what his role in the planning process and the Steps

2. Mentioned what FEMA approves and does not approve
iii. FEMA's Planning Implementation & Grant Development Webinar 8/18/22 2p-4p

VI. Public Comments
N/A

VII. Member Comments

N/A

VIII. Adjourn at 1:07pm
Motioned By: Kevin Shepard; Seconded By: Julia Drost
Passed: Unanimously



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: LEPC

Meeting: Charlevoix County Shirley Roloff Center
Place/Room: Committee Room

Date: 8/15/2022

Time: 12pm

Print Name

Organization

Title

Phone

E-Mail

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat
 Agriculture Energy Public Safety Long Term Recovery External Affairs

**Charlevoix County
Local Emergency Planning Committee
November 21st, 2022
12:00pm**

**Charlevoix County
Shirley Roloff Center-Committee Room
13513 Division St.
Charlevoix, MI 49720**

I. CALL MEETING TO ORDER: 12:02PM

- a. **Present:** John McDonald; Munson Chx, Chris Anderson; MAEAP, Julia Drost; County Clerk, Meghan Meyer; JVEMSA, Andrea Seese; Grandvue, Sienna Wenz; County EM, Larry Levengood; Lake Charlevoix Assoc
- b. **Guests:** Kiersten Stark; County Planning, Rob Scholey; CXPD, Nancy Ferguson; Planning Comm., Michael DeCastro; MSP EMHSD, Becki King; County Finance, William Church, CXSH, Jennifer Neal; Networks Northwest, Stephanie Marchbanks; Networks Northwest
- c. **Attendance via ZOOM:** Chris Christensen; County Commissioner, Courtney Hessel; GTB, Becky Oien; GTB, Sgt Russ Cavanaugh; GTB, Matthew Glenn; American Red Cross, Robin Perry; Melrose Twp Clerk, Pam Grassmick; Planning Comm., Chole Capaldi; HDNW, Garret Fairchild; GTB- Fire, Jennifer McKay; Tip of the Mitt, Patrick Weeks; Chx Co Road Comm., Chris Heckman; CCE-911, Jolanda Murphy; GTB-EM, Lori Savaso; GTB EDC, Xavier Gaudard; Bay Twp Supervisor

II. APPROVE AGENDA

- a. Motioned By: Larry Levengood; Second By: Julia Drost
- b. Passed: Unanimously

III. APPROVE MINUTES August 15th, 2022

- a. Motioned By: Julia Drost; Seconded By: Chris Anderson
- b. Passed: Unanimously

IV. OLD BUSINESS

- a. COVID update
 - i. Munson Chx: no major developments. COVID patient numbers have declined
 - ii. Heath Dept: Seeing the same thing as the Hospital. Was a slight increase in numbers last week, but that is usually due to delayed numbers received from the State. Do see COVID numbers decreasing.
- b. Hazard Mitigation Planning (**see presentation packets attached**)
 - i. Community Survey Results
 - ii. Hazard Analysis
 - iii. 2022 Seasonal Population Study

V. NEW BUSINESS

- a. LEPC Chair Position "interim"
 - i. Re-Elect in January
 - 1. Minimum Discussion. All agree to wait till January meeting to vote on Chair Position along with Vice-Chair and Secretary
- b. LEPC Officer/Membership Review

- i. Minimum Discussion. Added Larry Levingood back on the list
- ii. Rob Scholey will be added to represent Charlevoix Police Dept.
- iii. William Church will be added as an alternate for Charlevoix Co. Sheriff's Office
- c. Tentative 2023 LEPC Mtgs (Quarterly, 3rd Monday of Month at 12pm)
 - i. 1/16/2023, 4/17/2023, 8/21/2023, 11/20/2023
 - ii. 1/16/2023 falls on a Holiday (Martin Luther King), so the meeting would fall on 1/23/2023. Dates will be reviewed again at next meeting (1/23/2023) at 12pm.
- d. Exercises
 - i. Cybersecurity 12/13/22-12/15/22 or 2/7/23-2/9/23
 - 1. OEM is aiming to sign up for the February exercise dates.
 - ii. Active Shooter- Beaver Island Maritime
 - 1. Will be testing our logistics portion of our county Emergency Operation Plan

VI. PUBLIC COMMENTS

- a. Kiersten Stark: What would entail the Cybersecurity exercise?
It would be targeting more of the IT portion of each agency's computer security critical infrastructure. Could be targeted towards elections as an example.

VII. MEMBER COMMENTS

- a. John McDonald:
 - i. October 18th, windstorm that came through blew portion of the hospital roof off (was scheduled to get replaced). Did cause some water damage but the roof company was quick with response to help hospital recover timely.
 - ii. Staff will be starting some Active Shooter training/exercises. Looking to start with some tabletops drills and possibly escalate those drills into functional exercise drills in the future.

VIII. ADJOURN at 1:22PM

- a. Motioned By: Andrea Seese; Seconded By: Christ Anderson
- b. Passed: Unanimously

[Join Zoom Meeting](#)

<https://us02web.zoom.us/j/84372135371?pwd=S3dzSEdhbWZEa21TNEpYUDRwR0gydz09>

Meeting ID: 843 7213 5371
Passcode: 718470

One tap mobile
+19292056099,84372135371#,,,*718470# US (New York)



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: LEPC / Hazard Mitigation

Date: 11/21/22

Place/Room: EDC / Sheriff Trg Rm

Time: 12pm

Print Name

Organization

Title

Phone

E-Mail

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat
 Agriculture Energy Public Safety Long Term Recovery External Affairs



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: Hazard Mitigation Planning Mtg
Place/Room: Whitings Park

Date: 1/23/2023

Time: 10am

Print Name

Organization

Title

Phone

E-Mail

Sienna Wenz	Chx OEM	EM	231-350-3633	
Pamelia Warburton	CCE	Director	289-413-7117	pwarburton@ce911.org
Chris Heckman	CCE	Dep. Dir.	231-622-3299	heckman@ce911.org
Becki King	Chx County	Finance Director	231-350-2810	
Robin Hissom Berry	Melrose Twp.	Clerk	231-535-2310	rberry@melrose-twp.org
Julia Drift	Chx County	Clerk	231-517-7100	drift@charlevoix.org
Kiersten Stark	Chx County	Planning Dir.	231-547-7234	starkk2@charlevoixcounty.org
Mandy Ferguson	Chx Co.	Planning	231-675-8616	
Doug Tilly	PEACE Twp. Supervisor	Supervisor	231-330-0644	
Bobbi Welke	S. James Twp.	Supervisor	269-217-5901	supervisor.sjames.twp.b.welke@charlevoix.org
Scott Hawkins	Chx County	Comm. Dir. S	231-675-0852	
Kevin Shepard	Chx County	Administrator	231-675-7085	shepardke@charlevoixcounty.org
Stephanie Marchbanks	Networks NW	Community planner		
Jenni Neal	" "	" "	" "	
Andrea Seese	YMCF	Comp Officer/EP	231-350-0015	aseese@grandvista.org
Blair Blayte	Finney Co.	EMI	231-776-2000	tblayte@grandvista.org
Robert Jess	Chx Co	Commissioner		

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat
 Agriculture Energy Public Safety Long Term Recovery External Affairs

Road Commission Mtg Re: Hazard Mitigation Planning

3 messages

Sienna Wenz <wenzs@charlevoixcounty.org>
To: "manager@chxroads.org" <manager@chxroads.org>, Jennifer Neal <jennifer.neal@networksnorthwest.org>, Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Tue, Jan 24, 2023 at 2:37 PM

Thank you, Jennifer and Stephanie, for getting back with me. I will mark down in my calendar this upcoming meeting with Pat.

Friday; February 3rd, 2023 at 9am.

Location: Charlevoix County Road Commission

[1251 Boyne Ave, Boyne City, MI 49712](https://www.google.com/maps/place/1251+Boyne+Ave,+Boyne+City,+MI+49712/@45.1811111,-84.5111111,17z)

Stephanie, I will create a zoom link for you to join and will connect that with my phone.

Best Regards,

Sienna L. Wenz, PEM

Emergency Management Coordinator

Charlevoix County

W: 231-547-4461

C: 231-676-2462

F: 231-547-6720

**Charlevoix County
Local Emergency Planning Committee**

**April 17th, 2023
12:00pm**

**Charlevoix County Sheriff's Office- Training Room
1000 Grant St.
Charlevoix, MI 49720**

- I. CALL MEETING TO ORDER**
- II. APPROVE AGENDA**
- III. APPROVE MINUTES January 30th, 2023.**
- IV. OLD BUSINESS**
 - a. Hazard Mitigation Planning
 - i. Survey Results
 - ii. Goals & Objectives Discussion
- V. NEW BUSINESS**
 - a. Review/Awareness: Tier II sites
- VI. PUBLIC COMMENTS**
- VII. MEMBER COMMENTS**
 - a. Emergency Management:
 - 1. Beaver Island Exercise- April 29th, 2023
- VIII. ADJOURN**

**Charlevoix County
Local Emergency Planning Committee**

April 17th, 2023

12:00pm

**Charlevoix County Sheriff's Office
Training Room/EOC
1000 Grant St.
Charlevoix, MI 49720**

- I. CALL MEETING TO ORDER: 12:01pm**
 - a. Present: William Church; CXSH, Julia Drost; County Clerk, Tim Horan; Big Rock, Andrea Seese; Grandvue MCF, Scott Hankins; Elected Official, Sienna Wenz; County EM, John McDonald; Munson Charlevoix Hospital
 - b. Guests: Jennifer Neal; Networks Northwest, Stephanie Marchbanks; Networks Northwest
- II. APPROVE AGENDA**
 - a. Motion By: Scott Hankins; Second by: Andrea Seese
 - b. Passed: unanimously
- III. APPROVE MINUTES January 30th, 2023.**
 - a. Motion by: William Church; Second by: Scott Hankins
 - b. Passed: unanimously
- IV. OLD BUSINESS**
 - a. Hazard Mitigation Planning: Discussion on the survey results that were posted on the Charlevoix County Emergency Management website and sent to Township officials, County officials and county residents. Also reviewed the previous goals and objectives that were set in the previous Hazard Mitigation plan Goals and objectives stayed the same.
- V. NEW BUSINESS**
 - a. Review/Awareness: Tier II sites: Sienna mentioned that there are 6 sites within Charlevoix County that must report on the hazardous chemicals housed at their facility year-round. The main chemical that is reported for all sites is sulfuric acid, which is due to batteries (whether it's just a stationary battery or to be used in the forklifts). Sienna had requested the fire chiefs that have jurisdiction of those sites to review the current hazardous emergency plans and no changes were made.
- VI. PUBLIC COMMENTS**
- VII. MEMBER COMMENTS**
 - a. Emergency Management:
 - 1. Beaver Island Exercise- April 29th, 2023: Exercise coming up. Had the final planning meeting on April 13th, 2023. Day 1 of the exercise is April 28th, 2023, here in the training room to start off the exercise. Day 2 of the exercise is on April 29th, 2023, on Beaver Island.
- VIII. ADJOURN**
 - a. Motioned by: Scott Hankins; Second By: Sienna Wenz
 - b. Passed: Unanimously



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: LEP C

Date: 4/17/2023

Place/Room: Chx Co. Sheriff - Training Rm/EOC

Time: 12:00pm

Print Name

Organization

Title

Phone

E-Mail

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat

Agriculture Energy Public Safety Long Term Recovery External Affairs

**Charlevoix County
Local Emergency Planning Committee**

**August 21st, 2023
12:00pm**

**Charlevoix County Sheriff's Office- Training Room
1000 Grant St.
Charlevoix, MI 49720**

- I. CALL MEETING TO ORDER**
- II. APPROVE AGENDA**
- III. APPROVE MINUTES April 17th, 2023.**
- IV. OLD BUSINESS**
 - a. Hazard Mitigation Planning
 - i. Hazard Mitigation Plan is being drafted
 - ii. 3 additional public meetings for input
- V. NEW BUSINESS**
 - a. County Emergency Operation Plan Update/Review
 - b. MI CIMS Training/Refresher upcoming
- VI. PUBLIC COMMENTS**
- VII. MEMBER COMMENTS**
- VIII. ADJOURN**

**Charlevoix County
Local Emergency Planning Committee
August 21st, 2023**

12:00pm

**Charlevoix County Sheriff's Office- Training Room
1000 Grant St.
Charlevoix, MI 49720**

- I. CALL MEETING TO ORDER: 12:00pm**
 - a. Present: William Church; CXSH, Julia Drost; County Clerk, Tim Horan; Big Rock, Andrea Seese; Grandvue MCF, Chloe Capaldi; HDNW, Chris Anderson; Charlevoix MAEAP, Jill McDonnell; Charlevoix PD, Pamela Woodbury; CCE911, Chris Heckman; CCE911, Sienna Wenz; County EM
 - b. Guests: Stephanie Marchbanks; Networks Northwest, Kiersten Stark; County Planning
- II. APPROVE AGENDA**
 - a. Motion By: Andrea Seese; Second by: William Church
 - b. Passed: Unanimously
- III. APPROVE MINUTES April 17th, 2023.**
 - a. Motion By: Andrea Sees; Second by: William Church
 - b. Passed: Unanimously
- IV. OLD BUSINESS**
 - a. Hazard Mitigation Planning
 - i. Hazard Mitigation Plan is in beginning stages of being drafted. All cities and townships within Charlevoix County except Hudson Twp. have participated in some sort of the planning portion. Sienna will be attempting to reach out to Hudson Twp clerk and fire chief to get some response.
 - ii. 3 additional public meetings for input. Looking at a location in EJ, BC and Charlevoix. Sienna mentioned of possibly doing a zoom for Beaver Island just incase there is other input missing that should be included in the plan.
- V. NEW BUSINESS**
 - a. County Emergency Operation Plan Update/Review
 - Will be working with those to review the current annexes/appendices. Also will be adding a appendix on the Basque bridge and debris management
 - b. MI CIMS Training/Refresher upcoming
 - Currently looking at dates end of September and beginning of October. Finalized dates TBD
- VI. PUBLIC COMMENTS**
- VII. MEMBER COMMENTS**
- VIII. ADJOURN**
 - a. Motioned by: Sienna Wenz; Second by: Andrea Seese
 - b. Passed: Unanimously



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: LEPC

Date: 8/21/23

Place/Room: Charlevoix EOC / Sheriff's Office Tigray Room
Print Name Organization

Time: 12pm

Print Name

Organization

Title

Phone

E-Mail

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat

Agriculture Energy Public Safety Long Term Recovery External Affairs

Messages sent during the meeting will be visible to all meeting participants

You Oct 9, 5:22 PM



When Joining Meeting, please type your name, residence, and if you are with an organization/title

When Joining Meeting, please type your name, residence, and if you are with an organization/title

Kiersten Stark GUEST Oct 9, 5:26 PM



Kiersten Stark

Bob Anderson, Beaver Island GUEST Oct 9, 5:26 PM



Bob Anderson, Beaver Island,

Kiersten Stark GUEST Oct 9, 5:26 PM



Kiersten Stark, Planning Director, Charlevoix County

Pam Grassmick, Beaver Island GUEST Oct 9, 5:27 PM



Pam Grassmick, Beaver Island and also on the Chx. County Planning Commission

Bob Anderson, Beaver Island GUEST Oct 9, 5:27 PM



Great Lakes Islands Alliance Steering Committee, video off due to poor internet capacity at our home

[Collapse All ^](#)

You Oct 9, 5:27 PM



No worries Bob, thank you for joining us tonight!



Reply...

Typing...



...



Pam Grassmick, Beaver Island GUEST Oct 9, 5:27 PM



If I start to lag, I will close my video as well.

[Collapse All ^](#)

You Oct 9, 5:28 PM



Sounds good :)

Pam Grassmick, Beaver Island GUEST Oct 9, 5:31 PM

PG

Bobbi,

Bobbi Welke, Beaver Island GUEST Oct 9, 5:34 PM

BW

Bobbi Welke, St James Township Supervisor, Beaver Island Resident

PG

Besides the pine trees did you look at spruce/Boreal areas?

Bob Anderson, Beaver Island GUEST Oct 9, 5:40 PM

BA

What is the source of the red & white pine population? It appears light from my experience...including my property!

Bobbi Welke, Beaver Island GUEST Oct 9, 5:41 PM

BW

Are we able to ask questions as we go?

You Oct 9, 5:41 PM



yes you can Bobbi

Pam Grassmick, Beaver Island GUEST Oct 9, 5:42 PM

PG

We only have beaver dams.

Could we also see the outer islands as some are privately owned?

You Oct 9, 6:49 PM



When Joining Meeting, please type your name, residence, and if you are with an organization/title

Steph Marchbanks_Networks NW GUEST Oct 9, 6:51 PM

SM

stephanie.marchbanks@networksnorthwest.org

Shelby GUEST Oct 9, 6:51 PM

S

Thank you!

Bob Anderson, Beaver Island GUEST Oct 9, 7:26 PM

BA

manual "sires"....

You Oct 9, 7:33 PM



wenzs@charlevoixcounty.org



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: Hazard Mitigation Planning Public Input Session Date: 10/11/2023

Place/Room: EJ Emergency Services Bldg. Time: 5:30pm - 7:30pm
555 Madle St.

Print Name East Jordanian Organization Title Project Phone 050-240-0000 E-Mail eastjordanianorganization@gmail.com

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat

Agriculture Energy Public Safety Long Term Recovery External Affairs



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: Hazard Mitigation Planning - Public Input Session Date: 10/18/2023

Place/Room: Charlevoix County Shirley Roloff Time: 5:30pm - 7:30pm

Print Name

Organization

City/Twp Representing

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat

Agriculture Energy Public Safety Long Term Recovery External Affairs



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: Hazard Mitigation Planning - Public Input Session

Date: 10/25/23

Place/Room: Boyne City

Time: 5:30p - 7:30p

Print Name

City Hall - Commission Chambers

Organization

City/Twp Representing

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat

Agriculture Energy Public Safety Long Term Recovery External Affairs

**Charlevoix County
Local Emergency Planning Committee**

**November 20th, 2023
12:00pm**

**Charlevoix County Sheriff's Office- Training Room
1000 Grant St.
Charlevoix, MI 49720**

- I. CALL MEETING TO ORDER**
- II. APPROVE AGENDA**
- III. APPROVE MINUTES August 21st, 2023.**
- IV. OLD BUSINESS**
 - a. Hazard Mitigation Planning
 - i. 3 public input sessions
 - b. County Emergency Operation Plan Updates/Review
- V. NEW BUSINESS**
 - a. MI CIMS Training/Refresher
 - b. 2024 LEPC Dates
 - c. Hazard Mitigation Plan Draft
 - i. Stephanie Marchbank; Networks Northwest Planner
- VI. PUBLIC COMMENTS**
- VII. MEMBER COMMENTS**
- VIII. ADJOURN**

**Charlevoix County
Local Emergency Planning Committee**

**November 20th, 2023
12:00pm**

**Charlevoix County Sheriff's Office- Training Room
1000 Grant St.
Charlevoix, MI 49720**

- I. CALL MEETING TO ORDER: 12:00pm**
 - a. Present: William Church; CXSH, Julia Drost; County Clerk, Tim Horan; Big Rock, Tom LaCroix; Big Rock, Pat Weeks; County Road Commission, Chris Anderson; Charlevoix MAEAP, Jill McDonnell; Charlevoix PD, Chris Heckman; CCE911, Andrea Seese; Grandvue MCF, Sienna Wenz; County OEM
 - b. Guests: Stephanie Marchbanks; Networks Northwest, Kiersten Stark; County Planning, Michale Cain; City Manager-BC, Kevin Spate; BCPD, Bobbi Welke; St. James Twp Sup., J.B. Hoyt; Charlevoix Twp Trustee
- II. APPROVE AGENDA**
 - a. Motion By: Andrea Seese; Second By: William Church
 - b. Passed: Unanimously
- III. APPROVE MINUTES August 21st, 2023.**
 - a. Motion By: Andrea Seese; Second By: William Church
 - b. Passed: Unanimously
- IV. OLD BUSINESS**
 - a. Hazard Mitigation Planning
 - i. 3 public input sessions
 - b. County Emergency Operation Plan Updates/Review
- V. NEW BUSINESS**
 - a. MI CIMS Training/Refresher: Sienna is a trainer in the MICIMS program and will be having at least 2 trainings each year.
 - b. 2024 LEPC Dates (see attached)
 - c. Hazard Mitigation Plan Draft
 - i. Stephanie Marchbank; Networks Northwest Planner
 - ii. Briefly what the plan currently looks like with current information and input sessions. Still gathering more information to consolidate into the draft plan.
- VI. PUBLIC COMMENTS**
- VII. MEMBER COMMENTS**
 - a. Tim Horan: Introduced Tom LaCroix who has taken over his position at Big Rock. Tim will be assisting Tom transition.
- VIII. ADJOURN**
Motioned by: Andrea Seese



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: LEPC

Date: 11/20/23

Place/Room: Charlevoix County Sheriff's Office-
Training Rm/EOC

Time: 12pm

Print Name

Organization

Title

Phone

E-Mail

<u>Sienna Wenz</u>	<u>Chx OEM</u>	<u>EM</u>	<u>231-876-2462</u>	<u>wenzs@charlevoixcounty.org</u>
<u>Chris Anderson</u>	<u>MAEAP Chx Co</u>	<u>Manager</u>	<u>231-582-6193</u>	<u>Chris@charlevoix.org</u>
<u>Bobbi Welke</u>	<u>St. James Twp</u>	<u>Supervisor</u>	<u>269-217-5901</u>	<u>stjames.twp.bobbi.supervisor@equit.co</u>
<u>Tim Hansen</u>	<u>Holtec</u>	<u>Contractor</u>		
<u>Tom Lacroix</u>	<u>Holtec</u>	<u>Site Manager</u>	<u>269-303-0724</u>	<u>tlacroix@holtec.com</u>
<u>Andrea [redacted]</u>	<u>MSCE</u>	<u>Comp Office</u>	<u>231-675-5470</u>	<u>[redacted]@charlevoix.org</u>
<u>Patrick Weeks</u>	<u>Road Comm</u>	<u>Manager</u>	<u>231-582-7330</u>	<u>Manager@charlevoixroads.org</u>
<u>J.B. Hoyt</u>	<u>CVX Twp</u>	<u>Trustee</u>		<u>trustee.Hoyt@charlevoix.twp.org</u>
<u>Kiersten Stark</u>	<u>Charlevoix Co.</u>	<u>Planning Director</u>	<u>231-547-7234</u>	<u>starkk2@charlevoixcounty.org</u>
<u>Chris Heckman</u>	<u>CCE</u>	<u>DD</u>	<u>231-622-7299</u>	<u>chheckman@charlevoix.org</u>
<u>Michigan Co</u>	<u>Boatuse Comm</u>	<u>CM</u>	<u>231-582-0277</u>	<u>Michigan.Boatuse@charlevoix.org</u>
<u>Julia Drost</u>	<u>Nhx [redacted]</u>	<u>Clerk</u>	<u>231-547-7200</u>	<u>drostj@charlevoix.org</u>
<u>Jill McDonald</u>	<u>City of Charlevoix</u>	<u>Chief</u>	<u>231-547-3258</u>	<u>jillm@charlevoix.org</u>
<u>Kevin Spate</u>	<u>City of Boyne City</u>	<u>Chief</u>	<u>231-373-0413</u>	<u>Kspate@boynecity.org</u>
<u>Willie Church</u>	<u>CIS/H</u>	<u>C+</u>	<u>231-675-1584</u>	<u>Church.w2@charlevoixcounty.org</u>
<u>Stephanie Marchionis</u>	<u>Networks NW</u>	<u>Community Planner</u>		

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat

Agriculture Energy Public Safety Long Term Recovery External Affairs

An educational opportunity for elected and appointed planning officials

Charlevoix County Planners Forum

Wednesday, November 29, 2023

4:00 - 8:30 PM

Charlevoix Public Library
220 W Clinton St, Charlevoix
Community Rooms A & B

Registration 3:30 - 4:00 PM

MICHIGAN STATE
UNIVERSITY | Extension



A MICHIGAN HISTORICAL SITE



EGLE

MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

Agenda

4:00 – 4:10 PM: Welcome and Opening Remarks

Anna McGlashen, Local Policy Manager, Tip of the Mitt Watershed Council

4:10 – 4:50 PM: Plenary Session: Planning & Zoning for Solar Energy Systems

Mary Reilly, Government and Public Policy Educator, MSU Extension

5:00 – 5:40 PM: Plenary Session: Part 301 Inland Lakes and Streams

Erin Emington, Environmental Quality Analyst, EGLE

5:45 – 6:30 PM: Supper Break, Networking & Discussion

6:45 – 7:30 PM: Breakout Session 1

Option A: Lake Charlevoix Shoreline Planning

Lake Charlevoix Association, LIAA, Tip of the Mitt Watershed Council

Option B: Charlevoix County Hazard Mitigation Plan: An

Opportunity to Provide Your Input

Stephanie Marchbanks, Community Planner, Networks Northwest

7:30 – 7:40 PM Break

7:40-8:20 PM: Breakout Session 2

Option A: Lake Charlevoix Septic Pilot Study

Marcella Domka, Tip of the Mitt Watershed Council

Option B: Master Plan Implementation: Bridging the Gap Between the Master Plan and the Zoning Ordinance

Mary Reilly, Government and Public Policy Educator, MSU Extension

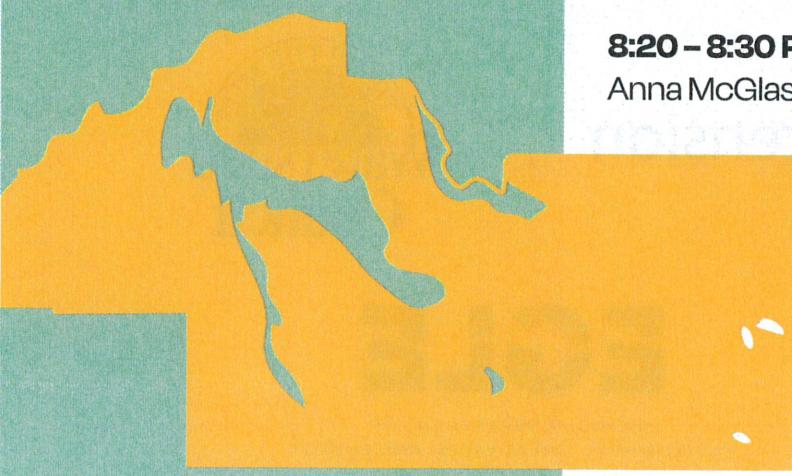
8:20 – 8:30 PM: Closing Remarks

Anna McGlashen, Tip of the Mitt Watershed Council

Join us again for this opportunity to learn about hot planning topics in Charlevoix County.

Event is funded by EGLE and the Charlevoix County Planning Commission. Thanks to the Charlevoix County Planning Commission for providing a light supper for all participants.

Master Citizen Planners are eligible to receive 4 MCP credits!



**Charlevoix County
Local Emergency Planning Committee**

**January 22nd, 2024
12:00pm**

**Charlevoix County Sheriff's Office- Training Room/EOC
1000 Grant Street
Charlevoix, MI 49720**

- I. CALL MEETING TO ORDER**
- II. APPROVE AGENDA**
- III. APPROVE MINUTES November 20th, 2023.**
- IV. OLD BUSINESS**
 - a. Hazard Mitigation Draft- Update
 - i. Special Hazard Mitigation Meeting coming soon
 - 1. Review current updates
 - 2. Discuss Strategies/Vulnerability Analysis Tables
 - b. County Emergency Operation Plan Update
 - i. State has new format and requirements.
 - 1. [Local EOP Review Guide](#)
 - a. Plan Format
 - b. Reference Public-Private partnerships
 - c. Updated Hazard-Specific Appendix Standards
 - d. Removed Catastrophic Incident
 - e. Added Cyber Incident/Power Outage Incident
- V. NEW BUSINESS**
 - a. [LEPC Member Roster](#): Review/Update
 - b. SARA Title III- Tier II Reporting
 - i. New Facility adding to list: Daifuku
- VI. PUBLIC COMMENTS**
- VII. MEMBER COMMENTS**
- VIII. ADJOURN**



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: Charlevoix County LEPC Date: 1/22/2024

Date: 1/22/2024

Time: 12pm

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat
 Agriculture Energy Public Safety Long Term Recovery External Affairs

Charlevoix County Hazard Mitigation Plan Draft Update

Sienna Wenz <wenzs@charlevoixcounty.org>

Mon, Jan 22, 2024 at 1:36 PM

To: Melrose <Melrose@melrosetwp.org>, Andrea Seese <aseese@grandvue.org>, Brian Kelly <kellyb@charlevoixcounty.org>, "Cathy M. Kelbey" <Cathy.Kelbey@cmsenergy.com>, Chloe Capaldi <C.Capaldi@nwealth.org>, Chris Anderson <chris@charlevoicxd.org>, Chris Christensen <district2@charlevoixcounty.org>, Chris Heckman <checkman@cce911.com>, Chuck Vondra <vondrac@charlevoixcounty.org>, Dan Thorp <dthorp5699@gmail.com>, "gronfire@gmail.com" <gronfire@gmail.com>, James Vanek <engineer@chxroads.org>, Jesse Silva <jesses@lcemsami.gov>, Jill McDonnell <jillm@charlevoixmi.gov>, John McDonald <jmcdonald@mhc.net>, Julia Drost <drostj@charlevoixcounty.org>, Kevin Shepard <shepardk@charlevoixcounty.org>, "Larry Levingood (larrylevingood@yahoo.com)" <larrylevingood@yahoo.com>, "manager@chxroads.org" <manager@chxroads.org>, Meghan Powers <meghan.powers@redcross.org>, Pam Woodbury <pwoodbury@cce911.com>, Scott Hankins <district5@charlevoixcounty.org>, Thomas LaCroix <tlacroix@holtec.com>, William Church <churchw@charlevoixcounty.org>, Ryan Novotny <rnovotny@cctransit.org>, Bill Tarrant <bill@jvems.org>, "zoning@norwoodtwp.org" <zoning@norwoodtwp.org>, "tlamey@msn.com" <tlamey@msn.com>, "wilsonclerk49712@gmail.com" <wilsonclerk49712@gmail.com>, Vern Goodwin <vern@melrosetwp.org>, "thistledew4me@gmail.com" <thistledew4me@gmail.com>, Sue Hobbs <supervisor@boynovalleytwp.org>, Shelby Harris <stjamesadmass.bi@gmail.com>, "sammie.dyal@gtb-msn.gov" <sammie.dyal@gtb-msn.gov>, Pamela Grassnick <pgrassnick@gmail.com>, Jennifer McKay <jenniferm@watershedcouncil.org>, Eveline Twp Clerk <evelinetwpclerk@gmail.com>, "charclerk@chartwp.com" <charclerk@chartwp.com>, "rmillington9094@charter.net" <rmillington9094@charter.net>, Jeremy Runstrom <jrunstrom@cheboygancounty.net>, Ryan Novotny <novotny@charlevoixcounty.org>, "director@beaverislandhistory.org" <director@beaverislandhistory.org>, "tcannon@eastjordancy.org" <tcannon@eastjordancy.org>, "hudsontwpfirerescue@outlook.com" <hudsontwpfirerescue@outlook.com>, "boynefire@boynecity.com" <boynefire@boynecity.com>, "boynovalleyfire@gmail.com" <boynovalleyfire@gmail.com>, "ctfd5600@gmail.com" <ctfd5600@gmail.com>, Fire Chief <firechief@melrosetwp.org>, Tim McDonough <jmcd99@yahoo.com>, Meghan <meghan@jvems.org>, Brenda-Boyne EMS <ems@boynecity.com>, "kmason@biems.org" <kmason@biems.org>, Bobbi Welke <supervisor.stjameswp.bi@gmail.com>, Peaine Township - Supervisor <peainetownship@gmail.com>, Krys Lyle <peainetownship.aadm@gmail.com>, Kiersten Stark <Stark2@charlevoixcounty.org>, "nancyfern1965@gmail.com" <nancyfern1965@gmail.com>, "matcunningham.34@gmail.com" <matt.cunningham.34@gmail.com>, "Ritter, Michael" <mritter@rayder.net>, "dlskornia@msn.com" <dlskornia@msn.com>, "kenneytim8@gmail.com" <kenneytim8@gmail.com>, Robert Jess <district1@charlevoixcounty.org>, Patrick Harmon <district3@charlevoixcounty.org>, Josh Chamberlain <district4@charlevoixcounty.org>, Annemarie Conway <district6@charlevoixcounty.org>, "info@ejchamber.org" <info@ejchamber.org>, "info@boynechamber.com" <info@boynechamber.com>, Charlevoix Chamber <info@charlevoix.org>, "chamber@beaverisland.org" <chamber@beaverisland.org>, "supervisor@baytownshipmi.org" <supervisor@baytownshipmi.org>, Bay Twp Clerk <clerk@baytownshipmi.org>, "kbaranski9333@gmail.com" <kbaranski9333@gmail.com>, "joejo01@hotmail.com" <joejo01@hotmail.com>, "barbara.mathes@gmail.com" <barbara.mathes@gmail.com>, "jhshp.boyne@gmail.com" <jhshp.boyne@gmail.com>, "trustee2@baytownshipmi.org" <trustee2@baytownshipmi.org>, "danlisonbee@yahoo.com" <danlisonbee@yahoo.com>, "village01@centurytel.net" <village01@centurytel.net>, Marilyn Cousineau <marilyncousineau.mc@gmail.com>, "clerk@boynovalleytwp.org" <clerk@boynovalleytwp.org>, Dennis Howard <dhoward5599@yahoo.com>, "mgmco@freeway.net" <mgmco@freeway.net>, Pat Howard <barefootdirt@yahoo.com>, "clerk@charlevoixtownship.gov" <clerk@charlevoixtownship.gov>, "supervisor@charlevoixtownship.gov" <supervisor@charlevoixtownship.gov>, "Josben72@yahoo.com" <Josben72@yahoo.com>, "bradfordjlewis@gmail.com" <bradfordjlewis@gmail.com>, "Jbhoy7@gmail.com" <Jbhoy7@gmail.com>, James Howell <supervisor@evangelinetwp.org>, Evangeline Twp Clerk <clerk@evangelinetwp.org>, "evelinesupervisor@gmail.com" <evelinesupervisor@gmail.com>, "kelcou39@yahoo.com" <kelcou39@yahoo.com>, "ericbeishlag@yahoo.com" <ericbeishlag@yahoo.com>, "prudykurtz@gmail.com" <prudykurtz@gmail.com>, "one.hotoat@gmail.com" <one.hotoat@gmail.com>, "hwttrue@gmail.com" <hwttrue@gmail.com>, "Cheltzi M. Wilson" <cwilson@eastjordancy.org>, "rwgriffits3@gmail.com" <rwgriffits3@gmail.com>, "Burnett.pc@outlook.com" <Burnett.pc@outlook.com>, "trustee2@hayestownshipmi.gov" <trustee2@hayestownshipmi.gov>, "steve@bulmanndock.com" <steve@bulmanndock.com>, "greensladerex@gmail.com" <greensladerex@gmail.com>, Ron VanZee <supervisor@hayestownshipmi.gov>, "Hayes Twp Clerk (clerk@hayestownshipmi.gov)" <clerk@hayestownshipmi.gov>, "terryerber24@gmail.com" <terryerber24@gmail.com>, "htccindi19@yahoo.com" <htccindi19@yahoo.com>, "Erik@Stonearch.io" <Erik@stonearch.io>, "hudsontwpptreasurer@gmail.com" <hudsontwpptreasurer@gmail.com>, Michael Cain <mcain@boynecity.com>, Jessica Puroll <jpuroll@boynecity.com>, "markh@charlevoixmi.gov" <markh@charlevoixmi.gov>, "sarahd@charlevoixmi.gov" <sarahd@charlevoixmi.gov>, "wilsonsupervisor49712@gmail.com" <wilsonsupervisor49712@gmail.com>, "cnt90@att.net" <cnt90@att.net>, "tdneid@gmail.com" <tdneid@gmail.com>, "j435y@torchlake.com" <j435y@torchlake.com>, "rubydip@hotmail.com" <rubydip@hotmail.com>, "erickbennett3870@gmail.com" <erickbennett3870@gmail.com>, "crick@eastjordancy.org" <crick@eastjordancy.org>, South Arm Twp Clerk <southarmclerk@gmail.com>, Julie Gillespie <clerk.stjameswp.bi@gmail.com>, "chair.pc.stjameswp.bi@gmail.com" <chair.pc.stjameswp.bi@gmail.com>, "cole.stjameswp.bi@gmail.com" <cole.stjameswp.bi@gmail.com>, "peainetownshipclerk@gmail.com" <peainetownshipclerk@gmail.com>, "wmrky531@gmail.com" <wmrky531@gmail.com>, "wmrky531@gmail.com" <wmrky531@gmail.com>, Angela LeFevre-Welke <lefevream@hotmail.com>, "danburtonbuilder@yahoo.com" <danburtonbuilder@yahoo.com>, Treasurer Vicki Smith <treasurer.peainetownship@yahoo.com>, Tim Matchett <timmatchett@hotmail.com>, "johnhamsinc@charter.net" <johnhamsinc@charter.net>, Norwood Twp Clerk <trusteeb@norwoodtwp.org>, "trusteeA@norwoodtwp.org" <trusteeA@norwoodtwp.org>, "member2@norwoodtwp.org" <member2@norwoodtwp.org>, "member1@norwoodtwp.org" <member1@norwoodtwp.org>, "member1@norwoodtwp.org" <member1@norwoodtwp.org>, "member4@norwoodtwp.org" <member4@norwoodtwp.org>, "member3@norwoodtwp.org" <member3@norwoodtwp.org>, "Adams, Chris" <chris.adams@boynemountain.com>, Mark Lercel <mlercel@ejplastics.com>, "Perl, Jason" <jason.perl@boynemountain.com>, Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>, "fire@charlevoixtownship.gov" <fire@charlevoixtownship.gov>

Good Afternoon all,

There will be a special hazard mitigation plan draft meeting to go over the current draft.

There will be discussion on:

- Strategies
- The Vulnerability Analysis Tables
- Any additional information Stephanie may share.

Here is the live draft link for your reference. <https://drive.google.com/file/d/1kvqD1zF1lvRxaE4yEDFxt2N8JpUSDDc/view?usp=sharing>

It can also be downloaded at: <https://www.networksnorthwest.org/community/natural-hazard-mitigation/charlevoix-county.html>

While reviewing the current draft plan, if you have any questions or have suggestions for some changes, please feel free to let Stephanie Marchbanks (stephanie.marchbanks@networksnorthwest.org) and I know.

If I missed anyone, please forward this invite onto them.

So, I can make sure we have an adequate amount of seating, please let me know if you will be attending.

Thank you!

Best Regards,

Sienna L. Wenz, PEM

Emergency Management Coordinator

Charlevoix County



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: Charlevoix Co. Hazard Mitigation

Date: 2/26/2024

Place/Room: Chx Sheriff Training/EOC Planning

Time: 1 pm

Print Name	Organization	Title	Phone	E-Mail
Sienna Wenz	Charlevoix County	OEM		wenzs@charlevoixcounty..
Bobbi Kielke	St. James Twp	SPUR		supervisor.st ...
Chuck Vondra	Sheriff's Office	Sheriff		vondrac@charlevoixcounty..
Dan Black	GTB	Safety admin.		daniel.blacke@GTBindians.com
Garrett Fairchild	GTB	Fire Chief		Garrett.Fairchild@GTB-Nor. Ga
Andrea Seese	Grandville	Comp Officer		aseese@grandville.org
Tom LaCroix	Hotec - Big Rock	Prog Manager		tlacroix@hotec.com
Jill McDonnell	CXPD	Chief		jillm@charlevoixmi.gov
Brad Bishop	Coast Guard	OIC		Bradley.T.Bishop@uscg.mil
Jennifer Neal	Boyne City / Evangeline Twp.	Planning Administrator		jneal@boynecity.com
Kiersten Stark	Charlevoix County	Planning Director		starkk2@charlevoixcounty.org
Chloe Capaldi	HDNW	Emergency Prep Coordinator	231-373-2937	c.capaldi@hndnw.org
Julia Drost	Charlevoix County	Clerk	231-547-7200	drostj@charlevoixcount...org
Christopher Heckman	CCE TII	DID	231-622-3299	heckman@cce.ti...
Stephanie Marchbanks	Networks NW	Community Planner		Stephanie.marchbanks@networksnw.org
Tom Cannon	City of EJ	City Administrator		
Cheltzi Wilson	City of EJ	City Clerk		
Pat Weeks	Chx Co. Rott	manager		
Kathleen Mason	Bl. EMS	EMS Director		
Matt Adamek	Antrim Co.	SEM		

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat
 Agriculture Energy Public Safety Long Term Recovery External Affairs



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: _____

Date: _____

Place/Room: _____

Time: _____

Print Name

Organization

Title

Phone

E-Mail

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting
 Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat
 Agriculture Energy Public Safety Long Term Recovery External Affairs

Charlevoix County Hazard Mitigation Plan - your input requested

Amy Wieland <wielanda@charlevoixcounty.org>
To: Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>, Sheri Shepard <shepards@charlevoixcounty.org>, "info@aaanm.org" <info@aaanm.org>
Cc: Sienna Wenz <wenzs@charlevoixcounty.org>

Fri, Mar 15, 2024 at 10:23 AM

Good Morning Stephanie,

I have reviewed the Charlevoix County Hazard Mitigation plan and the COA's planned role.

Strategy #5 – We already have this as part of our process and can create and updated list very quickly.

Strategy #6 – We can call all our COA clients but the Beaver Island Rural Health Center would have access to anyone on the island, so I agree with this part of the plan we are included in.

Strategy #21 – We have had a Senior Residential Snow Removal Program for our Charlevoix County Seniors since 2017.

Strategy #24a – We already do this and have contingency plans for Severe Weather and Public Health Emergencies.

Strategy #37, 37a & 38b – We are currently identifying “Safe Rooms/Areas” in our offices and Senior Centers and doing beginning training on what to do in an emergency situation. The only center currently OWNED by Charlevoix County is the Charlevoix Senior Center and would be the best place for a preferred shelter site. East Jordan is OWNED by the School, and they have control over what is done at that building. It makes more sense to me to invest in a generator for the Charlevoix location due to the size, capacity and resources of the building.

Strategy #43 – We already do this.

Strategy #44 – Creating a new “Cool Care Program” is a good idea but funds would need to be allocated towards a new program and it would need to be approved by the County Commissioners. I would be willing to develop something for the 2024/25 Fiscal Year if this is something the County wants.

Let me know if you need anything else from me. Thank you.

Amy Wieland
Executive Director
Charlevoix County Commission on Aging

Work Phone: 231-237-0103

Email: wielanda@charlevoixcounty.org

Address: 13513 Division Street, Charlevoix, MI 49720

Changing what aging looks like and feels like in Charlevoix County!

[Quoted text hidden]



Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: Charlroix County Hazard Mitigation Date: 4/22/2024

Place/Room: Charlevoix County Sheriff's Trg Rm/EOC Time: 2pm

Related ESF (Check all that apply): Transportation Communication Public Works Fire Fighting

Information & Planning Mass Care Logistics Public Health/EMS Search & Rescue HazMat
 Agriculture Energy Public Safety Long Term Recovery External Affairs



CHARLEVOIX COUNTY PLANNING COMMISSION

13513 Division Street
Charlevoix, Michigan 49720
(231) 547-7234
planning@charlevoixcounty.org

Approved Meeting Minutes June 6, 2024

I. Call to Order

Chairperson Nancy Ferguson called the meeting to order at 6:00 p.m. in the Committee Room at the Charlevoix County Shirley Roloff Center.

Members present: Nancy Ferguson, Pam Grassmick, Mike Ritter, and Dave Skornia

Members absent: Matt Cunningham (excused)

Others present: Kiersten Stark (Planning Director), Bob Jess (County Commissioner Liaison), Stephanie Marchbanks (Community Planner, Networks Northwest), Dan Barron, Bryan Noirot, Robert Wojan, Dana Dvoracek, Hayden Dvoracek, and others

II. Pledge of Allegiance

M. Ritter led the Pledge of Allegiance to the Flag of the United States of America.

III. Approval of Agenda

MOTION by P. Grassmick to approve the agenda as presented. M. Ritter seconded the motion. Voice vote: all in favor. Motion passed.

IV. Public Comments

None

V. County Business Items

Approval of Minutes of May 9, 2024 Meeting

MOTION by M. Ritter to approve the minutes of the May 9, 2024 meeting as presented. D. Skornia seconded the motion. Voice vote: all in favor. Motion passed.

Correspondence and Communications

K. Stark presented a flyer for MSU Extension's "2024 Master Citizen Planner Live Webinar Series"; the next webinar will be held on June 20, 2024 from 6:30 to 7:30 p.m. on the topic of "Site Plan

Review for Planning Commissioners".

P. Grassmick and D. Skornia would like to register for this webinar.

Hazard Mitigation Plan Presentation (Stephanie Marchbanks, Networks Northwest)

Stephanie Marchbanks, Community Planner from Networks Northwest, introduced herself and presented the proposed 2024 Charlevoix County Natural Hazards Mitigation Plan.

S. Marchbanks made the following points:

- In order for a hazard mitigation project to be eligible for federal funding, the project must be identified in the plan.
- It's important to include references to this plan in the County Future Land Use Plan and the Parks & Recreation Plan the next time these plans are updated.

S. Marchbanks requested that any additional comments on the proposed plan be submitted within the next few weeks; she would like to submit the draft plan to begin the approval process by the end of June. She described the steps in the approval process and the approximate timeline to have an official approved plan in place.

S. Marchbanks noted she had not received input from several local communities. N. Ferguson asked Staff to reach out to those communities that have not yet provided input.

Commission members and Staff thanked Stephanie Marchbanks for presenting the proposed plan.

Proposed FY 2025 Budget

K. Stark reviewed the proposed Fiscal Year 2025 Budget for the Planning Department, which includes the Planning Commission.

N. Ferguson asked if the proposed budget for Travel would cover the expense of transportation for the Planning Commission to tour (and hold their monthly meetings) in two different townships, which is one of their goals for 2024. K. Stark said yes.

Discussion took place regarding the staffing level in the Planning Department. K. Stark said she has Board approval to hire a part-time Administrative Assistant. She explained that she has held off on posting the opening due to the possibility of a substantial increase in the workload in her department related to Materials Management Planning; if she is appointed as the Designated Planning Agency (DPA) for Materials Management Planning, then she would need to go back to the Board and request that the Administrative Assistant position be full-time.

Commissioner Jess encouraged K. Stark to request a full-time Administrative Assistant position. He asked if the proposed budget would need to be amended. K. Stark explained that changing the position to full-time would first require Board approval and then the proposed budget would be amended.

MOTION by N. Ferguson to recommend that K. Stark hire a full-time Administrative Assistant. P. Grassmick seconded the motion. Voice vote: all in favor. Motion passed.

MOTION by P. Grassmick to accept the proposed FY 2025 Budget for the Planning Department as presented. D. Skornia seconded the motion. Voice vote: all in favor. Motion passed.

VI. Townships, Cities, MI Dept of EGLE & Corps of Engineers Items

Marion Township Proposed Rezoning

Commission members and Staff reviewed the request by Bryan Noirot and NBS Ventures LLC to rezone a total of three (3) parcels. Two (2) parcels, having property tax identification numbers 15-009-011-008-10 and 15-009-011-008-20, located at 4987 Loeb Rd. and 13540 Veenstra Rd., respectively, are proposed for rezoning from General Commercial (C-2) to Mixed Residential (R-2). The third parcel, having property tax identification number 15-009-011-007-00, located at 4947 Loeb Rd., is proposed for rezoning from Agricultural (A) to Mixed Residential (R-2).

K. Stark reviewed the Planning Department Staff Report, which included a comparison of land uses allowed and dimensional requirements, existing uses on the subject parcels and surrounding properties, the zoning of adjacent properties, the relationship to the Township Master Plan, the soil types, and the Township Planning Commission recommendation.

N. Ferguson explained the County Planning Commission's advisory role in the approval process for a proposed rezoning, emphasizing we do not have the authority to overrule decisions made by a Township.

Dan Barron, representing the applicant, commented on two (2) factors which the Marion Township Planning Commission had found weighed against the proposed rezoning. He stated that the subject parcels are designated as Moderate Density Residential in the Marion Township Master Plan.

Acceptable land uses in the Moderate Density Residential category include multi-family dwellings. Therefore, the proposed rezoning to Mixed Residential (R-2) is consistent with the Master Plan. Mr. Barron said some of the Township Planning Commission members had concerns regarding, under R-2, there's no density restrictions. Perhaps, part of the reason is that the Township does not have any land available for multi-family use, so they have not encountered this issue in the past. As a result, the applicant has expanded the public record and earlier this week filed with the Township an offer a conditional rezoning to place a restriction on the subject parcels that no more than eight (8) dwelling units may be established, maintained or occupied upon or within the premises. An offer of conditions on a proposed rezoning by the applicant is authorized by the Zoning Ordinance at any point in the rezoning process. There are currently eight (8) dwelling units on the subject property. This equates to four (4) units per acre, which is one of the more conservative standards in this area for multi-family zoning, but it would be acceptable and appropriate for this property. The property can support eight (8) dwelling units.

N. Ferguson questioned whether the County Planning Commission could make a recommendation on the proposed rezoning since the rezoning request has become a conditional rezoning request, but the Township Planning Commission has not yet reviewed and made a recommendation on the applicant's offer of conditions. N. Ferguson did not think the County Planning Commission has the authority to weigh in on the conditional rezoning if the Township Planning Commission has not yet reviewed it. K. Stark said allowing the Township Planning Commission to review the conditional rezoning first and to send it back to us for review seems like the best way to handle the situation.

Dana Dvoracek, a Marion Township resident and a member of the Marion Township Planning Commission, advised that the County Planning Commission should consider the original rezoning request, but not the additional information (offer of conditions) that was just submitted this week, which has not yet been reviewed by the Township Planning Commission.

Robert Wojan, a Marion Township resident, expressed concerns regarding the density on the property and how this would impact the existing septic system. He commented that, according to the Health Department, there is not enough space on the property for a new septic system if the existing system fails. The Marion Township Planning Commission has worked hard to develop a new Master Plan for the Township residents. Township residents want to see open space, rural character, and low-density development where public sewer and water is available. This was expressed through a community survey of Township residents. There's also a map in the Master Plan which shows the suitability of the land to support septic systems. He noted his water well is only fifty (50) feet from the nearest property line of the subject parcels; he didn't know how close the septic system on Bryan Noirot's property is to the property line. Mr. Wojan said the existing residential units on the subject property all went in without permits; the safety of the residents in those units is not being taken into account either. He asked that the County Planning Commission please respect the decision of the Marion Township Planning Commission, as they worked diligently in considering this application. Even though there were findings in favor of the proposed rezoning, there were other issues considered by the Township. He believes it is in the best interests of the citizens of Marion Township for the County Planning Commission to support the recommendation of the Township Planning Commission.

One member of the audience asked for clarification on the difference between moderate density and high density residential. K. Stark said it's expressed in units per acre, but it varies from one community to the next. The audience member said, in Marion Township, there is no high-density residential development. In his opinion, eight (8) dwelling units on 2 acres is pretty high density. Another audience member added, especially without sewer service.

P. Grassmick asked, does this give the owner of the property a unique benefit that other landowners in Marion Township would not have, as far as the density is concerned?

N. Ferguson asked, does the Township Zoning Ordinance define moderate-density and high-density?

A member of the audience said the Ordinance specifies the density allowed in the R-2 District with and without sewer.

One member of the audience asked, if one property owner is allowed to do this, why wouldn't other landowners be allowed to do it, too?

Dan Barron said he thought some of the comments being made are beyond what is in the public record. These issues, relative to sewer, have been addressed within the public record and considered by the Township Planning Commission. He reiterated that the Township Zoning Ordinance is very specific that an offer of conditions can be made for a proposed rezoning at any point in the process. The Zoning Ordinance also stipulates that a conditional rezoning only goes back to the Township Planning Commission only if there has been a previous offer of conditions that has been withdrawn. He noted there has been no offer of conditions that has been withdrawn. He disagreed that the County Planning Commission's decision should not include consideration of the conditions offered. He asked that, at the very least, a decision be made on the original rezoning request and sent to the Township Board. The Board then has the prerogative to refer it back to the Township Planning Commission.

The Planning Commission deliberated further on the proposed rezoning. D. Skornia commented they did not have enough information to make a recommendation. M. Ritter said the proposed rezoning seems to be consistent with the Township Master Plan. However, there remains the question of density. M. Ritter said there is also the question of whether other landowners in the Mixed Residential (R-2) District would be allowed to have a density of up to eight (8) units per acre. M. Ritter said he did not see where that would be the case.

MOTION by N. Ferguson that the Planning Commission has the following questions, which need to be answered before we can make a recommendation on the proposed rezoning: 1) What is considered moderate density and high density residential, with and without municipal sewer service? 2) Is there space on the subject property to expand the existing septic system or to place an additional (new) septic system if needed? 3) Would a rezoning to Mixed Residential (R-2) give the property owner a unique benefit that other property owners in Marion Township would not have, as far as the density is concerned? P. Grassmick seconded the motion. Voice vote: all in favor. Motion passed.

Chandler Township Proposed New Zoning Ordinance

K. Stark reviewed the highlights of the proposed new Chandler Township Zoning Ordinance as follows: 1) Improves language consistency, 2) Reduces the minimum size of a dwelling unit from 960 to 720 square feet, 3) Increases the minimum setback distance for telecommunication towers from any adjoining lot line from 75% to 110% of the tower height, 4) Updated provisions to comply with federal and state regulations and recent court rulings; the sign regulations in particular were revised to be content-neutral, 5) Eliminates non-intensive recreational uses as a permitted use in the Agricultural District, 6) Changes the minimum lot size from 10 acres to 5 acres in the Agricultural District, from 20 acres to 5 acres in the Forest Recreational District, and from 5 acres to 2.5 acres in the Rural Residential District, 7) Reduces the minimum front yard setback in all districts from 133 feet to 50 feet, 8) Adds provisions for seasonal accessory lodging, 9) Adds a 24-month expiration date from date of issuance for a zoning permit, and 10) Clarifies that an accessory building can be the first structure on a parcel as long as a building envelope is provided for the principal structure.

Commission members and Staff made the following comments:

- On page 1, Section 1.3, change the word “became” to “is”.
- On page 9, in the definition of “Nonconforming Structure”, second line, remove the words “the use”. Similarly, in the definition of “Nonconforming Use”, end of the first line and beginning of second line, remove the words “the use”.
- On page 11, in the definition of “Tavern”, the word “spirituous” is used. This is not a commonly used term. Could the definition be reworded using more common terminology?
- On page 15, section 3.14, introductory paragraph, second line, should this be ninety (90) *consecutive* days?
- On page 16, Section 3.18, subsection 4., in the first line, change the word “are” to “is”; in reference to the last sentence, some standards need to be included here to ensure consistency; also, the Township may want to specify that existing vegetation and topography will be taken into consideration in determining screening requirements. It was also acknowledged that the purpose of screening requirements is to provide a buffer for neighboring properties. In a rural

community with large tracts of open space and a small population, the screening requirements should be modified accordingly to be site-specific. Some rewording here would be helpful.

- On page 17, under Section 3.19, subsection 2.b., omit extra wording in the first line. Also, subsections a. and b. seem to conflict with each other.
- Pages 17 – 18, the wording in Section 3.19 Sign Regulations seems like it was taken from another source. If so, the proposed regulations should be reviewed closely to ensure they are appropriate for Chandler Township (i.e., the number of signs allowed seems excessive for a rural community).
- On page 18, under subsection 4.a., insert the word “make”, so it reads “Sign lighting shall be no greater wattage than is necessary to make the sign visible at night.”
- Also on page 18, under subsection 4.e., who determines if the night lighting is excessive? What standards are used to make this determination? Also, ground-mounted lighting has traditionally been the most common way to provide night lighting for a flag.
- Also on page 18, under subsection 3.f., what is meant by “unclear”?
- It would be helpful to have more illustrations not only in Section 3.19, but throughout the ordinance. Illustrations make it easier to understand and see the intent behind the regulations.
- On page 20, in subsection 2.b., change “Guys” to “Guy wires”.
- Also on page 20, in subsection 3., last line, change “anti-limbing” to “anti-climbing”.
- On page 21, subsection 6.b., landscaping requirements here and throughout the zoning ordinance should specify that *native species* be used.
- On page 21, in subsection 6.d., third line, what is considered “normal aural acuity”? It would be simpler and more straightforward to specify a decibel level.
- On page 22, in Section 3.22, subsection 3.b., the wording should be corrected to read “Confined Animal Feeding Operations shall be maintained in accordance with the Generally Accepted Agricultural and Management Practices (GAAMPS)...”; in the last line, the name of the state agency should be corrected to read “Michigan Commission of Agriculture and Rural Development”; also, in subsection 3.c., second line, “DEQ” should be changed to “EGL”.
- Also on page 22, Section 3.23, campgrounds are required to have a permit from EGL; reference to this should be added to this section; the Township may also want to consider the use of generators and specifying a maximum decibel level and hours of operation.
- On page 29, the zoning map should have been included in the draft ordinance, even though no changes are proposed to the map, because this is a new ordinance, not just text amendments.
- The text on page 32 should be moved to page 33 and vice versa, so the Rural Residential District is Article VI and the Forest Recreational District is Article VII.

- Also on page 32, in Section 7.2, subsection 4., the word “proceeding” should be changed to “preceding”.
- There are 2 pages numbered “33”; change the second one to page 34.
- On page 34, Article VIII – Table of Area and Height Regulations, the front setback in all zoning districts was reduced from 133 feet to 50 feet. In addition, footnote (a) in the current zoning ordinance, which reads “Measured from the center of the existing road”, is proposed to be omitted. However, in the public hearing notice, it states that the minimum front setback would be reduced to 83 feet and would be measured from the center of the road right-of-way. Is the Township changing how the front yard setback is measured? This needs to be clarified.
- Also referring to the table on page 34, it was noted that reducing the minimum lot size in the Agricultural and Rural Residential districts is a good idea, but it was recommended to reduce the minimum lot size in each of these districts even further to more effectively preserve large tracts of land for farming and forestry, which is the stated purpose of the Agricultural district and the Forest Recreational district and a goal of the County Future Land Use Plan; applying the concept of equivalent density would help achieve this purpose/goal.
- On page 36, subsection 1., a brief explanation of what is considered “usable open space” as well as some examples of what is not considered usable open space and, therefore, should not be included in the calculation (i.e., wetlands) for a planned unit development (PUD).
- On pages 58-60, Section 13.2 Guidelines for Decisions on Text Amendments and Rezoning Requests was well done and very thorough.
- Grammatical corrections are needed throughout the ordinance.
- It was noted in several places that certain provisions were amended in 2023. However, the County did not receive any proposed amendments for review during that time.
- When proposed zoning ordinance amendments are submitted for County Planning Commission review, particularly a proposed new ordinance, it would be extremely helpful if the proposed changes are highlighted. Otherwise, it’s not clear what the specific changes are and how they affect other regulations in the ordinance.

MOTION by P. Grassmick to send our comments and recommendations to Chandler Township for their consideration. D. Skornia seconded the motion. Voice vote: all in favor. Motion passed.

EGLE Public Notice (Phillip)

K. Stark introduced the public notice for the permit application submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) by Lincoln Phillip to 1) construct a permanent open-pile “h”-shaped dock with two (2) finger piers, 2) install two (2) permanent boat hoists, and 3) dredge sediment to a depth of two (2) feet from two (2) areas within the applicant’s riparian area twice during the life of the permit. The project is located on Lake Charlevoix in South Arm Township.

N. Ferguson said the proposed dock does not appear to extend further out into the lake than other existing docks nearby. She noted the applicant received a violation notice from EGLE in March for

installing an excessive platform in wetland and excessive cutting of vegetation. The applicant had subsequently submitted a plan for restoration, which was accepted by EGLE in April. It was noted the dredged spoils will be taken off-site.

P. Grassmick said she was concerned about the potential impact of the project on the neighboring parcel to the south because the proposed dock is very close to the applicant's southern riparian line. However, the application shows the project is within the riparian area. It was noted the applicant would like to place the dock on the south side of his riparian area due to the lake grass bed on the north side and also to allow space for swimming.

K. Stark said dredging had previously been done here. N. Ferguson agreed but noted that a permanent dock had not been located there in the past.

P. Grassmick acknowledged the reason the dock is proposed to go out into the lake so far is due to the anticipated decrease in the water level and the required draw for the applicant's watercraft.

The merits of permanent open pile docks over seasonal docks, described in the application, were noted.

MOTION by M. Ritter that we reviewed the public notice and have no comment on the proposed project. D. Skornia seconded the motion. Discussion: P. Grassmick said, even though the Planning Commission has no comment, it is important for EGLE to know that we have reviewed the application. She commented that the local units of government and the public are not seeing these public notices. P. Grassmick emphasized it is important for EGLE to know that we have spent time reviewing this application. N. Ferguson said we may want to pass along the comment that we think the proposed project is very close to the south riparian line. P. Grassmick noted, as the Planning Commission has previously discussed, EGLE needs to find a better way of notifying communities and the public regarding proposed projects. M. Ritter commented that the proposed permanent dock is a better placement, entirely within the applicant's riparian area, compared to the existing seasonal dock, which angles over and encroaches on the riparian area of the adjacent parcel to the south. Voice vote: all in favor. Motion passed.

VII. Comments/Reports

Planning Director

K. Stark gave an update on Planning Department activities over the past month:

- Construction continues on Phase 3 of the Boyne City to Charlevoix Trail; we've had some engineering issues, but most of them have been resolved.
- Drafted a Request for Proposals (RFP) for engineering services to complete the Boyne City to Charlevoix Trail; she presented the draft RFP to the County Board's Building & Grounds Committee this week; some revisions are needed to the section pertaining to insurance coverage, based on a review by the County's insurance agent; civil counsel will also need to review the RFP.
- Attended a DNR Natural Rivers Zoning Review Board training session, which the DNR began holding a few years ago as an annual refresher for members of the Natural Rivers Zoning Review Boards around the state; K. Stark is a member of the Jordan River Zoning Review Board; she described the purpose and function of these boards.

County Commissioner Liaison

Commissioner Jess was pleased to confirm the Building & Grounds Committee approved moving the draft RFP for engineering services to complete the Boyne City to Charlevoix Trail to the full Board for final approval. He reported that the Committee also recommended to the full Board for approval one of the construction bids received for the Commission on Aging dining room addition to the Shirley Roloff Center.

N. Ferguson inquired about plans for the County Building downtown. Commissioner Jess said, based on conversations he had with the judges, the current courtrooms are meeting their needs, so there isn't a reason to move the courts to another location. Commissioner Jess thought the County should maintain possession of the building, adding that it is in very good condition.

Planning Commission Members

M. Ritter reported that Charlevoix Public Schools graduation was held last weekend; there were 73 graduates. The 6th grade graduation was held today. He also reported that Staff is preparing the proposed budget for FY 2025. Contract negotiations with the teachers will take place this summer.

D. Skornia complimented Stephanie Marchbanks on the proposed Charlevoix County Natural Hazards Mitigation Plan, which includes goals, objectives and strategies. He commented that too often community master plans do not include enough content pertaining to goals and objectives and how to accomplish them. He also reported that Bay Township continues to work on proposed amendments to the waterfront greenbelt provisions in their zoning ordinance. D. Skornia also announced an upcoming Agricultural Field Day, which will be held on July 18, 2024. An event flyer is being developed, which will be shared with Commission members and Staff. D. Skornia described the planned program.

P. Grassmick reported that both of the Beaver Island ferries are operational again. She also reported that she has almost completed the MSU Extension Citizen Planner Program via Zoom. She also reported that a new director was hired for the CMU Biological Station on the Island. There is also a meeting of the DNR's Northern Lake Michigan Islands Collaborative coming up in June.

N. Ferguson reported she attended the Eveline Township Planning Commission public hearing held on May 8, 2024 regarding a proposed rezoning of the parcel adjacent to her property, which fronts on M-66, from Farm Forest to Mobile Home Park. Following the public hearing, the Township Planning Commission tabled the rezoning request for further discussion at their next meeting on June 12, 2024.

VIII. Any Unfinished County Business

Hayden Dvoracek, Marion Township citizen, commented that he does not want to see the Traverse City to Charlevoix Trail go through Fisherman's Island State Park.

N. Ferguson noted that Hayden Dvoracek is running for Marion Township Supervisor.

IX. Adjournment

MOTION by D. Skornia to adjourn the meeting. M. Ritter seconded the motion. Voice vote: all in favor. Motion passed.

Chairperson Ferguson adjourned the meeting at 8:45 p.m.

Minutes submitted by,

Pam Grassmick
Secretary

PG/kjs

Kiersten Stark

From: Hudson Township Treasurer <hudsontownshiptreasurer@gmail.com>
Sent: Wednesday, June 26, 2024 9:30 AM
To: Kiersten Stark
Subject: Re: Natural Hazard Mitigation Plan

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Kiersten,
I will look at it. One quick thing I saw was the spelling of "HUFFMAN" Lake (correct) verses the incorrect spelling as "Hoffman"

Frank D Wasylewski
Hudson Township Treasurer
08755 Huffman Lake Road
Elmira, Michigan 49730
(231) 549-3019

On Wed, Jun 26, 2024 at 8:16 AM Kiersten Stark <Starkk2@charlevoixcounty.org> wrote:

To Hudson Township,

The Charlevoix County Department of Emergency Management, with assistance from Networks Northwest, has prepared a draft of the County's 2024 Natural Hazard Mitigation Plan. This is a multi-jurisdictional plan. The objective is to reduce or eliminate long-term risks to people, property, the environment, and the economy from natural hazards as well as certain technological and human-related hazards (i.e., dam failure, public health emergency, etc.). The plan identifies natural hazards which are common or likely in our county based on past events or experience, and potential mitigation strategies to help minimize the impact of these hazards on the community. The mitigation strategies address site-specific as well as county-wide hazard risks.

The updated 5-year plan must pass review by the Michigan State Police and the Federal Emergency Management Agency (FEMA), and then be adopted by each local unit of government that participated in the plan's development. A current, approved local hazard mitigation plan is one of the requirements for a community to apply for and/or receive grant funding from FEMA to help cover the cost of hazard mitigation projects.

Some examples of potential mitigation projects that would be eligible for federal grant funding include tornado sirens, infrastructure improvements to address flooding issues, efforts to reduce shoreline flooding/erosion; water quality/invasive species improvement projects; increasing preparedness for severe weather events, wildfire watches, public awareness efforts, etc.

It's important to us to obtain input for this plan from each local unit of government in the county. A copy of the draft plan is attached. We'd appreciate it if your township can review and provide input on the plan, ***especially the mitigation strategies, which begin on page 130.*** Additional information about the hazard mitigation planning process can be accessed here: <https://www.networksnorthwest.org/community/natural-hazard-mitigation/charlevoix-county.html>.

If your township is considering applying for a FEMA mitigation grant in the next five years, your proposed project must address a hazard issue/risk identified in the Natural Hazard Mitigation Plan.

After reviewing the plan, if your township does not have any natural hazard issues/concerns or mitigation strategies that you'd like included in the plan, *please reply to this effect.* If you have any questions, please feel free to contact me at (231) 547-7234 or starkk2@charlevoixcounty.org.

Kiersten Stark

Planning Director

Charlevoix County

MARION TOWNSHIP Board of Trustee Minutes

Excerpt of the Minutes of the Regular Marion Township Meeting held on July 15, 2024.

Call to Order: Supervisor Martin called the meeting to order at 7:00pm with the Pledge of Allegiance to the Flag.

Roll Call: Members present were John Martin, Micheal Jarema, Timothy Matchett, Joseph Seidel and Julie Whitley.

Absent: None

2024 Charlevoix County Hazard Mitigation Plan: Board members had all received a copy of the updated 2024 Charlevoix County Hazard Mitigation Plan, (CCHMP), via email. After reviewing the CCHMP, Board members did not have any concerns to add to the plan in regard to Marion Township. Whitley moved to accept the updated 2024 CCHMP as presented as adequately covering Marion Township at this point. Seconded by Martin. Carried.

Adjournment: Being no further business, meeting was adjourned by the Supervisor. Meeting adjourned at 7:45pm.



Timothy Matchett
Marion Township Clerk

Beaver Island Haz Mit Plan Notes

Bobbi Welke <supervisor.stjamestwp.bi@gmail.com>

Tue, Sep 3, 2024 at 9:30 AM

To: Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Hi Stephanie,

Attached are the notes from Beaver Island officials in regard to the draft Hazardous Mitigation Plan.

See you on September 30th.

Bobbi

 **20240903.BeaverIsland.HazMitigationPlan.Notes.pdf**
3171K

From: Kathrine Gray <cakecisma@macd.org>
Sent: Wednesday, September 25, 2024 2:32 PM
To: Sienna Wenz <wenzs@charlevoixcounty.org>
Subject: Re: Charlevoix County Hazard Mitigation Plan- Draft overview

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Hi Sienna,

I am the new program coordinator for the invasive species management area (CAKE CISMA) that covers Charlevoix County, and I just started about 2 weeks ago, but I've been with the CISMA for several years. I appreciate the inclusion of CAKE CISMA in the Hazard Mitigation Plan. We want to coordinate our response efforts with the county. Do you know if there's anything I need to prepare for the upcoming meeting? I've briefly reviewed the sections where CAKE is mentioned throughout the plan, and everything related to us looks correct so far.

Sincerely,
Katie Gray

--
Katie Gray
CAKE CISMA Coordinator
231-533-8363 ext. 5
cakecisma@macd.org

Welcome! Today's Agenda

- Brief Overview of the Charlevoix County Plan contents
- Review draft strategies; address any questions/changes needed
- Review Maps- generated by Networks Northwest
- What is the next step?
 - Schedule agenda item at County BOC meeting to hold public hearing
 - County BOC recommend plan to be sent to MSP/FEMA for review
 - Networks Northwest to mail/email notification letters regarding Public hearing/comment period
- Fill out In-Kind forms & return to Sienna





Charlevoix County Office of Emergency Management

Sign-In Sheet

Meeting: Charlevoix Co Hazard Mitigation Meeting

Date: 09/30/2024

Place/Room: Charlevoix Sheriff's Trg Room

Time: 2pm

Print Name	Organization	Title	E-Mail
Sienna Wenz	Charlevoix Co.	EM	wenzs@charlevoixcounty.org
Marilyn Cousineau	Boyne Falls Village	President	marilyn.cousineau.mcgmail.co
Chloe Capaldi	HDNW	EPC	c.capaldi@nwhealth.org
William Church	Cks 14	2t	
Kiersten Stark	Chx Co. Planning	Director	starkk2@charlevoixcounty.org
Andrea Seeser	Grandview	Comm. Officer	Seeser@grandview.org
Stephanie Marchbanks	Networks NW	Comm. Planner	stephanie.marchbanks@network
Tom LaCroix	Hotec	Proj Manager	tr+lacroix@hotec.com
Julia Drost	Char. Cty	Clerk	drostj@charlevoixcounty.org
Chuck Vondra	Char. Cty	Sheriff	vondrac@charlevoixcounty.org
Dan Duncan	DNR	Supervisor	
Bobbi Welke	St. James Twp	Supervisor	
Maria Dal Pra	Plaine Twp	Supervisor	
Robin Berny	Melrose Twp	Clerk	
Kevin Shepard	Char. Cty	Administrator	
Matt Adamek	Antrim Cty	OEM	

Related ESF (Check all that apply):

Transportation Communication Public Works Firefighting Information & Planning Mass Care
 Logistics Public Health/EMS Search & Rescue HazMat Agriculture Energy Public Safety
 Cross-Sector & Infrastructure External Affairs

From: Myron Matz <mgmco@freeway.net>
Sent: Thursday, October 3, 2024 9:07:26 PM
To: Sienna Wenz <wenzs@charlevoixcounty.org>
Subject: RE: New Form Entry: Contact Form

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Hello

Chandler township does not have any hazard mitigation risks at this time.

Thank you,

Myron Matz

Chandler Township Clerk

From: no-reply@weebly.com <no-reply@weebly.com>
Sent: Thursday, October 03, 2024 8:38 AM
To: mgmco@freeway.net
Subject: New Form Entry: Contact Form

You've just received a new submission to your [Contact Form](#).

[Mark as Spam](#)

Submitted Information:

Name

Sienna Wenz

Email

wenzs@charlevoixcounty.org

Comment

The Charlevoix County Office of Emergency Management is in the process of updating the county's 5-year Natural Hazard Mitigation Plan, with assistance from Networks Northwest Community Development staff. At this point, a draft plan and associated mitigation strategies have been developed and will be sent out for public comment within the month.

I am reaching out to you as a stakeholder to gather any other hazard mitigation input pertaining to Chandler Township. If you do/don't have any hazard mitigation risks within your township, please let me know at your earliest convenience.

Your input is very valuable and if provided, your name/title/organization will be included in the acknowledgements section of the plan to reflect your participation. If no participation is received for this plan, Chandler Township would not be eligible to apply/receive any FEMA mitigation grants within the next 5 years.

Here is the link to review the current draft plan. <https://www.networksnorthwest.org/userfiles/filemanager/bt63z5hxmjf126wrdj49/>

At your earliest convenience, please look over the plan and get back with me on if there needs to be any suggestions/corrections needed to be made pertaining to Chandler Township.

COUNTY BOARD OF COMMISSIONERS
CHARLEVOIX, MICHIGAN 49720

Wednesday, October 9, 2024
9:30 a.m.
13513 Division Street
Charlevoix, MI 49720

VirtualLink: <https://www.youtube.com/live/ITQNefOQXfg?si=9SuH4LMIcesxgYma>

AGENDA

9:30 a.m. Meeting called to order and Pledge of Allegiance to the Flag of the United States of America
Approval of Agenda (Before approving the agenda, items can be removed from the consent agenda)

Public Comment on any Agenda items listed on current agenda (limited to 3 minutes)

Approval of Consent Agenda

CONSENT AGENDA

Approval of Minutes.....	Pages 3-8
County Expenditures.....	Pages 9
Charlevoix County Commission on Aging.....	Pages 10-13
Charlevoix County Transit Oversight Committee.....	Pages 14
Grandvue.....	Pages 15-16
Area Agency on Aging.....	Pages 17-23
Wexford County Resolution 24-20.....	Pages 24-26

SCHEDED APPEARANCES: (Limited to 15 minutes)

Stephanie Marchbanks, Networks Northwest (Hazard Mitigation Plan)	
Emily Selph (Apportionment Report).....	Pages 27-65

UNFINISHED BUSINESS:

None

NEW BUSINESS:

None

RESOLUTIONS:

Public Hearing Notice.....	Pages 66
2024 Apportionment Report.....	Pages 67
County Network Switches.....	Pages 68

Public Comment (limited to three (3) minutes)

ADMINISTRATOR'S COMMENTS:

SHERIFF'S COMMENTS:

COMMISSIONER COMMENTS/COMMITTEE REPORTS:
Board Members

Adjourn to the call of the Chair

CHARLEVOIX COUNTY BOARD OF COMMISSIONERS
OCTOBER 9, 2024

The Chairman called the meeting to order at 9:30 a.m. Present were Commissioners Robert Jess, Chris Christensen, Tim Kenney, Joshua Chamberlain, Scott Hankins, and Annemarie Conway, 6.

Oration of the Pledge of Allegiance to the Flag of the United States of America.

APPROVAL OF AGENDA

Moved by Commissioner Chamberlain and seconded by Commissioner Conway to approve the agenda as presented. Motion carried. Roll Call Vote 6.0.

PUBLIC COMMENT

McCarther Griffis, CCE 911Executive Director introduced himself to the Board.

APPROVAL OF CONSENT AGENDA

Moved by Commissioner Jess and seconded by Commissioner Kenney to approve the consent agenda as presented: Approval of Minutes, Charlevoix County Commission on Aging, Charlevoix County Transit Oversight Committee, Grandvue, Area Agency on Aging, Wexford County Resolution 24-20, and a monthly resolution for County Expenditures. Motion carried. Roll Call Vote 6.0.

RESOLUTION – COUNTY EXPENDITURES (#24-116)

WHEREAS, the Charlevoix County Audit Committee reviewed the September invoices on the 11th and 25th of September; and

WHEREAS, the total expenditures for the month of September are \$1,003,598.68; and

WHEREAS, the Audit Committee recommends that the above invoices be approved for payment by the entire Board;

NOW THEREFORE BE IT RESOLVED, that the Charlevoix County Board of Commissioners accepts the above recommendation and approves the September expenditures in the amount of \$1,003,598.68.

SCHEDULED APPEARANCES

Stephanie Marchbanks from Networks Northwest presented a draft of the Charlevoix County Hazard Mitigation Plan.

Emily Selph, Director of Equalization presented the 2024 Apportionment Report.

UNFINISHED BUISNESS

None.

NEW BUSINESS

None.

RESOLUTION- PUBLIC HEARING NOTICE (#24-117)

Moved by Commissioner Conway and seconded by Commissioner Chamberlain that the above listed resolution be adopted.

WHEREAS, the County of Charlevoix will conduct a public hearing for the purpose of affording citizens an opportunity to comment on the proposed Natural Hazard Mitigation Plan; and

NOW THEREFORE BE IT RESOLVED, that a hearing be held on the 2024 Natural Hazard Mitigation Plan for the County of Charlevoix, in the Commissioner's Room, Shirley Roloff Center, 13513 Division Street, Charlevoix, MI 49720 at or after 6:00 p.m., on October 23, 2024, and notice of said hearing shall be published at least 6 days prior to the hearing in the following form:

COUNTY OF CHARLEVOIX
PUBLIC NOTICE

HEARING ON 2024 NATURAL HAZARD MITIGATION PLAN

Notice is hereby given that the proposed Natural Hazard Mitigation Plan for the County of Charlevoix is now on file and available to the public for inspection at the office of the County Clerk, 203 Antrim Street, Charlevoix, MI 49720.

The Charlevoix County Board of Commissioners will hold a public hearing on the proposed Natural Hazard Mitigation Plan on Wednesday, October 23, 2024, at 6:00 p.m. in the Commissioner's Room, Shirley Roloff Center, 13513 Division Street, Charlevoix, MI 49720. Motion carried. Roll Call Vote: 6.0.

RESOLUTION- 2024 APPORTIONMENT REPORT (#24-118)

Moved by Commissioner Chamberlain and seconded by Commissioner Jess that the above listed resolution be adopted.

WHEREAS, MCL 211.37 as amended, requires the County Board of Commissioners at a session held not later than October 31 in each year, to apportion the amount of property taxes to be raised by the various taxing jurisdictions; and

WHEREAS, the 2024 Apportionment Report prepared by the Charlevoix County Equalization Department provides a summary of the requests for millages to be levied by the various taxing jurisdictions and the County of Charlevoix; and

NOW THEREFORE BE IT RESOLVED, that the 2024 Apportionment Report is accepted as the 2024 apportionment of tax rates, and that authorization and direction is hereby given to the assessing officers of the local units of government in Charlevoix County to apportion and spread the various tax rates against the 2024 taxable valuations within their taxing jurisdictions in accordance with the law.

Motion carried. Roll Call Vote: 6.0.

RESOLUTION- COUNTY NETWORK SWITCHES (#24-119)

Moved by Commissioner Kenney and seconded by Commissioner Conway that the above listed resolution be adopted.

WHEREAS, the I.T. Department requires 3 network switches to replace aging infrastructure; and

WHEREAS, the I.T. Department has presented a quote for the purchase of necessary equipment from CDWG at the approximate cost of \$6,776.37; and

WHEREAS, the Building and Grounds Committee concurs with this request and recommends it be accepted by the entire Board; and

NOW THEREFORE BE IT RESOLVED that the Charlevoix County Board of Commissioners hereby accepts the above recommendation and authorizes the purchase of three network switches, not to exceed the amount of \$6,776.37. Funds for this purchase are to come from the IT Department budget.

Motion carried. Roll Call Vote: 6.0.

UNSCHEDULED PUBLIC COMMENT

Dorne Davis, Evangeline Township commented on the non-motorized trail.

Bobbi Welke, St. James Township would like to be considered for the Commission on Aging Advisory Board.

ADMINISTRATOR'S COMMENTS

Kevin Shepard, County Administrator attended the Commission on Aging Advisory Board meeting on Beaver Island. The residents on the Island requested increased services including but not limited to changes to the meal voucher program. Shepard suggests creating a Beaver Island Senior Advisory Committee and working towards enhancing some of the services available. Shepard is still gathering information regarding Dorne Davis's appeal.

SHERIFF'S COMMENTS

Sheriff Vondra was not present.

COMMISSIONER COMMENTS/COMMITTEE REPORTS

The Commissioners gave their committee reports.

The meeting was adjourned to the call of the Chair at 10:18 a.m.

COUNTY BOARD OF COMMISSIONERS
CHARLEVOIX, MICHIGAN 49720

Wednesday, October 23, 2024
6:00 p.m.
13513 Division Street
Charlevoix, MI 49720

AGENDA

6:00 p.m. Meeting called to order and Pledge of Allegiance to the Flag of the United States of America
Approval of Agenda (Before approving the agenda, items can be removed from the consent agenda)

Public Comment on any Agenda items listed on current agenda (limited to 3 minutes)

Approval of Consent Agenda

CONSENT AGENDA

Approval of Minutes.....	Pages 3-4
Grandvue.....	Pages 5-6
Treasurer's Investment.....	Pages 7-12
Charlevoix County Parks Committee.....	Pages 13-14
Transit Oversight Committee.....	Pages 15
Health Department of Northwest Michigan.....	Pages 16-17
CCE-911.....	Pages 18-22
Networks Northwest.....	Pages 23-24
Washtenaw County Resolution.....	Pages 25-27
Beaver Island Correspondence.....	Pages 28-35

PUBLIC HEARING: 2024 Natural Hazard Mitigation Plan

SCHEDULED APPEARANCES:

None

UNFINISHED BUSINESS:

COA Discussion
Hazard Mitigation Plan

NEW BUSINESS:

November 27, 2024, Board Meeting	
Committee Resignation.....	Pages 36
FY 2024 Emergency Management Performance Grant.....	Pages 37-66
FY 2025 EMPG Local Work Agreement.....	Pages 67-94

RESOLUTIONS:

2024 EMPG Grant Agreement.....	Pages 95
2025 EMPG Work Agreement.....	Pages 96
Veterans Affairs Emergency Fund Urgent Needs.....	Pages 97

Public Comment (limited to three (3) minutes)

ADMINISTRATOR'S COMMENTS:

SHERIFF'S COMMENTS:

COMMISSIONER COMMENTS/COMMITTEE REPORTS:

Board Members

Adjourn to the call of the Chair

For Remote Public Access click the virtual link below or use your phone to scan the QR Code:

Virtual Link: <https://youtube.com/live/cuE9ampIT-E?si=h6kvcraNY00aqdM1>

CHARLEVOIX COUNTY BOARD OF COMMISSIONERS
OCTOBER 23, 2024

The Chairman called the meeting to order at 6:00 p.m. Present were Commissioners Robert Jess, Chris Christensen, Tim Kenney, Joshua Chamberlain, Scott Hankins, and Annemarie Conway, 6.

Oration of the Pledge of Allegiance to the Flag of the United States of America.

APPROVAL OF AGENDA

Moved by Commissioner Christensen and seconded by Commissioner Chamberlain to approve the agenda as presented. Motion carried. Roll Call Vote 6.0.

PUBLIC COMMENT

Lori Taylor Blitz, Executive Director Beaver Island Historical Society commented on the need for Commission on Aging services on Beaver Island.

Bobbi Welke, St. James Township Supervisor commented on the need for Commission on Aging services on Beaver Island.

APPROVAL OF CONSENT AGENDA

Moved by Commissioner Conway and seconded by Commissioner Kenney to approve the consent agenda as presented: Approval of Minutes, Treasurer's Investment, Charlevoix County Parks Committee, Charlevoix County Transit Oversight Committee, Health Department of Northwest Michigan, CCE-911, Networks Northwest, Washtenaw County Resolution, Beaver Island Correspondence, and a monthly resolution for Grandvue. Motion carried. Roll Call Vote 6.0.

RESOLUTION – GRANDVUE OPERATING TRANSFER (#24-120)

WHEREAS, the Department of Human Services Board through the Grandvue Administrator has requested the transfer of \$47,125.84 from the Capital Depreciation Account to the Operating Account for the payment of the following items: Justin Shattuck (Shattuck Glass) – Window Replacement \$6,917.40; Justin Shattuck (Shattuck Glass) – Window Replacement \$6,945.00; Hooker DeJong – Roof Inspection \$630.00; Penske (Monthly Truck Rental-Visa) – Elevator Replacement \$1,102.20; Direct Supply – Dietary Equipment (Reach-in Refrigerator) \$5,260.00; Kone Inc. – Elevator Replacement \$11,478.24 and Cabinets By Robert Inc. – Countertop & Cabinet Replacements \$14,793.00; and

WHEREAS, the Board of Commissioners concurs with this request;

NOW THEREFORE BE IT RESOLVED that the Treasurer be authorized to make this transfer as outlined above.

Chairman Hankins opened the Public Hearing on the 2024 Natural Hazard Mitigation Plan for comments from the floor at 6:05 p.m. With no further comments, the Chairman closed the public hearing at 6:07 p.m.

SCHEDULED APPEARANCES

None.

UNFINISHED BUISNESS

Amy Wieland, Commission on Aging Executive Director presented the 2024 Commission on Aging Annual Report.

Moved by Commissioner Chamberlain and seconded by Commissioner Conway to send the current version of the 2024 Natural Hazard Mitigation Plan as presented to FEMA for review and approval. Motion carried. Roll Call Vote 6.0.

NEW BUSINESS

Moved by Commissioner Hankins and seconded by Commissioner Conway to cancel the November 27, 2024, Board of Commissioners meeting. Motion carried. Voice Vote 6.0.

Moved by Commissioner Kenney and seconded by Commissioner Jess to approve Sharon Misiak's resignation from the Charlevoix County Commission on Aging Advisory Board. Motion carried. Voice Vote 6.0.

**RESOLUTION- 2024 EMERGENCY MANAGEMENT PERFORMANCE
GRANT AGREEMENT (#24-121)**

Moved by Commissioner Conway and seconded by Commissioner Christensen that the above listed resolution be adopted.

WHEREAS, the Charlevoix County Emergency Management Coordinator is requesting to enter into the Emergency Management Performance Grant Agreement; and

WHEREAS, the purpose of this grant agreement is to provide federal pass-through funds to the County of Charlevoix for the development and maintenance of an emergency management program capable of protecting life, property, and vital infrastructure in times of disaster or emergency; and

WHEREAS, the Board of Commissioners reviewed and accepts the above request and recommends this grant application be approved;

NOW THEREFORE BE IT RESOLVED, that the Charlevoix County Board of Commissioners hereby authorizes the Charlevoix County Emergency Management Coordinator to apply for the above outlined Emergency Management Performance Grant Agreement and further authorizes the Chairman of the Board of Commissioners to sign any necessary documents. Motion carried. Roll Call Vote: 6.0.

**RESOLUTION- 2025 EMERGENCY MANAGEMENT PERFORMANCE GRANT WORK
AGREEMENT/QUARTERLY REPORT (#24-122)**

Moved by Commissioner Christensen and seconded by Commissioner Chamberlain that the above listed resolution be adopted.

WHEREAS, the Charlevoix County Emergency Management Coordinator is requesting to enter into the Emergency Management Performance Grant Work Agreement/Quarterly Report; and

WHEREAS, the purpose of this work agreement is to provide survey responses that will assist in the assessment of emergency management programs, determine how Emergency Management Performance Grant funds are utilized and help validate the importance of these emergency management activities to all levels of government; and

WHEREAS, the Board of Commissioners reviewed and accepts the above request and recommends this Emergency Management Performance Grant Work Agreement/Quarterly Report request be approved;

NOW THEREFORE BE IT RESOLVED, that the Charlevoix County Board of Commissioners hereby authorizes the Charlevoix County Emergency Management Coordinator to apply for the above outlined Emergency Management Performance Grant Work Agreement/Quarterly Report and further authorizes the Chairman of the Board of Commissioners to sign any necessary documents. Motion carried. Roll Call Vote: 6.0.

RESOLUTION- VETERANS AFFAIRS EMERGENCY FUND URGENT NEEDS (#24-123)

Moved by Commissioner Jess and seconded by Commissioner Hankins that the above listed resolution be adopted.

WHEREAS, the Veterans Affairs Officers are requesting to transfer \$6,000 from the Veterans Affairs general surplus fund to their emergency fund; and

WHEREAS, at this time they have very little capital in the emergency fund and the Veterans Affairs Board agrees with this request; and

WHEREAS, the Internal Government Committee concurs and recommends to the entire Board that the Veterans Affairs Officers make the transfer; and

NOW THEREFORE BE IT RESOLVED that the Charlevoix County Board of Commissioners hereby accepts and authorizes the above request and authorizes the transfer of funds. Motion carried. Roll Call Vote: 6.0.

UNSCHEDULED PUBLIC COMMENT

Bobbi Welke, St. James Township Supervisor reiterated concerns on the need for Commission on Aging services on Beaver Island.

Lori Taylor Blitz, Executive Director Beaver Island Historical Society reiterated concerns on the need for Commission on Aging services on Beaver Island.

Dorne Davis, Boyne City reiterated concerns about addressing a segment of the wall on the non-motorized trail being over the property line and erosion issues.

ADMINISTRATOR'S COMMENTS

Kevin Shepard, County Administrator is working on addressing both the Beaver Island COA needs and Dorne Davis's property concerns.

SHERIFF'S COMMENTS

Sheriff Vondra was not present.

COMMISSIONER COMMENTS/COMMITTEE REPORTS

The Commissioners gave their committee reports.

The meeting was adjourned to the call of the Chair at 6:50 p.m.

SCOTT HANKINS, CHAIRMAN

JULIA A. DROST, COUNTY CLERK



Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

South Arm Twp.

Sienna Wenz <wenzs@charlevoixcounty.org>
To: Stephanie Marchbanks <stephanie.marchbanks@networksnorthwest.org>

Fri, Oct 25, 2024 at 1:55 PM

Hi,

I just got off the phone with Bob Christensen- Township supervisor for South Arm Twp.

I explained what the hazard mitigation plan was and what concerns they may have for any risks/hazards within their township.

The topics he mentioned that are already mentioned in the plan are flooding concerns, tornado threats and also soil erosion.

So, if possible, can we make sure South Arm Twp is included as a participant in the plan ?

Thank you 😊

Best Regards,

Sienna L. Wenz, PEM

Emergency Management Coordinator

Charlevoix County

1000 Grant St.
Charlevoix, MI 49720