



# Grand Traverse Band of Ottawa and Chippewa Indians Natural Hazard Mitigation Plan

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2023

**Final Draft for Public Review 9/22/2023**



## Tribal Resolution of Adoption

## ACKNOWLEDGEMENTS

This Natural Hazard Mitigation Plan is prepared for the Grand Traverse Band of Ottawa and Chippewa Indians, a Native Sovereign Nation. This plan is a culmination of the interdisciplinary and interagency planning effort that required the assistance and expertise of the tribal and non-tribal entities listed below. Refer to Appendix \_ for a table of how and when the representatives of each participating entity contributed to the development of the plan.

### Tribal Participation

Name	Title	Department
David Arroyo	Tribal Chairman	Tribal Council
Mark Wilson	Tribal Vice Chair (former)	Tribal Council
Ruth Dudley	Executive Assistant to Tribal Chairman	Tribal Council
Dee Wonegeshik	Manager	Elders Program
Jolanda Murphy	Manager/Emergency Manager	Public Safety – Emergency Management
David Crockett	Police Captain	Public Safety – Tribal Police
Russ Cavanaugh	Police Sergeant	Public Safety – Tribal Police
Suzanne McSawby	Law Enforcement Specialist	Public Safety – Tribal Police
Garrett Fairchild	Fire Chief	Public Safety - Fire & Rescue
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Doris Winslow	Executive Assistant to the Tribal Manager	Tribal Management Office
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<b>Andy Doornbos</b>	Fire Chief	Cedar Area Fire and Rescue
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<b>Jim Schwantes</b>	Supervisor	Centerville Township
<b>Dana Boomer</b>	Clerk	Kasson Township
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<b>Lt. James Kiessel</b>	Undersheriff	Leelanau County Sheriff's Office
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<b>Brendan Mullane</b>	Managing Director	Leelanau County Road Commission
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## I. INTRODUCTION

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

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

A *hazard*, in the context of this plan, is an event or physical condition that has potential to cause fatalities; injuries; damage to personal property, infrastructure, or the environment; agricultural product loss; or interruption of business or civic life. The Grand Traverse Band of Ottawa and Chippewa Indians (GTB) Natural Hazard Mitigation Plan focuses on *natural* hazards such as extreme heat, drought, wildfires, flooding, shoreline erosion, dangerous shoreline currents, thunderstorms, high winds, hail, tornadoes, extreme winter weather, and invasive species. An exception is that it will also consider these technological and human-related hazards: dam failure and public illness outbreak.

The following natural hazards were not included in the analysis for this Hazard Mitigation Plan: earthquakes, subsidence, space weather, 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, Leelanau County does not contain potential subsidence hazards such as active or abandoned mines, and sinkhole risks in the county range from "absent or likely absent" to "infrequent or likely infrequent". Damaging space weather events were not evaluated due to the lack of significant historical impact in northern Michigan. 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 Plan is to permanently eliminate or reduce long-term risks to people and property from natural hazards so that Tribal assets such as infrastructure, commerce, and housing can be sustained and strengthened. This can be accomplished through collaborative efforts/activities amongst agencies within the government to protect the health, safety, and economic interests of the residents and businesses through planning, awareness, and implementation.

This plan represents an update to the GTB's 2016 Hazard Mitigation Plan that meets the requirements of Title 44 of the Code of Federal Regulations, Section 201.7. A FEMA-approved hazard mitigation plan is required for receiving certain types of non-emergency disaster assistance, including funding for Hazard Mitigation Assistance projects and Public Assistance permanent work (categories C-G) for Tribal governments applying directly to FEMA for assistance. The Plan includes a description of the planning process, a description of the community, hazard identification and analysis, current mitigation capabilities, a strategy and action plan, and a process for incorporating the plan into other Tribal processes and updating the Hazard Mitigation Plan.

Through this Plan, a broad perspective was taken in examining multiple natural hazard mitigation activities and opportunities for protecting the GTB community from future hazard events. Each natural hazard was analyzed from a historical perspective, evaluated for potential risk, and considered for possible mitigation.

Section VII of this plan, "Mitigation Strategies and Priorities", provides a current list of hazard mitigation strategies for each natural hazard identified. Mitigation strategies were developed based on discussions with local officials and a review of FEMA/MSP best practices for hazard mitigation. (Refer to Appendix D for a list of Alternative Mitigation 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.

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

Recognizing the importance of reducing community vulnerability to natural hazards, GTB is actively addressing the issue through the development and implementation of this plan. This process will help ensure that Tribal community remains a vibrant, safe, enjoyable place in which to live, raise a family, continue to conduct business. The Plan serves as the foundation for natural hazard mitigation activities and actions on GTB lands within Leelanau County and surrounding areas, 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 GTB Natural Hazard Mitigation Goals:

1. Increase local awareness and participation in natural hazards mitigation strategies
2. Integrate natural hazards mitigation considerations into the community's comprehensive planning process
3. Utilize available resources to apply for future natural hazard mitigation grants or partnerships
4. Develop and complete natural hazards mitigation projects in a timely manner
5. Protect human life from the impacts of natural hazards through planning and preparedness efforts
6. Ensure uninterrupted government and emergency functions in a disaster
7. Increase public awareness on being prepared before, during and after a disaster, when essential services may not be available



## 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 Tribal nations to have a natural hazards mitigation plan in place and updated on a 5-year cycle as a condition for receiving grant money related to natural hazard remediation. The Grand Traverse Band of Ottawa and Chippewa Indians is adopting an updated Hazard Mitigation Plan that meets the requirements of Title 44 of the Code of Federal Regulations, Section 201.7 (44 CFR § 201.7). The adoption of a 2023 plan will affirm the Tribe's eligibility for federal funding.

The creation of the Tribe's plan was led by the Natural Hazards Task Force (Task Force) comprised of the Tribal Local Planning Team (LPT). Team members consist of Tribal Councilmembers, emergency response personnel, and government staff that ensure the readiness of the Tribe by recommending equipment purchases, training and exercises, and member education on preparedness issues. Networks Northwest assisted with the planning process and provided support to facilitate meetings and plan writing. The Task Force met regularly virtually and in-person at the GTB Tribal Police Department Conference Room in Peshawbestown (located in Suttons Bay Township, Leelanau County). The following is an outline of events for the development of the 2023 Natural Hazard Mitigation Plan:

- On July 1, 2021, Jolanda Murphy and Garrett Fairchild attended a project kick off meeting with regional county and tribal emergency managers.
- On October 21, 2021 Networks Northwest attended a LPT meeting and provided an introduction and timeline for the project. The meeting was held virtually.
- In October 2021, the Tribe released an online community survey; details about the survey are provided below.
- On January 14, 2022 Networks Northwest presented the community profile information and provided a summary of preliminary survey results. The meeting was held virtually.
- On March 11, 2022 Networks Northwest presented the final survey results and the hazard analysis including historic weather events. The meeting was held virtually.
- On April 14, 2022 a joint community meeting was held between Tribal officials and representatives from Leelanau County to discuss potential hazards. The meeting was held in person at the Leelanau County building.
- On August 18, 2022 the LPT met to discuss the partial draft plan, goals and objectives, and hazard mitigation strategies.
- On October 7, 2022 the LPT met to confirm the goals and objectives and the mitigation strategies and discuss implementation efforts.
- On December 20, 2022 the LPT met to provide clarification and edits to mitigation strategies.
- On February 9, 2023 the LPT reviewed updated mitigation strategies, which were consolidated by hazard type, and discussed next steps in the planning process.
- On May 3, 2023 Networks Northwest presented the draft hazard maps, plan, and strategies to the Tribal Council at a special Tribal Council Work Session meeting to obtain feedback. Members of the LPT were also present at the meeting to assist in feedback and answering questions from councilmembers.
- The final draft plan was released for **public comment on** via the following outreach/notification methods: posting on the GTB website, the GTB's "Regroup" mass electronic notification system, and the project page on Networks Northwest's website.
- The final draft plan and a summary of any comments received during the public review period were presented to the Tribal Council during a special meeting of the Tribal Council on October 25, 2023. The Council then passed a resolution to approve the draft plan for review by Michigan State Police/FEMA.

In terms of obtaining "public" input as a part of developing this plan update for the GTB, the term "public" can be described as persons who are GTB tribal members/citizens, residents on tribal land, tribal government employees, or participants in any of the County Local Planning Teams (LPTs) in the GTB service area (Antrim, Benzie, Charlevoix, Grand Traverse, Leelanau, and Manistee Counties).

Refer to the Acknowledgments 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 F for meeting and participation documentation.

### *Community Survey Results*

The primary source of feedback was gathered through the Community Survey. The survey was shared electronically through GTB member email addresses, published as a notification in the GTB Tribal Newsletter, and was also available in on the GTB website and Networks Northwest website. The survey asked 14 questions related to hazard mitigation and

received 121 responses between October 5, 2021 and January 21, 2022. The first question asked participants to identify their role in the GTB community. The majority of participants were government employees and/or citizens.

Responses to Question 2 asked how familiar participants were with the existing Natural Hazard Mitigation Plan. The majority (73%) were not familiar with the plan. However, Question 3 asked how concerned participants were with natural hazard events impacting their community. 51.24% were “somewhat concerned” and 42.15% were “very concerned.”

Responses to Question 4 largely represent the primary concern of the time, the COVID-19 Pandemic. For example, when asked what natural hazard event is likely to have the largest impact on your community, 80 of 120 responses were related to pandemic/illness outbreak or lack of outbreak resources. Other top concerns included snowstorms/winter storms/blizzards, and major or severe weather storms, especially those causing power outages (34 responses), flood (22 responses), and wildfire (17 responses). Tornado, drought, invasive species, and water contamination were mentioned less frequently.

Questions 5 asked about community concerns regarding the current condition of infrastructure and if it would be able to withstand a future natural hazard event.

- 47 of 118 respondents said “no” or were “unsure” if infrastructure was a concern. Of those who responded that infrastructure is a concern, many participants were concerned about power outages and the need for back-up power. For example, the survey received the following response, *“Power lines in weather events have shut things down for up to a week a few times in the last decade or so with no power.”*
- Bridges and dams were also frequently mentioned and the concern about flooding damages. One participant said, *“Yes. Many local dams and road stream crossings were designed and constructed decades ago and under hydrologic regimes that are now rapidly shifting towards more frequent and of higher intensity. Further, many stormwater and wastewater systems are also rapidly becoming outdated given these climate related hydrologic regime shifts. Much more funding needs to be directed towards assessment and re-design and construction of substandard infrastructure.”*

Similarly, Question 6 asked if the community has concerns that a future natural hazard would require investment in new/upgraded infrastructure and technology.

- 27 respondents said “no” or were “unsure” about needed infrastructure upgrades.
- 23 respondents indicated renewable energy is potential investment to upgrade infrastructure and reduce the impact of a natural hazard. Other infrastructure that was mentioned included roads, bridges, stormwater management, access to natural gas service, and increased and wireless and internet service coverage. For example, one person said, *“Yes, internet service needs to be improved in Peshawbestown as well as other rural areas. Renewable energy / energy independence would benefit the tribe. Existing buildings are older and may not be the most energy efficient.”* Another respondent indicated that *“there are a several areas within downtown Lake Leelanau that do not have cellular connection due to topography as well as along CR-204 and M-22”*.

Question 7 asked if there have been any negative impacts on the public health and/or natural environment of their community that they attributed climate change.

- 56 of the 118 participants who provided a response said “no” or were unsure if there have been. A few of those who responded they were unsure, did request additional information.
- Of those who responded in the affirmative, many associated climate change to public health concerns such as poor air quality, water quality, illness outbreaks, increased precipitation, high water levels, milder winters, hot summers, and the influx of invasive species. Several responses identified a connection between unusual or uncommon weather patterns and negative effects on native plant and animal species.

Questions 8-11 asked about participants' familiarity with hazard mitigation planning.

- 89% said they were not involved in the previous planning process.
- 84% of respondents did not know if requests have been made by the Tribe for assistance with mitigation projects.
- Of the respondents who indicated that their community's hazard mitigation project assistance was granted, most were not aware of that type of project was included.
- 83% of respondents were unaware if their community had considered mitigation strategies for potential hazards.

Question 12 asked participants to identify potential mitigation strategies they would like to explore in the future.

- 58 of 88 responses were, “unknown” or not applicable.
- However, several responses included ideas such as renewable energy opportunities, providing back up power sources, providing education and training, providing emergency shelters, improving infrastructure and installing underground power lines, and maintaining and increasing native habitats especially water draining areas such as wetlands, streams, and drainage paths.

Question 13 asked if there was any additional information to be considered for the Tribe’s Natural Hazard Mitigation Plan.

- First and foremost, participants requested transparency and information.
- Preparedness was also mentioned several times.
- Include all six county areas for inclusion in the plan.
- Consider age-related circumstances and current methods of communication such as the website.
- Several responses asked for the plan to reflect cultural appreciation of lands/property as well as Tribal values.
- Participants also suggested addressing Tribal needs and getting everyone the help they need.
- One respondent suggested considering community displacement from heavy snow storms.
- One respondent expressed concern about tornado siren coverage: “Addressing county tornado notification system. Unless you were standing outside in Lake Leelanau it couldn't be heard on the west side of town. I haven't heard the notification in near Suttons Bay.”

The final question, Question 14, asked survey-takers to respond with their contact information if they wish to be involved with the plan process. Several responses included a name, email address, and phone number to contact those who are interested. Many indicated no, they are not interested.

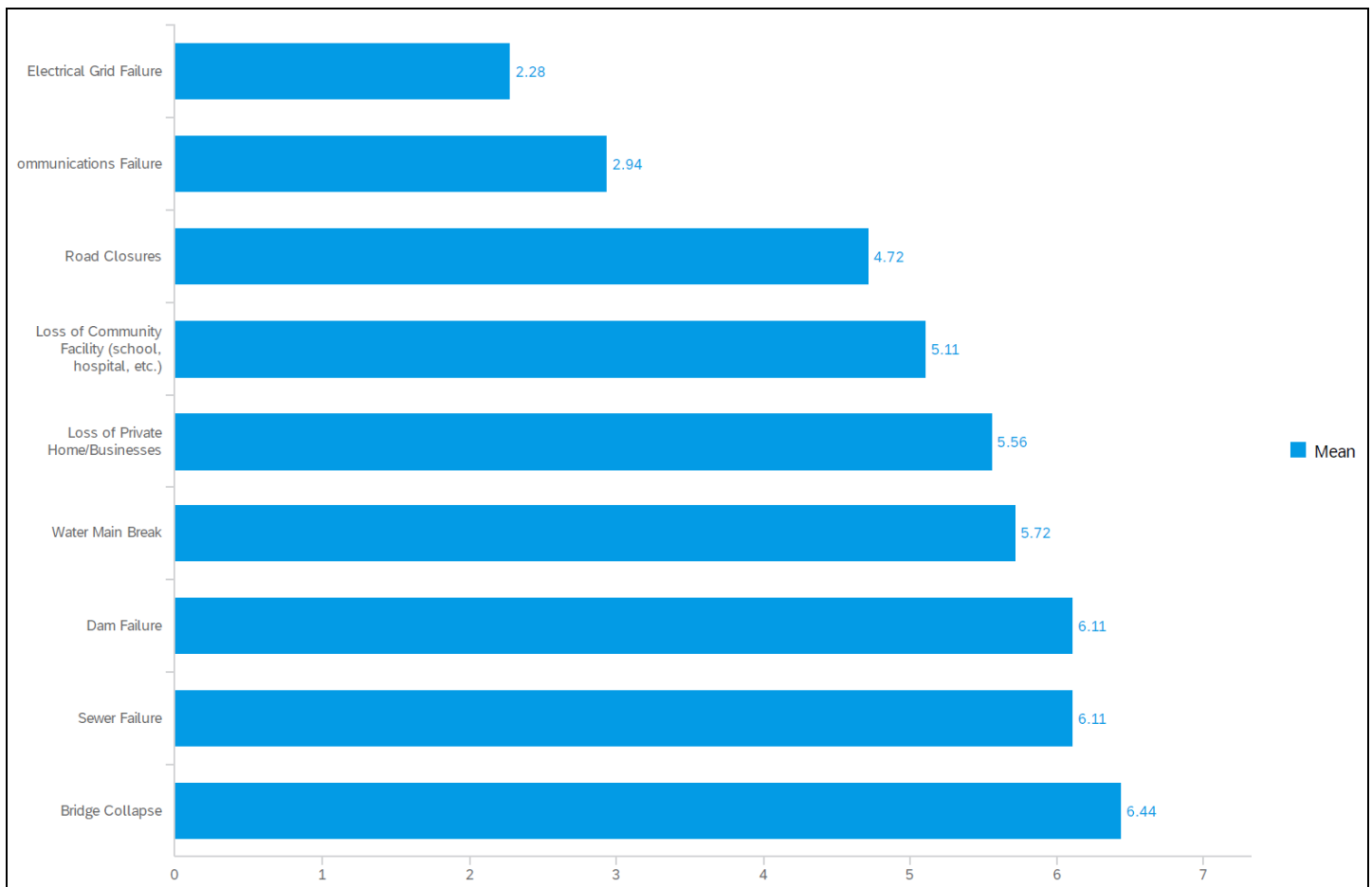
*April 14, 2022 Combined Leelanau County and GTB Hazards Input Session Results*

A “sticky note” exercise was performed at this meeting, asking attendees to indicate their top 3 hazards of concern (with the exception of public health emergency). The results are similar to the top hazards of concern identified in the Community Survey.

**04/14/2022 Sticky Note Exercise – Top 3 Hazards of Concern**

<b>Natural Hazard Event or Impact</b>	<b># of Times Indicated</b>
High Winds	10
Heavy Snow/Snowstorm	8
Electrical Grid Failure	6
Wildfire	5
Thunderstorm/Severe Storm/Tornado	4
Flood	3
Dam Failure	2
Communications Failure	2
Road Closures	2
Agriculture Loss	1
Invasive Species	1
Loss of Community Facilities	1
Shoreline Erosion	1
Sewer Failure	1
Extreme Cold	1

In addition, participants were asked to rank the infrastructure failures that would most concern them, with 1 being the most concerning and 9 being the least concerning. The responses are listed below, in order from most concerning (electrical grid failure, followed by communications failure and road closures) to least concerning.



Other feedback obtained from this input session about particular hazard concerns is provided in the “Probability of Future Events and Vulnerability Assessment” sub-section of each hazard described in Section IV (Hazard Identification and Assessment) of this plan.

#### *Draft Plan Review and Comment*

Upon approval by the Natural Hazards Task Force, the plan was released for review and comment. A notice of availability was published in the *GTB News* community newsletter, and government staff and the entire membership were encouraged to view the plan and submit comments, questions and suggested changes to be considered.

Additionally, other tribal, county and regional entities that share jurisdictional boundaries with the Grand Traverse Band of Ottawa and Chippewa Indians were provided the opportunity to formally comment on the draft plan and other related materials. A copy of the plan in its draft form was published openly on the GTB’s website and Networks Northwest’s website. Those agency staff members are:

- David Thom Jr., Safety/Emergency Management Coordinator, Little Traverse Bay Band of Odawa Indians
- Brandy Martin, Incident Commander, Little River Band of Ottawa Indians
- Matthew Adamek, Emergency Operations Director, Antrim County
- Rebecca Hubers, Emergency Management Coordinator, Benzie County
- Sienna Wenz, Emergency Management Coordinator, Charlevoix County
- Matt Ansorge, Emergency Management/911 Director, Leelanau County
- Kelly LaCross, Emergency Management/911 Deputy Director, Leelanau County
- Gregg Bird, Emergency Management Coordinator, Grand Traverse County
- Alvin Rischel, 911 Deputy Director, Manistee County
- Robert Carson, Regional Director of Community Development, Networks Northwest

While no formal written comments were received, the GTB Public Safety Department Manager/Emergency Manager received feedback via other informal means. This feedback took the form of phone calls, emails and conversations that occurred at various non-mitigation related meetings.

The final draft plan was released for public comment on \_\_\_\_\_ via the following outreach/notification methods: posting on the GTB website, the GTB's "Regroup" mass electronic notification system, and the project page on Networks Northwest's website. Below are images of the online notifications..

Figure 1. "Regroup" Message

Figure 2. GTB's Webpage Notification of the Draft Plan Available for Review

Source: Grand Traverse Band of Ottawa and Chippewa Indians' website (date)

Figure 3. Networks Northwest's Project Webpage for the GTB Hazard Mitigation Plan

Source: Networks Northwest's website (date)

### III. COMMUNITY PROFILE

The Grand Traverse Band of Ottawa and Chippewa Indians (GTB or the “Tribe”) is a Federally-recognized Native Sovereign Nation. The Anishinaabek are the people of the Three Fires Confederacy, the Odawa (Ottawa), the Ojibwa (Chippewa), and the Bodowadomi (Pottawatomi) people. The GTB had its status as a federally recognized Indian tribe reaffirmed and restored by the United States in 1980. The Tribe has a government-to-government relationship with the United States by action of the Department of the Interior effective May 27, 1980.

#### *Location*

The Grand Traverse Band of Ottawa and Chippewa Indians Tribal lands are located in northwest lower Michigan, across six counties: Antrim, Benzie, Charlevoix, Grand Traverse, Leelanau, and Manistee. The GTB’s reservation and service area covers 2,562 acres. The GTB continues to purchase land within the service area for historical, spiritual, environmental, economic, and development purposes. Refer to Appendix A for maps of the GTB service area and “trust” and “non-trust” lands.<sup>1</sup>

As the majority of Tribal facilities are in Peshawbestown, Leelanau County will be the primary geographic area considered in this hazard mitigation plan. Peshawbestown is located along M-22 in Suttons Bay Township, Leelanau County.

#### *History of the Anishinaabek People<sup>2</sup>*

“Our oral history traces us back to the Eastern Coast of Turtle Island where our spiritual leaders told us that we should travel to the west until we found the food growing on the water. Our people traveled until we found wild rice growing on the water and we knew we were home.

We were traders and established trade routes as far east as the Atlantic Ocean, as far west as the Rocky Mountains, as far North as Northern Canada, and as far South as the Gulf of Mexico. We were a wealthy nation respected by all our neighboring Nations. When the French arrived in our land we established trade with them and when the English came to our land they also sought us out as trading partners.

A great war broke out between France and England on our lands and the right to trade with our nation. Some of the people remained neutral in the war and some of the people sided with the French and fought against the Native Nations who sided with the English. The English won the war and the French moved north. The people continued to trade with the French to the north as well as the English on our lands.

A second war occurred on our lands when the Americans fought the English. When the war ended our people found a new government interested in our lands. This new United States government brought us a treaty to sign in 1836, and in 1837 the State of Michigan was established from lands ceded in this treaty. Two thirds of the land that is now the State of Michigan was ceded in that treaty. The people reserved lands for their own use and the use of the ceded lands. The people reserved their hunting, fishing, and gathering rights in this Treaty.

In 1855 the United States government brought another treaty to our people and asked that the remaining third of what is now Michigan be ceded to the United States Government. When this treaty was signed a reserve was established that included most of Leelanau County and a large tract of land in Antrim County. Almost all of this land was illegally taken from the people and had to be re-purchased.

The two treaties with the people were broken many times by the federal government. Services promised were not received and the people went without any federal or state assistance from a time period shortly after the treaty of 1855 until 1980 as the Bureau of Indian Affairs determined incorrectly that the Tribe had been terminated by signing the treaty. The Tribe applied for federal recognition under the Indian Reorganization Act under the leadership of Ben Peshaba in 1934. The Tribe was denied. The Tribe applied for federal recognition in 1943 under the leadership of Casper Ance. The Tribe was denied. The Tribe applied for federal recognition in 1978 under the leadership of Dodie Harris Chambers. On May 27, 1980 the Tribe was re-recognized by the federal government as the Grand Traverse Band of Ottawa and Chippewa Indians. The Tribe drafted a Constitution and formed a government.

Under the Indian Reorganization Act, the Tribe developed Tribal programs to serve the membership and in 1983 established an Economic Development Corporation and began to establish businesses for the Tribe. The Tribe has been very successful in business and today is able to provide many forms of assistance to the members of

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<sup>1</sup> Tribal Trust Lands are lands that have been acquired by the secretary of the Department of the Interior and held “in trust” for a governance by a Native American tribe or members of a tribe. Trust Lands are exempt from certain state and local laws. Non-Trust lands are lands that are owned by the Tribe, but not held “in trust” and therefore may continue to be subject to state and local laws. (Suttons Bay Community Master Plan, 2011).

<sup>2</sup> Cited from <https://www.gtbindians.org/history.asp>

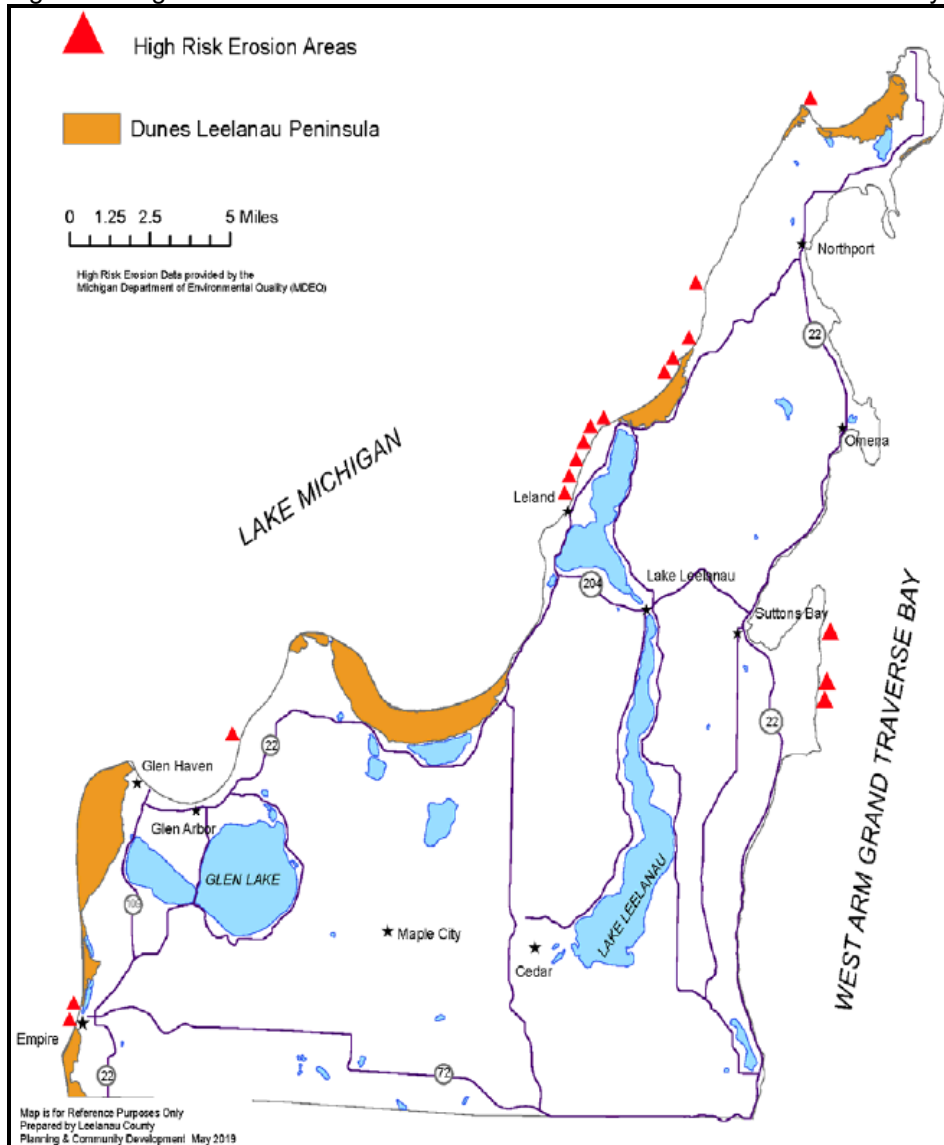
the Tribe. The Tribe, in the tradition of the people, honors our elders and gives respect and encouragement to our youth for they are our future.”

### Land Use and Natural Features

Northwest Michigan is blessed with abundant and high quality natural resources: the Lake Michigan coastline, extensive river systems, vast forested areas, high value wetlands, productive soils, and fresh-water lakes. The GTB Reservation in Leelanau County is located within the North Central Hardwood Forest Ecoregion, a transitional region between the predominantly forested areas and lakes to the north and the agricultural ecoregions to the south. Land use/land cover in this ecoregion consists of mosaic forests, wetlands and lakes, cropland agriculture, pasture, and dairy operations. The GTB land base is designated as rural by the U.S. Department of Agriculture.<sup>3</sup>

Leelanau County has 151 miles of Lake Michigan shoreline including several State-designated Critical Dune Areas and some High-Risk Erosion Areas (Figure 4). The 1995 *Leelanau General Plan*, last amended in 2019, describes the major land features of the county as high dune and glacial ridges, which generally run north to south. There are small pocket valleys between the ridges, as well as broad slightly rolling plateaus in the center of the county. High points on the ridges are landmarks because of the striking views they provide to the inland lakes, Lake Michigan or Grand Traverse Bay. The area north of Northport is flat compared to the rest of the county, with large open fields and large conifer plantations. Sleeping Bear Dunes National Lakeshore is located along the southwest coast of the county, near Empire, and includes the North and South Manitou Islands. The National Lakeshore extends south into adjoining Benzie County.

Figure 4. High Risk Erosion Areas and Critical Dune Areas in Leelanau County



Source: Leelanau County General Plan, Updated 2019

<sup>3</sup> 2010 GTB Forest Management Plan

The importance of fresh water and water bodies for providing sustenance is immeasurable. One such resource is wild rice, or manoomin. The word manoomin translates in Anishinaabemowin or Ojibwemowin, to 'the good berry,' a literal reflection of the cultural importance it has to Anishinaabek communities. Manoomin rice beds used to sit at the mouths of Michigan's rivers where it grows best in near-perfect shallow, slow moving waters. Some beds were thousands of acres in size. Today, only one large bed remains in Michigan. **Provide table of culturally significant animal and plant species.**

Including the area of Lake Michigan within its jurisdiction, Leelanau County is a total 2,532.38 square miles or 1,620,723.2 acres in area. Approximately 347.20 square miles are land area, and 86% of the county area, or 2,183.91 square miles, is water. Additionally, the county has 151 miles of Lake Michigan shoreline. Excluding the area of Lake Michigan, the County has a total of 240,523 acres (Table 1). Land cover in Leelanau County is a checkerboard of woodlots, pastures or meadows, active crop fields, orchards and water. There are few routes where forest borders the roads for more than a half mile, nor where open fields stretch for more than a mile without encountering another woodlot. There is more wooded landscape than open fields. The predominant land cover type is "Forested," a combination of deciduous forest, evergreen forest, and mixed forest. The second most prevalent land cover type is "Agriculture," a combination of cultivated crops and hay/pasture lands. There are over 18,500 acres of wetlands in the county, some 7.71% of the total land area. These wetlands are primarily located along Lake Michigan and Grand Traverse Bay coastlines, along with the major lakes (Glen Lake and Lake Leelanau, various smaller inland lakes and the creeks that feed these lakes. 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.

Table 1. Land Cover by Type, Leelanau County

Classification	Acres	Percent
<b>Developed, High Intensity</b>	141.39	0.06%
<b>Developed, Low Intensity</b>	7,011.56	2.92%
<b>Developed, Medium Intensity</b>	762.60	0.32%
<b>Developed, Open Space</b>	9,980.24	4.15%
<b>Agriculture (Cultivated Crops and Hay/Pasture)</b>	42,423.31	17.64%
<b>Forested (Deciduous, Evergreen and Mixed Forest)</b>	105,084.07	43.69%
<b>Wetlands (Emergent Herbaceous and Woody Wetlands)</b>	18,550.13	7.71%
<b>Herbaceous, Shrub/Scrub</b>	30,295.98	12.60%
<b>Open Water (does not include Lake Michigan)</b>	18,573.95	7.72%
<b>Barren Land</b>	7,699.99	3.20%
<b>TOTAL</b>	<b>240,523.22</b>	<b>100.00%</b>

Source: Networks Northwest

The 1995 *Leelanau General Plan*, last amended in 2019, describes the major land features of the county as high dune and glacial ridges, which generally run north to south. There are small pocket valleys between the ridges, as well as broad slightly rolling plateaus in the center of the county. High points on the ridges are landmarks because of the striking views they provide to the inland lakes, Lake Michigan, and Grand Traverse Bay. Big and Little Glen Lakes and Lake Leelanau are the largest lakes in the county. Numerous smaller lakes and streams, usually associated with wetlands, are scattered throughout the county. The area north of Northport is flat compared to the rest of the county, with large open fields and large conifer plantations. Sleeping Bear Dunes National Lakeshore is located along the southwest coast of the county, near Empire, and includes the North and South Manitou Islands. The National Lakeshore extends south into adjoining Benzie County.

According to the 2017 Census of Agriculture, the county had 50,053 acres of land in farms for a total of 470 farms. This represents a 5% and 16% drop in the number of farms and acreage of farms, respectively, since the 2012 USDA Census of Agriculture. About 93.7% of the market value of agricultural products sold in the county is from crops. Fruits, tree nuts, and berries had the highest market value of agriculture products sold at \$35,292,000. Leelanau County ranks 5<sup>th</sup> in the State of Michigan for the sale of fruits, tree nuts, and berries overall.

Developed land cover is found predominantly in and around the city, townships, and villages in southeast and east Leelanau County. The City of Traverse City crosses the Leelanau-Grand Traverse County line north into Leelanau County and development extends into Elmwood Township, along state highway M-22, into Bingham Township, Suttons Bay



Township, the Village of Suttons Bay, and Peshawbestown. Due to close proximity to commercial centers in Grand Traverse County, downtown Traverse City and Garfield Township, areas within a manageable commute-time in Leelanau County will continue to develop. New development will largely be residential, support services, and agri-business or agri-tourism.

The 2016 Hazard Mitigation Plan indicated that 126,900 acres of the county was composed of forested lands. Based on the 2023 land cover data, there has been a decrease in forested areas by 21,815 acres, or 17.2 percent. 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. The Environmental Features Maps in Appendix A show the intensity of development in each county within the GTB service area, as well as these features:

- Waterbodies, rivers/streams, and State-regulated wetlands
- High Risk Erosion Areas
- Critical Dune Areas
- Slopes > 30%
- Eastern White Pine and Red Pine Forested Areas (medium fire risk)
- Jack Pine forested Areas (high fire risk)
- 1836 and 1855 Tribal Reservation Boundaries
- Non-Trust and In-Trust Tribal Parcels

*Climate*

Northwest Michigan experiences a four season climate with mild summers and cold, snowy winters. The GTB reservation lands are all located within a counties that have a Lake Michigan coastline. Lake Michigan keeps coastal areas warmer in the winter and cooler in the summer, with less rainfall than locations further inland. Since 1991, Leelanau County has experienced the most precipitation in October with 3.91 inches on average and an average annual total precipitation of 35.54 inches. June and July share the hottest month with a mean average temperature of 92°F, however, June has the highest temperature on record of 103°F. February is the coldest month with a mean average temperature of -11°F. The lowest temperature on record is -29°F in February 2015.

On any given day, coastal areas including Leelanau 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 events.

*Membership Demographics*

Tribal membership is located throughout the six-county region as shown in Table 2. There are 4,189 members enrolled in the Grand Traverse Band Tribe, of which 1,942 members and their dependents reside on the reservation lands or within the GTB service area. Grand Traverse County has the greatest number of Tribal members followed by Leelanau County. Manistee County has the fewest number of members. Compared to enrollment numbers in the GTB’s 2016 Hazard Mitigation Plan, there has been an increase of 10 enrolled members, and an increase of 51 of those members who reside on the reservation lands or within the GTB service area.

Table 2: GTB Membership Population by County, 2021

County	2021 Membership	% of Total Enrolled (4,189 persons)
<b>Manistee</b>	42	2%
<b>Antrim</b>	97	5%
<b>Benzie</b>	144	7%
<b>Charlevoix</b>	203	10%
<b>Leelanau</b>	690	36%
<b>Grand Traverse</b>	766	39%
<b>TOTAL</b>	<b>1,942</b>	<b>46%</b>

Source: Grand Traverse Band of Ottawa and Chippewa Indians Membership Records

Additionally, the “Vulnerable Populations” map in Appendix A illustrates the density of GTB tribal members by their location of residence in the six county service area. The Peshawbestown area has the highest density of residents, followed by Blair and Garfield Townships in Grand Traverse County. Other concentrations of GTB members occur in/around these communities: Benzonia Township in Benzie County; Village of Thompsonville in Benzie and Manistee Counties; Elk Rapids, Milton Township, and Mancelona in Antrim County; and the Village of East Jordan and City of Charlevoix in Charlevoix County.

The age cohorts of tribal members is provided in Table 3. The GTB’s total 2021 population is broken into age cohorts (analyzing which proportions of the population are in which stages of life). The membership age is broken down into cohorts of members aged 0-19, 20-54, and Elders, those aged 55 and over. The table identifies the number of members within each cohort for each county. Understanding the age distribution and median age can help identify social, economic, and public service needs in the community.

Based on current membership ages overall, the Tribe is likely to increase membership due to the high percentage of persons in the family-forming age group (20-54). 53% of all members are aged 20-54. Grand Traverse County has the highest number of members and the highest number and proportion of members aged 20-54. This would indicate the membership in this county will grow in future years if persons in this family-forming age group decide to have children. Leelanau County has the second highest membership and the highest number and proportion of youth, persons aged 0-19. This is indicative of the high number of membership ages 20-54 and 55+. Persons in those age groups likely did have multiple children, thus the membership count increased. The youth cohort, persons aged 0-19, is the next highest membership category with 25% of the membership. Followed closely by Elders are those aged 55+ at 22% of the membership. While the Tribe is fairly young, there should be consideration and planning for the Elder membership in 10-20 years as those in the family-forming age group move into the Elder cohort. Members living in Benzie County are showing early signs of this as Benzie has the largest percentage of Elders and the second lowest number and percentage of youth.

Table 3: GTB Membership Age by Cohort, County, 2021

County	0-19	%	20-54	%	55+	%	TOTAL
Antrim	25	26%	55	57%	17	18%	97
Benzie	25	17%	70	49%	49	34%	144
Charlevoix	44	22%	95	47%	64	32%	203
Grand Traverse	178	23%	451	59%	137	18%	766
Leelanau	211	31%	340	49%	139	20%	690
Manistee	4	10%	24	57%	14	33%	42
<b>TOTAL</b>	<b>487</b>	<b>25%</b>	<b>1,035</b>	<b>53%</b>	<b>420</b>	<b>22%</b>	<b>1,942</b>

Source: Grand Traverse Band of Ottawa and Chippewa Indians Membership Records

Other GTB demographic information can be collected from the U.S. Census Bureau. In 2020, population, employment, household, income, education, and health-related information was collected via the Decennial Census and the American Community Survey 5-Year Estimates for GTB Reservation and Off-Reservation Trust Land in Michigan. The 2020 Decennial Census indicates that the tribe contains 595 members (Figure 5).

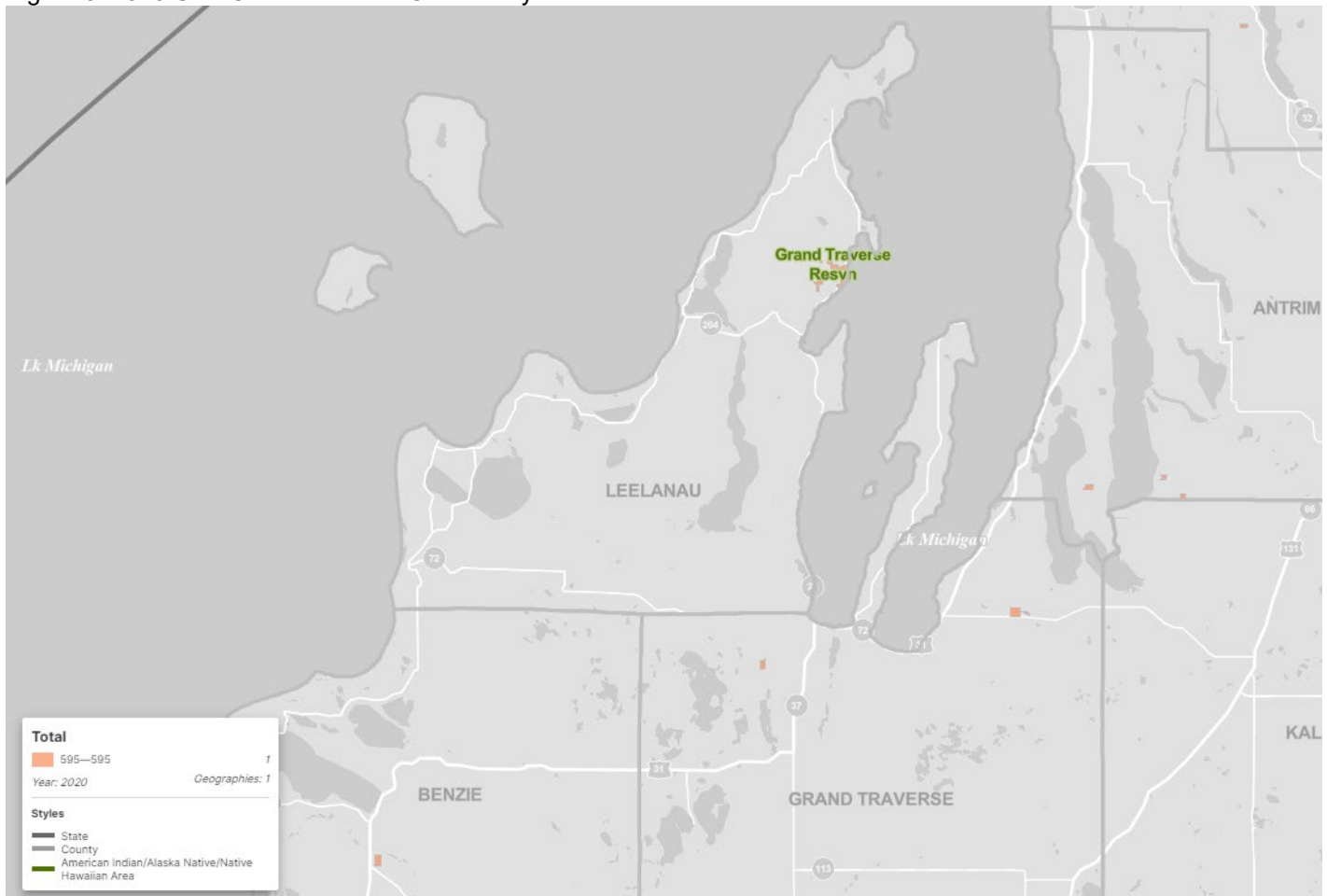
An estimated 17% of the GTB population has one or more type of disability. The majority of those persons are between 35 and 64 years of age, followed by those in the age 65+ cohort (Table 4).

Table 4. Estimated GTB Population with a Disability

Age Group	Total Population	With a Disability	% of Age Group with a Disability
<b>0 to 17 years</b>	203	20	9.9%
<b>18 to 34 years</b>	104	1	1.0%
<b>35 to 64 years</b>	197	56	28.4%
<b>65 years and over</b>	90	24	26.7%
<b>Total</b>	<b>594</b>	<b>101</b>	<b>17.0%</b>

Source: US Census Bureau, 2020 ACS 5-year Estimates

Figure 5: 2020 U.S. Census Bureau Community Profile



Source: U.S. Census Bureau, 2020 Decennial Census, Grand Traverse Reservation & Off-Reservation Trust Land.

### Housing

According to the U.S. Decennial Census, in 2020, there were 206 estimated total housing units<sup>4</sup> on GTB Reservation and Off-Reservation Trust Land in Michigan. Of these, 190 were occupied, and 16 were vacant. A total of 94 of these units were owner-occupied, while 96 units were renter-occupied.

According to the U.S. Census Bureau's 2020 ACS 5-Year Estimates, there were an estimated 195 households<sup>5</sup> on GTB Reservation and Off-Reservation Trust Land in Michigan, with an average household size of 3.05 persons. An estimated 77.4% of households were living in a 1-unit structure; 13.8% were living in a 2-or-more-unit structure, and 8.7% were living in a mobile home or other type of housing unit. An estimated 50.3% of households were owner-occupied units, while an estimated 49.7% were renter-occupied.

Additionally, membership housing data and the number of building permits issued for the GTB on tribal lands are provided in Tables 5 and 6.

<sup>4</sup> The US Census Bureau defines a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Separate living quarters are those in which the occupants live separately from any other people in the building and which have direct access from the outside of the building or through a common hall.

<sup>5</sup> A household includes all the people who occupy a housing unit, regardless of their relationship to one another. (People not living in households are classified as living in group quarters.)

Table 5: Membership Housing Units on Tribal Land by County, 2023

County	2023 Member Housing Units	Percent of 2023 Total
Antrim County	7	4.4%
Benzie County	18	11.3%
Charlevoix County	12	7.5%
Grand Traverse County	16	10.0%
Leelanau County	107	66.9%
Manistee County	0	0%
<b>TOTAL</b>	<b>160</b>	<b>100%</b>

Source: Grand Traverse Band of Ottawa and Chippewa Indians Membership Records

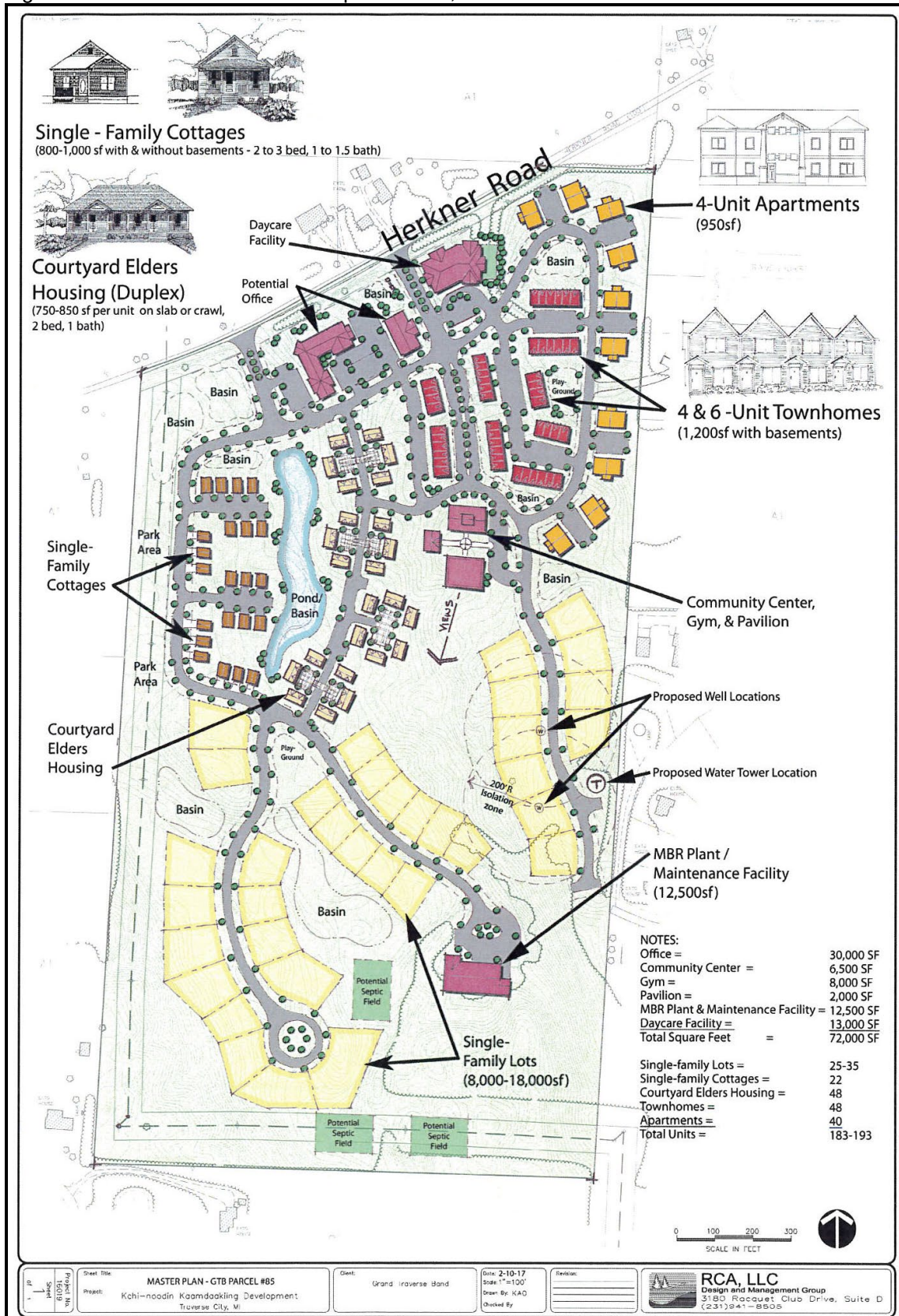
Table 6: Housing Units by Permit, 2010-2019

Year	# of Permits
2010	6
2011	12
2012	4
2013	7
2014	0
2015	0
2016	2
2017	8
2018	2
2019	0
<b>TOTAL</b>	<b>41</b>

Source: Grand Traverse Band of Ottawa and Chippewa Indians Planning Department

Residential development for members continues to be a main priority for the Tribe. The Herkner Road property located in Garfield Township, Grand Traverse County, is currently under development with an anticipated completion date in 2024. The site is planned for up to 193 residential units including 4 one-bedroom apartments, 4 two-bedroom apartments, 4 one-bedroom townhouses, 8 three to four bedroom townhouses, 4 single family homes, and 12 two bedroom elder duplexes and a community center.

Figure 6. Herkner Road Site Development Plan, 2017



The social-economic profile for the GTB members includes employment and income characteristics reported to the U.S. Census Bureau as shown in the following tables. Table 7 indicates that the largest number of workers are employed in the “arts, entertainment, & recreation” and “accommodation & food services” industries, followed by those in “public administration”, “educational services”, “health care”, “social assistance”, and “retail trade” industries.

Table 7: GTB Member Occupation by Industry, 2020

Industry	Estimate	% of Employed Population
<b>Arts, entertainment, and recreation, and accommodation and food services</b>	61	37.9%
<b>Public administration</b>	26	16.1%
<b>Educational services, and health care and social assistance</b>	25	15.5%
<b>Retail trade</b>	21	13.0%
<b>Professional, scientific, and management, and administrative and waste management services</b>	8	5.0%
<b>Construction</b>	7	4.3%
<b>Manufacturing</b>	6	3.7%
<b>Other services, except public administration</b>	3	1.9%
<b>Agriculture, forestry, fishing and hunting, and mining</b>	2	1.2%
<b>Transportation and warehousing, and utilities</b>	2	1.2%
<b>Finance and insurance, and real estate and rental and leasing</b>	0	0.0%
<b>Information</b>	0	0.0%
<b>Wholesale trade</b>	0	0.0%
<b>Total civilian employed population 16 years and over</b>	<b>161</b>	<b>161</b>

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

GTB households estimated income and benefit information as shown in Table 7. Of the estimated 195 total households, largest number of households reported an income between \$25,000 and \$34,999, followed by those who reported an income level between \$15,000 and 24,999. The median household income for GTB residents is \$32,583, compared to \$67,330 for Leelanau County as a whole.

An estimated 21% of households collect supplemental security income; 16.4% collect food stamp/SNAP benefits, and 6.2% collect cash public assistance income. Table 8 presents the poverty level estimates for GTB residents compared to Leelanau County residents. An estimated 42.8% (247 persons) in the GTB Tribe live below the poverty level, compared to 6.4% (1,361 persons) within Leelanau County.

Based on the available demographic data, a significant amount of GTB members have limited financial resources, and/or may be physically unable to prepare or evacuate for a hazard event. These households may have more of a need for social/public services - such as assistance with transportation, food, water, medical care, or shelter - before, during or after a hazard event.

Table 8: Estimated GTB Household Income and Benefits, 2020

Household Income	Estimate	Percent
Less than \$10,000	26	13.3%
\$10,000 to \$14,999	25	12.8%
\$15,000 to \$24,999	30	15.4%
\$25,000 to \$34,999	31	15.9%
\$35,000 to \$49,999	29	14.9%
\$50,000 to \$74,999	28	14.4%
\$75,000 to \$99,999	7	3.6%
\$100,000 to \$149,999	6	3.1%
\$150,000 to \$199,999	11	5.6%
\$200,000 or more	2	1.0%
Median household income	\$32,583	(X)
Mean household income	\$43,533	(X)
Households with earnings	113	57.90%
Mean earnings	\$50,573	(X)
Households with Social Security	72	36.90%
Mean Social Security income	\$14,578	(X)
With retirement income	39	20.00%
Mean retirement income	\$10,790	(X)
With Supplemental Security Income	41	21.00%
Mean Supplemental Security Income	\$10,990	(X)
With cash public assistance income	12	6.20%
Mean cash public assistance income	\$2,192	(X)
With Food Stamp/SNAP benefits in the past 12 months	32	16.40%

Source: U.S. Census 2020 ACS 5-Year Estimates

The following tables describe the population with the lowest incomes. It is estimated, in 2019, that 6.4% of all people in Leelanau County lived at or below the poverty level, compared to 42.8% of people in the GTB Tribe living on reservation and off-reservation trust land (Table 10). 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 9 below.

Table 9. 2019 Federal Poverty Level Guidelines

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

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

Table 10. Estimated Population Living Below Poverty Level, 2020

	Leelanau County			GTB Population on Reservation and off Reservation Trust Land		
	Total	Below Poverty Level	Percentage	Total	Below Poverty Level	Percentage
Population for whom poverty status is determined	21,431	1,361	6.4%	577	247	42.8%

Source: U.S. Census 2020 ACS 5-Year Estimates

### Transportation

The GTB service area is crossed by several national and state highways: U.S. 31, U.S. 131, and state highways M-22, M-72, and M-66. U.S. 31 is a north-south route that follows the Lake Michigan coastline and connects Charlevoix and Antrim County with Grand Traverse County. U.S. 131 is another north-south route that is more inland and connects Petoskey to Kalkaska. M-22 is a north-south corridor which runs from Northport in the north to Traverse City in the south. M-72 is an east-west corridor which runs from Empire in the west and traverses the state to end in Harrisville in the east. M-66 is north-south corridor through Charlevoix County. It follows Lake Charlevoix in the north and then meets with Mancelona in the south. Traverse City is a transportation hub where U.S. 31, M-22, and M-72 intersect. The remainder of the GTB service area is accessed via numerous county roads and MDNR forest roads. The area also contains many miles of seasonal roads with a number in Leelanau County being built and maintained by the National Parks Service for Sleeping Bear Dunes National Lakeshore. Local County Road Commissions are the primary owners of the local street network and maintains roads within township jurisdictions.

There is currently no passenger rail service available in this region. Traverse City's Cherry Capital Airport is the main hub for air travel, but the region also has access to Manistee County Blacker Airport in Manistee and the Charlevoix Municipal Airport in Charlevoix. Ferry travel to Beaver Island is available from Charlevoix, and ferry travel to the Manitou Islands is available from Leland. Members rely on the Arthur Duhamel Marina (land owned by the GTB) at 3410 N West Bayshore Drive in Suttons Bay Township, Leelanau County, for access to Lake Michigan waters for fishing and recreation.

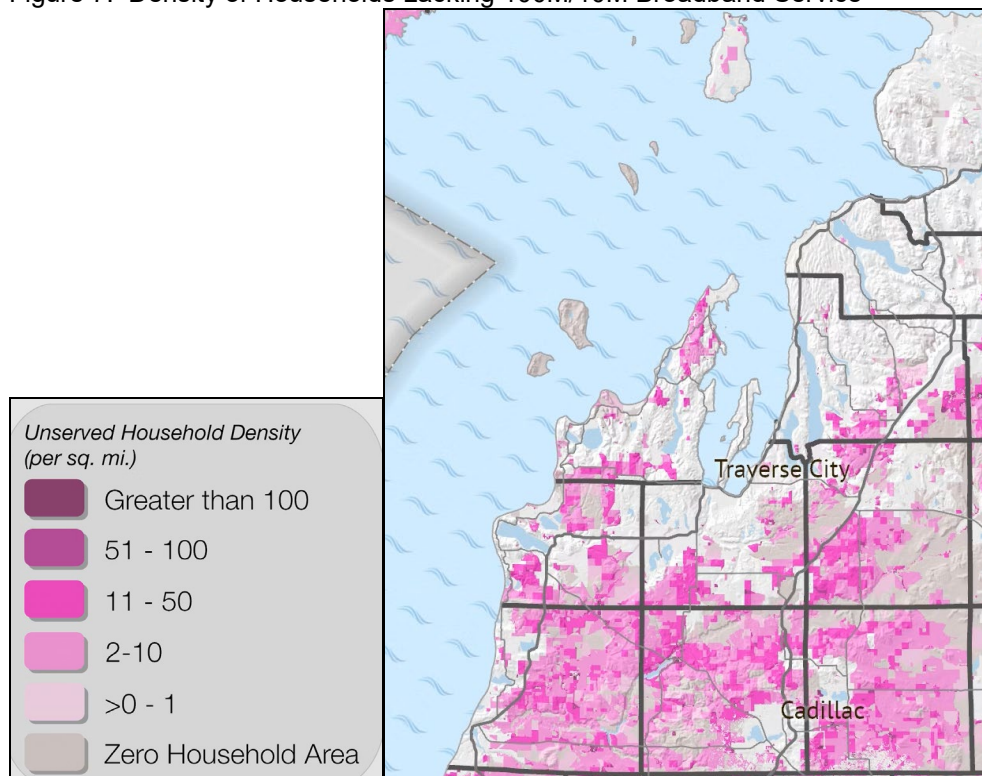
### Utilities and Energy

The GTB operate water and wastewater utility services in portions of Leelanau County. The Utility Department, led by the Utility Director, was created to manage the water and wastewater systems. GTB utilities are considered critical infrastructure, listed as "government facilities" in Table 9. Recently, the Tribal Council expressed an interest in leveraging the successful self-managing wastewater system and explore a similar expansion into renewable energy, such as solar technology, to assist with achieving energy sovereignty.

Natural gas service is provided by Consumers Energy throughout portions of the GTB service area; outlying rural areas often rely on propane fuel. Electric service is provided by Cherryland Electric, Consumer's Energy, Traverse City Light and Power, or Great Lakes Energy.

High-speed broadband internet is available in some areas throughout the GTB service area, primarily near cities or villages. However, many areas remain underserved. Figure 7 is an excerpt of a map showing the household density of areas of the state that are estimated to be unserved by broadband service with a speed of at least 100/10 Mbps.

Figure 7. Density of Households Lacking 100M/10M Broadband Service



Source: Connected Nation Michigan, published September 30, 2021



### *Site and Building Guidelines*

Per the Peshawbestown 2012 Master Plan:

“Because its sovereign status exempts the Tribe from state zoning and planning enabling legislation, the preparation of a site and building guidelines code should be considered to regulate development activity in the future. This action would ensure that as properties are developed that the same site amenities (lighting, parking, signage, landscaping, etc.) and architectural details would be followed. This will provide some uniformity and consistency when build-out occurs. It is suggested that separate guidelines be prepared for the business and entertainment district, residential neighborhoods, and the commercial district at Putnam and M-22.

To encourage the use of sustainable design techniques the guidelines should include provisions for low impact stormwater design, dark-sky lighting, reduction of heat islands (parking lots), convenient transit stops, and non-motorized connections.”

### *Future Land Use*

The Leelanau County General Plan, last updated in 2019, states the following vision for future land use in Leelanau County:

“The **General Plan** proposes a compact land development pattern that protects renewable resource lands (such as orchard land and forests) as well as sensitive natural resources (like wetlands and dunes). It proposes policies to encourage location of future land development in and near existing villages, as well as near Traverse City. It proposes infrastructure management policies to achieve and reinforce this land use pattern. It encourages open space protection, while simultaneously permitting large landowners an opportunity to capture the development value of their land. Open space zoning and rural clustering techniques are also proposed to encourage new development in rural areas to be sited so as to minimize visual impacts on the landscape and to minimize public service costs.

The plan proposes measures to protect the small-town, rural character of County villages and the scenic qualities of the major road corridors. Using naturally occurring vegetation for landscaping, minimizing signs, burying utilities, placing parking at the side or behind commercial buildings are all measures proposed to retain the existing character in the County.

More specifically, the plan proposes an environmental protection strategy that also:

- Identifies and avoids development near sensitive environments.
- Protects water quality of surface water and ground water.
- Minimizes land fragmentation of large parcels.
- Links open spaces.
- Restricts keyhole development.
- Protects renewable resources.

The plan proposes widespread acceptance by citizens of a stewardship ethic that views land not as an asset to be exploited, but rather as a resource held in trust for future generations for use by the present generation.

The **General Plan** is neither a slow growth nor an anti-growth plan. It calls for balanced growth that is carefully guided to protect and enhance the quality of life in the County. It accepts the principle that environmental protection and economic development are not incompatible objectives.”

The Peshawbestown Master Plan, completed in 2012 for the GTB, provides the following description for Peshawbestown’s envisioned future land use:

“The Consensus Conceptual Framework Plan addresses the overall guiding principles for Peshawbestown: walkability and compactness; creating a sense of place on M-22; slowing traffic along M-22; clustering new land and water-based development to create a synergy conducive for economic development; establishing traditional neighborhoods for tribal members; providing a diversity of housing types for all age groups, including tribal Elders; and providing defined areas for agriculture and vineyards. It provides a vision for the Peshawbestown community: a blueprint for land use and development decisions.

The future land use arrangement for the Peshawbestown study area consolidates commercial development on M-22 just north of the present day Leelanau Sands Casino and Eagletown Market Gas Station and at the southwest corner of M-22 and Putnam Road. The commercial development north of the present day casino would form the core of the Peshawbestown community. This area would become Peshawbestown’s downtown with a connection

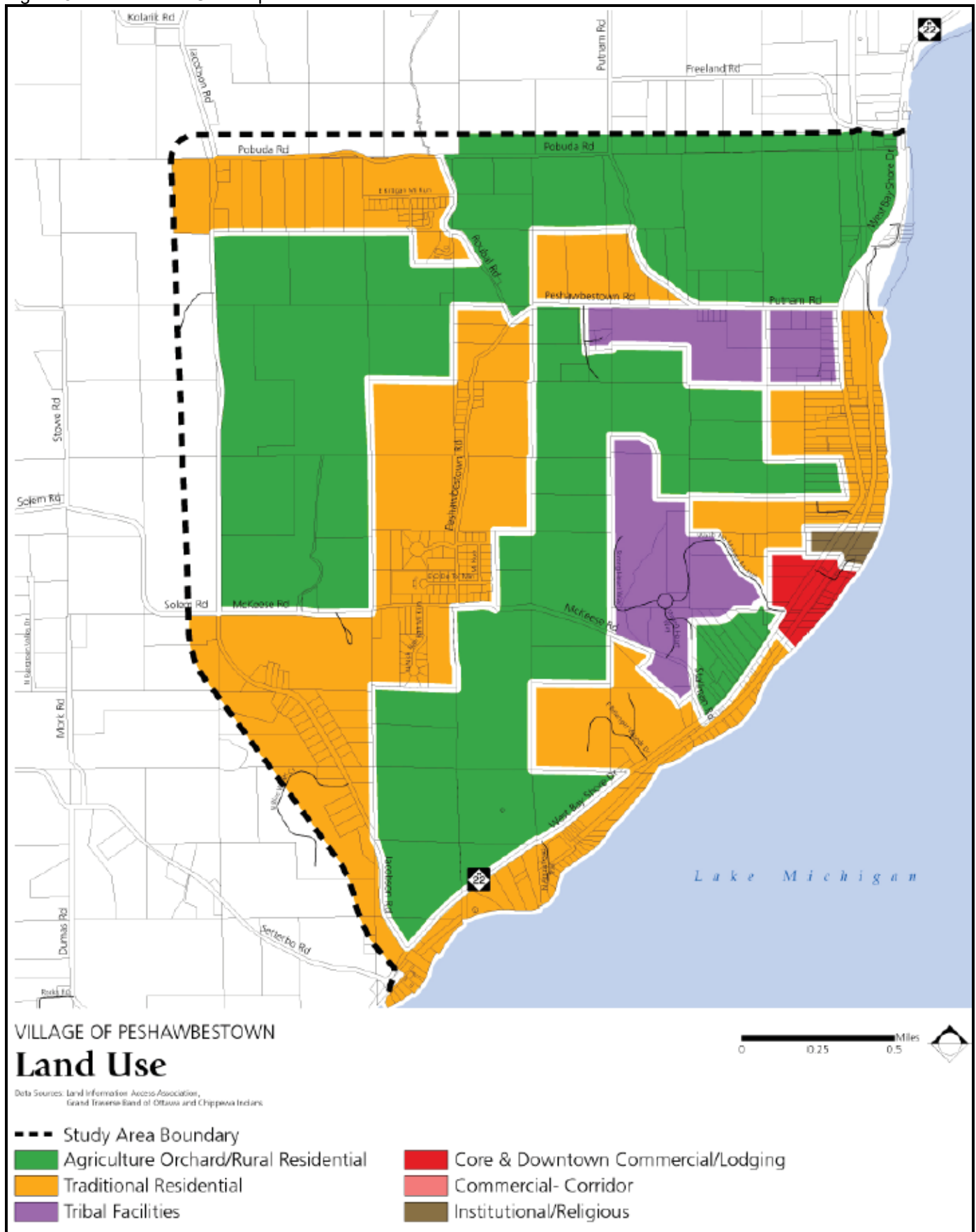
to a new governmental center and working waterfront and marina. The downtown commercial area would be anchored by a new casino and hotel and retail shops.

The commercial area north of the downtown located at the intersection of M-22 and Putnam Road would be a traditional shopping center with a gas station, small grocery store, laundry/dry cleaners, and small retail and food stores. This area would serve Peshawbestown, portions of Northport and the areas just south of Peshawbestown. Vineyards and/or orchards (agricultural) areas are proposed south and north of the downtown commercial area. It is envisioned that these areas will provide non-gaming opportunities for tribal members in the established northwest Michigan wine industry.

Existing and proposed residential areas are proposed surrounding the commercial core. These neighborhoods would provide detached and attached residential housing connected by new roads, walkways, and shared pathways throughout the Village. On Putnam Road a warehousing and distribution center is proposed. This would provide a centralized facility for all Tribal storage and distribution services, maintenance, and support services.”

The Future Land Use map (Figure 8) shows the location and relationship of these proposed land uses in Peshawbestown.

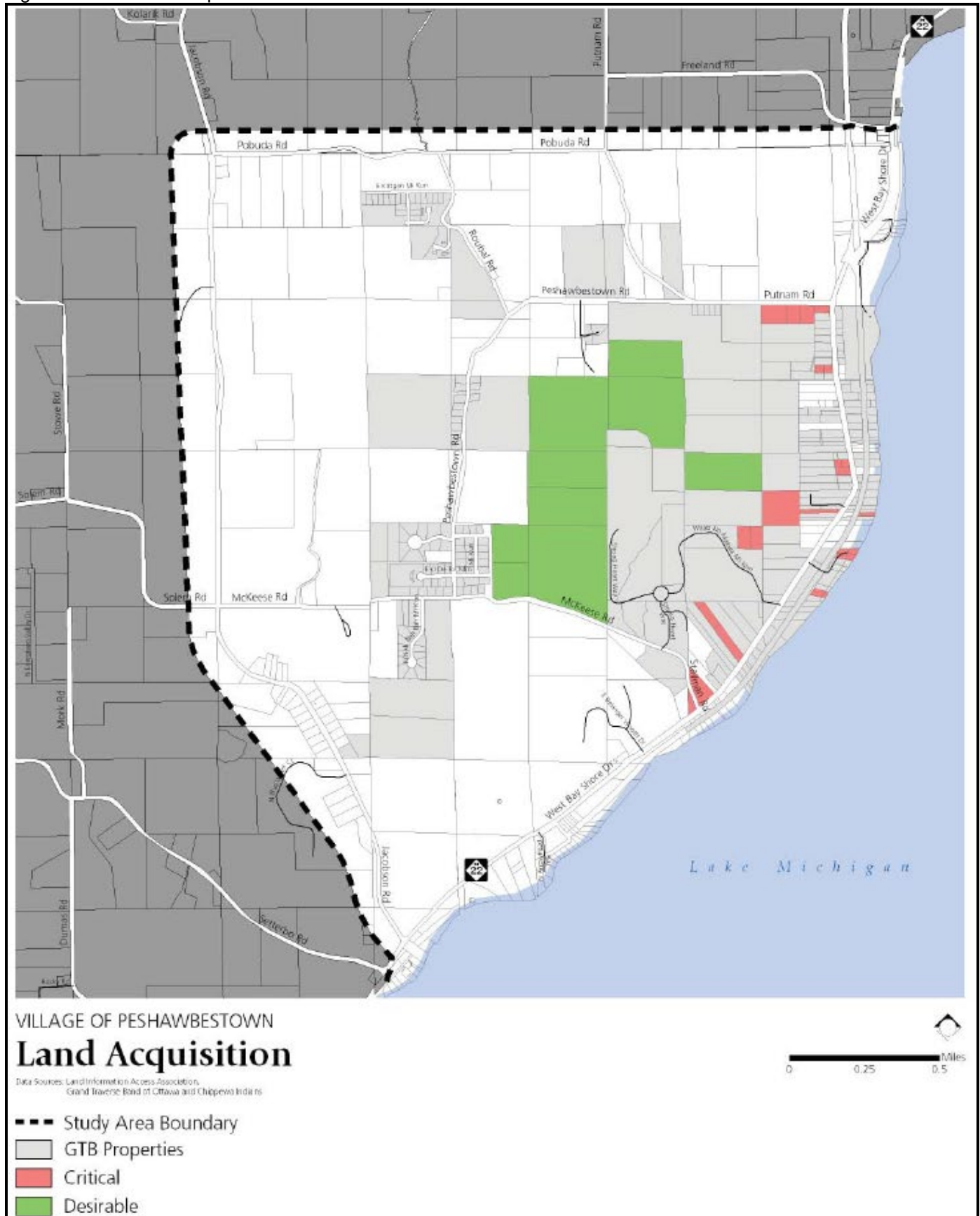
Figure 8. Future Land Use Map of Peshawbestown



Source: Village of Peshawbestown 2012 Master Plan, Figure 6.1

The Peshawbestown Master Plan also identified several parcels targeted for future land acquisition in order to serve the growth of the community (Figure 9).

Figure 9. GTB Land Acquisition Goals for Peshawbestown



Source: Village of Peshawbestown 2012 Master Plan, Figure 7.2

## IV. Hazard Identification and Assessments

### Vulnerability Assessment

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

- People
- Economy
- Built environment
- Natural environment

Vulnerable populations include persons of racial/ethnic minority groups, the economically disadvantaged, elderly, homeless, and persons with a disability. Those that live unsheltered or in homeless encampments, assisted living facilities, mobile home parks, or isolated residences are also more susceptible to hazardous events. For the purpose of this Plan, the density of GTB tribal members by their residential address is illustrated the "Vulnerable Populations" and "Vulnerable Populations and Hazard Areas" maps in Appendix A.

As shown in Table 11, the primary economic generators for the GTB are Tribal government, Grand Traverse Economic Development, and the Hotels, Resort and Casinos. Leelanau Sands Casino and Lodge is located in Peshawbestown, Leelanau County). Turtle Creek Casino & Hotel is located in Williamsburg, Grand Traverse County, and Grand Traverse Resort and Spa is located inn Acme, Grand Traverse County. Government facilities are located in Peshawbestown while Grand Traverse Economic Development is located in the City of Traverse City. These resources are all located along the Grand Traverse Bay and within relatively close proximity to each other. Grand Traverse Resort & Spa and Turtle Creek Casino & Hotel are located within four miles of each other; both are within a 45 minute drive from GTB facilities in Peshawbestown. This concentration of population and resources make the Grand Traverse Bay area critically important economically and as a resource for community members. It is vulnerable to all countywide hazards and shoreline hazards which is further detailed in the hazard analysis.

Infrastructure points (stream crossings, bridge conditions, and dams) and their ratings for the six-county GTB service area are illustrated on the Infrastructure Map in Appendix A. GTB-owned critical infrastructure (per Table 11) is represented on the Critical Infrastructure Maps in Appendix A.

The natural environment is one of the primary features of GTB culture and traditions. Its significance shows up in different aspects of daily life and Tribal celebrations and festivals. The forest lands, water features, and Lake Michigan shorelines and all of the native plants and animals within them 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 plant and animal populations that require specific climates and habitats to survive. Damaged, destroyed, or changing environments may decrease the chances for certain species' survival.

GTB critical infrastructure is represented in Table 11. While a total of 50 critical facilities are listed in the table and mapped (see the Critical Infrastructure Points Map in Appendix A), it should be noted that several of the locations listed contain more than one type of facility sector. For example, the satellite offices and casinos also provide emergency services and communications (IT) operations.

Table 11: Critical Facilities and Infrastructure

Facility Name	City	County	# of Facilities per Sector Type
<b>Grand Traverse Resort and Hotel</b>	Acme	Grand Traverse	6 Commercial
<b>Turtle Creek Casino and Hotel</b>	Williamsburg	Grand Traverse	
<b>Eyaawing Museum</b>	Peshawbestown	Leelanau	
<b>Leelanau Sands Casino</b>	Peshawbestown	Leelanau	
<b>GTB The Lodge Hotel</b>	Peshawbestown	Leelanau	
<b>The Ridge Microbrewery</b>	Peshawbestown	Leelanau	
<b>GTB Medicine Lodge EOC</b>	Peshawbestown	Leelanau	4 Communications
<b>Grand Traverse Band COLO</b>	Peshawbestown	Leelanau	
<b>Grand Traverse Band COLO</b>	Traverse City	Grand Traverse	
<b>Grand Traverse Band North Tower</b>	Peshawbestown	Leelanau	2 Emergency Services
<b>Grand Traverse Band Strongheart Center</b>	Peshawbestown	Leelanau	
<b>Grand Traverse Band Fire and Rescue</b>	Peshawbestown	Leelanau	4 Energy
<b>Grand Traverse Resort Charge Point Charging Station</b>	Acme	Grand Traverse	
<b>Eagletown Market Mobil Gas Station</b>	Peshawbestown	Leelanau	
<b>Grand Traverse Band Solar Energy</b>	Peshawbestown	Leelanau	
<b>Turtle Creek Market Mobil Gas Station</b>	Williamsburg	Grand Traverse	26 Government Facilities
<b>Grand Traverse Band Sewage Lift Station Antrim County</b>	Rapid City	Antrim	
<b>GTB Benzie Satellite Office</b>	Benzonia	Benzie	
<b>GTB Charlevoix Satellite Office</b>	East Jordan	Charlevoix	
<b>GTB Sewage Lift Station Herkner Rd</b>	Traverse City	Grand Traverse	
<b>Hammersmith Building</b>	Williamsburg	Grand Traverse	
<b>Grand Traverse Resort Water Tower</b>	Acme	Grand Traverse	
<b>GTB Water-Sewer SBR Billing Office</b>	Williamsburg	Grand Traverse	
<b>Grand Traverse Band Water Tower Peshawbestown</b>	Suttons Bay	Leelanau	
<b>GTB Elders Complex</b>	Peshawbestown	Leelanau	
<b>GTB Housing Billing Office</b>	Peshawbestown	Leelanau	
<b>GTB EDC Administration Building Billing Office</b>	Peshawbestown	Leelanau	
<b>GTB Benodjenh Daycare Billing Office</b>	Peshawbestown	Leelanau	
<b>GTB Human Resource Building</b>	Peshawbestown	Leelanau	
<b>GTN Sewage Lift Station Peshawbestown</b>	Suttons Bay	Leelanau	
<b>Grand Traverse Band Water Main Peshawbestown</b>	Suttons Bay	Leelanau	
<b>GTB Administration Building</b>	Peshawbestown	Leelanau	
<b>GTB Automotive Repair</b>	Peshawbestown	Leelanau	
<b>GTB Accounting Shipping and Receiving Warehouse</b>	Peshawbestown	Leelanau	

<b>GTB Library M22 Building</b>	Peshawbestown	Leelanau	
<b>Grand Traverse Band Public Works</b>	Peshawbestown	Leelanau	
<b>GTB Tribal Court Building</b>	Peshawbestown	Leelanau	
<b>Grand Traverse Band SBR West</b>	Suttons Bay	Leelanau	
<b>GTB Natural Resource Department</b>	Peshawbestown	Leelanau	
<b>Grand Traverse Band Sewage Lift Station TCC</b>	Williamsburg	Grand Traverse	
<b>Grand Traverse Band Water Tower TCC</b>	Williamsburg	Grand Traverse	
<b>GTB Traverse City Office</b>	Traverse City	Grand Traverse	
<b>GTB Medicine Lodge</b>	Peshawbestown	Leelanau	1 Healthcare
<b>GTB Arthur Duhamel Marina Cold Storage</b>	Peshawbestown	Leelanau	
<b>GTB Arthur Duhamel Marina Fish Processing Building</b>	Peshawbestown	Leelanau	3 Industry
<b>Bay Shore Steel Works</b>	Charlevoix	Charlevoix	
<b>GTB Lifelong Learning</b>	Peshawbestown	Leelanau	2 School
<b>GTB Benodjenh Headstart</b>	Peshawbestown	Leelanau	
<b>GTB Arthur Duhamel Marina</b>	Peshawbestown	Leelanau	2 Transportation
<b>GTB Tribal Dock in Saint James Harbor</b>	Beaver Island	Charlevoix	

Source: GTB Emergency Management

On April 10, 2022 members of the GTB Hazard Mitigation Advisory Team and members of the Leelanau County Hazard Mitigation Advisory Team held a joint meeting to discuss potential hazards in the community and specific concerns with those hazards. Participants in the meeting were asked about each known hazard to the community and asked to identify their top three hazards. Table 12 represents the tally of sticky notes gathered at the meeting. The number one hazard of concern is high winds, followed by heavy snow or snowstorms, and electrical grid failure.

Table 12: Sticky Note Exercise, Top Hazard Concerns

<b>Natural Hazard Event or Impact</b>	<b># of Times Indicated</b>
<b>High Winds</b>	10
<b>Heavy Snow/Snowstorm</b>	8
<b>Electrical Grid Failure</b>	6
<b>Wildfire</b>	5
<b>Thunderstorm/Severe Storm/Tornado</b>	4
<b>Flood</b>	3
<b>Dam Failure</b>	2
<b>Communications Failure</b>	2
<b>Road Closures</b>	2
<b>Agriculture Loss</b>	1
<b>Invasive Species</b>	1
<b>Loss of Community Facilities</b>	1
<b>Shoreline Erosion</b>	1
<b>Sewer Failure</b>	1
<b>Extreme Cold</b>	1

## Historical Analysis

The Historical Analysis of weather-related hazards in Leelanau County and the surrounding service area uses information on impacts and losses from previous hazard events to predict potential impacts and losses during a similar event. Based on the history and of the frequency of these events, communities are more likely to have experience with and data on impacts and losses. These events are included in the hazard analysis for individual event types.

Table 13: Presidential, Governor, or Tribal Disasters/ Emergency Declarations for the GTB Service Area

Date of Incident	Type of Incident	Affected Area	Type of Declaration
3/27/2020	Pandemic	All 83 Counties and GTB Tribe	Gov. Emergency
1/29/2019	Extreme Cold	All 83 counties	Gov. Emergency
8/2/2015	Thunderstorms	<b>City of Traverse City (Grand Traverse Co.), Township of Acme (Grand Traverse Co.), Township of East Bay (Grand Traverse Co.), Township of Garfield (Grand Traverse Co.), Township of Long Lake (Grand Traverse Co.), Township of Peninsula (Grand Traverse Co.), and Township of Whitewater (Grand Traverse Co.); Grand Traverse, and Leelanau Co.</b>	Gov. Disaster
2/13/2014	Deep frost	<b>Charlevoix</b> , Cheboygan, Chippewa, Delta, Emmet, Gogebic, Luce, Mackinac, and Marquette Co.	Gov. Emergency
6/18/2013 5/7/13	Flooding	Allegan, Baraga, Barry, <b>Benzie</b> , Genesee, Gogebic, Gratiot, Houghton, Ionia, Iron, Kent, Keweenaw, Marquette, Mecosta, Midland, Muskegon, Newaygo, Ontonagon, Osceola, Ottawa and Saginaw Co.; City of Grand Rapids (Kent Co.); City of Ionia (Ionia Co.)	Gov. Disaster
7/14/2008	Thunderstorms, flooding	12 counties: Allegan, Barry, Eaton, Ingham, Lake, <b>Manistee</b> , Mason, Missaukee, Osceola, Ottawa, Saginaw, and Wexford Co.	Pres/ Major Disaster (1777)
9/7/2005	Hurricane evacuation	All 83 counties	Emergency (3225)
9/4/2005	Hurricane evacuation	All 83 counties	Gov. Disaster
3/10/94 3/4/94 2/23/94, 2/25/94	Underground freeze	<b>Charlevoix</b> , Cheboygan, Chippewa, Delta, Gogebic, Houghton, Mackinac, Marquette, Ontonagon, and Schoolcraft Co.	Gov. Emergency
12/93-5/94	Underground freeze	10 counties: <b>Charlevoix</b> , Cheboygan, Chippewa, Delta, Gogebic, Houghton, Mackinac, Marquette, Ontonagon, and Schoolcraft Co.	Pres. Major Disaster (1028)
10/28/86 9/15/86 9/12/86	Flooding, heavy rain	Allegan, Arenac, Bay, Clare, Clinton, Genesee, Gladwin, Gratiot, Huron, Ionia, Isabella, Kent, Lake, Lapeer, Macomb, <b>Manistee</b> , Mason, Mecosta, Midland, Montcalm, Muskegon, Newaygo, Oceana, Osceola, Ottawa, Saginaw, Shiawassee, Tuscola, and Van Buren Co.	Gov. Disaster
9/10-19/86	Flooding	30 counties: Allegan, Arenac, Bay, Clare, Clinton, Genesee, Gladwin, Gratiot, Huron, Ionia, Isabella, Kent, Lake, Lapeer, Macomb, <b>Manistee</b> , Mason, Mecosta, Midland, Montcalm, Muskegon, Newaygo, Oceana, Osceola, Ottawa, Saginaw, Sanilac, Shiawassee, Tuscola, and Van Buren Co.	Pres. Major Disaster (774)
2/21/1986	Great Lakes flooding, wave action	Allegan, Arenac, Bay, Berrien, <b>Grand Traverse</b> , Iosco, Macomb, Marquette, Menominee, Monroe, Muskegon, Ottawa, Saginaw, St. Clair, Tuscola, Van Buren, and Wayne Co.	Gov. Disaster
1/26-27/78	Blizzard, snowstorm	Statewide	Pres. Emergency (3057)
1/26/1978	Blizzard, snowstorm	Statewide	Gov. Disaster
3/2/1977	Drought	44 counties: Alcona, Alger, Alpena, <b>Antrim</b> , Arenac, Baraga, <b>Benzie</b> , <b>Charlevoix</b> , Cheboygan, Chippewa, Clare, Crawford, Delta, Dickinson, Emmet, Gladwin, Gogebic, <b>Grand Traverse</b> , Houghton, Iosco, Iron, Isabella, Kalkaska, Lake, <b>Leelanau</b> , Luce, Mackinac, <b>Manistee</b> , Marquette, Mason, Mecosta, Menominee, Missaukee, Montmorency, Oceana, Ogemaw, Ontonagon, Osceola, Oscoda, Otsego, Presque Isle, Roscommon, Schoolcraft, and Wexford Co.	Pres. Emergency (3035)
4/5/1956	Tornado	4 counties: <b>Benzie</b> , <b>Leelanau</b> , <b>Manistee</b> , and Ottawa Co.	Pres. Major Disaster (53)

Sources: FEMA <https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties> and Michigan State Police 2019 Michigan Hazard Analysis (MHA) pub. 103; GTB Department of Emergency Management



## Hazard Descriptions

The GTB lands and service area is vulnerable to a wide range of natural hazards. Hazard events have the potential to impact members, economic drivers in the community, critical infrastructure and the built environment, and the natural environment. The Grand Traverse Band of Ottawa and Chippewa Indian's Emergency Management is challenged with managing these threats to protect life and property. This plan includes a profile for each natural hazard event the GTB is likely to encounter. Due to a concentration of facilities and members, the primary focus of the hazard analysis is events in Leelanau County. A snapshot of severe weather events for the entire Tribal service area is provided in Table 15. Each profile includes the location, extent, previous occurrences, probability of future events, and vulnerability assessment.

- Location is the geographic areas within the planning area that are affected by the hazard, such as a floodplain. The entire planning area may be uniformly affected by some hazards, such as drought or a winter storm. Location may be described in narrative and/or through map illustrations.
- Extent is the strength or magnitude of the hazard. Extent can be described in a combination of ways depending on the hazard.
- Previous occurrences describe the history of previous hazard events within the county. This information helps estimate the likelihood of future events and predict potential impacts. The extent of historic events may be included when the data is available. Severe weather event data is primarily collected from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) Storm Events Database.
- Probability of future events is the likelihood of the hazard occurring in the future and any trends that may appear. Probability may be defined using historical frequencies or statistical probabilities.
- Vulnerability assessment accounts for the type, amount, and value of assets such as: existing and future buildings, infrastructure, critical facilities, populations, recreation areas and environmental features that may be impacted by a hazard, along with existing community assets to mitigate or respond to the hazard.

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

- FEMA's webpage on Disaster Declarations for States and Counties was referenced for the most up-to-date data on Presidential- and Governor-Declared emergencies and disasters pertaining to Leelanau County (Table \_\_\_).
- Tribal emergency declarations (Table \_\_\_)
- Climate: <https://www.weather.gov/wrh/Climate?wfo=apx> – Historical local observed weather data; Climate prediction and variability; local high impact event summaries
- Past Weather: NOAA Storm Events Database <https://www.ncdc.noaa.gov/stormevents/> - Data available to search beginning in 1950 to within approximately 3 months prior to present day; however, information on record for various types of events is limited and non-contiguous. The database provides local storm reports, damage reports, and recorded event descriptions. The event types researched for Leelanau 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*)
- The [Michigan Hazard Analysis](#), completed by the Michigan Department of State Police in 2019, was referenced to collect data on wildfires that occurred on State of Michigan owned land between 1981 and 2018 (as reported by the MDNR).
- The websites for the National Inventory of Dams and MI-EGLE's Michigan Dam Inventory were used to collect information on dams in the county.
- The Great Lakes Current Incident Database <https://www.michiganseagrant.org/dcd/dcdsearch.php> provided by the National Weather Service and Michigan Sea Grant provides a list of all types of dangerous current-related fatalities and rescues on the Great Lakes from 2002 to 2020.

The Storm Events Database is updated on a rolling basis, and thus the database is always being added to. The most up to date information was added to Table 14 but as events occur the database will change. Thus, additional events will be added in subsequent years. 255 events were reported between 01/01/1950 and 6/30/2022 (26,479 days). There were a total of 212 days with an event, 2 days with event and death, 2 days with an event and death or injury, 35 days with event and property damage, and 6 days with event and crop damage. Those events as well as the emergency declaration events are included in the hazard analysis. The hazard analysis groups the events into the following categories:

Table 14: Leelanau County – Number of Events by Type

Type of Event	# of Events	Event Location	Time Interval/ Year Event Recorded
<b>Extreme Winter Weather</b>	139	Countywide	1978*, 1996-2016, 2018-2022
<b>Thunderstorm/Wind; High/Strong Winds</b>	65	Countywide	1975, 1982, 1987, 1995, 1999-2003, 2005, 2007-2011, 2013, 2015, 2017-2022
<b>Hail</b>	35	Countywide	1998, 2000-2009, 2011, 2013, 2015-2017, 2021
<b>Shoreline Hazards (Lakeshore Flooding, Seiche, Rip Current)</b>	5	Empire Township, Glen Arbor Township, Cleveland Township, Centerville Township, Leland Township, Leelanau Township, Suttons Bay Township, Bingham Township, Elmwood Township, Village of Northport, Village of Suttons Bay, Village of Empire	2012, 2019 (3), 2020
<b>Flash Flood</b>	4	Countywide; Empire & Solon Townships	1999, 2000, 2021 (2)
<b>Tornado</b>	3	Glen Arbor Township, Cleveland Township, Leland Township, Suttons Bay Township	1977, 1978, 2011
<b>Extreme Temperatures (Cold / Heat)</b>	3 / 2	Countywide	2007, 2008; 2019* / 2001, 2018
<b>Drought</b>	2	Countywide	1977*, 2001
<b>Lightning</b>	2	Countywide; Solon Township	2000, 2007
<b>Wildfire</b>	60	MDNR Lands	1981-2018
<b>Public Health Emergency (COVID-19 Pandemic)</b>	1	Tribal-Designated and Statewide	2020 – 2023*
<b>Invasive Species</b>	Ongoing	Countywide	Ongoing

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

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

Table 15 provides a summary of all natural hazard events in the six county service area of the GTB. Many of the events reported occurred in multiple locations, and therefore may be duplicated in one or more counties. However, some areas of the region are more susceptible to certain hazards. For example, Antrim County has had the most tornadoes (11) of all of the counties, and therefore, a tornado is most likely to occur in Antrim County of the six counties.

Table 15: Natural Hazard Events, 1950-2022, GTB Service Area

		Antrim	Benzie	Charlevoix	Grand Traverse	Leelanau	Manistee	Total Events
Occasionally Occurring Events (1950-2022)	Wildfire*	0	0	0	0	0	0	0
	Dense Fog	0	0	0	0	0	1	1
	Drought	2	1	1	2	2	1	9
	Extreme Heat	2	2	2	2	2	2	12
	Lightning	2	1	1	6	2	2	14
	Extreme Cold	2	3	3	3	3	3	17
	Dangerous Current	0	3 deaths, 11 rescues	0	0	1 death; 2 rescues	1 death; 2 rescues	20
	Tornado	11	4	4	4	3	2	28
	Flooding (inland and coastal)	3	4	4	14	7	14	46
Frequently Occurring Events (1950-2022)	Hailstorm	36	18	34	41	35	35	199
	High Wind/T-Storm Wind	83	41	51	91	65	65	396
	Winter Weather	165	108	148	132	139	103	795
<b>Total Events</b>		<b>306</b>	<b>196</b>	<b>248</b>	<b>295</b>	<b>261</b>	<b>231</b>	<b>1,537</b>

Sources: NOAA National Centers for Environmental Information Storm Events Database; Michigan State Police-Dept. of Homeland Security; FEMA; Great Lakes Current Incident Database. \*Note: only wildfires reported as events in the NOAA NCEI Storm Events database; not those reported by the MDNR.

## Economic Impact Analysis

Table 16 presents the *reported* deaths, injuries, property damages, and crop damages of storm events in Leelanau County from 1950-2022. There were two deaths and zero injuries. One death occurred from an extreme cold event on February 10, 2008, and the other death occurred from a rip current on August 30, 2012. The estimated economic impact of the previously described Leelanau County natural hazard events that were *reported* to NOAA is \$25,576,000 in property damages and \$53,563,000 in crop damages. It should be noted that many events likely cause numerous small amounts in property damage, but this often goes unreported. The total reported Damaging Events' Costs recorded with NOAA for Leelanau County are as follows:

Table 16. Extent of Damage by Event Type

Leelanau County	Deaths	Injuries / Illness	Property Damage Estimate	Crop Damage Estimate
<b>Thunderstorm/Wind; High Winds</b>	0	0	\$24,269,000	\$8,000
<b>Extreme Winter Weather</b>	0	0	\$832,000	\$50,500,000
<b>Hail</b>	0	0	\$85,000	\$3,055,000
<b>Shoreline Hazards (Lakeshore Flooding, Seiche, Rip Current)</b>	1	0	\$184,000	\$0
<b>Flash Flood</b>	0	0	\$50,000	\$0
<b>Tornadoes</b>	0	0	\$295,000	\$0
<b>Extreme Temperatures (Cold / Heat)</b>	1	0	\$0	\$0
<b>Drought</b>	0	0	\$0	\$0
<b>Lightning</b>	0	0	\$40,000	\$0
<b>Wildfire</b>	0	0	\$0	\$0
<b>Public Health Emergency (COVID-19 Pandemic)</b>	63	4,173	n/a	n/a
<b>TOTALS</b>	<b>65</b>	<b>4,173</b>	<b>\$25,576,000</b>	<b>\$53,563,000</b>

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

\* According to the State of Michigan, this is the total of confirmed and probable deaths and illnesses for COVID-19 in Leelanau County as of as of October 4, 2022.

Table 17 provides an overview of each potential hazard's impact on the permanent population and the estimated impact on the State Equalized Values (SEV) for real and personal property (residential and commercial). The SEV is equal to half of the True Value of the property. Population data is collected from the US Census, 2019 ACS data. According to the 2022 *Seasonal Population Study for Northwest Lower Michigan*, assume a 169% increase from the base population of permanent residents to account for the highest estimated annual average seasonal population within the county (which occurs in July).

Table 17: Geographic Economic Impact by Event

Hazard Event	Geography	Population Estimates	State Equalized Value
<b>Extreme Winter Weather, Thunderstorm, Wind, Hail, Lightning, Tornado, Extreme Temperatures, Drought, Public Health Emergency</b>	These hazards have the potential to impact all communities in Leelanau County	21,652	\$4,219,402,702.00
<b>Flooding</b>	Bingham Township, Centerville Township, Cleveland Township, Glen Arbor Township, Kasson Township, Leelanau Township, Solon Township, Leland Township, Suttons Bay Township, Elmwood Township, City of Traverse City, Village of Suttons Bay, Village of Northport	20,491	\$514,117,893.58
<b>Shoreline Erosion/Flooding &amp; other Shoreline Hazards</b>	Empire Township, Glen Arbor Township, Cleveland Township, Centerville Township, Leland Township, Leelanau Township, Suttons Bay Township, Bingham Township, Elmwood Township, Village of Northport, Village of Suttons Bay, Village of Empire, and City of Traverse City	18,448	\$687,023,270.39
<b>Wildfire</b>	Pine Forest Areas Countywide (White, Red, and Jack Pine)	21,652	\$271,192,557.90
<b>Wildfire</b>	Fire Prone Areas: Leland Township, Leelanau Township, Centerville Township, Cleveland Township, Glen Arbor Township, Elmwood Township, Solon Township, Kasson Township, Empire Township, Village of Empire	15,939	\$140,911,313.88

Sources: 2019 ACS 5-Year Estimates from the US Census Bureau; Leelanau County Equalization

## Extreme Winter Weather

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

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

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

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

### Location

Extreme winter weather events are regional events that are not confined to geographic boundaries and can affect several areas at one time with varying severity depending on factors such as elevation and wind patterns. All of Leelanau County and other GTB lands are at risk to the occurrence and impacts from extreme winter weather. All counties in the GTB service area are coastal communities, and therefore, are more susceptible to lake-effect snow due to proximity to Lake Michigan.

### Extent

Snowstorms can be measured based on snowfall accumulations or damages. Leelanau County receives the most snowfall in January with a normal amount of 26.3 inches, followed by December with 21.2 inches, and February with 19 inches. Snowfall in March, April, and November are each 12.6 inches or less.

Table 18 is a summary of winter weather events. Extreme winter weather events in total caused \$653,000 in property damages and \$50,500,000 in crop damages on record with NOAA.

Table 18: Leelanau County Extreme Winter Weather Events

Event Type	Number of Events	Property Damage	Crop Damage	Event Year(s)
Winter Weather	1	\$ 0	\$ 0	2006
Winter Storm	55	\$ 3,000	\$ 0	1997-1999, 2003-2010, 2012-2016, 2018-2022
Ice Storm	4	\$ 0	\$ 0	2001, 2002, 2005, 2008
Heavy Snow	51	\$ 650,000	\$ 13,000,000	1996-2009, 2011, 2012, 2014, 2016, 2018, 2020
Blizzard	6	\$ 0	\$ 0	1978*, 1997, 1998, 1999, 2002, 2019
Frost/Freeze	1	\$ 0	\$ 37,500,000	2012
Lake-Effect Snow	21	\$ 0	\$ 0	2006-2013, 2016, 2019
<b>TOTAL</b>	<b>139</b>	<b>\$ 653,000</b>	<b>\$ 50,500,000</b>	

### *Previous Occurrences*

Since 1996, there have been 138 extreme winter weather events, including heavy snowstorms, lake effect snow, ice storms, frost/freeze, blizzards, and winter storms reported in Leelanau County (Table 18). Additionally, in 1978, Leelanau 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. With combined property and crop damages, winter weather events are also the most costly events to occur in the county.

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 \$650,000 in reported damages and \$13,000,000 in reported crop damages.*

The frost/freeze event on listed in Table 18 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. Crop damages were reported to be \$37,500,000.*

### *Probability of Future Events and Vulnerability Assessment*

Between 2022 and 1996, Leelanau County has had 138 extreme winter weather events. This averages to about 5.5 events every year. The probability of an extreme winter weather event occurring in a future year is 100 percent. Heavy snow events have the potential of shutting down towns and businesses for a significant period of time. Blowing and drifting snow with blizzard conditions cause driving hazards. Ice damage may occur when high winds push lake water and ice past the shoreline, causing damage to public infrastructure and residential property. Due to major agriculture losses in the past, farmers and agriculture producers should be aware of the potential for damage from an extreme winter weather event.

GTB members are generally considered a vulnerable population during winter weather-related events. The reasons for member vulnerability include: the high percentage of Elder members in some communities, the high percentage of members within poverty level, members who live in remote areas, limited access to technology including cellular phone service and broadband internet, and minimal access to backup power sources. The Community Survey specifically mentioned internet and cell access was an issue and there were concerns about access to power in the event of a natural hazard. Ice storms have the capability to take out power, and cold temperatures can be fatal for members without a backup power source. Providing help and assistance to members in remote locations can treacherous when combined with icy or snowy roads.

### *Comments from April 2022 Leelanau County/GTB Hazards Input Session*

- Ice dams along rivers/lakes can damage adjoining properties
- Food pantry can lose their supplies if the power is out.
- Agricultural products (vineyards, cropland) can be impacted if there is a late spring heavy frost, ice or hail storm. This can negatively impact the local agriculture economy and people's personal property.
- People who aren't aware of storm damage to their seasonal homes and return in the spring/summer to find and report damaged property (perhaps they had a roof leak or water lines that froze)

- More vulnerable residents whose homes are not well insulated could have more problems with roof damage and frozen pipes.
- 2012 storms left businesses, government and roads closed for 5 days
- Have a lack of community shelters
- Winds and ice can pull electrical lines down
- Increased potential for car accidents
- Gas stations down if they don't have back up power
- Cell towers down causes challenges with communications
- Many people rely on wood/propane fuel to heat their homes and often live in rural areas that are difficult to access in an emergency to provide their fuel source if needed.
- Population stranded on rural properties; can't be accessed by emergency vehicles with heavy/drifted snow or ice.
- Erratic winter weather patterns recently – less consistent.
- Extra burden and cost placed on the Road Commission and emergency services.
- 1977 Blizzard MSP/Corp of Engineers – road closures
- GTB Tribe added generators to their critical infrastructure since the 2012 winter storms



## 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.

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

### Location

Thunderstorms and 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 Leelanau County and the GTB service area is at risk to the occurrence and impacts from thunderstorms and severe winds.

### Extent

Thunderstorms can be measured based on wind speed or damages. The average wind speed for events thunderstorm/wind and high wind or strong wind events in Leelanau County is 52 knots. There have been a total of \$24,269,000 in property damages and \$8,000 in reported crop damages since 1975 (Table 19).

Table 19: Thunderstorm and Wind Events, Leelanau County

Event Type	Number of Events	Property Damage	Crop Damage	Event Year(s)
<b>Thunderstorm Wind</b>	50	\$ 24,200,000	\$ 8,000	1975, 1982, 1987, 1995, 1999, 2001-2003, 2005, 2007, 2008, 2010, 2011, 2013, 2015, 2017-2019, 2021, 2022
<b>High Wind</b>	12	\$ 47,000	\$ 0	1998, 2000, 2001, 2003, 2005, 2009, 2010, 2015, 2020, 2021
<b>Strong Wind</b>	3	\$ 22,000	\$ 0	2001, 2007
<b>TOTAL</b>	<b>65</b>	<b>\$ 24,269,000</b>	<b>\$ 8,000</b>	

Source: NOAA: National Centers for Environmental Information

### Previous Occurrences

Since 1975, there have been a total of 65 thunderstorm/wind and high wind events reported in Leelanau County. This is the second most frequently occurring type of severe weather event in the county. There have been two thunderstorm or wind-related Presidential or Governor declared emergencies or disasters across the entire GTB area (2008 and 2015). This is the second most frequently occurring type of severe weather event in the county.

The most damaging event occurred on August 2, 2015. *A historic severe weather outbreak in northern Michigan, as multiple waves of severe thunderstorms crossed the region. A passing cold front would finally end the activity during the evening hours. This episode featured widespread straight-line wind damage in parts of northwest lower Michigan, and the largest hail on record in northern Michigan in Ogemaw County.* Winds speeds during this event were reported to be 78 knots. This event resulted in \$18,800,000 in property damages.

### *Probability of Future Events and Vulnerability Assessment*

Since 1975, Leelanau County has had 65 thunderstorm/wind and high wind events. This averages to 1.4 events every year. The probability of an event occurring in a future year is 100%. Damage from straight line winds usually affects multiple counties through the loss of electricity from trees/tree limbs downing power lines; causing widespread property damage; and potentially exposing members to severe injury or fatality due to flying debris. The magnitude of the impact of a thunderstorm/high wind event is dependent on the seasonal, population, seasonal activity, and the spread of development.

During the warm or summer months, the area's population expands to include both the permanent population and visitors. The seasonal population is attracted to both rural, sparsely populated rural areas and urban activity centers. Impoverished persons living in substandard housing and the elderly and/or disabled persons are also vulnerable to impacts from high wind events, such as encountering damage to their structural residence or power outages. Additionally, the Tribe holds festivals and events such as the Annual Pow Wow during the third weekend of August, and the Annual Language Camp, taking place over 3 days in mid-August. Both events are held at the Peshawbestown Pow Wow Grounds, which offers rustic camping accommodations. In general, those without permanent shelter or are caught outside in a quickly moving storm are vulnerable to hazardous conditions.

### *Comments from April 2022 Input Session*

- Power outages, trees down, wires down
  - Gas stations are closed; impacts commerce. Gas is needed to fuel generators!
  - Road closures due to downed trees, etc. prohibits EMS timely response to incidents; people can be stuck in their homes/neighborhoods. Also impacts local commerce if the roads are not able to be used to transport goods and services.
  - People living on oxygen or who have a low food supply or primarily perishable food supply are directly impacted
  - Glen Arbor, Peshawbestown and other areas of the County in 2015 – 5-day stretch without power after a thunderstorm. GTB had downed lines (they have a lot of overhead lines). Their sewer stations had pump failures at the main lift and had to supply generators to power them. Many negative impacts to commerce and transportation. Debris management is a cost to the county and to contract out at the State level.
  - Only have 1 power company in the County, which limits their ability to respond quickly to all outages in a wide-spread event.
  - Power outages are costly to emergency services and residents.
- Can result in big floods
- Lightning strikes can cause fires, impacting homes, woodlands
- Money and time spent on the extreme demand placed on local responders – pay overtime for increased personnel
- Cost to pay for debris cleanup
- Leelanau County receives 1-2 events per year that meet the criteria of a severe thunderstorm, windstorm, hail, lightning, tornado... Given our seasonal influx of tourists and the high potential for these storms at the same time of the year this could have devastating impacts to the economy, infrastructure and environment.

## Hail

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

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

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 area farms, and damaging several homes and vehicles.

### *Location*

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

### *Extent*

According to the NOAA National Centers for Environmental Information, the approximate size of hail is described as follows in Table 20. If a thunderstorm produces hail that is 1 inch in diameter (quarter size) or larger, it is considered to be a severe thunderstorm.

Table 20. 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 (Severe)
Walnut/Ping Pong	1.50 inch
Golf Ball	1.75 inch
Hen Egg	2.00 inch
Tennis Ball	2.50 inch
Baseball	2.75 inch
Tea Cup	3.00 inch
Grapefruit	4.00 inch
Softball	4.50 inch

The greatest extent hail reported in Leelanau County was 3 inches on July 8, 2016 in Empire. According to the scale, hailstones of this size are equivalent to a tea cup. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people. Hailstorms have caused no deaths or injuries, \$85,000 in property damages and \$3,055,000 in crop damages in Leelanau County.

*Previous Occurrences*

Between 1998 and 2022, Leelanau County had 35 hailstorms reported to NOAA (Table 21).

Table 21: Hail Events, Leelanau County, 1998-2022

BEGIN LOCATION	BEGIN DATE	MAGNITUDE
SUTTONS BAY	6/24/1998	0.75
LELAND	5/12/2000	1
SUTTONS BAY	5/12/2000	1
MAPLE CITY	5/12/2000	1
NORTHPORT	6/9/2000	0.88
LELAND	5/15/2001	1
SUTTONS BAY	5/15/2001	1.75
SUTTONS BAY	5/15/2001	1
LELAND	5/30/2002	0.75
GREILICKVILLE	8/28/2003	0.88
LELAND	6/13/2004	1
GLEN HAVEN	8/9/2004	0.75
CEDAR	9/7/2005	0.88
LELAND	7/17/2006	1
EMPIRE ARPT	10/18/2007	1
EMPIRE	6/15/2008	0.88
HATCHS	6/15/2008	1
CEDAR	7/2/2008	0.88
SUTTONS BAY	7/2/2008	0.75
LELAND	9/7/2008	0.88
SUTTONS BAY	4/25/2009	0.75
MAPLE CITY	4/10/2011	0.88
EMPIRE	4/10/2011	1
MAPLE CITY	4/10/2011	1
LAKE LEELANAU	6/8/2011	1
SUTTONS BAY	6/8/2011	0.88
GREILICKVILLE	5/20/2013	1
NORTHPORT	5/20/2013	1
NORTHPORT	8/30/2013	1.5
LAKE LEELANAU	8/2/2015	1
EMPIRE	7/8/2016	3
BOCUS	7/8/2016	1.5
SUTTONS BAY	7/8/2016	1
LELAND	4/10/2017	0.88
GREILICKVILLE	8/10/2021	0.75

Source: NOAA: National Centers for Environmental Information

During one particularly strong event on July 17, 2006, hail damage was significant within Leelanau County and the region. A strong cold front ran headlong into warm and humid air in place over Michigan. Thunderstorms ignited by midday in Eastern Upper Michigan, and became widespread by late afternoon in Northern Lower Michigan. A large number of storms became severe, as this became the largest severe weather outbreak in Northern Michigan in several years. Millions of pounds of fruit crops were destroyed by hail and wind. The reported hail size in Kewadin was 1", roughly the size of a quarter.

Another strong event occurred on July 8, 2016 in Empire and Glen Arbor Township. 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. Golf ball-sized hail was reported in Empire, and up to three inches in diameter in Glen Arbor. Some vehicles were damaged, and a few homes lost windows and skylights. Considerable damage was done to orchards and vineyards in the area.

*Probability of Future Events and Vulnerability Assessment*

With 35 events reported in the past 25 years, Leelanau County has a 100% chance of a hailstorm every year. All existing and future buildings, exposed infrastructure, and populations are at risk from hailstorms since hail causes damage to roofs, brick walls, glass, landscaping, crops, and cars. Manufactured homes and campground populations located throughout the county and are more susceptible to hail damage. Hail can also damage roads, sidewalks, bridges, and above ground utilities. Hail has the potential to cause injury and death, and populations are advised to take shelter when an event occurs.

## Riverine and Urban Flooding

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

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

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

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

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

### *Location*

Urbanized areas or areas with higher concentrations of impervious surface and low-lying areas are most likely to flood in Leelanau County. Heavy rainfall can oftentimes overwhelm a city stormwater system causing backups and ponding or flooding. There are few instances of flooding in Peshawbestown. The County's hilly terrain will cause water to cascade oftentimes bringing sediment with it. Water and sediment will congregate in the low lying areas. Enough rain will cause erosion of the road bed and eventually cause road washouts. Cherry Bend Rd, Tumble Rd, and N West Bay Shore Dr (M-22) have been known to flood.

According to the National Inventory of Dams, Leelanau County has four major dams listed including: Belanger Dam, Cedar Lake Dam, Leland Dam, and Meeuwenberg Dam (Table 22, Figure 10). The Belanger Dam, which is located within Peshawbestown, has a Hazard Potential Classification of "Low". Low hazard potential dams are not required to have an Emergency Action Plan on file with the State of Michigan/ Leelanau County Emergency Management. Additionally, there is no expected loss of human life or impact to lifeline interests if the dam were to fail, and economic losses and environmental damages would be low and generally limited to that of the dam owner.

The three remaining dams: Cedar Lake Dam, Leland Dam, and Meeuwenberg Dam have a higher Hazard Potential Classification of "Significant" and "High." "Significant" means that if the dam were to fail, there would be economic losses, environmental damages, and impacts to lifeline interests, but no expected loss of human life. "High" means that if the dam were to fail, there would be economic losses, environmental damages, impacts to lifeline interests, and probably cause loss of human life.

- The owner/operator of the Cedar Lake Dam is Elmwood Township. According to the Michigan Dam Inventory, it was last inspected October 11, 2021, receiving a "Satisfactory" condition rating, and is due for

inspection again by December 30, 2025. It is listed as having an Emergency Action Plan on file as of March 14, 2001.

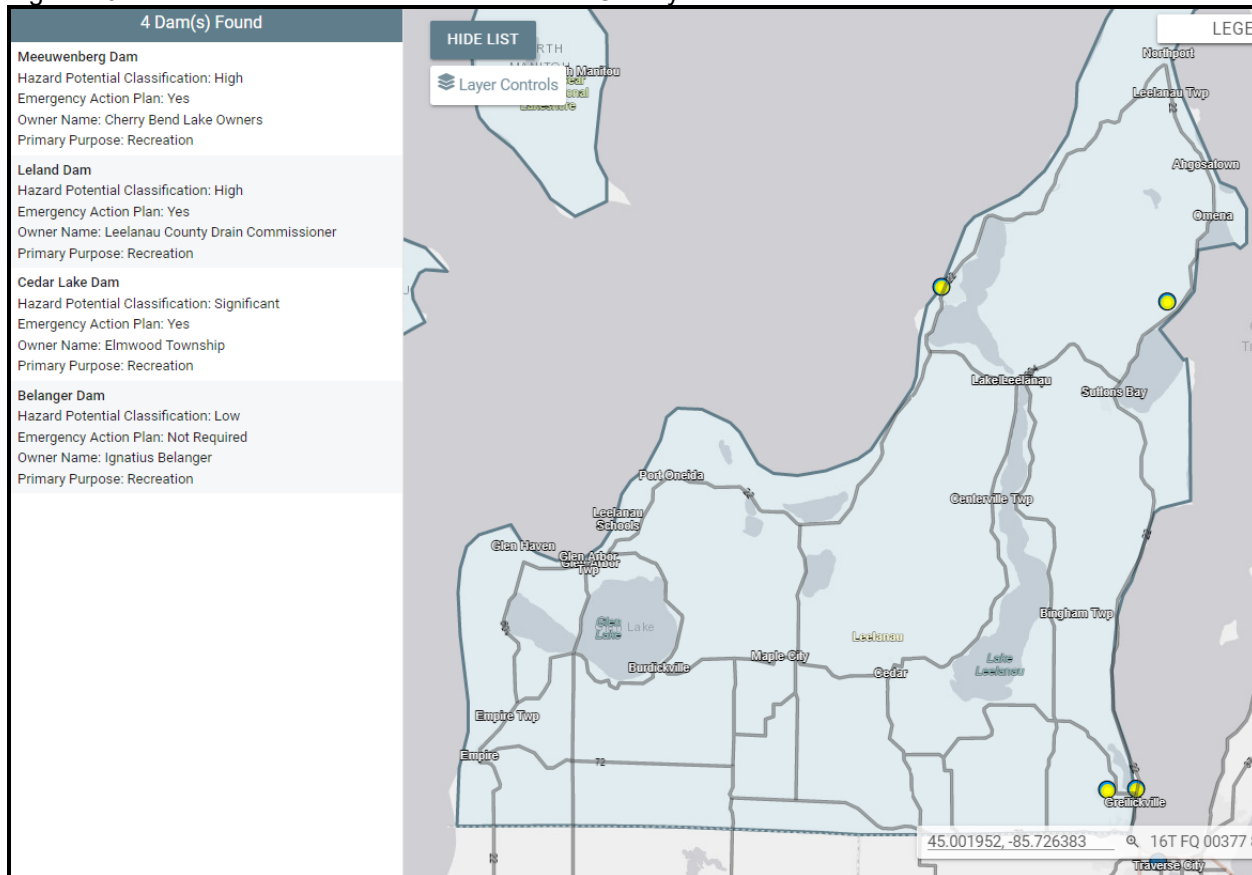
- The owner/operator of the Leland Dam is the Leelanau County Drain Commission. According to the Michigan Dam Inventory, it was inspected on September 29, 2019, inspected again on September 1, 2022, report dated October 2022, and received a “Satisfactory” condition rating. It is listed as having an Emergency Action Plan on file.
- The owner/operator of the Meeuwenberg Dam is the Cherry Bend Lake Owners. According to the Michigan Dam Inventory, it was last inspected August 11, 2019, receiving a “Satisfactory” condition rating, and is due for inspection again by December 30, 2022. It is listed as having an Emergency Action Plan on file as of January 5, 2011.

Table 22. Public Dams in Leelanau County

Name	Height (Ft)	Storage (Acre-Ft)	Location	City/Township	Owner	Year Completed	Hazard Potential
<b>Belanger Dam</b>	21	50	Belanger Creek	Peshawbestown (Suttons Bay Township)	Ignatius Belanger	1864	Low
<b>Cedar Lake Dam</b>	16	1,600	Cedar Lake Outlet	Elmwood Township	Elmwood Township	1856	Significant
<b>Leland Dam</b>	19	86,950	Lake Michigan Tributary	Leland Township	Leelanau County Drain Commission	1910	High
<b>Meeuwenberg Dam</b>	42	193	Cedar Lake Tributary	Elmwood Township	Cherry Bend Lake Owners	1968	High

Source: National Inventory of Dams

Figure 10. Locations of Public Dams in Leelanau County



Source: National Inventory of Dams

### Extent

Flood extent can be measured by the amount of property damage and accumulation of rainfall. There have been four (4) flood events in Leelanau County (Table 23). In total, flood and flash flood events have caused \$50,000 in property damages, no crop damages, and no deaths or injuries. Since 2000, the average annual precipitation is 34.18 inches. October is historically the wettest month with an average of 4.27 inches.

Table 23. Leelanau County Fluvial and Pluvial Flood Events

LOCATION	DATE	EVENT TYPE	PROPERTY DAMAGE	CROP DAMAGE	FLOOD CAUSE
COUNTYWIDE	7/6/1999	Flash Flood	\$ 0	\$ 0	Heavy Rain
COUNTYWIDE	9/1/2000	Flash Flood	\$50,000	\$ 0	Heavy Rain
EMPIRE	8/10/2021	Flash Flood	\$ 0	\$ 0	Heavy Rain
SOLON	8/10/2021	Flash Flood	\$ 0	\$ 0	Heavy Rain

Source: NOAA: National Centers for Environmental Information

### Previous Occurrences

Leelanau County has experienced four flash flood events. The event narrative as reported in the NOAA NCEI database for the flash flood event on September 1, 2000 is as follows:

*Thunderstorms formed along a warm front that stretched across northern Lower Michigan. The first thunderstorms began in Leelanau County around 400 pm and intensified quickly over the next hour. One thunderstorm intensified west of Traverse City and quickly moved over the downtown area. As the storm moved east of the city, a 60 MPH wind gust was reported, followed by a report of one inch diameter hail. Meanwhile, more storms producing very heavy rainfall formed over Lake Michigan and continued to dump rain over Leelanau county, mainly to the south of Leland and Suttons Bay, as well as over the Traverse City metropolitan area. The rain lasted over these locations from 600 pm to 1130 pm. Another area of thunderstorms formed over northern Benzie county around 700 pm. These also moved into the Traverse City metropolitan area. As with the storms over Leelanau county, these storms persisted until 1130 pm, continually affecting the same areas. Over the 4 to 5 hour period of rainfall, much of Leelanau county reported rainfall amounts ranging from 4 to 8 inches, while amounts ranged from 2 to 6 inches in Benzie and Grand Traverse counties.*

*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.*

### Probability of Future Events and Vulnerability Assessment

Since 1999, Leelanau County has had 4 flash flooding events. This equates to a 16.7% annual chance of a flash flood. 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. The seasonal population is attracted to both rural, sparsely populated rural areas and urban activity centers. Impoverished persons living in substandard housing those living in and elderly independent/assisted living facilities are also vulnerable to flooding that may occur from nearby rivers. The Tribe holds festivals and events such as the Annual Pow Wow during the third weekend of August, and the Annual Language Camp, taking place over 3 days in mid-August. Both events are held at the Peshawbestown Pow Wow Grounds, which offers rustic camping accommodations.

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.

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



beds reduce the amount of water flow. Rivers and lakes with sedimentation buildup will experience water backups and flooding events unless mitigated.

Members of the task force identified the following sites for concern within Peshawbestown:

- The Belanger Creek Dam (at the end of Belanger Creek at the intersection with M-22)
- Belanger Creek, located southeast of Stallman Road to the outlet in the Bay – potential for overflow
- Stallman Road near the intersection with Belanger Creek, located SW of Strongheart Way.

Specific flood hazard areas were identified during public meetings and are identified on the Hazard Areas Map provided in Appendix A. Areas that are particularly vulnerable to flooding are areas adjacent to inland lakes (areas surrounding Lake Leelanau: Solon Township, Elmwood Township, Centerville Township, and Bingham Township), wetland areas (north of Glen Lake: Glen Arbor Township), and other generally recognized flood zone areas (Cleveland and Leelanau Townships).

Flood zone hazard information may be obtained from the Flood Rate Insurance Maps (FIRM) available for jurisdictions through FEMA’s online Flood Map Service Center. Flood hazard zones are also labeled on the Environmental Features Maps in Appendix A.

Additionally, the Infrastructure Maps included in Appendix A illustrates the locations of road/stream crossings, bridges and dams with their currently available condition rating. The Townships of Bingham, Elmwood, Leelanau and Suttons Bay have road/stream crossings that are rated as having a moderate or severe condition.

*NFIP Participation Status*

The Grand Traverse Band of Ottawa and Chippewa Indians is not a participant in the National Flood Insurance Program; however, mapped areas for Leelanau County are displayed in Table 24 for informational purposes.

The Flood Insurance Rate Map (FIRM) panels for the area of Peshawbestown in Suttons Bay Township indicate that the Special Flood Hazard Area (SFHA) Zone AE is present along land adjoining the West Traverse Bay in Peshawbestown. SFHAs are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. The Base Flood Elevation in this zone is 584 feet. Panel 286E indicates that the Arthur Duhamel marina docks, breakwalls and some land (but no structures) are located in this zone. There are no other SFHAs designated on GTB Tribal property on the FIRMs. Additionally, the GTB has not identified any properties or structures that have suffered repetitive loss from flooding. The Tribe will continue to monitor properties and structures located in flood-prone areas.

Table 24: Leelanau County NFIP Participation

Municipality	Community ID #	Initial FIRM Issued	Current Effective Map
<b>City of Traverse City</b>	260082B	12/15/1982	06/07/2023
<b>Village of Empire</b>	260605B	08/28/2018	06/07/2023
<b>Village of Northport</b>	260580B	03/02/1989	06/07/2023
<b>Village of Suttons Bay</b>	260283B	06/01/1977	06/07/2023
<b>Bingham Township</b>	260772B	08/28/2018	06/07/2023
<b>Centerville Township</b>	260625B	02/01/1986	06/07/2023
<b>Cleveland Township</b>	260302B	09/01/1986	06/07/2023
<b>Elmwood Charter Township</b>	260113B	02/02/1983	06/07/2023
<b>Empire Township</b>	260765B	08/28/2018	06/07/2023
<b>Glen Arbor Township</b>	260604B	09/01/1986	06/07/2023
<b>Kasson Township</b>	No Special Flood Hazard Areas	None issued	Not in the NFIP
<b>Leelanau Township</b>	260114B	04/02/1986	06/07/2023
<b>Leland Township</b>	260760B	08/28/2018	06/07/2023
<b>Solon Township</b>	261510B	08/28/2018	08/28/2018
<b>Suttons Bay Township</b>	260770B (FIRM Map Panels 269E, 270E, 286E, and 288E cover Peshawbestown)	08/28/2018	06/07/2023

Source: FEMA Community Status Book Report; FEMA Flood Map Service Center <https://msc.fema.gov/portal/home>

## 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 Leelanau County is at risk to the occurrence and impacts from lightning.

### *Extent*

Lightning can be measured by damages it has caused, such as deaths, injuries, property damages, and/or crop damages. Since 1996, two lightning events have been reported to NOAA for Leelanau County. Those events have caused \$40,000 in property damage, no crop damages, no injuries, and no fatalities.

### *Previous Occurrences*

There have been two lightning strikes reported to NOAA since 2000. There have been no fatalities. There have been no other reports of damages or injuries from lightning. Table 25 is a record of lightning events in Leelanau County.

The event narrative of August 12, 2007 is as follows:

*A small cluster of thunderstorms produced severe weather in Leelanau County. A lightning strike ignited a fire, which destroyed a three-car garage and a boat that was inside, and melted vinyl siding on an adjacent home.*

Lightning from the event on September 1, 2000 caused a fatality and an injury in Grand Traverse County. A man and his son were struck by lightning when they climbed a hill to view the approaching lightning. Lightning also caused delays in numerous high school football games.

Table 25. Lightning Events

LOCATION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE
<b>County/Region</b>	9/1/2000	0	0	\$0
<b>Solon Township</b>	8/12/2007	0	0	\$40,000
<b>TOTAL</b>		<b>0</b>	<b>0</b>	<b>\$40,000</b>

Source: NOAA: National Centers for Environmental Information

### *Probability of Future Events and Vulnerability Assessment*

Since there have been two lightning events reported in the last 23 years, the data shows that there is an 8.7% chance a lightning strike would occur in a given year. However, not all lightning events may have been reported since events with injuries, deaths, and extensive damages tend to be the only ones reported. Therefore, the number of lightning events and damages may be higher.

All existing and future buildings, exposed infrastructure, and populations are at risk from lightning events since it may cause structural and wildland fires, loss of electrical and telecommunications equipment, and damage to buildings or vehicles from falling trees struck by lightning. People that work outside or participate in outdoor recreation activities are at a higher risk to be struck by lightning. Every community in the GTB service area has a variety of outdoor recreation areas.

## 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, tornados 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 Leelanau County is at risk to the occurrence and impacts from tornadoes. It is impossible to predict where and with what magnitude a tornado will touch down. Approximate trajectories of recorded tornadoes with NOAA are illustrated on the Vulnerable Populations and Hazard Areas Map in Appendix A.

### Extent

The Fujita Scale (Table 26) 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, Leelanau County's most damaging tornado occurred on August 15, 1978; wind speeds are unknown. It caused no injuries or deaths, but \$ 250,000 in property damages.

Table 26. 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

Between 1977 and 2022, Leelanau County has had three reported tornadoes touch down, causing a reported \$ 295,000 in property damage (Table 27). As a result of these tornadoes, there were no deaths, no injuries, and no reported crop damage. The tornado event on August 15, 1978 caused \$250,000 in damage, the most destructive of the three. The tornado touched down in Suttons Bay Township and proceeded northeast into Peshawbestown across E. McKeese Road.

The event narrative is as follows:

A tornado touched down on M-22, south of Leland, and skipped ENE damaging four homes and two mobile homes and blocking roads with felled trees. Most of the damaged homes were on Dumas Road. Many small boats on Lake Leelanau broke loose from their moorings with several sail boats capsizing.

Table 27. Tornado Events

BEGIN LOCATION	DATE	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE
Glen Arbor Township	7/31/1977	F1	0	0	\$25,000
Suttons Bay Township	8/15/1978		0	0	\$250,000
Leland Township	6/22/2011	EFO	0	0	\$20,000
<b>TOTAL</b>			<b>0</b>	<b>0</b>	<b>\$295,000</b>

Source: NOAA: National Centers for Environmental Information

*Probability of Future Events and Vulnerability Assessment*

Since there have been three tornadoes events reported in the last 46 years, the data shows that there is a 6.5% 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. Due to increased residential growth in the county, the chances of a tornado touching down and causing residential damage is very high, especially in Traverse City and surrounding townships where population densities are highest. Persons with a disability, elderly persons, and those in campgrounds and mobile homes (see Table 25) are also more vulnerable. Tornadoes can occur suddenly with very little warning, and it may be difficult for these populations to find adequate shelter in a hurry.

The GTB Department of Emergency Management offers GTB members the ability to sign up for “Regroup” emergency alert system, which allows members to receive SMS, email and voice emergency alerts. Leelanau County currently utilizes the “Rave” mass notification system for notification of tornado warnings and watches, along with other severe weather alerts. The system notifies a participant via their mobile or land-line phone. The National Weather Service may concurrently utilize their notification system when deemed necessary in severe weather event situations to send phone notifications to all users within signal of a cellular tower. Additionally, there are severe weather warning sirens located at fire stations throughout Leelanau County (Suttons Bay, Leland, Elmwood, Northport, Cedar, and Glen Lake), as well as one in Peshawbestown near the Pow-Wow grounds that serve as audible tornado warning systems. The Leelanau County Emergency Management Office Dispatch Center conducts monthly tests on the sirens from April 1<sup>st</sup> to October 1<sup>st</sup> every year. Annual community notifications of siren tests are placed in the GTB newsletter in March and October. The GTB Tribal Government conducts annual tornado, inclement weather and fire drills.

The new Herkner Road residential development on GTB land in Garfield Township, Grand Traverse County, is expected to be completed in 2024 with up to 193 residential units; some of those units will have basements; some will be constructed as slab-on-grade. With the expected increase in GTB residents in this area, a tornado mitigation strategy is to utilize the Community Center that will be built as part of the development as a designated storm shelter for residents.

Additionally, in 2008, the GTB completed construction on six underground severe storm “safe rooms” (shelters) located on tribal lands in the counties of Leelanau, Antrim, Benzie and Charlevoix (Table 28). This \$76,800 project, funded in part by a FEMA hazard mitigation project grant, provides protection for 192 individuals. 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 six shelters are located in close proximity to tribal residences, community centers, and recreational areas.

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 11). 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.

This project provided a unique and economical solution to the problem of providing shelter from severe weather for tribal members without basements or other adequate forms of protection. In addition, locating the shelters near areas where large numbers of people are likely to gather during the spring and summer months for tribal and/or recreational activities also maximizes the level of protection provided.

Table 28. GTB Severe Weather “Safe Room” Locations

#	Tornado Shelter	Location	Address	County
1	Elder’s Complex	West side of Elder’s Complex (behind complex)	11201 Ki-Dah-Keh Road – behind	Leelanau
2	Elder’s Complex	East side of Elder’s Complex (near cul-de-sac in front)	11201 Ki-Dah-Keh Road – front	Leelanau
3	Peshawbestown	Peshawbestown Road, near the Natural Resources weather monitoring station	2809 NW Bay Shore Drive	Leelanau
4	Antrim	Near playground area	Wiingash-Mi-kun, Rapid City	Antrim
5	Benzie	Near the Pow-Wow grounds at the Benzie Satellite Office	7282 Hoadley Rd., Benzonia	Benzie
6	Charlevoix	Near playground area by the Charlevoix Satellite Office	10085 Wa-Ba-Noong Mi-Kun, East Jordan	Charlevoix

Source: GTB Emergency Management

Figure 11. GTB Storm Shelter Entrance in Benzie County



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

Leelanau County Office of Emergency Management maintains contracts with six local fire stations and seven other facilities in the county so that they may be utilized as temporary shelters in the event of an emergency. A full list of temporary shelter locations is included in the Mitigation Strategies section of this plan. Additionally, the American Red Cross can set up temporary shelters within 12-24 hours after an emergency event occurs; usually this is done within an existing structure. Private and religious facilities, as well as local libraries, have been utilized during regular hours for temporary shelters to be used during the day. There are no homeless shelters located within Leelanau County.

**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.

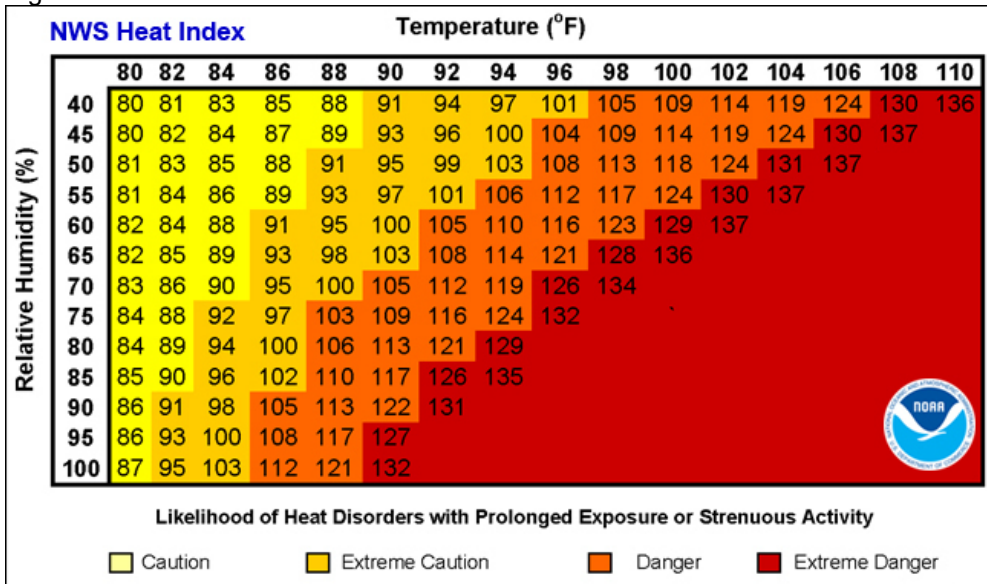
According to the 2019 Michigan Hazard Mitigation Plan, Michigan has 11 average annual extreme heat events with 0.4 average annual deaths and 41 average annual injuries.

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 12). 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.

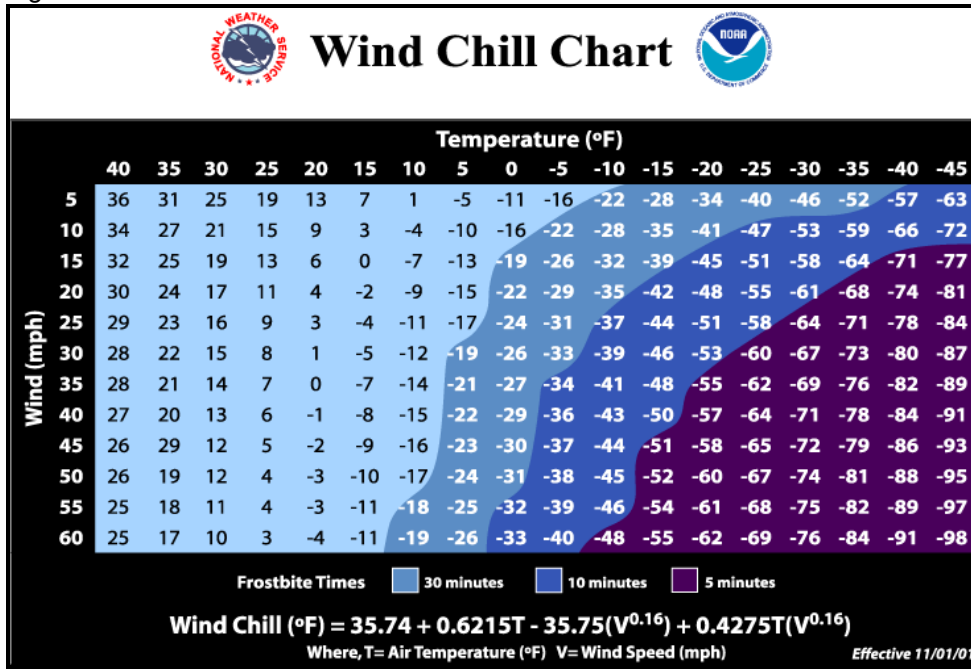
Figure 12: National Weather Service Heat Index



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

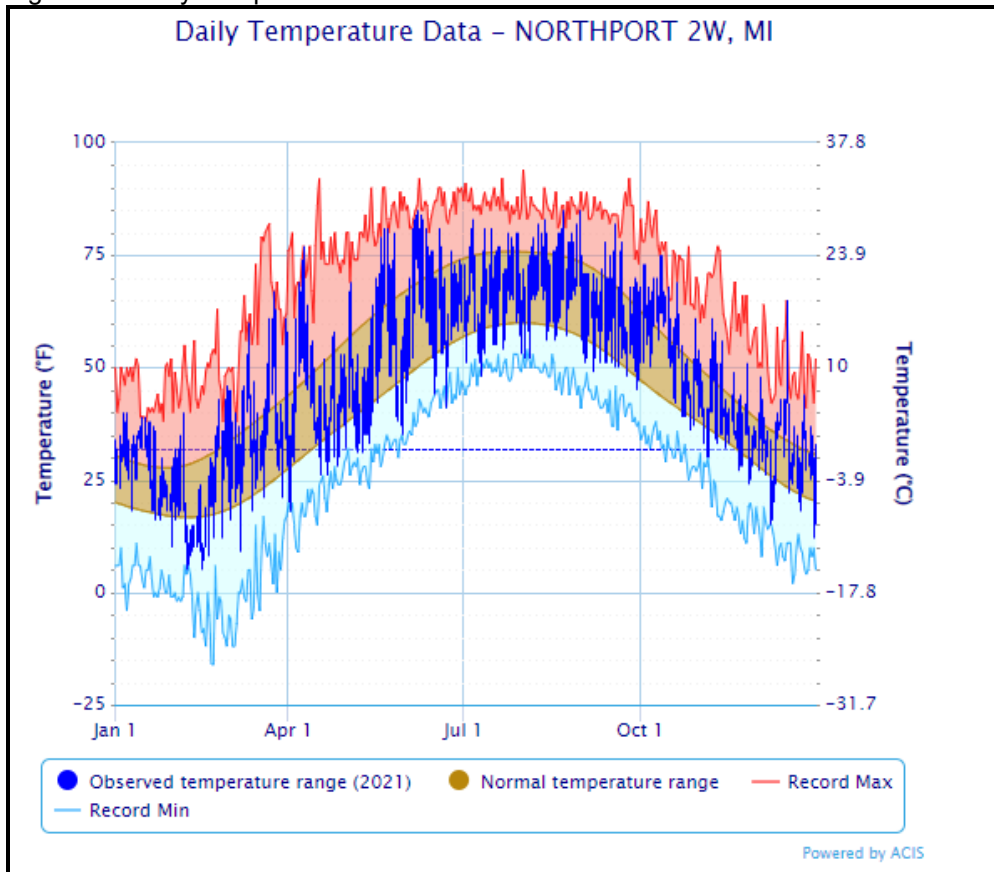
Figure 13: National Weather Service Wind Chill Chart



Source: National Weather Service

Figure 14 illustrates the observed temperatures in Northport for 2021. The dark blue line shows temperatures recorded between January 1 2021 and December 21, 2021. The red line above shows record high temperatures for that day, and the light blue line below indicates record low temperatures for that day.

Figure 14: Daily Temperature Data:



Source: NOAA Climate Data Online

*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 Leelanau County and the GTB service area is at risk to the occurrence and impacts from extreme temperatures.

*Previous Occurrences*

Leelanau County has had two extreme heat events in 2001 and 2018 (Table 29). The events did not have any deaths, injuries, or property/crop damages. The events consisted of hot and humid conditions that caused outdoor events to be modified and attendance at outdoor events to be lower than normal.

Table 29: Heat Related Events

	DATE	EVENT TYPE	INJURIES, DEATHS, DAMAGES	EVENT DESCRIPTION
LEELANAU (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.
LEELANAU (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



Since 2000, there have been three extreme cold events reported in Leelanau County (Table 30). There was one death, no injuries, and no 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 in the State was enacted in 2019 and included Leelanau County.

Table 30: Cold Related Events

	DATE	EVENT TYPE	INJURIES, DEATHS, DAMAGES	EVENT DESCRIPTION
LEELANAU (ZONE)	2/4/2007	Extreme Cold/wind chill	0	High temperatures on the 4th (Super Bowl Sunday) were around zero, with low temperatures that night from five to ten below zero. Gusty northwest winds produced hazardous wind chills of 20 to 30 below zero, along with blowing and drifting snow. Many area schools closed on the 5th, due to the extreme cold and poor road conditions.
LEELANAU (ZONE)	2/10/2008	Extreme Cold/wind chill	1	<p>Polar air surged into the region behind the departing system, dropping temperatures to around zero. Lake effect and lake enhanced snow quickly developed, with a widespread two to five inches in the snowbelts. There were isolated higher amounts of seven inches in Gaylord, nearly nine inches south of Traverse City, and eight inches near Trout Lake. Wind gusts up to 45 mph, when combined with falling and blowing snow, produced outright blizzard conditions in the open country of central Chippewa County, and near blizzard conditions at times across much of the rest of Northern Michigan.</p> <p>In Leland, an 87-year-old male Alzheimers patient was found dead five blocks from his home on the morning of the 10th. Local law enforcement stated he died of exposure to the cold. A number of area schools were closed on the 11th (Monday) as the clean-up was still underway.</p>
LEELANAU (ZONE)	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.

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

*Probability of Future Events and Vulnerability Assessment*

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

There have been three extreme cold events on record affecting the County since 2007. This indicates that there is an 18.75% chance an extreme cold event would occur in a future year. However, 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.

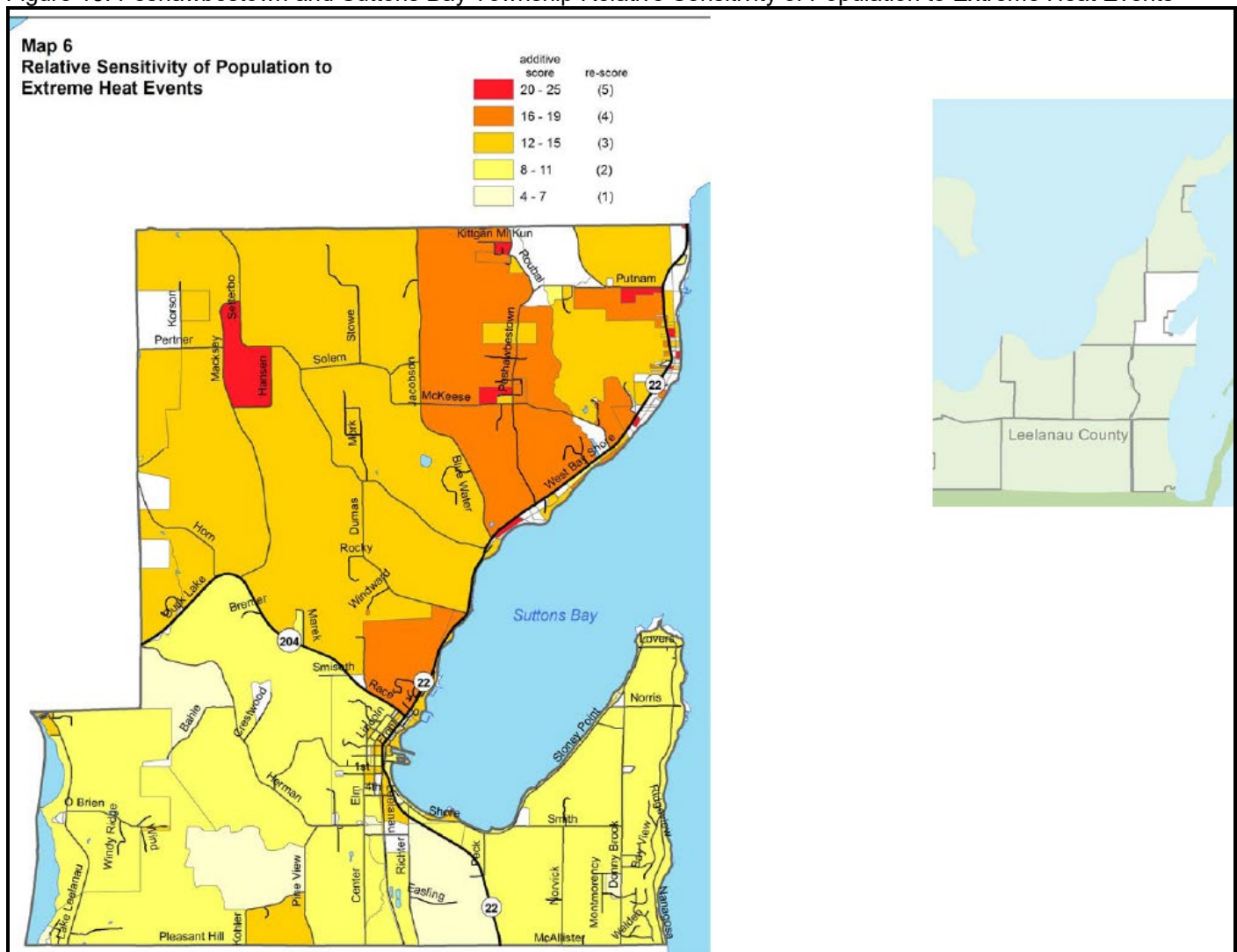
Extreme heat and cold events are more likely to impact unsheltered populations. The homeless population is especially vulnerable. Seasonal Emergency Shelters such as Safe Harbor (Grand Traverse County) are essential services for the community. Also, Leelanau County Office of Emergency Management maintains contracts with six local fire stations and seven other facilities in the county so that they may be utilized as temporary heating or cooling shelters in the event of an extreme heat or extreme cold emergency. A full list of temporary shelter locations is included in the Mitigation Strategies section of this plan.

Those working and recreating outside are also vulnerable. The *Northwest Lower Michigan Coastal Resilience Atlas* written by the Land Information Access Association (LIAA), completed a Heat Vulnerability Assessment<sup>6</sup> of Lake Michigan 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 the following factors:

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

The GTB population's vulnerable population increases the demand for emergency services. Anecdotally, emergency personnel also see more fatalities during extreme temperature events. Vulnerable populations may not be able to find or access heating or cooling stations or are able to 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. Water scarcity is a concern.

Figure 15: Peshawbestown and Suttons Bay Township Relative Sensitivity of Population to Extreme Heat Events



Source: LIAA Northwest Lower Michigan Coastal Resilience Atlas, page 913

<sup>6</sup> Land Information Access Association. (2019). *Northwest Lower Michigan Coastal Resilience Atlas*. [http://www.resilientmichigan.org/nw\\_atlas.asp](http://www.resilientmichigan.org/nw_atlas.asp)

*Feedback from April 2022 Input Session regarding Extreme Temperatures:*

- GTB has the following groundwater wells that could be affected by excessive water usage during extreme heat or a drought: 3 at Turtle Creek Casino (Grand Traverse County); 3 in Peshawbestown; 2 at Grand Traverse Resort (Grand Traverse County; 2 for farmland irrigation use
- Crop and livestock impacts on agricultural properties
- Strain on power grid from high power demand from air conditioning use
- Provide shelters and welfare checks for vulnerable populations

## 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 causes losses to agriculture; affects domestic water supply, energy production, public health, and wildlife; and contributes to wildfire, to name a few of its effects.

### Location

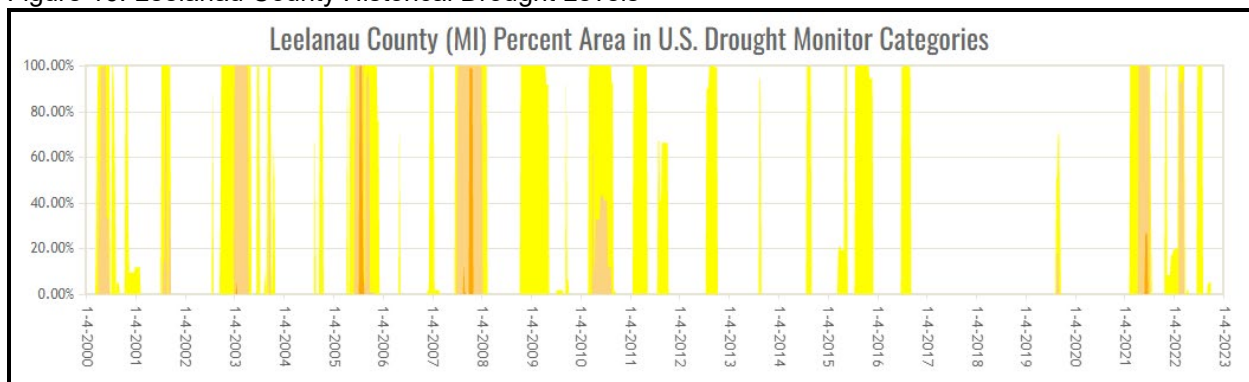
Drought is a regional event that is not confined to geographic boundaries and range in severity across the affected areas. All of Leelanau County and the GTB lands are at risk to the occurrence and impacts from drought.

### Extent

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

The U.S. Drought Monitor (Figure 16) combines several input sources including the PDSI and the Standardized Precipitation Index to prepare a weekly map showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3) and exceptional (D4) (Figure 17).

Figure 16: Leelanau County Historical Drought Levels



Source: US Drought Monitor

Figure 17: U.S. Drought Categories and Historically Observed Impacts

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

Source: US Drought Monitor

### *Previous Occurrences*

There have been two instances of drought in Leelanau County. The first event was a Presidential Declared Emergency enacted in 1977 for drought in 44 Michigan counties, including those in the northwestern Lower Peninsula. The second event occurred on August 1, 2001. No deaths, injuries, or damages are associated with these drought events.

The August 1, 2001 event narrative is as follows:

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

### *Probability of Future Events and Vulnerability Assessment*

Since 2001, Leelanau County has experienced one drought event. This equates to a 4.5% annual chance for a drought event in Leelanau County. Drought can adversely impact residential water sources when well levels decline, agriculture including both crops and livestock, and some tourism and recreational enterprises. Residential water sources are vulnerable during a drought. Many county residents rely on ground water wells for drinking water. Even drought events in category D1 experience water well level decline. Drought events combined with excessive heat can have severe impacts on elderly and low income people.

Leelanau County's economy is highly dependent on agriculture and agri-tourism. Drought may cause the following damages to crops and pastures:

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

Interruption in agriculture production can also cause a drop in income, which impacts other economic sectors.

The biggest problem drought presents, however, is the increased threat of wildfire. Western and southern portions of Leelanau County (Cleveland Township, Empire Township, and Glen Arbor Township) are heavily forested and are therefore highly vulnerable to drought-related wildfire threats.

### *Input from April 2022 Input Session Regarding Drought:*

- GTB has the following groundwater wells that could be affected by excessive water usage during extreme heat or a drought:
  - 3 at Turtle Creek Casino (Grand Traverse County)
  - 3 in Peshawbestown
  - 2 at Grand Traverse Resort (Grand Traverse County)
  - 2 for farmland irrigation use
- Crop and livestock impacts on agricultural properties

## **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 depend on fire to provide all the right conditions for regeneration, while aspen and white pine forest stands have a moderate risk. The primary cause of wildfires is from human activities, specifically burning outdoor debris. Wildfires cause destruction to property and timber resources, and injuries or loss of life to wildlife and persons living or recreating in wildfire prone areas. Long-term effects include scorched and barren land, soil erosion, landslides/mudflows, water sedimentation, and loss of recreational opportunities.

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

Michigan's fire season starts in early spring, when leaves and grasses remain dry from fall and winter and trees are not yet green. Wildfires are often accompanied by drought where dry conditions increase the potential to burn. Often a 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 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.

However, lightning strikes are not the primary cause of wildfires in Michigan. Recently, only about 4% of all wildfire in Michigan were caused by lightning strikes, and most other causes have been attributed to human activity. Outdoor debris burning is the leading cause of wildfires in Michigan. Most Michigan wildfires occur close to where people live and recreate, which puts both people and property at risk. The immediate danger from wildfires is the destruction of property, timber, wildlife, and injury or loss of life of persons who live in the affected area or who are using recreational facilities in the area.

### *Location*

All GTB communities and developed areas are vulnerable to wildfires since the community centers and rural residential developments interface with the high risk forest types (e.g. Red Pine, Eastern White Pine, and Jack Pine). Over 105,000 acres, or 41%, of Leelanau County is forested. Jack Pine forests make up 645 acres of forested land while Red Pine makes up 13,083 acres, and Eastern White Pine makes up 1,062 acres. As shown on the Environmental Features Map in Appendix A, Jack Pine forests are minimal, located primarily in Leland, Leelanau, Glen Arbor, Cleveland, Solon, Bingham, and Elmwood Townships. Red Pine and Eastern White Pine forests are located countywide.

### *Extent and Previous Occurrences*

Extent can be measured by the number of acres burned and the cost of property damage. Between 1996 and 2017 there were no wildfires reported outside of MDNR lands in Leelanau County. Between 1981 and 2018 there were 60 reported fires on lands under MDNR jurisdiction. This resulted in 267.6 acres burned and 7 acres burned per year. No property damages were recorded.

### *Probability of Future Events and Vulnerability Assessment*

There is a 100% chance there will be a wildfire on MDNR lands in a future year, and a small chance there will be a wildfire on lands outside of MDNR jurisdiction in a future year. Forest types (Red Pine, Eastern White Pine, and Jack Pine) within Leelanau County are susceptible to wildfires. Western and southern portions of Leelanau County (Cleveland Township, Centerville Township, Empire Township, and Glen Arbor Township) are heavily forested and are therefore highly vulnerable to wildfire threats.

Additional factors that increase fire risk include dead or dying Ash trees as a result of disease/invasive species, invasive species 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 Leelanau 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 and Federal fire protection agencies.

*Comments from April 2022 Input Session related to Wildfire Concern Areas on GTB property:*

- Putnam Road, east of Peshawbestown Rd., where the Natural Resources building, Fire Station and residences are located.





### *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.”

Jurisdictions located on the Lake Michigan and Grand Traverse Bay coast in Leelanau County are impacted by shoreline hazards: City of Traverse City, Village of Empire, Village of Northport, Village of Suttons Bay, and the following coastal townships: Elmwood, Bingham, Suttons Bay, Leelanau, Leland, Centerville, Cleveland, Glen Arbor, and Empire. The Land Information Access Association documented potential shoreline hazards for these communities in the *Northwest Lower Michigan Coastal Resilience Atlas*. Specific areas of shoreline hazards were also identified during the public input session for this plan. These are marked as a “shoreline erosion” type of hazard area on the Hazard Area Map in Appendix A.

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

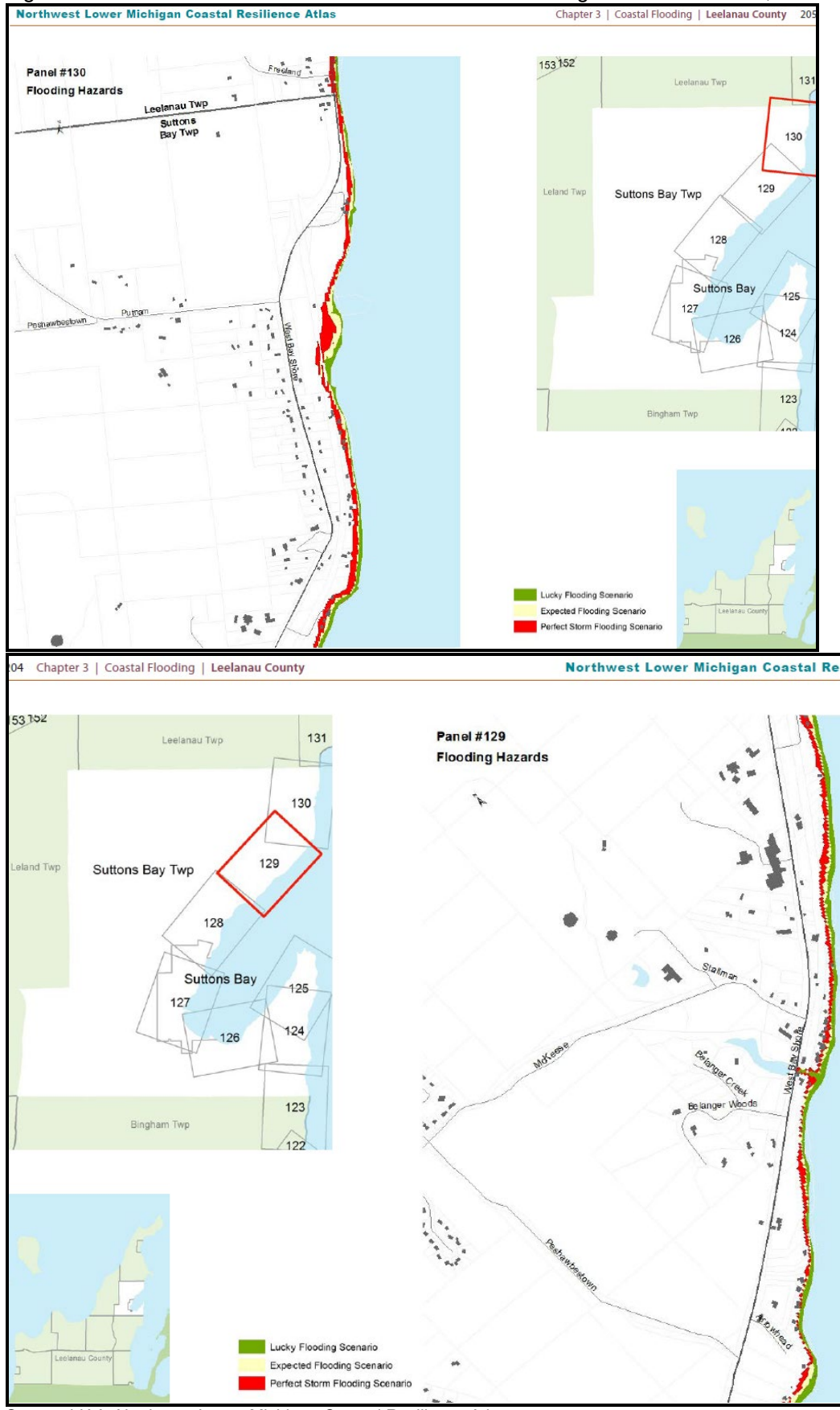
The first scenario, **“Lucky” Future**: Under the Lucky Climate Future, Great Lakes water levels will continue to stay relatively low. Although there will be wave and wind action, major storm events and wave impacts will not encroach on properties landward of current beaches. A Lucky Future projection,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

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

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

Figures 19 and 20 illustrate the three potential flooding scenarios in the Peshawbestown area. “Lucky” scenario flooding is shown in green, “Expected” flooding scenario is shown in yellow, and “Perfect Storm” future scenario is shown in red.

Figures 19 and 20: Panels #129 and #130 – Coastal Flooding Hazard Scenarios, Peshawbestown



Source: LIAA, Northwest Lower Michigan Coastal Resilience Atlas

Coastal recession, or erosion, to Lake Michigan communities is a constant, but very small wearing away of the shoreline. The Great Lakes are estimated to lose one foot of shoreline per year to normal wave and wind activity. However, storms and increased wave activity have caused increased coastal recession to varying degrees in Leelanau County's coastal communities. Chapter 4 of the *Northwest Lower Michigan Coastal Resilience Atlas* describes bluffline recession since its recorded shoreline in 1938. The blue line indicates the shoreline in 1938, the green line indicates the bluffline in 1938, the yellow line is the bluffline in 2016, and the red line is the predicted 30 year bluffline.

Figure 21: Panel #129, Shoreline Recession, Peshawbestown

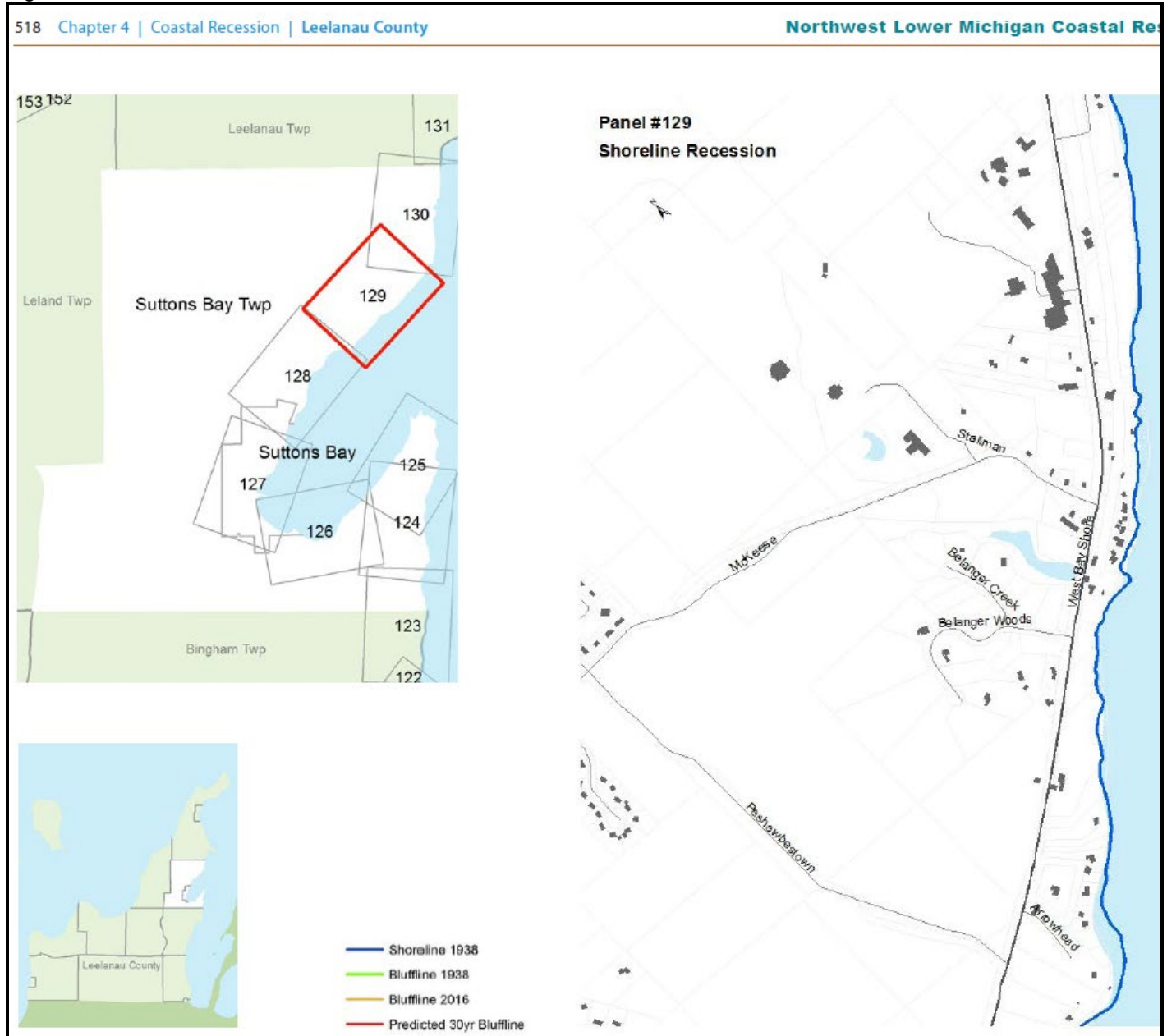
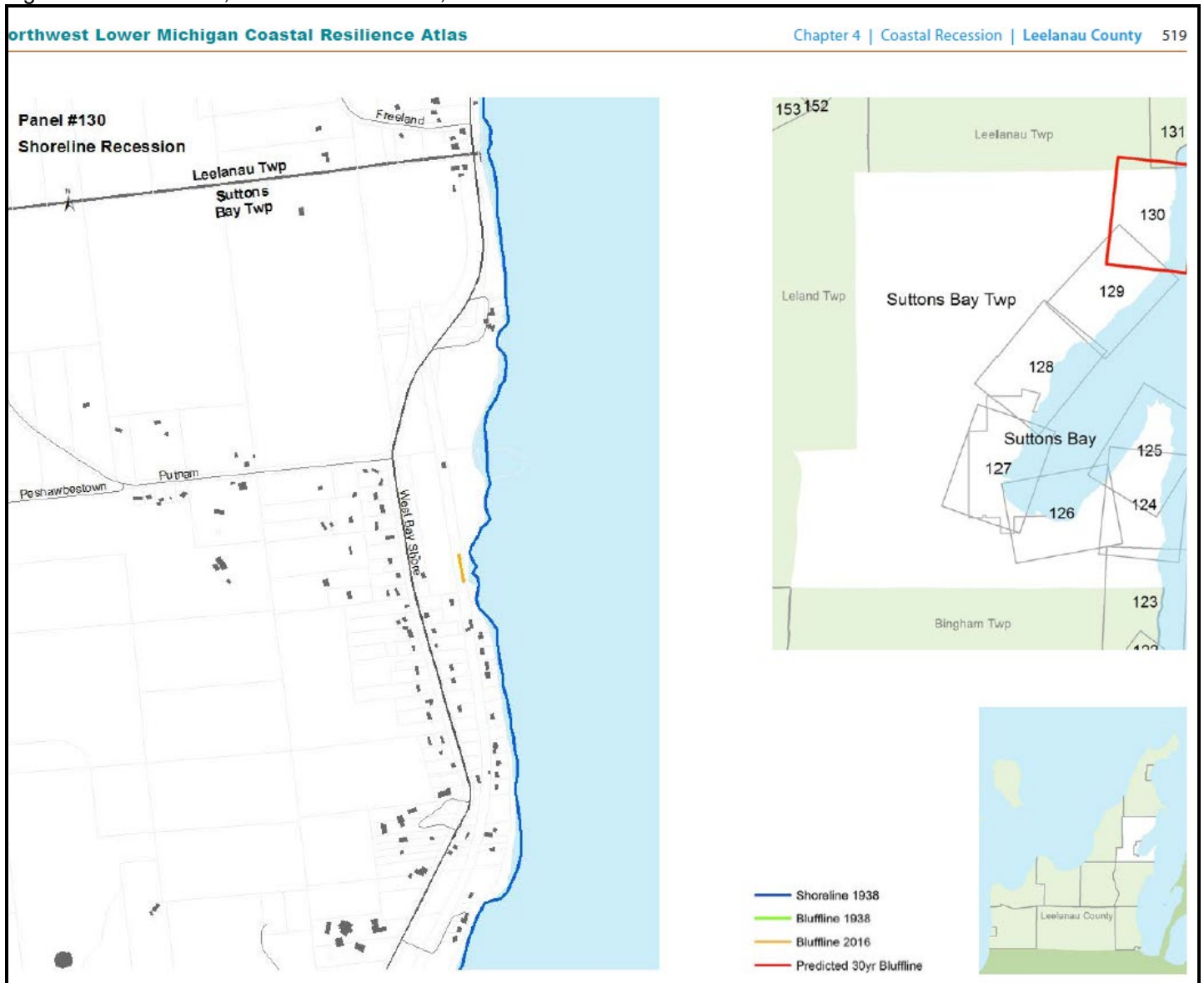


Figure 22: Panel #130, Shoreline Recession, Peshawbestown



Source: LIAA, Northwest Lower Michigan Coastal Resilience Atlas

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

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

The communities of Centerville Township, Cleveland Township, Empire Township, Village of Empire, Glen Arbor Township, Leelanau Township and Leland Township contain State-designated “Critical Dune Areas” (CDAs), are a combination of coastal barrier dunes, land that has dune-like features, and unique plant communities along a Great Lakes shoreline. Regulatory authority goes to the water’s edge. The CDAs include public lands and private properties where developmental, silvicultural, and recreational activities are regulated and a permit is required under Part 353, Sand Dunes Protection and Management, of the Natural Resources and Environmental Protection Act for activities that significantly alter the CDA, such as the construction of a house or garage, building a road or driveway, installing a septic system, installing retaining walls, and sand removal. The law balances the benefits of protecting, preserving, restoring and enhancing the diversity, quality, functions, and value of the critical dunes with the benefits of economic development, multiple uses, and public access. Currently EGLE administers Part 353 for all CDAs in the county.

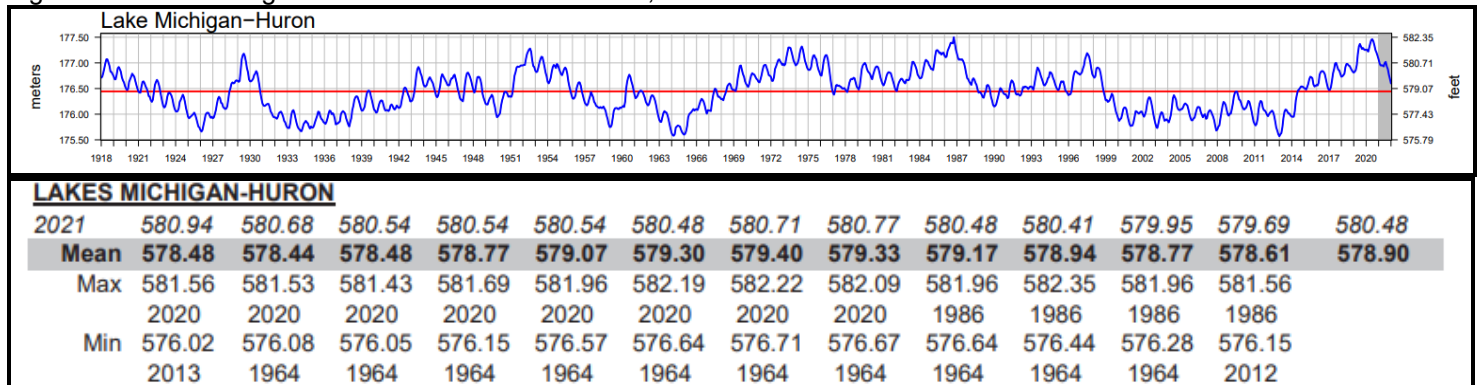
The HREAs and CDAs in Leelanau County are shown on the Environmental Features Map are included in Appendix A. There are no HREAs or CDAs on GTB-owned property.

**Extent**

Shoreline recession can be measured by feet of bluffline retreat and property damages. Bluffline retreat distances vary across the county and region, 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 23), and damages. The three (3) lakeshore flooding events in Leelanau County during 2019 and 2020 caused \$179,000 in property damages.

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

Figure 23: Lake Michigan-Huron Historic Water Levels, 1918-2021



Source: US Army Corps of Engineers

**Previous Occurrences**

In the approximately the past four decades, the Great Lakes experienced record high lake levels in 1985-86, 1997-98, and most recently in 2019-2020. Some shoreline erosion issues remain and high lake levels that caused rivers and tributaries to back up have caused infrastructure damage and failures throughout Leelanau County and the region. Despite not being recorded as a shoreline flood event in NOAA’s Storm Events Database, the first event occurred on February 21, 1986, when a Governor’s Disaster Declaration for shoreline problems in the State was enacted, and included Leelanau County. Since that time, three lakeshore flood incidents have been reported with NOAA for Leelanau County, as described below:

The narrative of the October 16, 2019 lakeshore flood event is as follows:

*Northwest to north winds produced high waves and elevated water levels along the northwest lower Michigan coastline. With Great Lakes water levels at near-record levels, significant coastal flooding and beach erosion resulted. The parking lot of the Grand Traverse Yacht Club was flooded.*

The narrative of the October 21, 2019 lakeshore flood event is as follows:

*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. In Northport on the 21st, a dock was damaged and a boat house was flooded. Water levels rose over the docks at Northport Marina. On the 22nd in*

*Empire, a part of the break wall at Empire Beach was destroyed. In Glen Haven, restoration efforts from flooding earlier in the month were eliminated, and shoreline fences were destroyed at Glen Haven Beach.*

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

*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.*

There are no recorded events with NOAA related to shoreline erosion for Leelanau County.

#### *Probability of Future Events and Vulnerability Assessment*

Over the past 37 years, four events have occurred. This indicates there is a 10.8% annual chance of shoreline flooding and an equal chance erosion will cause shoreline damages. The shoreline hazards of 2019 and 2020 occurred under unique circumstances when the Great Lakes water levels were above average. Based on past water level measurements, similar levels are not likely to occur for some time. On the contrary, the Great Lakes may experience low water levels with the ebb and flow of the lakes.

Shoreline or soil erosion hazards involve the loss of property or necessitate the relocation of homes as sand or soil is removed by flowing water (lake, river, etc.) and carried away over time. The foundation of a structure, or underground utility pipes in the area, may become fully exposed and vulnerable to weather, extreme temperatures, water damage, or other sources of risk. Shoreline banks that support roadways may erode and cause the road surface to crack, become unstable, or more prone to deposits of sand, snow, water, and ice. This hazard is especially relevant to those municipalities that contain residential and commercial development along Lake Michigan and the Grand Traverse Bay (City of Traverse City, Village of Empire, Village of Northport, Village of Suttons Bay, and the following coastal townships: Elmwood, Bingham, Suttons Bay, Leelanau, Leland, Centerville, Cleveland, Glen Arbor, and Empire) that experience seasonal shifts in water levels and possible ice erosion hazards.

As lake water levels fluctuate and increased storminess occurs, shoreline recession and flooding will continue. In 2021 the levels of Lakes Michigan and Huron began to decline, however, as historic data shows us, the water will begin to rise again. Those communities that have already faced shoreline hazards are likely to experience issues in the future. Changes in land use practices and improvements to the shoreline such as natural vegetation plantings or shoreline armoring may reinforce the shoreline for a period of time, but is likely not a permanent solution. The following is an excerpt from the *Leelanau County Plan* (2019) describing the sensitivity and threats to the County's shorelines and dunes:

*Seemingly endless shorelines and monumental dunal formations epitomize the grandeur of the area. While these resources serve as critical components of the County's tourism and recreation industry, they are particularly vulnerable to wind and wave action, as well as to any land use and development activities which disturb the stability of the dunes. The clearing of vegetation along shorelines and dunes seriously increases their susceptibility to erosion, shifting, and demise. Disturbance of their natural character by land use activities heightens their vulnerability to winds and waves, and other climatic forces. Many of the County's shoreline areas and dunal formations are considered "high risk erosion areas." The significance of these areas is highlighted by their inclusion for protection under the Michigan Natural Resources Act 451. This Act serves to protect designated "critical dune areas", including Sleeping Bear Dunes and Empire Bluffs as well as less prominent dune areas.*

*The Lake Michigan shoreline and dunal formations harbor yet another sensitive environmental resource - threatened and endangered plant and animal species. Inventories by the Michigan Department of Natural Resources have identified numerous unique plant and animal species in the County which rely largely upon shoreline and dune areas for their survival. Other threatened species which rely upon a more inland environment have also been identified. The fact that these plant and animal species are already considered unique due to their threatened survival emphasizes the need to prevent disturbances in the ecosystem in which they thrive.*

*Shorelines of inland lakes are also sensitive natural resources. The calmer waters and areas of interface between the land and water are particularly important habitats for wildlife and plant life. Understandably, these areas are also actively sought for development and recreational use. The resulting threat to these environments through soil*

*erosion and sedimentation, disturbance of the natural shoreline and vegetation, and leachate from faulty septic systems is a concern today and will become more significant as the County's population grows.*

**Comments from April 2022 Input Session**

- 3 areas of concern regarding flooding/erosion along the shoreline in Peshawbestown; one is near a gas station – possible contamination source if impacted by rising lake levels

## 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 always present. Structural currents are dangerous on their own, but when paired with others like longshore or rip currents, the combination can create a washing machine effect, moving the swimmer from one dangerous current area to another with no clear path to safety.

Outlet currents can be found where rivers and streams empty into the Great Lakes. The flow of water from the river or stream can move quickly. As it enters the open water of a lake, it may take 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.

### *Location*

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

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

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



### Location

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

Rip currents can be measured by damages-caused including deaths and injuries. There has been one significant rip current event in Leelanau County, and one death was reported.

### Previous Occurrences

Leelanau County has had one reported fatality from a rip current event (Table 37). The event occurred on August 30, 2012. The event narrative is as follows:

*Southwest winds of 20 to 30 mph producing significant wave action and strong currents along the Lake Michigan coast. Three individuals were caught in rip currents near Van's Beach in Leland. One was rescued via kayak; a second managed to escape and swim back to shore. Unfortunately, the third, a teenaged male from Lake Leelanau, went under and disappeared. His body was found by searchers the next day, in about six feet of water.*

Table 37. Rip Current Events

Date	Fatalities	Rescues	Beach Name	Location	Type Of Current	Wave Direction	Wave Height (ft.)
8/30/2012	1	2	Van's Beach	Leland Township	Classic Rip	S	5 TO 6

Source: Great Lakes Current Incident Database <https://www.michiganseagrant.org/dcd/dcdsearch.php>

It is likely that more rip current events have occurred and gone reported. There are instances of fatalities from rip currents in nearby coastal counties including Benzie, Emmet, and Manistee Counties.

### Probability of Future Events and Vulnerability Assessment

Three dangerous current incidents occurred in Leelanau County in 2012. This equates to a 27% annual chance of a dangerous current event happening in a future year. Dangerous current events are likely to occur more frequently, but go unreported as injuries and deaths do not occur. Lake Michigan currents are 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. 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. All communities in Leelanau County, with the exception of Kasson and Solon Townships, have public beach access to Lake Michigan or West Grand Traverse Bay.

## 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.

Seiches are 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 due to seiche events.

### *Location*

Seiches are 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 to the occurrence and impacts from a seiche.

### *Extent*

Seiche events can be measured by damages-caused including deaths, injuries, and property damages. There has been one significant seiche event in Leelanau County, and no deaths or injuries were reported.

### *Previous Occurrences*

Leelanau County has had one seiche event. The event occurred on May 9, 2019, affecting Leland Township, and caused \$5,000 in property damages. The NOAA NCEI Storm Events Database narrative for the event is as follows:

*The sudden relaxation of a gusty east wind, and quick transition to a northwest wind, resulted in a seiche on Lake Michigan. With very high water levels already in place on all of the Great Lakes, localized flooding developed. Water entered some of the historic fishing shanties in the Fishtown section of Leland. Sandbags and other methods were deployed to attempt to keep the water out.*

### *Probability of Future Events and Vulnerability Assessment*

One seiche event has occurred in Leelanau County in the past 25 years, indicating that there is a 4% of a seiche event happening in a future year. Seiche events are likely to occur more frequently, but go unreported as injuries, deaths, or damages do not occur. As noted in the May 9, 2019 event and others, watercraft, persons and property along the lake shore are also vulnerable to high waves caused by a seiche. Seiche events are also dangerous to all swimmers, especially those who are unprepared to be swept up in the current. Many Lake Michigan beaches do not have a lifeguard on duty who may identify potential hazardous swimming conditions. All communities in Leelanau County, with the exception of Kasson and Solon Townships, have public beach access to Lake Michigan or West Grand Traverse Bay. The GTB also owns two commercial marinas on Lake Michigan: one in Peshawbestown and one on Beaver Island. There is also beach access to Lake Michigan in Peshawbestown.

## 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." Tornadoic 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 tornadoic.

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 the six-county GTB service area.

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 the six-county GTB Tribal service area, it is likely that waterspouts have occurred in the past, but have not been officially documented.

The GTB operates two commercial marinas on Lake Michigan – the Arthur Duhamel Marina in Peshawbestown, and one on Beaver Island (Charlevoix County). Fishing boats, as well as Tribal government employees conducting work on the Lake Michigan (for natural resource management purposes, for example), may encounter waterspouts, particularly during the time of year they are most likely to occur (August through October).

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 the GTB marine 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. The mobile emergency alert system service offered by GTB, "*Regroup*", can also be utilized as an informational source for waterspout forecasts and warnings.

## **Public Health Emergency (Infectious Disease)**

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

### *Location*

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

### *Extent*

The extent of a public health emergency can be determined by the number of cases and deaths, and the amount of money spent to prepare for and respond to public health threats. In Leelanau County, the Benzie-Leelanau Health Department works with local, state, and federal agencies to prepare for and respond to public health threats. It developed a comprehensive emergency preparedness program capable of responding to a variety of emergency situations with funds from the Centers for Disease Control. The State of Michigan reports, as of October 4, 2022, there are 4,173 cumulative cases of COVID-19 and 63 deaths in Leelanau County. Those 80 years and older have the most deaths of any age range at 31 deaths.

### *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 2020, a Presidential and Governor Emergency Order was declared for COVID-19 Pandemic in Michigan, as well as by the GTB Tribe. Variants of the corona virus are still being found two years after the initial spread; vaccinations are available to limit the reaction from exposure and limit the spread of the disease. The State of Michigan reports, as of October 4, 2022, there are 4,173 cumulative cases of COVID-19 and 63 deaths in Leelanau County. Those 80 years and older have the most deaths of any age range at 31 deaths.

### *Probability of Future Events and Vulnerability Assessment*

Naturally occurring pandemics may result in widespread precautions around the world. The Tribe created a pandemic plan that serves as a template for responding to a large-scale outbreak of influenza and other highly infectious respiratory diseases. That plan is currently being tested, and the response is ongoing to this pandemic. The elderly, immune-compromised, and low income populations are most vulnerable to public health emergencies.

### *Comments from April 2022 Input Session*

- Shortcomings/ Problems in response to Pandemic
  - Located so far “up north” that they didn’t have the resources and equipment needed to service large populations of sick people
  - Exposed reliability on Munson Healthcare hospitals – limited capacity of beds
  - They typically do not stockpile resources because they do not have the funds to do so.
  - Munson – mental stress on workers, constantly changing COVID protocols.
  - Effects of isolation, work stress...increased behavioral health problems in the community. There is a lack of mental health resources to support everyone.
  - This was a long process and taxed EM/Healthcare workers with protocol changes; difficult to inform people of what recommendations and rules were as they changed frequently.
  - The economic impact from reduced services/shutdown on businesses, housing, and EMS/healthcare. Need to plan for sustainability in these areas in a future scenario.
  - Still dealing with supply chain issues – vehicles and equipment down in EMS/Fire/Road Commission fleet because can’t get repair parts.

- What Worked Well in response to Pandemic
  - Benzie-Leelanau Health Dept. testing and vaccination clinics – set up and service delivery – positive feedback
  - GTB – Health Dept. – positive feedback on vaccination and testing clinics and case monitoring. Collaboration with local, state, and federal partners.
  - Specific fire/EMS teams were dispatched to handle emergencies that were COVID-related. Had ambulances set up to only handle COVID patients.
  - They had never gone through this public health scenario before but they got what they needed.
  - Had agreements and good coordination with other EMS departments for staffing – could share staff if one dept. was short staffed. Also coordinated with use and sharing of COVID-specific ambulances.
  - Municipalities managed to the election process with health protocols
  - Zoom meetings improved communication processes and will continue to be used in combination with in-person meetings

## 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.” Invasive species harmful to Michigan and GTB Tribal lands 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 (water-dwelling) species include non-native 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.

The GTB’s Natural Resources (NR) department strives to preserve, protect, and enhance native plant communities and wildlife populations important to the Tribe and its membership. To promote native plant species and protect the ecosystems they rely on, NR staff manage Tribal properties by removing invasive plant species, such as autumn olive, Russian olive, spotted knapweed, and honeysuckle, among others. Invasive plants may outcompete native vegetation for space and nutrients so removing them reduces their risk of establishing monocultures and frees up resources for native species. Invasive plants are very persistent and often require multiple treatments to eradicate them. Therefore, this has been an ongoing multi-year project for staff, but the table below highlights work done over the past year. GTB NR staff also plant native species to help restore natural ecosystems and promote biodiversity.

### *Location*

Combined, terrestrial and aquatic invasive species may be present in the entire six county service area including 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.”

### *Extent*

According to the State of Michigan 2013 Aquatic Invasive Species State Management Plan, “Since the 1800s, at least 182 nonindigenous aquatic organisms have colonized habitats of the Great Lakes ecosystem. These species include: algae (27), vascular plants (55), invertebrates (66), fish (28), and bacteria and viruses (6) (National Oceanic and Atmospheric Administration 2011). Roughly 55% of these species are native to Eurasia; 13% are native to the Atlantic Coast.” The Great Lakes Regional Collaboration estimates that a new aquatic invasive species arrives in the Great Lakes at a rate of one every eight months. **GTB has allocated \$\$\$ of the 2023 NR budget to treating affected areas. ### acres were treated for invasive species control/removal from 2021-2022.**

### *Previous Occurrences*

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 Canal. There are 32 AIS specifically listed in the State Management Plan. The State TIS Management Plan lists fourteen species including insects, mollusks, plants, mammals, a shrub, and a bird. Top priority plants in the region include garlic mustard, Japanese knotweed, invasive phragmites, and Oriental bittersweet.

### *Probability of Future Events and Vulnerability Assessment*

The Great Lakes and connecting channels and rivers form the largest surface freshwater system in the world. This freshwater system, along with Michigan’s inland lakes, streams, rivers, and wetlands represent an invaluable resource and are therefore justifiably a top natural resource management priority. The State of Michigan estimates 42% of threatened or endangered species are considered at risk due to non-native species. The Michigan Department of Environment, Great Lakes, and Energy produced the “Michigan Watch List Aquatic Invasive Plants: A Guide for Identification” for those species that have been identified as posing an immediate or potential threat to Michigan’s economy, environment, or human health. Included in the watch list are ten species that have been found in limited parts of

Michigan and surrounding states. The State TIS Management Plan provides a list of eleven terrestrial species on the watch list. GTB NR staff coordinate with the Northwest Michigan Invasive Species Network, Leelanau Conservation District and other land management partners “protect, enhance, and promote Northwest Michigan’s natural communities through terrestrial invasive plant management and outreach.”

While the Tribe and other conservation agencies work to remove and control invasive species, some species are pervasive and spread more quickly than can be managed. There is a maintenance cost for invasive species management, and there is also a cost to the native wildlife species. Much of northern Michigan’s native terrestrial and aquatic species have adapted to specific set of environmental conditions. Where invasive species out compete natural flora there may be a reduction in food sources for fauna.

**Comments from April 2022 Input Session regarding Invasive Species:**

- Crowding out forests – Woolly adelgid; pests and diseases that affect ash, beech, maple trees
- Aquatic invasives damaging the Great Lakes ecosystem/local fishing.
- Considering what trees from southern latitudes to plant up here because they are adapted to our current climate. ½ the plant species that were here 30 years ago are gone due to climate change.
- Fisheries – invasive mussels; algal bloom on lake bottom causes fish not being able to spawn.



## 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 and over many sectors of 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-fold” (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*<sup>8</sup>, 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.<sup>9</sup> 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).<sup>10</sup>

### Precipitation

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

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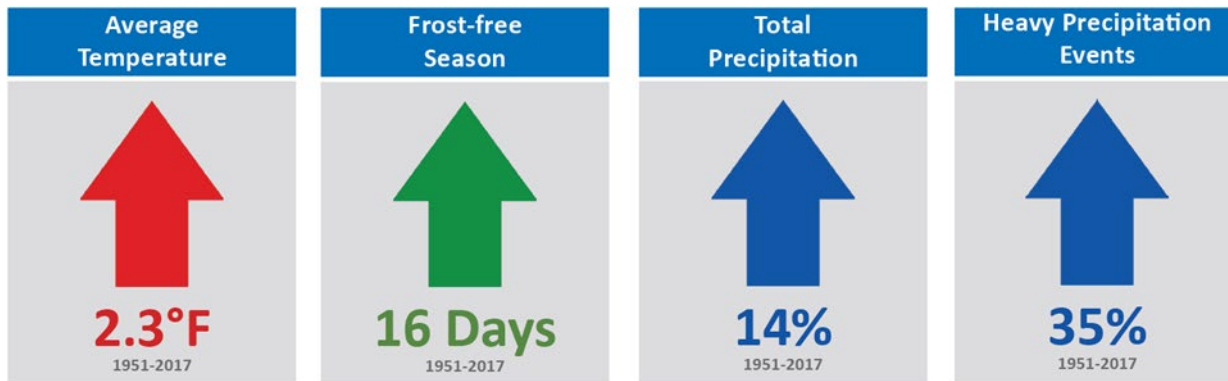
<sup>7</sup> World Meteorological Organization. (2021, August 31). Retrieved from Weather-related disasters increase over past 50 years, causing more damage but fewer deaths: <https://public.wmo.int/en/media/press-release/weather-related-disasters-increase-over-past-50-years-causing-more-damage-fewer>

<sup>8</sup> (2019, February 14). Retrieved from Climate Change in the Great Lakes Region: <https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Page.pdf>

<sup>9</sup> 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).

<sup>10</sup> Hibbard, K. A., F. M. Hoffman, D. Huntzinger, and T. O. West, 2017: Changes in Land Cover and Terrestrial Biogeochemistry. *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. Wuebbles, D. J., D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock, Eds., U.S. Global Change Research Program, Washington, DC, USA, 277–302. doi:[10.7930/J0416V6X](https://doi.org/10.7930/J0416V6X).

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



#### *Snow, Ice Cover and Lake Temperature*

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

#### *Extreme Weather*

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

The NCA *Fourth National Climate Assessment Volume II: Impacts Risks, and Adaptation in the United States 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*

A vulnerability assessment can be found in the two-page report: [Climate Change in the Great Lakes Region](https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Page.pdf) by GLISA at <https://glisa.umich.edu/wp-content/uploads/2021/04/GLISA-2-Page.pdf> The report identifies key challenges from climate change such as:

- **Public Health**
  - Increased risk of heat waves and increased humidity may amplify the number of heat-related deaths and illnesses.
  - More storm activity and flooding, resulting in increased point- and non-point source pollution, will likely increase watershed contamination and water-borne illnesses, while warmer surface waters amplify the risk of toxic algal blooms and fish contamination.
- **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.
- *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*.
- *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.

In addition to concerns that impact all of northwest Lower Michigan, the GTB have identified particular natural resources that are directly impacted by climate change and have reached a critical population size. The following describes the Tribe's work with ###.

### **Responses from Community Survey**

Question 7 asked if there have been any negative impacts on the public health and/or natural environment of their community that they attributed climate change.

- 56 of the 118 participants who provided a response said “no” or were unsure if there have been. A few of those who responded they were unsure, did request additional information.
- Of those who responded in the affirmative, many associated climate change to public health concerns such as poor air quality, water quality, illness outbreaks, increased precipitation, high water levels, milder winters, hot summers, and the influx of invasive species. Several responses identified a connection between unusual or uncommon weather patterns and negative effects on native plant and animal species.

## V. Tribal Vulnerability Summary

### GTB Population Characteristics for Future Planning Considerations

Based on current membership ages overall, the Tribe is likely to increase membership due to the high percentage of persons in the family-forming age group (20-54). 53% of all members are aged 20-54. Grand Traverse County has the highest number of members and the highest number and proportion of members aged 20-54. This would indicate the membership in this Grand Traverse County will grow in future years if persons in this family-forming age group decide to have children. Furthermore, an increase in GTB tribal members is expected in Garfield Township with the upcoming completion of the Herkner Road residential development.

Leelanau County has the second highest membership and the highest number and proportion of youth, persons aged 0-19. This is indicative of the high number of membership ages 20-54 and 55+. Persons in those age groups likely did have multiple children, thus the membership count increased. The youth cohort, persons aged 0-19, is the next highest membership category with 25% of the membership. The Peshawbestown area has the highest density of GTB residents. Also, if re-development and new development occurs in the future per recommendations in the Peshawbestown Master Plan, there would be a resulting increase in residents and visitors to the GTB Reservation in Peshawbestown.

Followed closely by Elders are those aged 55+ at 22% of the membership. While the Tribe is fairly young, there should be consideration and planning for the Elder membership in 10-20 years as those in the family-forming age group move into the Elder cohort. Members living in Benzie County are showing early signs of this as Benzie has the largest percentage of Elders and the second lowest number and percentage of youth.

Based on the available demographic data from the US Census Bureau and GTB Administration, a significant amount of GTB members have limited financial resources, and/or may be physically unable to prepare or evacuate for a hazard event. These households likely would have more of a need for social/public services - such as assistance with transportation, food, water, medical care, or shelter - before, during or after a hazard event.

The following is a list of key issues related to hazard mitigation planning for the GTB's tribal service area. These issues are addressed in the mitigation strategies table provided in Section VII of this plan; note that each strategy in the table can mitigate more than one type of hazard.

#### **Extreme Winter Weather; Thunderstorm/Severe Wind – most common events; can cause a large impact**

- Power outages affects the operability of cell towers, gas stations (gas is also needed to fuel back up power generators), home heating, ability to pump water from wells; downed power lines are a hazard in themselves; sanitary sewer pump failures have occurred in the past (requiring generator power)
- Road accessibility for emergency vehicles; increased potential for car accidents
- Economic impact of multi-day business, governmental and road closures
- Those living in substandard housing in the winter may have roof/structural damage, frozen water pipes, lack of heat
- Only have 1 power company in the County, which limits their ability to respond quickly to all outages in a wide-spread event.
- Money and time spent on the extreme demand placed on local responders – pay overtime for increased personnel to clear roads, provide emergency response services, and maintain utility operations
- Community Survey Response: *Renewable energy / energy independence would benefit the tribe. Existing buildings are older and may not be the most energy efficient.*
- Community Survey Response: *“Internet service needs to be improved in Peshawbestown as well as other rural areas.”*

#### **Hail, Lightning – relatively medium to low risk of an impactful event occurring**

- Lightning strikes can cause fires, impacting homes, woodlands
- Outdoor recreation areas are where people are most at risk to injury

#### **Inland Flooding Concerns – relatively medium risk**

- Intense rainstorms can result in riverine flooding, flash flooding on roads
- The Belanger Creek Dam (a privately owned dam at the end of Belanger Creek at the intersection with M-22; not on GTB owned property; not State-regulated)

- Belanger Creek, located southeast of Stallman Road to the outlet in the Bay – potential for overflow (not on GTB-owned land)
- Stallman Road near the intersection with Belanger Creek, located SW of Strongheart Way (on GTB-owned land)
- There are four (4) road/stream crossings in Peshawbestown over Belanger Creek; near North Roubal Road/ E. Pobuda Road and N. Peshawbestown Road with “moderate” to “severe” condition ratings. If these road/stream crossings failed due to high creek levels, it would prevent access to tribal development/land along these roads.
- Community Survey response: *“Many local dams and road stream crossings were designed and constructed decades ago and under hydrologic regimes that are now rapidly shifting towards more frequent and of higher intensity. Further, many stormwater and wastewater systems are also rapidly becoming outdated given these climate related hydrologic regime shifts. Much more funding needs to be directed towards assessment and re-design and construction of substandard infrastructure.”*
- Acme Creek and surrounding GTB lands between railroad corridor and M-72 in Grand Traverse County was also identified as a flood hazard area.

### **Tornado – relatively low risk, high impact**

The new Herkner Road residential development on GTB land in Garfield Township, Grand Traverse County, is expected to be completed in 2024 with up to 193 residential units; some of those units will have basements; some will be constructed with slab-on-grade foundations. With the expected increase in GTB residents in this area, a tornado mitigation strategy is to utilize the Community Center that will be built as part of the development as a designated storm shelter for residents.

All other residential developments on GTB lands have designated tornado storm shelters. A tornado siren is located in Peshawbestown by the pow-wow grounds.

### **Extreme Heat/Cold; Drought; Wildfire – relatively low risk, medium impact**

- Increased risk of wildfire or drought with extreme heat
- Damage to crops, forests; affects the health of livestock
- All GTB communities and developed areas are somewhat vulnerable to wildfires since GTB community/economic centers and rural residential developments interface with areas of pine forest, which are more vulnerable to fire than other tree species.
- Community Survey Response: *“Renewable energy / energy independence would benefit the tribe. Existing buildings are older and may not be the most energy efficient.”*
- GTB has the following groundwater wells that could be affected by excessive water usage during extreme heat or a drought: 3 at Turtle Creek Casino (Grand Traverse County); 3 in Peshawbestown; 2 at Grand Traverse Resort (Grand Traverse County); 2 for farmland irrigation use
- Strain on power grid from high power demand from air conditioning use
- Provide heating/cooling shelters and welfare checks for vulnerable populations

### **Coastal Hazards – Coastal Recession and Shoreline Flooding – relatively low risk, high impact**

- 3 areas of concern (GTB structures) regarding flooding/erosion along the shoreline in Peshawbestown; one is near a gas station – possible contamination source if impacted by rising lake levels
- FEMA FIRM Panel 286E for Suttons Bay Township/Peshawbestown indicates that the Arthur Duhamel Marina docks, breakwall, and some land (but no structures) are located within SFHA “AE”, with a base flood elevation of 584 feet.
- FEMA FIRM Panel 288E and 286E indicates land along the entire shoreline of West Grand Traverse Bay is in SFHA “AE”, with a base flood elevation of 584 feet.

### **Coastal Hazards – Dangerous Currents, Seiche, Waterspout – relatively low risk, but high impact**

The GTB operates two commercial marinas on Lake Michigan – the Arthur Duhamel Marina in Peshawbestown, and one on Beaver Island (Charlevoix County). Fishing boats, as well as Tribal government employees conducting work on the Lake Michigan (for natural resource management purposes, for example), may encounter waterspouts, particularly during the time of year they are most likely to occur (August through October).

A mitigation strategy for the GTB marine operators and beach visitors 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. The mobile emergency alert system service offered by GTB, “*Regroup*”, can also be utilized as an informational source for waterspout forecasts and warnings.

### **Public Health Emergency – high impact**

#### • Shortcomings/ Problems in response to Pandemic

- Located so far “up north” that they didn’t have the resources and equipment needed to service large populations of sick people
- Exposed reliability on Munson Healthcare hospitals – limited capacity of beds
- They typically do not stockpile resources because they do not have the funds to do so.
- Munson – mental stress on workers, constantly changing COVID protocols.
- Effects of isolation, work stress...increased behavioral health problems in the community. There is a lack of mental health resources to support everyone.
- This was a long process and taxed EM/Healthcare workers with protocol changes; difficult to inform people of what recommendations and rules were as they changed frequently.
- The economic impact from reduced services/shutdown on businesses, housing, and EMS/healthcare. Need to plan for sustainability in these areas in a future scenario.
- Still dealing with supply chain issues – vehicles and equipment down in EMS/Fire/Road Commission fleet because can’t get repair parts.

#### • What Worked Well in response to Pandemic

- Benzie-Leelanau Health Dept. testing and vaccination clinics – set up and service delivery – positive feedback
- GTB – Health Dept. – positive feedback on vaccination and testing clinics and case monitoring. Collaboration with local, state, and federal partners.
- Specific fire/EMS teams were dispatched to handle emergencies that were COVID-related. Had ambulances set up to only handle COVID patients.
- They had never gone through this public health scenario before but they got what they needed.
- Had agreements and good coordination with other EMS departments for staffing – could share staff if one dept. was short staffed. Also coordinated with use and sharing of COVID-specific ambulances.
- Municipalities managed to the election process with health protocols
- Zoom meetings improved communication processes and will continue to be used in combination with in-person meetings
- Community Survey Response: “*Internet service needs to be improved in Peshawbestown as well as other rural areas.*”

### **Invasive Species**

- Crowding out forests; Woolly adelgid is a threat to Eastern hemlock; other pests and diseases that affect ash, beech, maple trees
- Considering what trees from southern latitudes to plant up here because they are adapted to our current climate. Half of the native plant species that were here 30 years ago are gone due to climate change.
- Aquatic invasives damaging the Great Lakes ecosystem/local fishing.
- Fisheries – invasive mussels; algal bloom on lake bottom causes fish not being able to spawn.

## VI. Goals and Objectives

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

Specific goals and objectives have been established based upon the community's natural hazards analysis, as well as input from the Task Force participants and the public through meetings, request for comments on the draft plan, and the presentation of the plan to the Local Emergency Planning Team. These goals remain essentially unchanged as compared to the goals listed in section IX of the Tribe's 2016 Natural Hazard Mitigation Plan.

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

- Encourage cooperation and communication between planning and emergency management officials
- Encourage additional local governmental agencies to participate in the natural hazards mitigation process
- Encourage public and private organizations to participate
- Encourage use of the "Firewise Communities Program" ([www.firewise.org](http://www.firewise.org)) which offers both workshops and web-based interactive training geared toward homeowners, forestry professionals, firefighters and others on a variety of wildfire safety topics.

### **Goal 2: Integrate natural hazards mitigation considerations into other community planning processes**

- Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures; and into the county's comprehensive master plan
- Incorporate natural hazards mitigation into basic land use regulation mechanisms
- Update or create zoning ordinances to reflect any new building codes, shoreline protection rules, etc.
- Incorporate natural hazard area classifications into standard zoning classifications
- Develop community education and warning systems
- Integrate natural hazards mitigation into the capital improvement planning process so that public infrastructure does not lead to development in natural hazard areas
- Encourage county agencies to review local roads, bridges, dams, and related transportation infrastructure for natural hazards vulnerability

### **Goal 3: Utilize available resources to apply for future natural hazard mitigation grants or partnerships**

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

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

- Encourage public and business involvement in natural hazards mitigation projects

### **Goal 5: Protect human life from the impacts of natural hazards through planning and preparedness efforts**

### **Goal 6: Ensure uninterrupted government and emergency functions in a disaster**

### **Goal 7: Increase public awareness on being prepared before, during and after a disaster, when essential services may not be available**

## VII. Mitigation Strategies and Priorities

### Types of Mitigation Actions

Mitigation strategies are agency-specific actions intended to reduce the risk to natural hazards and disasters. FEMA's standard tribal mitigation plan requirements include identifying and analyzing 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 Planning and Regulations
- Building and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Programs

Furthermore, a set of evaluation criteria was developed to determine which mitigation strategies were best suited to address the identified problems for the GTB Tribe.

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

### Existing Tribal Pre- and Post-Disaster Hazard Management Capabilities

#### *Emergency Warning System Coverage*

- The GTB Department of Emergency Management offers GTB members the ability to sign up for “Regroup” emergency alert system, which allows members to receive SMS, email and voice emergency alerts. Leelanau County currently utilizes the “Rave” mass notification system for notification of tornado warnings and watches, along with other severe weather alerts. The system notifies a participant via their mobile or land-line phone. The National Weather Service may concurrently utilize their notification system when deemed necessary in severe weather event situations to send phone notifications to all users within signal of a cellular tower.
- The GTB makes regular updates to their Tribal website and Facebook page.
- Leelanau County utilizes the RAVE Mobile Alert System and IPAWS (Integrated Public Alert and Warning System - 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.)
- Radio warning system: Leelanau County uses radio channels 580 AM and 103.5 FM for emergency weather alerts.
- Tornado/Severe Weather Systems: Manual severe weather warning sirens are located at fire departments: Suttons Bay, Leland, Elmwood, Northport, Cedar, and Glen Lake; there is also and one warning siren located in Peshawbestown at the Pow-Wow Grounds on Stallman Road for the Grand Traverse Band of Ottawa and Chippewa Indians. The Leelanau County Emergency Management Office Dispatch Center conducts monthly tests on the sirens between April 1<sup>st</sup> to October 1<sup>st</sup> every year. Annual community notifications of siren tests are placed in the GTB newsletter in March and October. The GTB Tribal Government conducts annual tornado, inclement weather and fire drills.



- Flood warning system: The Leland Dam has an alarm and monitoring system for dam failure/flooding; other dams in Leelanau County do not.

*Shelters*

Table 38. GTB Tornado/Severe Weather Shelter Sites

#	Tornado Shelter	Location	Address	County
1	Elder's Complex	West side of Elder's Complex (behind complex)	11201 Ki-Dah-Keh Road – behind	Leelanau
2	Elder's Complex	East side of Elder's Complex (near cul-de-sac in front)	11201 Ki-Dah-Keh Road – front	Leelanau
3	Peshawbestown	Peshawbestown Road, near the Natural Resources weather monitoring station	2809 NW Bay Shore Drive	Leelanau
4	Antrim	Near playground area	Wiingash-Mi-kun, Rapid City	Antrim
5	Benzie	Near the Pow-Wow grounds at the Benzie Satellite Office	7282 Hoadley Rd., Benzonia	Benzie
6	Charlevoix	Near playground area by the Charlevoix Satellite Office	10085 Wa-Ba-Noong Mi-Kun, East Jordan	Charlevoix

The Leelanau Sands Casino, located on the GTB Reservation in Peshawbestown, serves as an important larger-sized shelter location amongst the other 14 temporary shelter sites in Leelanau County (Table 39).

Table 39. Shelter Sites Coordinated by the Leelanau County Office of Emergency Management

Emergency Shelter Site Name	Street Address	City	ZIP	Generator (Y/N)	Overnight Accommodations (Y/N)
<b>Cedar Area Fire &amp; Rescue</b>	8907 S. Railroad Avenue	Cedar	49621	Yes	No
<b>Elmwood Township Fire &amp; Rescue</b>	10090 E. Lincoln Road	Traverse City	49684	Yes	No
<b>Empire Township Hall</b>	10088 W. Front St.	Empire	49630	Yes	No
<b>Glen Lake Community Library</b>	10115 W. Front St.	Empire	49630	Yes	No
<b>Glen Lake Fire Department</b>	6401 W. State Street	Glen Arbor	49636	Yes	No
<b>Leland Township Fire &amp; Rescue</b>	503 S. Grand Avenue	Leland	49654	Yes	No
<b>Leelanau Township Fire Department</b>	100 W. 8 <sup>th</sup> Street	Northport	49670	Yes	No
<b>Suttons Bay-Bingham Fire &amp; Rescue</b>	201 S. St. Mary's Street	Suttons Bay	49682	No	No
<b>Leelanau Sands Casino</b>	2521 N. West Bay Shore Drive	Peshawbestown	49682	Yes	No
<b>Northport Public School</b>	104 S. Wing Street	Northport	49670	Yes	No
<b>Leland Public School</b>	200 N. Grand Avenue	Leland	49654	Yes	No
<b>Suttons Bay Public School</b>	500 S. Elm Street	Suttons Bay	49682		No
<b>Glen Lake Public School</b>	3375 W. Burdickville Road	Maple City	49664	Yes	No
<b>VFW Post 7731</b>	7475 E. Duck Lake Road	Lake Leelanau	49653	No	No
<b>Cedar/Maple City Lions Club</b>	100 E. Bellinger Road	Maple City	49664	No	No

### *Tribal Law and Planning Mechanisms*

The GTB Natural Resources Department issues Soil Erosion and Stormwater Runoff Control permits for construction on GTB lands. Earth changes requiring a soil erosion and stormwater runoff control permit from the enforcement officer(s) designated by the Tribal Council have the following requirements under the GTB Legal Code:

- (1) Earth changes connected with any of the following activities which disturb land within 500 feet of a lake or stream, except for normal maintenance:
  - (A) Transportation facilities, including streets, access roads, railroads, airports, common carrier pipelines, and mass transit facilities, except normal maintenance procedures such as earth or gravel road leveling and minor repairs or alterations to rights-of-way not affecting a lake or stream.
  - (B) Site preparation for a single-family residence and multiple family residential developments.
  - (C) Tribal buildings and service facilities, including but not limited to government buildings and facilities, commercial buildings, schools, vehicle maintenance facilities, and salt storage facilities.
  - (D) Recreational facilities, including but not limited to parks, golf courses, beaches above the ordinary high water mark, campgrounds or trails, including Tribal or private facilities.
  - (E) Utilities, including but not limited to underground pipelines or cables, except pole installation, service line and other earth changes of a minor nature, and emergency repairs.
  - (F) Oil, gas, and mineral wells. Access roads to well production sites shall be subject to permit requirements.
  - (G) Non-agricultural water impoundments and waterway construction or improvements.
  - (H) Logging activities including access roads, except the principal area where the trees are being cut.
  - (I) Mining activities including access roads, except the principal area where minerals are being removed.
  - (J) Earth changes on agricultural lands, including road construction and building construction, but not including plowing and tilling of soil for the purpose of crop production.
- (2) Earth changes for environmentally-sensitive residential sites.
- (3) Industrial or commercial use development sites, regardless of size, location, or environmental sensitivity.
- (4)
  - (A) All developments which includes housing, commercial, subsidiary enterprises, individual or other entity developments within the Tribe's jurisdiction regardless of size, location, or environmental sensitivity.
  - (B) All multi-family developments regardless of size, location or environmental sensitivity.
- (c) Identification of Environmentally-Sensitive Sites.
  - (1) Tribal land owners and lessees are responsible for determining whether their sites are environmentally-sensitive as defined in this ordinance (§ 302(u)).
  - (2) The Tribal administration and/or the county conservation district shall be requested to provide assistance to land owners and lessees in identifying earth changes and environmentally-sensitive sites subject to review by the enforcement officer(s) designated by the Tribal Council.

In March of 2020, the GTB enacted a Tribal Emergency Meetings Act. The purpose of this ordinance is to ensure that the Tribe's business can continue to be conducted by the Tribal Council in an open and public manner and subject to review by Tribal members in the case of a declared emergency. The Act defines the term "emergency" as "an emergency that is lawfully declared by the Tribal Chairperson pursuant to the Emergency Operation Guide, Basic Plan, as the Plan is established in accordance with the Tribe's Emergency Management Resolution, 02-20.1121, or its successor or by declaration of an emergency by the President of the United States."

The GTB Fire and Rescue Department issues directives to individuals employed by the GTB, its enterprises, businesses and subsidiaries to act in compliance of the National Fire Protection Association Code (adopted by the GTB) for all structures certified for occupancy.

#### 2012 Peshawbestown Master Plan Recommendations:

- Because its sovereign status exempts the Tribe from state zoning and planning enabling legislation, the preparation of a site and building guidelines code should be considered to regulate development activity in the future. This action would ensure that as properties are developed that the same site amenities (lighting, parking, signage, landscaping, etc.) and architectural details would be followed. This will provide some uniformity and consistency when build-out occurs. It is suggested that separate guidelines be prepared for the business and entertainment district, residential neighborhoods, and the commercial district at Putnam and M-22.
- To encourage the use of sustainable design techniques the guidelines should include provisions for low impact stormwater design, dark-sky lighting, and reduction of heat islands (parking lots).
- The Master Plan includes a map of buildable areas for that are suitable future development. These include areas that have slopes less than 18%, and do not have the presence of wetlands.

#### 2011 GTB Long-Range Transportation Plan Goals & Strategies:

- Ensure improvements will account for overall public safety for services such as EMS, school buses, snow plows, and police/fire, but at a scale that is not excessive.

- Minimize impacts to natural features such as woodlands, wetlands and steep slopes along transportation corridors.

#### 2010 GTB Natural Resource Management Plan Recommendations and Guiding Principles:

- Use community knowledge in NRD Management.
  - Pursue land preservation, acquisition and preservation opportunities
- Collaborate and sustain inter-departmental relationships
  - Economics: Protect ecological and culturally important areas through zoning and planning
  - Elders/Culture: Utilize cultural guidance for management and planning of programs especially seed and harvest activities
  - Language: Integrate Anishinaabemowin and concepts into management and programs
  - Community Health: Involve in development of native seeds and community garden program.
- Collaborate and communicate with other tribes, units of governments, NGOs and public.
  - Partner with Federal Departments.
  - Approach State of Michigan for co-management and access to healthy lands.
  - Develop and implement management recommendations.
  - Restore stream banks.
  - Repair road stream crossings and in stream habitats.
  - Restore desirable pool, riffle, run ratios.
  - Install in stream structures such as Large Woody Debris and substrate hardening.
  - Change, restore and improve landscape features to benefit both flora and fauna that depend on each other to function properly.
  - Establish and maintain cool/cold water culture production facilities for species (e.g. walleye and native salmonoids).

The 2008 Renewable Energy Feasibility Study in Wind, Biomass and Solar for the Grand Traverse Band of Ottawa and Chippewa Indians determined how to maximize renewable resources leading towards a path of energy sovereignty. The study concluded public facilities and housing districts provide the next best renewable energy opportunities where smaller biomass district heating plants can be installed in conjunction with home and neighborhood solar hot water heating systems. Peshawbestown residential areas and administrative facilities present opportunities for biomass heating plants. The tribe can generate electricity for self-supply but will require forming its own electric utility and establishing the basis for delivery, metering, billing and servicing its own facilities and contiguous residents. Unless GTB generated electricity has a lower cost than the market price, tribal facilities and residences will not economically benefit.

#### *GTB Natural Resources Department – Inland Management Responsibilities Related to Hazard Mitigation*

- Develop and foster working relationships with Federal and State agencies to improve management efficiency,
- Develop resource use agreements, and improve productive communication with other resource management agencies.
- Conduct wildlife harvest monitoring; including deer check stations, furbearer registrations, and other special inspections of harvested fish and game.
- Conduct fisheries and wildlife habitat surveys, inventories, and assessments.
- Maintenance of the Tribal Repository/Exercise of American Indian Religious Freedom Act
- GPS Mapping and Technical Assistance
- Plant, Insect, and Fish Identification
- Public Outreach and Education (including Natural Resources Fair and Feast, Kids Free Fishing Days, fishery survey reports to membership, lake associations, and watershed committees)
- Scuba Diving (Advanced Open Water) Underwater Search and Recovery
- Grant writing and administration for resource protection, restoration, and enhancement projects with particular emphasis on collaborative projects

#### *County/State Statutory Hazard Prevention Mechanisms*

Individual county building departments complete building and trade inspections for all GTB-owned building projects within the six-county service area. Permits related to water well and septic systems are issued by the Benzie-Leelanau District Health Department (Benzie and Leelanau Counties); Grand Traverse County Health Department; Health Department of Northwest Michigan (Charlevoix and Antrim Counties); or District Health Department #10 (Manistee County).

## Mitigation Strategies

Strategies were developed based on discussions with the Task Force and the GTB Tribal Council, 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, Electric Service & Communications 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 D provides a review of mitigation strategies included in the 2016 plan, their current status, and how they have or have not been incorporated into the 2023 plan. The assigned priority levels for the 2016 strategies are also compared to what the 2023 plan has assigned for them. The 2016 plan identified the top four most significant priority areas based largely on local knowledge regarding tribal assets, lands, hazards, risks, and vulnerabilities. The general rationale used to determine the priority levels of strategies in the 2023 plan differs, and is described on page 100.

## Implementation of the Strategies

To assist with the funding and/or enacting of the proposed natural hazards mitigation strategies, the following pages contain a table of potential resources that can help fund, staff or 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.

Some of the funding sources and partnerships that have previously been utilized by the GTB for hazard mitigation actions/projects include:

- Partnered with the non-profit Conservation Resource Alliance, along with local, state and federal agencies, to remove dilapidated dams on the Boardman River (Grand Traverse County) and restore the river to its natural flow.
- Partnering with the Grand Traverse Regional Land Conservancy, The Watershed Center of Grand Traverse Bay, and Conservation Resource Alliance to continuously monitor and work to improve the water quality of Mitchell Creek on the nature preserve. The Mitchell Creek watershed is a critically important tool for safeguarding water quality in East Grand Traverse Bay.
- In 2018, local middle-schoolers planted 500 trees provided by the GTB's Natural Resources Department at the Leelanau Conservancy's DeYoung Natural Area. The collaboration was part of GTB's goal to plant native-to-Michigan nuts and fruits species to create landscapes that provide the opportunities for tribal citizens and the wider community to gather healthy foods, to benefit wildlife, to improve water quality, and to adapt to climate change.
- The GTB was awarded FEMA hazard mitigation grant program funding in May 2005 for the construction of storm shelters on tribal lands in Antrim, Benzie, Charlevoix and Leelanau counties. The project was completed in August 2008 with a total cost of \$76,500.

## Resources List for GTB Tribe 2023 Hazard Mitigation Strategies

ID	Resource	Description	Website	Hazard Type
A	<b>Grand Traverse Band of Ottawa and Chippewa Indians</b>	Human resources include Tribal staff and members, including Emergency Manager. Monetary funding resources for tribal government operations discretionary programs include: the U.S Bureau of Indian Affairs (provides services directly or through contracts, grants, or compacts to 574 Federally recognized tribes); BIA Indian Health Service self-governance funding; federal ARPA funds; reimbursements from the GTB Economic Development Corporation; and internal tribal resources.	<a href="http://www.gtbindians.org/">http://www.gtbindians.org/</a>	All hazards
B	<b>Antrim County Government</b>	County staff including Emergency Management	<a href="https://www.antrimcounty.org/departments_services/_emergency_services/index.php">https://www.antrimcounty.org/departments_services/_emergency_services/index.php</a>	All hazards
C	<b>Benzie County Government</b>		<a href="https://www.benzieco.net/departments/emergency_operations_management/index.php">https://www.benzieco.net/departments/emergency_operations_management/index.php</a>	All hazards
D	<b>Charlevoix County Government</b>		<a href="https://www.charlevoixcounty.org/charlevoix_county_sheriff/emergency_management.php">https://www.charlevoixcounty.org/charlevoix_county_sheriff/emergency_management.php</a>	All hazards
E	<b>Grand Traverse County Government</b>		<a href="https://www.gtcountymi.gov/278/Emergency-Management">https://www.gtcountymi.gov/278/Emergency-Management</a>	All hazards
F	<b>Leelanau County Government</b>		<a href="https://www.leelanau.gov/emergencymgmt.asp">https://www.leelanau.gov/emergencymgmt.asp</a>	All hazards
G	<b>Manistee County Government</b>		<a href="https://www.manisteecountymi.gov/275/911-Dispatch">https://www.manisteecountymi.gov/275/911-Dispatch</a>	All hazards
H	<b>Little River Band of Ottawa Indians</b>		Tribal staff including Incident Commander	<a href="https://lrboi-nsn.gov/">https://lrboi-nsn.gov/</a>
I	<b>Leelanau County Local Emergency Services and Fire Departments</b>	GTB Fire & Rescue (Suttons Bay Twp.); Cedar Area Fire & Rescue (Solon Twp.); Elmwood Charter Township Fire & Rescue; Traverse City Fire Station (Elmwood Twp.); Glen Lake Fire & Rescue (Glen Arbor Twp.); Leland Township Fire & Rescue (Leland); Lake Leelanau Fire Station (Leland Twp.); Leelanau Township Fire Department; Suttons Bay-Bingham Township Fire & Rescue; Empire Fire Dept. (Village of Empire)	-	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Wildfire; Flooding; Extreme Temperatures; Public Health Emergency
J	<b>GTB Human Services Department</b>	Promotes community self-sufficiency, and physical and mental well-being for Tribal members residing within the six-county service area through direct service provision, education, and community involvement within the spirit of self-governance.  Income-eligible GTB households receive financial assistance through LIHEAP, RAO, ARPA, and CSBG. Income-eligible Federally recognized tribal members are eligible for assistance through LIHEAP and CSBG.  Emergency Heating Assistance Food purchase order to select stores Weatherization Emergency food pantry Community Food Rescue on Mondays	<a href="https://www.gtbindians.org/human_services.asp">https://www.gtbindians.org/human_services.asp</a>	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency
K	<b>"MI HOPE" Grants (Michigan Housing Opportunities Promoting Energy Efficiency)</b>	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.	<a href="http://www.michigan.gov/mi-hope">www.michigan.gov/mi-hope</a>	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency
L	<b>Northern Michigan Community Action Association (NMCAA)</b>	Weatherization Assistance Program and Emergency Home Repair Program for low- to moderate- income households.	<a href="https://www.nmcaa.net">https://www.nmcaa.net</a>	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency
M	<b>GTB Health Services Department</b>	Family Practice Medical Clinic; Virtual Care; Community Health Representatives; Dental Clinic; Optical Services; Immunizations; Special Diabetes Program for Indians	<a href="https://www.gtbindians.org/health_services.asp">https://www.gtbindians.org/health_services.asp</a>	Public Health Emergency

N	<b>Benzie-Leelanau District Health Department</b>	Provide programs and services in Benzie and Leelanau County: immunizations; community clinics; school health services; permitting processes for proper location and installation of water wells and septic systems; education about cleaning, monitoring and maintaining septic systems; septic or well repair financial assistance, point of sale (POS) evaluation, and the inspection and licensing of food service establishments.	<a href="https://www.blhd.org/">https://www.blhd.org/</a>	Flooding; Extreme Temperatures; Public Health Emergency
O	<b>Grand Traverse County Health Department</b>	Services include immunizations; communicable disease case reporting, follow-up, prevention, and education in our community; dental health services; help with basic services like food, housing or transportation to medical appointments through the Northern Michigan Community Health Innovations Region's Community Connections program; On-site well and sewage disposal permits.	<a href="https://www.gtcountymi.gov/2211/Health">https://www.gtcountymi.gov/2211/Health</a>	Flooding; Extreme Temperatures; Public Health Emergency
P	<b>Health Department of Northwest Michigan (HDNW)</b>	Provide programs and services in Charlevoix and Antrim Counties: immunizations; community clinics; school health services; permitting processes for proper location and installation of water wells and septic systems; education about cleaning, monitoring and maintaining septic systems; septic or well repair financial assistance, and the inspection and licensing of food service establishments.	<a href="https://www.nwhealth.org/">https://www.nwhealth.org/</a>	Flooding; Extreme Temperatures; Public Health Emergency
Q	<b>District Health Department #10</b>	Service area includes Manistee County. 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; education about cleaning, monitoring and maintaining septic systems; septic or well repair financial assistance, and the inspection and licensing of food service establishments.	<a href="https://www.dhd10.org/">https://www.dhd10.org/</a>	Flooding; Extreme Temperatures; Public Health Emergency
R	<b>GTB Elders Program</b>	Provides assistance to Tribal Elders so they can live independently and have a healthy lifestyle. Services include home delivery meals; farmer's market coupons; caregiver assistance program; Elders emergency fund program; technology education	<a href="https://www.gtbindians.org/elders.asp">https://www.gtbindians.org/elders.asp</a>	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency
S	<b>Leelanau County Senior Services (LCSS)</b>	A person must be 60 years of age or older and a resident of Leelanau County to be eligible for services. LCSS offers an emergency pendant called the "Freedom Alert". A person wears a small pendant with an emergency call button on it. When there is an emergency, the button is pressed; 9-1-1 is dialed automatically. There is no monitoring fee, service charges or contract. There is a one-time cost to purchase the system. Please contact the LCSS office regarding cost, financial assistance may be available. LCSS also offers a File of Life and the Medical Equipment Loan Closet free of charge. Seniors may receive assistance in paying for snow removal from their driveways/walkways. Other services include: Personal Care; Respite Care; Medication Management; Homemaking; Dental, Eyeglass or Hearing Aid Assistance; Heating/Utility Bill Payment Assistance; Legal Assistance; Unmet Needs Assistance (assistance with unpaid medical, safety related repairs/house/car). Financial assistance for these programs is available to seniors who meet LCSS's income and asset guidelines.	<a href="https://www.leelanau.gov/lcssprograms.asp">https://www.leelanau.gov/lcssprograms.asp</a>	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures; Public Health Emergency
T	<b>Midwest Agriculture Climate Team</b>	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.	<a href="https://www.climatehubs.usda.gov/hubs/midwest/topic/midwest-agriculture-climate-team-mac-t">https://www.climatehubs.usda.gov/hubs/midwest/topic/midwest-agriculture-climate-team-mac-t</a>	Drought, Extreme Temperatures, Flooding, Severe Winter Weather, High Winds, Hail
U	<b>NWS Climate Prediction Center</b>	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).	<a href="https://www.cpc.ncep.noaa.gov/products/Drought/">https://www.cpc.ncep.noaa.gov/products/Drought/</a>	Drought
V	<b>National Fire Protection Association</b>	Firewise USA Program: Each applicant must create a board/committee, complete a community wildfire risk assessment with a 3-year action plan to reduce ignition risk to homes, and complete annual educational and risk reduction actions identified in the plan. Also training on Assessing Structure Ignition Potential from Wildfire.	<a href="https://www.nfpa.org/">https://www.nfpa.org/</a>	Wildfire, Drought

W	<b>NFPA Community Wildfire Defense Grants</b>	Communities can use these grants from the USFS in a variety of ways to reduce the wildfire risk to people and property. One key use is capacity building for wildfire mitigation. For example, communities can use the grants to support the implementation and enforcement of wildfire-related codes and standards; to train people to assess wildfire risk and implement effective mitigation measures; and to perform outreach to community members through programs like Firewise USA®. Communities that build these fundamentals—sound land use and building practices, a skilled workforce, and an educated public—will be better prepared for sustained and effective risk reduction and better equipped to take advantage of future federal grants that prioritize communities with codes in place.	<a href="https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire">https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire</a>	Wildfire, Drought
X	<b>FEMA Assistance to Firefighters Grants Program</b>	Fire safety grants fund critically needed resources to equip and train emergency personnel, enhance efficiencies and support community resilience. Grants help firefighters and other first responders obtain critically needed resources necessary for protecting the public and emergency personnel from fire and related hazards. Staffing for Adequate Fire and Emergency Response (SAFER) grants fund fire departments and volunteer firefighter interest organizations directly to help them increase capacity in their communities. Fire Prevention & Safety (FP&S) grants support projects that enhance the safety of the public and firefighters from fire and related hazards	<a href="https://www.fema.gov/grants/preparedness/firefighters">https://www.fema.gov/grants/preparedness/firefighters</a>	Wildfire
Y	<b>US Department of the Interior (US DOI) Bureau of Indian Affairs (BIA) Division of Wildfire Management Programs</b>	<p><b>Hazardous Fuels Reduction</b> The Fuels Management Program works with the Bureau of Indian Affairs (BIA) 12 regional offices, local BIA agencies and Tribes to reduce wildfire risk through management of natural and invasive fuels. Hazardous fuels reduction treatments include prescribed fire, mechanical treatments (such as thinning, regeneration cuts, pruning, mastication, and chipping) and the careful use of natural fire.</p> <p><b>Traditional Ecological Knowledge</b> TEK is a body of observations, oral and written knowledge, practices, and beliefs that promote environmental sustainability and the responsible stewardship of natural resources through relationships between humans and environmental systems, applied across biological, physical, and cultural systems. BIA staff work alongside Tribes to blend traditional ecological knowledge with a scientific approach in their fuels management efforts.</p> <p><b>Reserved Treaty Rights Lands Program</b> The RTRL program facilitates collaborative projects between Tribal trust and non-Tribal land managers. The RTRL program's intent is to provide Tribes the opportunities to conduct Tribally-determined project work on ancestral lands regardless of ownership to enhance the health and resiliency of priority Tribal natural resources with high risks of wildland fire.</p>	<a href="https://www.bia.gov/service/fuels-management">https://www.bia.gov/service/fuels-management</a>	Wildfire, Drought
Z	<b>US DOI BIA Tribal Energy Development Capacity Grant</b>	<p>Every year, the BIA's Division of Energy and Mineral Development provides the opportunity for Tribes to receive financial assistance to establish the legal framework for developing and regulating their energy resources.</p> <p><b>Development Activities Eligible for Funding</b> Developing the legal infrastructure to create any type of Tribal energy business Establishing an energy-focused corporation under Tribal or state incorporation codes Establishing an energy-related Tribal business charter under federal law (IRA Section 17 corporation) Learn more about choosing a Tribal business structure</p> <p><b>Regulatory Activities Eligible for Funding</b> Developing or enhancing tribal policies, codes, regulations, or ordinances related to energy resource, including land-lease regulations in accordance with the Helping Expedite and Advance Responsible Tribal Homeownership (HEARTH) Act for energy development purposes or for business purposes connected to an energy project Establishing a Tribal utility authority (TUA) Adopting secured transaction codes and a subsequent joint power agreement with a state government</p>	<a href="https://www.bia.gov/service/grants/tedc">https://www.bia.gov/service/grants/tedc</a>	Severe winter weather, thunderstorm, lightning, hail, high winds, tornado, flooding, extreme heat
AA	<b>National Weather Service Education</b>	Outreach and education materials for school children and adults.	<a href="https://www.weather.gov/education/outreach">https://www.weather.gov/education/outreach</a>	Severe winter weather, thunderstorm, lightning, hail, high winds, tornado, flooding, extreme heat/cold, drought

BB	<b>Cherryland Electric Cooperative</b>	Cherryland Electric is a regional cooperative that provides electric service to the majority of Leelanau County. A power outage map is available to track outage locations.	<a href="https://cherrylandelectric.coop/outage/">https://cherrylandelectric.coop/outage/</a>	All hazards
CC	<b>Consumer's Energy Utility Service</b>	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.	<a href="https://www.consumersenergy.com/outage-map">https://www.consumersenergy.com/outage-map</a>	Severe winter weather; Thunderstorm, High Winds, Hail, Tornado, Lightning; Flooding; Extreme Temperatures
DD	<b>Michigan High Speed Internet Office</b>	Information on plans and funding opportunities to increase high speed internet service in Michigan.	<a href="https://www.michigan.gov/leo/bureaus-agencies/mihi">https://www.michigan.gov/leo/bureaus-agencies/mihi</a>	All hazards.
EE	<b>Connected Nation Michigan</b>	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.	<a href="https://connectednation.org/michigan/">https://connectednation.org/michigan/</a>	All hazards.
FF	<b>The Federal Communication Commission's Affordable Connectivity Program</b>	<p>An FCC program to help families and households struggling to afford internet service during the COVID-19 pandemic. This new benefit will connect eligible households to jobs, critical healthcare services, virtual classrooms, and so much more.</p> <p>The Emergency Broadband Benefit will provide a discount of up to \$50 per month towards broadband service for eligible households and up to \$75 per month for households on qualifying Tribal lands. Eligible households can also receive a one-time discount of up to \$100 to purchase a laptop, desktop computer, or tablet from participating providers if they contribute more than \$10 and less than \$50 toward the purchase price. The Emergency Broadband Benefit is limited to one monthly service discount and one device discount per household. A household is eligible if a member of the household meets one of the criteria:</p> <p>Has an income that is at or below 135% of the Federal Poverty Guidelines or participates in certain assistance programs, such as SNAP, Medicaid, or Lifeline; Approved to receive benefits under the free and reduced-price school lunch program or the school breakfast program, including through the USDA Community Eligibility Provision in the 2019-2020, 2020-2021, or 2021-2022 school year; Received a Federal Pell Grant during the current award year; Experienced a substantial loss of income due to job loss or furlough since February 29, 2020 and the household had a total income in 2020 at or below \$99,000 for single filers and \$198,000 for joint filers; or Meets the eligibility criteria for a participating provider's existing low-income or COVID-19 program.</p>	<a href="https://www.fcc.gov/broadbandbenefit">https://www.fcc.gov/broadbandbenefit</a>	All hazards.
GG	<b>"Lifeline" program provided by the Universal Service Administrative Co.</b>	Lifeline is a federal program that offers a monthly benefit of up to \$9.25 towards phone or internet services for eligible subscribers (up to \$34.25 for those living on Tribal lands). A consumer can qualify for the Lifeline benefit if their income is 135% or less than the federal poverty guidelines, or if they participate in SNAP, Medicaid, or other federal programs.	<a href="https://www.usac.org/lifeline/">https://www.usac.org/lifeline/</a>	All hazards.
HH	<b>Great Lakes Shoreviewer Tool</b>	View aerial imagery of Lake MI shoreline and associated risk levels for coastline, infrastructure/roads, and buildings.	<a href="http://www.greatlakesshoreviewer.org/">http://www.greatlakesshoreviewer.org/</a>	Shoreline flooding and erosion
II	<b>LIAA's Northwest Lower MI Coastal Resilience Atlas</b>	Mapped coastal flooding and coastal erosion based on three future climate scenarios for communities adjoining Lake MI; areas of the shoreline population, by census tract, that are most vulnerable to extreme heat events.	<a href="http://www.resilientmichigan.org/nw_atlas.asp">http://www.resilientmichigan.org/nw_atlas.asp</a>	Shoreline flooding and erosion, Extreme Heat
JJ	<b>State-designated high-risk erosion areas: programs and maps</b>	High risk erosion areas are those shorelands of the Great Lakes where recession of the landward edge of active erosion has been occurring at a long-term average rate of one foot or more per year, over a minimum period of 15 years.	<a href="https://www.michigan.gov/egle/about/organization/water-resources/shoreland-management/high-risk-erosion-areas">https://www.michigan.gov/egle/about/organization/water-resources/shoreland-management/high-risk-erosion-areas</a>	Shoreline erosion



KK	Michigan EGLE's Coastal Zone Management Program	A plethora of resources to improve coastal and climate resiliency through both planning and best management projects.	<a href="https://www.michigan.gov/egle/about/organization/water-resources/coastal-management">https://www.michigan.gov/egle/about/organization/water-resources/coastal-management</a>	Shoreline flooding and erosion
LL	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.	<a href="https://www.mcgi.state.mi.us/wetlands/mcqiMap.html">https://www.mcgi.state.mi.us/wetlands/mcqiMap.html</a>	Flooding, drought, extreme temperatures
MM	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.	<a href="https://www.greatlakeswatersafety.org/">https://www.greatlakeswatersafety.org/</a>	Coastal Hazards - rip currents
NN	FEMA Floodplain Management Resources for Local Government Officials	How to participate with the NFIP and tools and resources to provide higher standards for floodplain management.	<a href="https://www.fema.gov/floodplain-management/manage-risk/local">https://www.fema.gov/floodplain-management/manage-risk/local</a>	Inland and coastal flooding
OO	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. <ul style="list-style-type: none"> <li>▪ \$800 million available in funding for FY22</li> <li>▪ Application Period: September 30, 2022, to January 27, 2023</li> <li>▪ Period of Performance: 3 Years</li> <li>▪ Cost-share: 25% non-federal</li> <li>▪ Severe Repetitive Loss (up to 100% federal)</li> <li>▪ Repetitive Loss (up to 90% federal)</li> <li>▪ Priorities are set each fiscal year</li> </ul>	<a href="https://www.fema.gov/grants/mitigation/floods">https://www.fema.gov/grants/mitigation/floods</a>	Inland and coastal flooding
PP	FEMA Building Resilient Infrastructure and Communities (BRIC) Grant Program	BRIC is a non-disaster grant program, which provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. Funding has doubled for BRIC to \$2.295 billion for FY21. <ul style="list-style-type: none"> <li>▪ Caps: Tribal set-aside: \$2 million;</li> <li>▪ National Competition: \$2.133 billion</li> <li>▪ Application Period: September 30, 2022 to January 27, 2023</li> <li>▪ Period of Performance: 3 year from start date on Recipient's federal award</li> <li>▪ Cost-share: 25% non-federal</li> <li>▪ Economically disadvantaged rural communities are eligible for 10% non-federal</li> <li>▪ Priorities are set each fiscal year</li> </ul>	<a href="https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities">https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities</a>	All hazards
QQ	FEMA Hazard Mitigation Grant Program (HGMP)	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.	<a href="https://www.fema.gov/grants/mitigation/hazard-mitigation">https://www.fema.gov/grants/mitigation/hazard-mitigation</a>	All hazards
RR	Michigan Invasive Species Grant Program	The Departments of Natural Resources, Environmental Quality and Agriculture and Rural Development work together to address strategic issues of prevention, detection, eradication, and control for both terrestrial and aquatic invasive species in Michigan. This program is designed to address strategic issues of prevention, detection, eradication and control for both terrestrial invasive species (TIS) and aquatic invasive species (AIS) in Michigan.	<a href="http://www.michigan.gov/invasives/grants/misgp">www.michigan.gov/invasives/grants/misgp</a>	Invasive Species
SS	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 is 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.	<a href="http://www.canr.msu.edu/clean_boats_clean_waters/index">www.canr.msu.edu/clean_boats_clean_waters/index</a>	Invasive Species

TT	<b>EGLE's "NotMISpecies" webinar series</b>	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.	<a href="https://www.michigan.gov/invasives/take-action">https://www.michigan.gov/invasives/take-action</a>	Invasive Species
UU	<b>Michigan State University Extension</b>	Resources available for: training elected and appointed officials, agriculture and food support programs, and natural resources protections.	<a href="https://www.canr.msu.edu/outreach/">https://www.canr.msu.edu/outreach/</a>	Inland flooding, shoreline erosion; Invasive Species; Public Health Emergency
VV	<b>MSU Michigan Inland Lakes Partnership</b>	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.	<a href="https://www.canr.msu.edu/michiganlakes/convention/">https://www.canr.msu.edu/michiganlakes/convention/</a>	Inland flooding, shoreline erosion; Invasive Species
WW	<b>USDA Natural Resources Conservation Service (NRCS)</b>	The NRCS helps America's farmers, ranchers, and landowners conserve our nation's resources through voluntary programs and science-based solutions.	<a href="https://www.nrcs.usda.gov/">https://www.nrcs.usda.gov/</a>	Drought; Extreme Temperatures; Invasive Species; Wildfire; Public Health Emergency
XX	<b>The Leelanau Conservancy</b>	Since 1988, the Conservancy has preserved over 16,000 acres and created 28 Natural Areas for public enjoyment with more than 28 miles of trails. They have also worked with over 190 landowners to protect family farms and cherished private lands with legal agreements called conservation easements. These agreements restrict development and protect the land's most important natural features. The Conservancy's priorities include: protecting natural lands and water quality; preserving family farms; and caring for the lands they have protected, such as monitoring for invasive species.	<a href="https://leelanauconservancy.org/">https://leelanauconservancy.org/</a>	Flooding, Erosion, Invasive Species, Public Health Emergency
YY	<b>Leelanau Conservation District</b>	The District works closely with Federal, State and local agencies and organizations to promote the wise use of natural resources through information and technical assistance to the landowners and users of Leelanau County. Services include: • Natural Resource Site Visits • County Soil Erosion Permits, including Vegetation Removal Assurance Plan Application for Designated Critical Dune Areas • Forestry Assistance & Referrals • Plant, Insect & Disease Identification • Workshops & Demonstrations, Native Plant Sales	<a href="https://www.leelanaucd.org/">https://www.leelanaucd.org/</a>	Flooding, shoreline erosion; Invasive Species; wildfire; drought
ZZ	<b>Antrim Conservation District</b>	ACD serves as the first stop for local citizens, farmers, landowners, conservation groups, and county government for their natural resource needs.	<a href="https://www.antrimcd.com/">https://www.antrimcd.com/</a>	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency
AAA	<b>Benzie Conservation District</b>	The District's purpose is to foster the best use of land for the present and future benefits of the community, based on the land's capabilities and landowners goals	<a href="https://www.benziecd.org/">https://www.benziecd.org/</a>	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency
BBB	<b>Charlevoix Conservation District</b>	The Charlevoix Conservation District works to protect, promote and enhance natural resource conservation in Charlevoix County through partnerships, community outreach and providing landowner support.	<a href="https://www.charlevoixcounty.org/conservation-district/">https://www.charlevoixcounty.org/conservation-district/</a>	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency
CCC	<b>Grand Traverse Conservation District (GTCD)</b>	The GTCD provides conservation, education, Boardman River Stewardship, agriculture, invasive species management, and volunteering support services.	<a href="https://natureiscalling.org/">https://natureiscalling.org/</a>	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency
DDD	<b>Manistee Conservation District</b>	Our services assist Manistee County residents and landowners in the protection, enhancement and restoration of natural resources. We are passionate about helping our communities conserve their lands so our environment can be clean, healthy and robust for generations to come.	<a href="https://www.manisteedc2.org/">https://www.manisteedc2.org/</a>	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency
EEE	<b>Northwest Michigan Invasive Species Network (NMISN)</b>	A Cooperative Invasive Species Management Area (CISMA) serving Benzie, Grand Traverse, Leelanau & Manistee counties to manage populations of invasive species that threaten northwest Michigan's high-quality natural areas through terrestrial invasive plant management and outreach.	<a href="https://www.habitatmatters.org/">https://www.habitatmatters.org/</a>	Invasive Species

FFF	<b>Charlevoix, Antrim, Kalkaska, Emmet Cooperative Invasive Species Management Area (CAKE - CISMA)</b>	CAKE-CISMA was established in 2015 as a joint effort between local conservation districts and various non-profits. Their mission is to protect the natural resources, economy, and human health of Northern Lower Michigan through collaborative outreach and management of invasive species. They host educational events at schools, conduct invasive species treatment days with local non-profits, and treat high priority invasive species throughout the 4 county area. Most often they work with terrestrial invasive species, but occasionally work with aquatic invasive species as well. A particular funding source they are looking into is the NRCS' Environmental Quality Incentives Program (EQUIP) grant to fund workshops for landowners about Autumn Olive management options.	<a href="https://www.cakecisma.org/">https://www.cakecisma.org/</a>	Invasive Species
GGG	<b>Tip of the Mitt Watershed Council</b>	Dedicated to protecting lakes, streams, wetlands, and groundwater resources of Antrim, Charlevoix, Cheboygan and Emmet Counties through respected advocacy, innovative education, technically sound water quality monitoring, thorough research, and restoration actions.	<a href="https://www.watershedcouncil.org/">https://www.watershedcouncil.org/</a>	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency
HHH	<b>Elk River Chain of Lakes - Watershed Plan Implementation Team</b>	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.	<a href="https://gtbay.org/elk-river-chain-of-lakes-watershed-implementation-team/">https://gtbay.org/elk-river-chain-of-lakes-watershed-implementation-team/</a>	Flooding, Coastal Hazards, Invasive Species, Public Health Emergency
III	<b>The Watershed Center Grand Traverse Bay</b>	Advocates for clean water in Grand Traverse Bay and acts to protect and preserve the bay's watershed. Pollution prevention and/ or restoration projects include establishing stormwater management and green infrastructure practices, installing riparian vegetation, naturalizing shorelines and streambanks, and restoring wetlands and hydrologic connectivity. Water quality monitoring projects are implemented in a variety of locations – often through volunteer collaboration – to identify threats, gauge restoration progress, and track changes in water quality over time.	<a href="https://gtbay.org">https://gtbay.org</a>	Flooding & Erosion, Coastal Hazards, Invasive Species, Public Health Emergency
JJJ	<b>Conservation Resource Alliance (CRA)</b>	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. CRA works in the 10-county northwest MI region, along with the southerly adjoining counties of Mason, Lake, Osceola, Oceana and Newaygo.	<a href="https://www.rivercare.org/">https://www.rivercare.org/</a>	Flooding & Erosion; Invasive Species; Drought; Extreme Heat; Public Health Emergency
KKK	<b>Great Lakes Stream Crossing Inventory</b>	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.	<a href="https://great-lakes-stream-crossing-inventory-michigan.hub.arcgis.com/">https://great-lakes-stream-crossing-inventory-michigan.hub.arcgis.com/</a>	Flooding & Erosion
LLL	<b>Grand Traverse Regional Community Foundation</b>	GTRCF supports a variety of community need areas, including youth, arts and culture, education, environment, and health and human services. We do this by promoting giving, engaging in collaborative leadership, supporting nonprofit organizations through meaningful grants and local students through scholarships, and building endowments that make a lasting impact for generations to come. Service area includes Antrim, Benzie, Grand Traverse, Kalkaska, and Leelanau Counties.	<a href="https://www.gtrcf.org/">https://www.gtrcf.org/</a>	Invasive Species, Flooding, Extreme Temperatures, Public Health Emergency
MMM	<b>Groundwork Center for Resilient Communities</b>	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.	<a href="https://www.groundworkcenter.org/food-farming/">https://www.groundworkcenter.org/food-farming/</a>	Public Health Emergency
NNN	<b>Michigan Public Service Commission's Low Income Winter Protection Plan</b>	The state has adopted a Winter Protection Plan that protects seniors and low income families that receive services from MPSC-regulated natural gas and electric companies from having their electric or heat shut off during winter months.	<a href="https://www.michigan.gov/mpsc/consumer/get-help/utility-customers">https://www.michigan.gov/mpsc/consumer/get-help/utility-customers</a>	Extreme Cold; Severe Winter Weather; Public Health Emergency

## Rationale for Prioritization of Mitigation Strategies

The GTB Emergency Manager and Natural Hazards Task Force considered factors like level of need, economic impact, ease of execution/level of effort, cost, and range of benefit (short term, long-term, small group/area, large group/area) when determining the level of priority for each strategy. Strategies that addressed human health, community safety, and protecting property and critical infrastructure were prioritized as high priority strategies. High priority strategies are often action items that focus around education efforts and infrastructure improvements with potentially high costs associated with them. Necessary, but ongoing tasks that provide a direct benefit to the Tribe and natural resources were also categorized as either high or medium priority strategies. Strategies with minimal direct benefit to the Tribe or natural resources were marked as low priority. The resources needed to implement the strategy and the cost of the strategy was taken into account, but not above the need demonstrated.

### PRIORITY

<b>HIGH</b>
<b>MEDIUM</b>
<b>LOW</b>

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

### STRATEGY TYPES

<b>1</b>	<b>Local Planning &amp; Regulations</b>
<b>2</b>	<b>Building &amp; Infrastructure Projects</b>
<b>3</b>	<b>Natural Systems Protection</b>
<b>4</b>	<b>Education &amp; Awareness Efforts</b>

	GRAND TRAVERSE BAND OF OTTAWA AND CHIPPEWA INDIANS HAZARD MITIGATION STRATEGIES	HAZARD TYPE										WHO - Responsible Parties	HOW - Resources and/or Partnerships	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Medium, Low)	STRATEGY TYPE			
		Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Extreme Temperatures	Drought	Shoreline Hazards: Flooding, Erosion, Dangerous Currents, Seiche, Waterspout	Invasive Species	Public Health Emergency	1					2	3	4	
1	Continue to proactively inform the public about hazard preparation/prevention and available shelter sites via utilization and promotion of the Regroup mass notification system; NWS weather radio; GTB social media; mailings; newsletter articles; or classes.	X	X	X	X	X	X	X	X	X					X		X	X	
1a	Provide education to GTB marina/beach users about severe weather awareness/preparation on Lake Michigan. Recommend utilization of NOAA Weather Radio, NWS beach hazard forecasts, and the Regroup mobile emergency alert system.	X	X		X					X		Emergency Manager, Public Safety, Conservation, Natural Resources	A, AA, MM	1-3	H	X			X
1b	Coordinate shelter awareness and education efforts with Emergency Managers in service area	X	X		X	X					Emergency Manager, Public Safety	A, B-H, I	Ongoing	H	X			X	
1c	Post signage conveying natural hazard/severe weather awareness and preparation at outdoor recreation and large gathering venues.	X	X	X	X	X			X		Public safety, Public Works	A, AA, V-Y, MM	1-3	H				X	
1d	Continue the preparedness practice of conducting the annual statewide tornado drill.		X								Emergency Manager, Public Safety	A, B-G	Annually	H	X			X	
1e	Teach school children about the dangers of natural hazards including hail, lightning, and tornadoes and how to take safety precautions.	X	X	X	X	X			X	X	Public Safety, Education, Youth Services	A, AA	1-3	M				X	
1f	Promote awareness of vegetation/fuel management for fire prevention around homes and other structures.		X	X							Public Safety	V, W, Y	1-3	M				X	
1g	Promote participation in the NWS "Skywarn" Storm Spotter Training		X						X		Emergency Manager, Public Safety	A, AA	Annually	M				X	
1h	Mail informational brochures with monthly water bills.	X	X	X	X	X	X	X	X	X	Public Safety, Education, Natural Resources	A, AA, MM, EEE-III	1-3	L	X		X	X	
1i	Promote education about the benefits of shoreline and streambank restoration				X				X	X	Natural Resources, Education	XX, GGG-KKK	3-5	L			X	X	
2	Continue to coordinate with county and local officials for tornado siren operation to notify the public of potential tornado activity in the GTB service area		X								Emergency Manager, Public Safety	A, B-G	As needed	H	X			X	
3	Continue to regularly assess fire suppression access points and equipment and pursue improvements as needed.			X		X					Public Safety, Public Works	I, X	Ongoing	H	X	X			
4	Review secondary water sources for all vulnerable populations and ecologically sensitive resources				X	X				X	Public Safety, Natural Resources	A, I, LL	Annually	H	X		X		
5	Annually update the Tribe's basic Wildfire Operations Plan (coordinate with MDNR)			X							Public Safety	I	Annually	H	X				
6	Improve communication amongst County Dispatch, Road Commission, law enforcement and EMS about road closures as quickly as possible to improve emergency response arrival time.	X	X	X	X	X			X		Public Safety, Public Works, Health Services	B-G, I	1-3	H	X			X	
7	Offer reduced cost snow plow program, meal delivery service, and "telephone reassurance" call service to check on rural area, homebound Elders during hazard events / weekly.	X	X	X	X	X				X	Public Safety, Elders	R, S	1-3	H	X			X	
8	Continue to partner with/utilize the services of the local health departments and MDHHS				X					X	Public Safety, Health Services	M, N-Q	Ongoing	H	X	X	X	X	
9	Continue to coordinate with the MDHHS for guidance via their State Pandemic Plan and information about new or emerging disease threats.									X	Public Safety, Health Services	M	Ongoing	H	X			X	
10	Incorporate the Hazard Mitigation Plan's strategies into master plans and other community plans.	X	X	X	X	X	X	X	X	X	All departments	A - G	1-3	H	X	X	X	X	
11	Ensure that members, particularly vulnerable populations, have access to healthy, affordable food options.						X			X					X		X	X	
11a	Continue to provide and improve food assistance programs and emergency food programs to help communities prepare for unanticipated pandemics, but also increase food accessibility.						X			X	Public Safety, Health Services, Elders, Agriculture	J, R, S	Ongoing	H	X			X	

Awareness and Preparation

GRAND TRAVERSE BAND OF OTTAWA AND CHIPPEWA INDIANS HAZARD MITIGATION STRATEGIES		HAZARD TYPE										WHO - Responsible Parties	HOW - Resources and/or Partnerships	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Medium, Low)	STRATEGY TYPE						
		Severe Winter Weather	T-Storm, High Winds, Hail, Tornado, Lightning	Wildfire	Inland Flooding and Erosion	Extreme Temperatures	Drought	Shoreline Hazards: Flooding, Erosion, Dangerous Currents, Seiche, Waterspout	Invasive Species	Public Health Emergency	1					2	3	4				
Awareness and Preparation	11b	Create community gardens in residential areas and/or school locations to promote learning about growing local food and native pollinating plants.							X			X	X	Natural Resources, Health Services, Education, Agriculture	A, UU, MMM	3-5	M			X	X	
	11c	Support food rescue programs, involving public/private partnerships between restaurants, hotels and other venues of large food production, can partner with local food pantries to make good food more widely available.							X			X		Public Safety, Health Services, Agriculture	LLL, MMM	1-3	M	X			X	
	12	Maintain proper levels of PPE for local first responders.		X	X	X	X				X		X	Public Safety, Health Services	A - I	Ongoing	M	X				
	13	Continue interdepartmental cooperation and coordination of police, fire and rescue services to achieve service area coverage availability.		X	X	X	X				X		X	Emergency Manager, Public Safety	A - I	Ongoing	M	X				
	14	Consider becoming a recognized Firewise USA® community.				X			X					Public Safety	V, W	3-5	M	X			X	
	15	Maintain a GTB snow removal plan and coordinate snow removal with surrounding jurisdictions		X											Public Safety, Public Works	A, B-G	1-3	M	X			X
	16	Create areas of refuge involving imminent fire danger and emergency evacuation plans for a potential flooding event				X	X				X				Public Safety	V, Y, JJ, LL, NN, HHH	1-3	M	X			
	17	Consider developing a drought communication plan and early warning system to facilitate timely communication of local drought conditions/outlook to officials, decision makers, emergency responders, and the general public.								X					Public Safety	T, U	3-5	L	X			X
	18	Establish an irrigation scheduling program or process so that all agricultural land gets the required amount of water. Through incremental timing, each area is irrigated at different times so that all water is not consumed at the same time. Spacing usage may also help with recharge of groundwater.				X			X						Public Safety, Agriculture	T, U, WW, YY-DDD	3-5	L	X	X	X	
	19	Implement spraying programs to properly control mosquito populations to prevent mosquito-borne diseases.											X	X	Public Works, Natural Resources	M - Q	1-3	L	X			
20	Evaluate additional designated sites to utilize to temporarily store cleanup debris from downed trees after storm events.		X	X		X								Public Safety, Public Works	B-G, I	1-3	L	X				
Shelters	21	Maintain an accurate inventory of emergency shelter sites (overnight vs. daily use types) within the service area; review annually and update as needed.		X	X	X	X	X		X		X		Public Safety	A - H	Annually	H	X				
	22	Designate the Community Center building at the Hekner Road development as the community's shelter site.		X	X	X	X	X		X		X			A	0 - 2	H	X	X			
	23	Continue to establish areas of refuge and evacuation routes from at day camps, gathering grounds, and other locations with vulnerable populations		X	X	X	X	X		X		X		Public Safety	A	0-1	H	X				
	24	Collaborate with local Emergency Managers to provide adequate emergency shelters available to the public during emergency events.		X	X	X	X	X		X		X		Public Safety	A - H	Ongoing	M	X				
	25	Evaluate the feasibility of constructing additional community storm shelters, such as concrete "safe rooms", at day camps, gathering grounds, and other locations with vulnerable populations		X	X	X	X	X		X		X		Public Safety	PP, QQ	1-3	M		X			
	25a	Install generators to enable additional buildings to be used as emergency shelters.		X	X	X	X	X		X		X		Public Safety, Facilities Management	PP, QQ	3-5	M		X			
	26	Organize outreach to vulnerable populations, including establishing and promoting accessible heating or cooling centers for tribal residents.		X	X	X	X	X		X		X		Public Safety, Health Services, Elders	A, J, R	1-3	M	X			X	
27	Maintain procedures to create quarantine areas in group living quarters, such as overnight shelters or assisted living facilities.											X	X	Public Safety, Health Services, Housing	M - Q	1-3	L	X				

GRAND TRAVERSE BAND OF OTTAWA AND CHIPPEWA INDIANS HAZARD MITIGATION STRATEGIES		HAZARD TYPE										WHO - Responsible Parties	HOW - Resources and/or Partnerships	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Medium, Low)	STRATEGY TYPE						
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Buildings & Development	28	Continue to maintain community water and/or sewer infrastructure at acceptable operating standards.		X		X				X				Public Safety, Public Works	A	Ongoing	H	X	X	X		
	29	Pursue FEMA hazard mitigation assistance grants as appropriate (i.e., culvert/bridge replacement, storm sewer retrofitting, storm water management, dry flood-proofing of structures; structure elevation; property acquisition, for structure demolition or relocation; nature-based solutions.)	X	X	X	X	X			X	X			Public Safety, Natural Resources, Housing	PP, QQ	1-3	H	X	X	X		
	29a	Replace undersized and/or aging culverts/bridges for improved river function and hydraulic activity				X					X			Public Safety, Public Works, Natural Resources	PP, QQ	5-10	H	X	X	X		
	29b	Complete drainage improvements in areas of high flooding potential, including upgrading aging stormwater abatement structures				X					X			Public Safety, Public Works, Natural Resources	PP, QQ	5-10	H		X	X		
	29c	Identify the locations of where backup generators on sewer pump chambers are needed to alleviate manual pumping/hauling in the event of a power outage, and apply for funding.	X	X		X					X			Public Safety, Public Works	PP, QQ	1-3	H		X			
	29d	Install check valves on stormwater discharge locations as needed.		X		X					X			Public Safety, Public Works	PP, QQ	1-3	H		X			
	29e	Separate storm and sanitary sewer systems where applicable.		X		X					X			Public Safety, Public Works	PP, QQ	3-5	H		X	X		
	30	Continue enforcement of the BLDHD's Septic Inspection and Property Transfer Ordinance to protect public health and prevent or minimize the degradation of groundwater and surface water quality from malfunctioning sewage treatment and disposal systems.				X					X			Benzie-Leelanau District Health Department	N	1-3	H	X	X	X		
	31	Continue to enforce the GTB's Soil Erosion and Stormwater Runoff Control ordinance to ensure that proper measures are taken to protect the soil and water for any construction within 500 feet of a waterway or for earthwork done over one acre in size.				X								Natural Resources	A	Ongoing	M	X	X	X		
	32	Continue to implement applicable local building code enforcement, including floodplain/shoreline setbacks.	X	X	X	X	X	X			X	X		Tribal Fire and Rescue (Public Safety); County Governments	A - G	Ongoing	M	X	X	X		
	33	Consider joining the National Flood Insurance Program				X								Legal, Public Safety, Natural Resources	NN, OO	3-5	M	X	X			
	33a	Maintain a record of areas that have reported repetitive loss damages due to flooding				X								Public Safety, Natural Resources	NN, OO	0-1	M	X	X			
	34	Promote the availability of residential utility assistance and home improvement/weatherization programs.	X	X			X				X			Public Safety, Housing, Elders, Health Services	J - L, R, S, NNN	1-3	M		X		X	
	35	Educate developers and property owners about best building practices to mitigation impacts of natural hazards	X	X	X	X	X				X	X		County Building Departments	B - G	1-3	M	X				X
	36	As new buildings are built or buildings are modified, use new technology and/or natural techniques to create or increase structural stability; optimize stability for known site conditions	X	X	X	X	X				X	X		Tribal Council, Housing, Natural Resources	A	Ongoing	M	X	X	X		
37	Continue to pursue opportunities for brownfield and blight clean-up activities, including demolition and clearance of vacant, condemned structures, to remove actual and potential sources of land, water and air contamination.				X	X					X		Natural Resources; County Brownfield Redevelopment Authorities	A - G	3-5	M	X	X	X			
38	Improve ventilation techniques in areas, facilities, or vehicles that are prone to crowding or that may involve exposure to contagion or noxious atmospheres.									X			Housing, Health Services	A	3-5	L	X	X				
39	Consider the development of a reduced-cost program to install air conditioning in the homes of Elders.		X			X				X			Public Safety, Elders, Health Services	A, K, L, LLL	3-5	L		X				

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Electric Service & Communications Technology	40	Continue work amongst the utility companies and the County Road Commissions to clear vegetation (particularly diseased or dead trees, i.e., from Emerald Ash Borer infestations) along various road and utility right-of-ways to minimize power outages and road blockages from storms damage.	X	X	X	X					X	X	Public Safety, Public Works, Natural Resources	B-G, BB, CC	Ongoing	H	X		X	
	41	Pursue renewable energy projects on GTB land.	X	X	X	X			X		X		Public Safety, Public Works	Z	3-5	M	X	X	X	X
	42	Establish standards for tree pruning around power lines.	X	X	X	X							Public Safety, Public Works, Natural Resources	V-Y, BB, CC	0-1	M	X		X	
	43	Continue to maintain effective communications practices between electric utility companies regarding power restoration after storms. Promote the online electrical outage maps provided by utility companies.	X	X	X	X			X				Public Safety, Public Works, Natural Resources	BB, CC	Ongoing	M	X			X
	44	Investigate opportunities to bury overhead utilities, such as during new construction or in areas regularly prone to power outages.	X	X	X	X			X				Public Safety, Public Works	PP, QQ	Ongoing	M		X		
	45	Expand availability and affordability of high-speed internet service to allow for widely available remote work/learning.	X	X	X	X			X		X		Public Safety, Public Works	OO, GG	3-5	M	X	X	X	X
	46	Maintain Continuity of Operations (COOP) plans and alternative "remote work" schedules.	X	X	X	X			X		X		Public Safety	A	Ongoing	L	X			
Environment & Natural Resources	47	Continue and improve collaboration with natural protection agencies regarding technical assistance, outreach and education about aquatic and terrestrial invasive species management.									X	Natural Resources	AAA-FFF, XX-ZZ	Ongoing	H	X		X	X	
	47a	Continue to conduct annual routine invasive species surveying and monitoring to identify new emergent invasive species before they get established and spread.									X	Natural Resources	RR	Ongoing	H	X		X	X	
	47b	Prevent the introduction on new invasives and treat and remove existing ones by engaging the public in prevention practices to reduce the risk of moving invasive species into high-risk areas; or aid in early detection and response efforts for species on Michigan's Watch List									X	Natural Resources	SS - WW	Ongoing	H	X		X	X	
	47c	Promote EGLE's "NotMISpecies" webinars and resources on invasives control and management									X	Natural Resources	TT	Ongoing	H			X	X	
	47d	Promote MSUE's "Clean Boats, Clean Waters" comprehensive aquatic invasive species boater outreach program resources; apply for grant funding to communicate aquatic invasive species prevention information through outreach materials and in-person educational events to boaters.									X	Natural Resources	SS	Ongoing	H			X	X	
	47e	Participate in the annual Great Lakes Aquatic Invasive Species "Landing Blitz" event, emphasizing the need to Clean, Drain, Dry boats whenever they come out of the water, and properly Dispose of unwanted bait.									X	Natural Resources	VV, YY - DDD	Ongoing	H			X	X	
	47f	Support invasive species management services with a cost-share option between property owners and invasive species management agencies									X	Natural Resources	EEE, FFF	Ongoing	M			X	X	
	47g	Pursue alternative invasive species control measures, such as livestock grazing.									X	Natural Resources, Agriculture	RR, UU, WW	1-3	M			X	X	



GRAND TRAVERSE BAND OF OTTAWA AND CHIPPEWA INDIANS HAZARD MITIGATION STRATEGIES		HAZARD TYPE										WHO - Responsible Parties	HOW - Resources and/or Partnerships	WHEN - Timeframe (Years)	PRIORITY TYPE (High, Medium, Low)	STRATEGY TYPE				
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48	Provide boat wash stations and signage at all public boat launch sites.											X	Natural Resources	RR, SS	1-3	H	X	X	X	X
48a	Acquire mobile boat washing stations											X	Natural Resources	RR, SS	0-1	H	X	X	X	X
49	Install boot-cleaning and/or equipment cleaning facilities at popular trailheads (non-motorized, equestrian, and OR V/Motorcycle) to reduce the spread of invasive species.											X	Natural Resources	RR	1-3	H		X	X	X
50	Consider adoption of tribal ordinances that regulate activities to prevent the introduction of or the contribution to the spread of invasive species, such as prohibiting the use of invasive species in landscaping and/or vegetative riparian buffers.											X	Natural Resources, Legal	RR	1-3	H	X		X	X
51	Continue to identify and prioritize sites for open space protection/preservation, green infrastructure and/or stormwater management.			X	X	X	X		X			X	Public Safety, Natural Resources		1-3	H	X	X	X	X
51a	Maintain documentation of hydrologically sensitive environments, wetlands, coastal erosion problem areas on adjoining GTB owned lands			X	X	X	X		X			X	Natural Resources, Public Safety	HH - LL, XX, GGG, III	0-1	H	X		X	
51b	Implement nature-based solutions to mitigate stormwater runoff in infrastructure projects.				X				X			X	Public Safety, Public Works, Natural Resources, Housing	PP, QQ, GGG - KKK	3-5	H	X	X	X	
51c	Pursue the designation or acquisition of land, especially in flood prone or erosion areas, for open space/green infrastructure etc.	X	X	X	X	X	X		X			X	Public Safety, Natural Resources	XX	3-5	H	X		X	
51d	Partner with natural resources agencies to help restore natural shorelines				X				X			X	Public Safety, Natural Resources	HH - LL	Ongoing	H	X	X	X	
51e	Consider creating a natural shoreline preservation program				X				X			X	Public Safety, Natural Resources	HH - LL	3-5	H	X		X	X
51f	Identify priority shoreline and streambank restoration sites.				X				X			X	Natural Resources, Public Safety	XX, GGG - KKK	1-3	M	X		X	
51g	Identify low-impact development strategies to be applied in flood prone areas				X				X				Public Safety, Natural Resources, Housing	NN, XX, GGG - KKK	0-1	M	X	X	X	
52	Support implementation of Forestry Management Plans that include mitigation efforts for invasive species.			X		X	X					X	Public Safety, Natural Resources	RR, YY - DDD	Ongoing	M	X		X	
53	Continue to conduct wildfire management such as prescribed burns and surface fuels management projects on open space/public land (this also encourages regeneration of native plants).			X		X	X					X	Public Safety, Natural Resources	I, EEE, FFF	As needed	M	X		X	
54	Continue efforts to regularly clean up river and lake debris.				X							X	Public Safety, Natural Resources	GGG - JJJ	As needed	M			X	X
55	Continue to regularly clean out plugged culverts (due to sediment deposits, invasive species, etc.)				X				X			X	Public Safety, Public Works, Natural Resources	A - G, KKK	As needed	M	X		X	

## VIII. Implementation

Hazard mitigation is any action taken before, during, or after a disaster to permanently eliminate or reduce the long-term risk to human life and property from 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 GTB Tribe 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.

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 GTB Tribal Council will lead the implementation of the Natural Hazards Mitigation Plan with assistance from the Emergency Management Department and the Tribal Manager. The Tribal Local Planning Team (LPT), organized by the Emergency Management Department, is an inter-agency partnership and will collaborate to accomplish the goals and objectives of the Plan. The LPT 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 implementing, monitoring, evaluating and updating the Plan. Staff support will be provided by the GTB Emergency Management Department and will coordinate with the GTB Tribal Management and Tribal Council.

### Monitoring and Evaluating the Plan

The GTB 2023 Natural Hazard Mitigation Plan is a living document that will provide guidance for reducing the impacts of natural hazards for future generations. To make sure this plan is accurate and current, it will be monitored, evaluated, and updated over its life.

The plan will be reviewed annually on the anniversary of plan adoption and after any major disaster or emergency declaration that applies to the GTB service area. Annual plan maintenance tasks, to be completed by the Natural Hazards Task Force, include the following:

- Determine if the hazard identification and assessments, tribal vulnerability summary, and mitigation strategies continue to be accurate, current and relevant.
- Document progress made on mitigation strategies, including a description of any successes and challenges.
- Monitor the progress of all hazard mitigation projects, including FEMA-funded projects in accordance with applicable grant management standards, including progress reports and regular financial reviews from the accounting department to be completed throughout the lifecycle of the project.
- Any significant revisions to the plan within the 5-year period will be forwarded as a plan addendum to the MSP EMHSD.

Natural Hazards Task Force members will coordinate with their respective departments. When a department or entity assigned responsibility for a mitigation action is not represented by a Task Force member, the Task Force will select a member to work with that department/entity. Each tribal department responsible for an action will provide updates in a timely manner to the Natural Hazards Task Force and will provide documentation of progress for incorporation into the plan.

### Updating the Plan

The Stafford Act, as amended by the Disaster Mitigation Act of 2000, requires governmental entities to have a Natural Hazard Mitigation Plan be updated, adopted, and re-submitted for Federal Emergency Management Agency (FEMA) approval every five years.

Approximately 18 months prior to the plan's expiration date, the Natural Hazards Task Force will convene to review the plan in compliance with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR Parts 200 and 3002, and will amend its plan to reflect changes in tribal or Federal laws and statutes. The Task Force will also determine if the GTB will need to seek grant funding to assist with the plan update.

Future plan updates will include determining changes in the Tribal service area (such as changes in development, an increase in exposure to hazards, an increase or decrease in the Tribe's capability to address hazards); addition and/or removal of mitigation actions and strategies; reviewing goals and objectives; and any change in federal or state legislation. Upon completion of an updated draft plan and public review period, the GTB Tribal Council can review, approve and adopt the plan. The plan will then be sent to the State Hazard Mitigation Officer at the Michigan State Police for final review and approval in coordination with FEMA.

### **Continued Public Involvement**

The GTB Natural Hazards Task Force is committed to keeping tribal members and stakeholders involved in the implementation and update of the Hazard Mitigation Plan. As described previously, the Tribal LPT is comprised of representatives from the GTB Tribe and Leelanau County. LPT and Tribal Council meetings are always posted and open to tribal members.

Public comment on plan revisions and updates will be solicited through public outreach efforts that may include open houses, public meetings, press releases, websites or displays at community events. Task Force and Tribal members may review the status of mitigation projects by evaluating implementation actions and processes, identifying those that have worked well, difficulties encountered, and making suggestions for revisions to the mitigation strategies as necessary.

Copies of the current Natural Hazard Mitigation Plans for both the GTB as well as Leelanau County will be available on the GTB website and/or regional planning agency (Networks Northwest) website. The Emergency Management Office will be responsible for keeping a record of public comments on the plan.

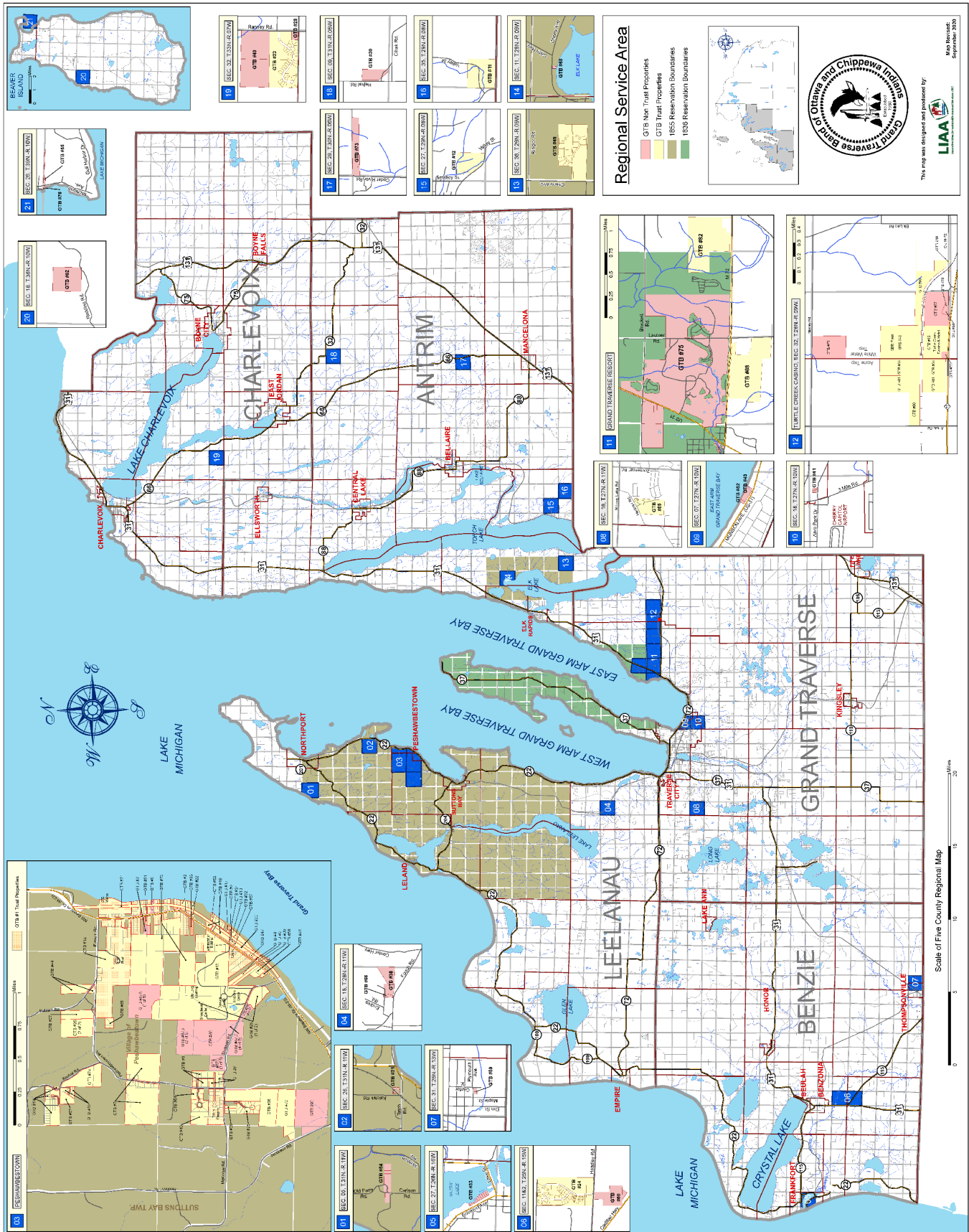
### **Plan Integration**

Part of ensuring that the plan is current and useful to a community is integrating it into existing and future planning efforts. Once a year, the GTB Emergency Manager will gather information on all planning mechanisms expected to be updated in the next year. Then, the Tribal LPT will determine into which plans it makes sense to incorporate the mitigation plan's goals and actions. Key plans for integration include plans such as the 2012 Peshawbestown Master Plan and other tribal plans regarding natural resources management, housing, economic development, and transportation. Additionally, pertinent mitigation goals and objectives may be integrated into future updates of local planning documents, such as the Leelanau County Comprehensive Plan or the Suttons Bay Community Joint Master Plan.

The GTB will also continue to be a participant in future Natural Hazard Mitigation Plan updates for the counties within its service area: Antrim, Benzie, Charlevoix, Grand Traverse, Leelanau and Manistee. As such, counties will work with tribal representatives to maintain and update their information when it is warranted. Grand Traverse Band will continue to have an open seat on each County's LPT/LEPC.

## APPENDIX A: MAPS

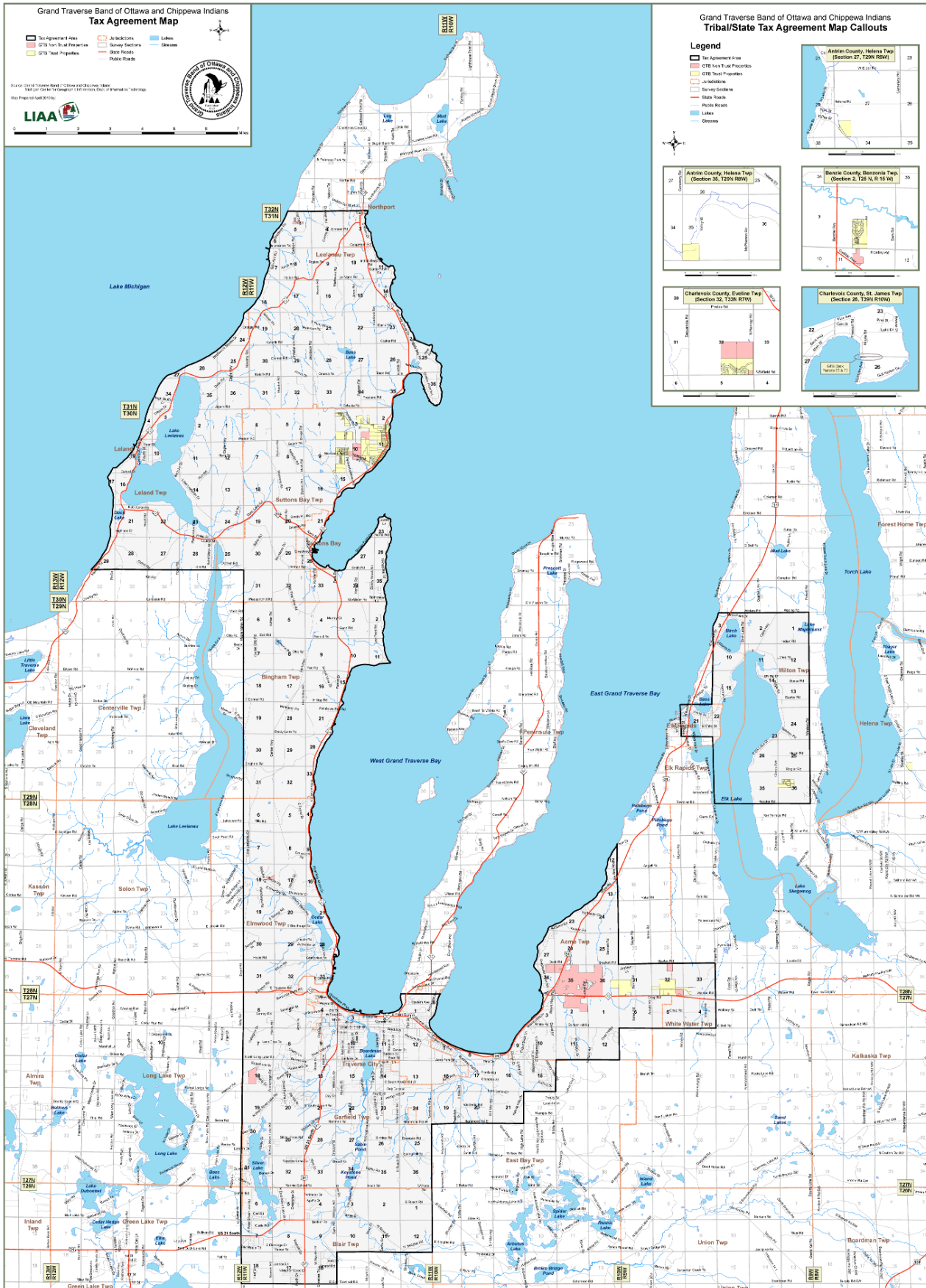
# GTB Regional Service Area Map, Showing Trust and Non-Trust Properties



# Peshawbestown Address Map



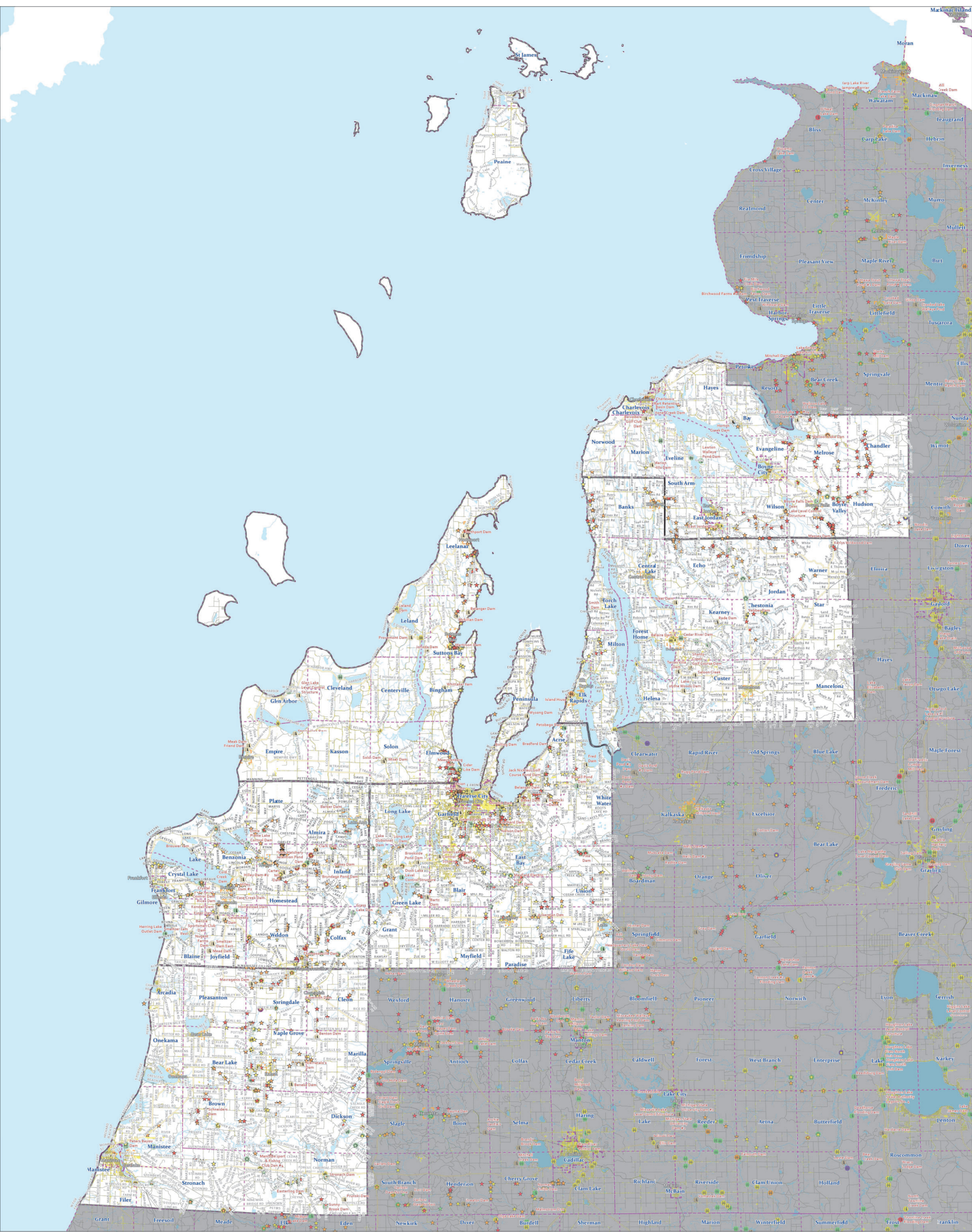
# GTB Tax Agreement Map



The following maps were created by Networks Northwest for this plan. Due to the large file size, they can be viewed by clicking on these links:

- **GTB Environmental Features – Northern Service Area**  
<https://drive.google.com/file/d/12MDjzRCDMNpl1ha1wh5jyyWTcSXKhDHZ/view?usp=sharing>
- **GTB Environmental Features – Central Service Area**  
<https://drive.google.com/file/d/11WPTI-FdOucQ6iVeDzqcJAasnSieSSLH/view?usp=sharing>
- **GTB Environmental Features – Southern Service Area**  
<https://drive.google.com/file/d/194M3Tz38alrLw3mJCqaDJIADoCGBkRZ4/view?usp=sharing>





**Grand Traverse Band  
of Ottawa & Chippewa Indians  
Infrastructure**

2023 Hazard Mitigation Plan

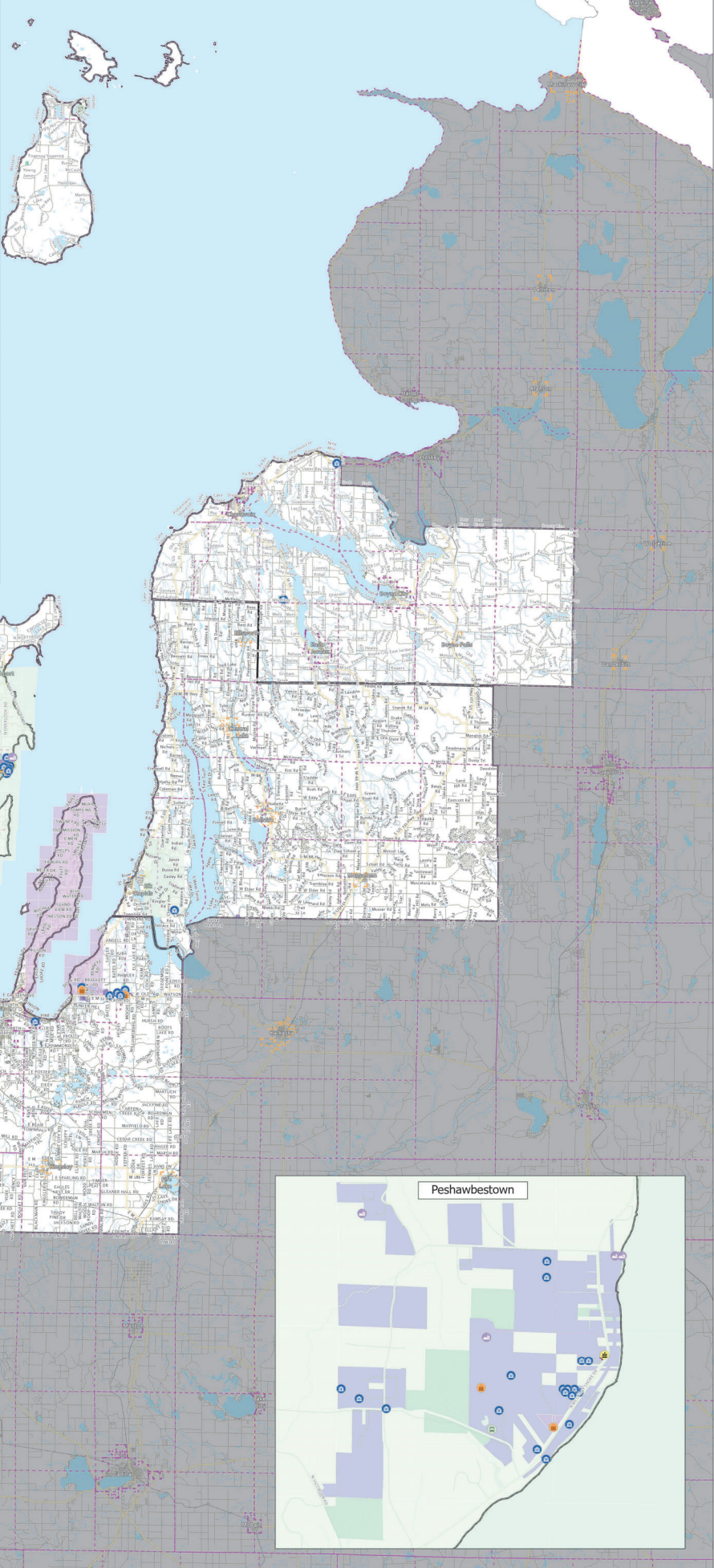
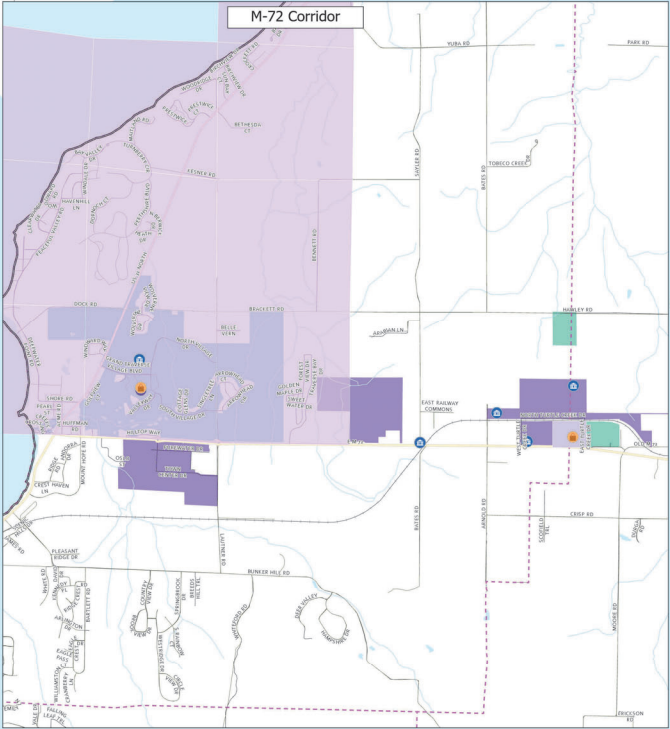
- Legend**
- Railroad
  - Highway
  - All Roads
  - River/Streams
  - Water Bodies
- Stream Crossings (CRA)**
- Severity
- ★ Satisfactory
  - ★ Minor
  - ★ Moderate
  - ★ Severe
  - ★ Unknown
- Bridge Condition**
- Rating
- Good
  - Fair
  - Poor
  - Serious
  - Critical
  - Closed
- MI Dam Inventory**
- Satisfactory
  - Fair
  - Poor
  - Unsatisfactory
  - Not Rated
- OTB Service Area
  - Non-Service Area
  - ▲ Villages
  - ▲ Cities
  - Township Boundaries



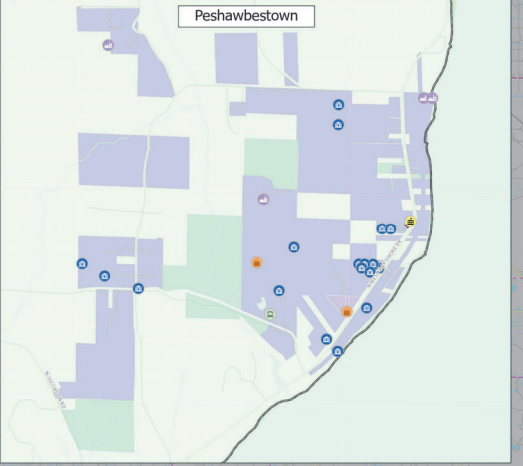
Grand Traverse Band of Ottawa and Chippewa Indians  
Hazard Mitigation Planning Process  
Map produced by Networks Northwest Community Development 2023.  
Map data sources: State of Michigan, Esri, NOAA, USGS,  
Emergency Management & Natural Planning Team

**Networks Northwest**  
Community Development

M-72 Corridor



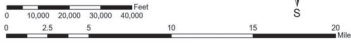
Peshawbestown



# Grand Traverse Band of Ottawa & Chippewa Indians Critical Infrastructure Points

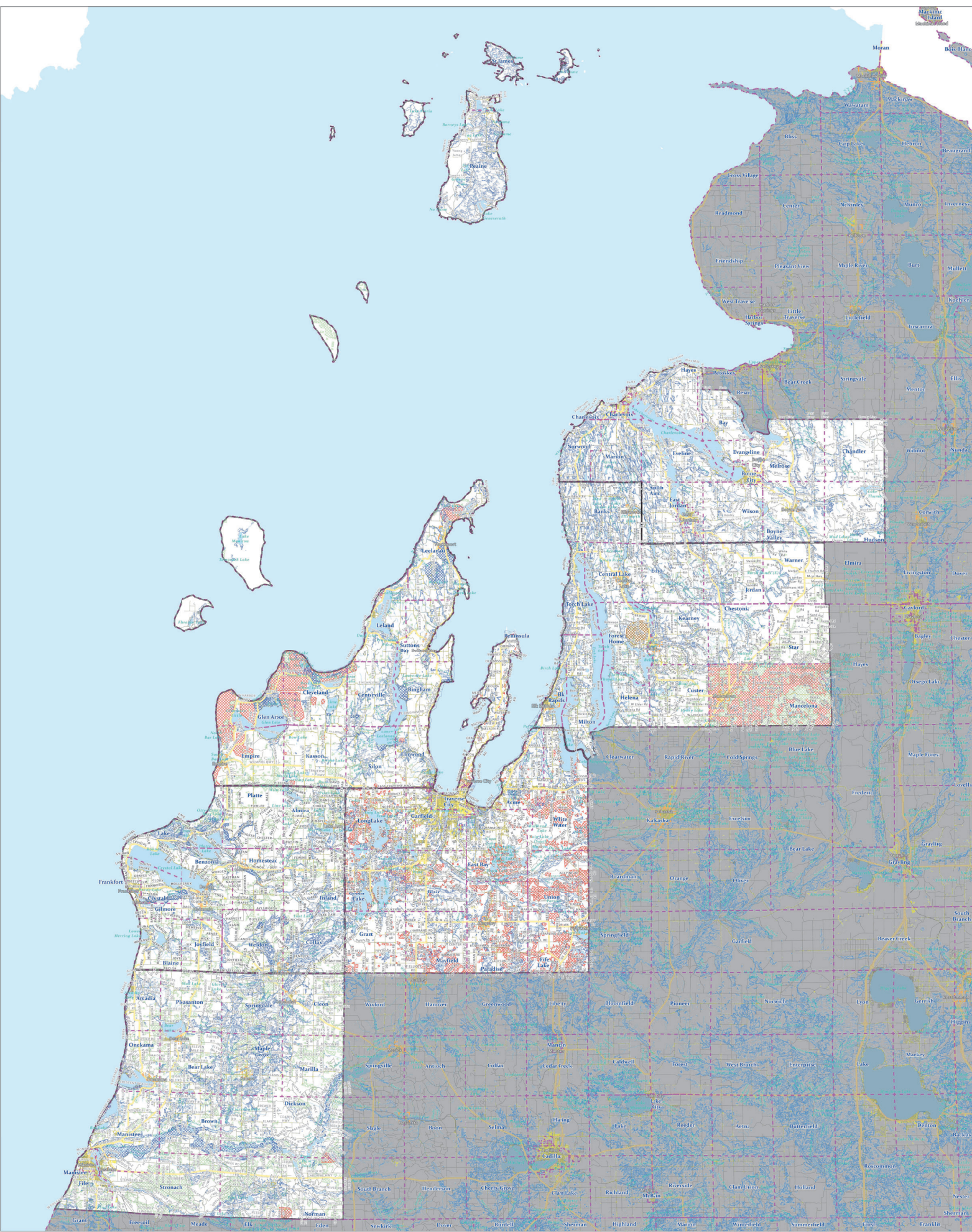
2023 Hazard Mitigation Plan

- Legend**
- Highways
  - All Roads
  - Railroad
  - Road/Streams
  - Water Bodies
- Critical Infrastructure Points**
- |                       |                |                       |                     |
|-----------------------|----------------|-----------------------|---------------------|
| Commercial            | Healthcare     | 18736ms               | Villages            |
| Communications        | Industry       | CTS Service Area      | City                |
| Emergency Services    | School         | Non-Service Area      | Township Boundaries |
| Energy                | Transportation | <b>Tribal Parcels</b> |                     |
| Government Facilities |                | Non Trust             |                     |
|                       |                | Trust                 |                     |



Grand Traverse Band of Ottawa and Chippewa Indians  
Hazard Mitigation Planning Process  
Map produced by Networks Northwest Community Development 2023.  
Map data sources: State of Michigan, Esri, NOAA, USGS, USGS, USGS,  
Emergency Management & Natural Planning Team





**Grand Traverse Band  
of Ottawa & Chippewa Indians  
Hazard Areas**

2023 Hazard Mitigation Plan

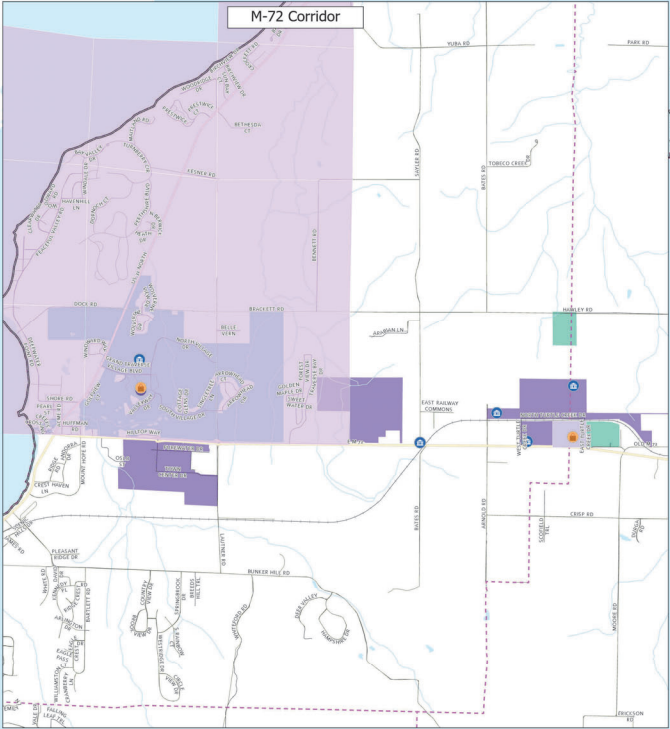
**Legend**

Highways	Rivers/Streams	Flood	Developed Land	GIB Service Area
All Roads	Water Bodies	Fire	High Medium & Low Intensity	Non Service Area
Railroad	Post 303 Wetlands	Wind Tree Damage		Cities
		Road Washout		Township Boundaries

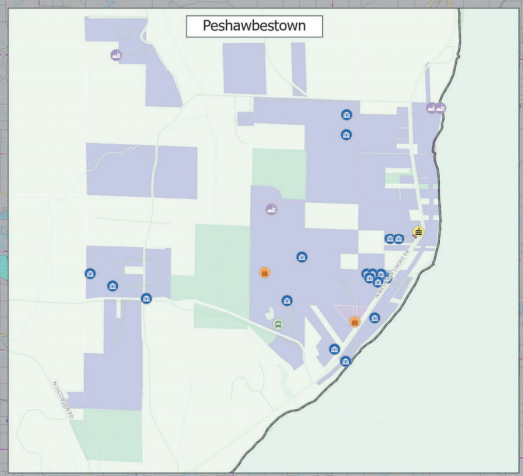


Grand Traverse Band of Ottawa and Chippewa Indians  
Hazard Mitigation Planning Project  
Map produced by Networks Northwest Community Development 2023.  
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M-72 Corridor



Peshawbestown



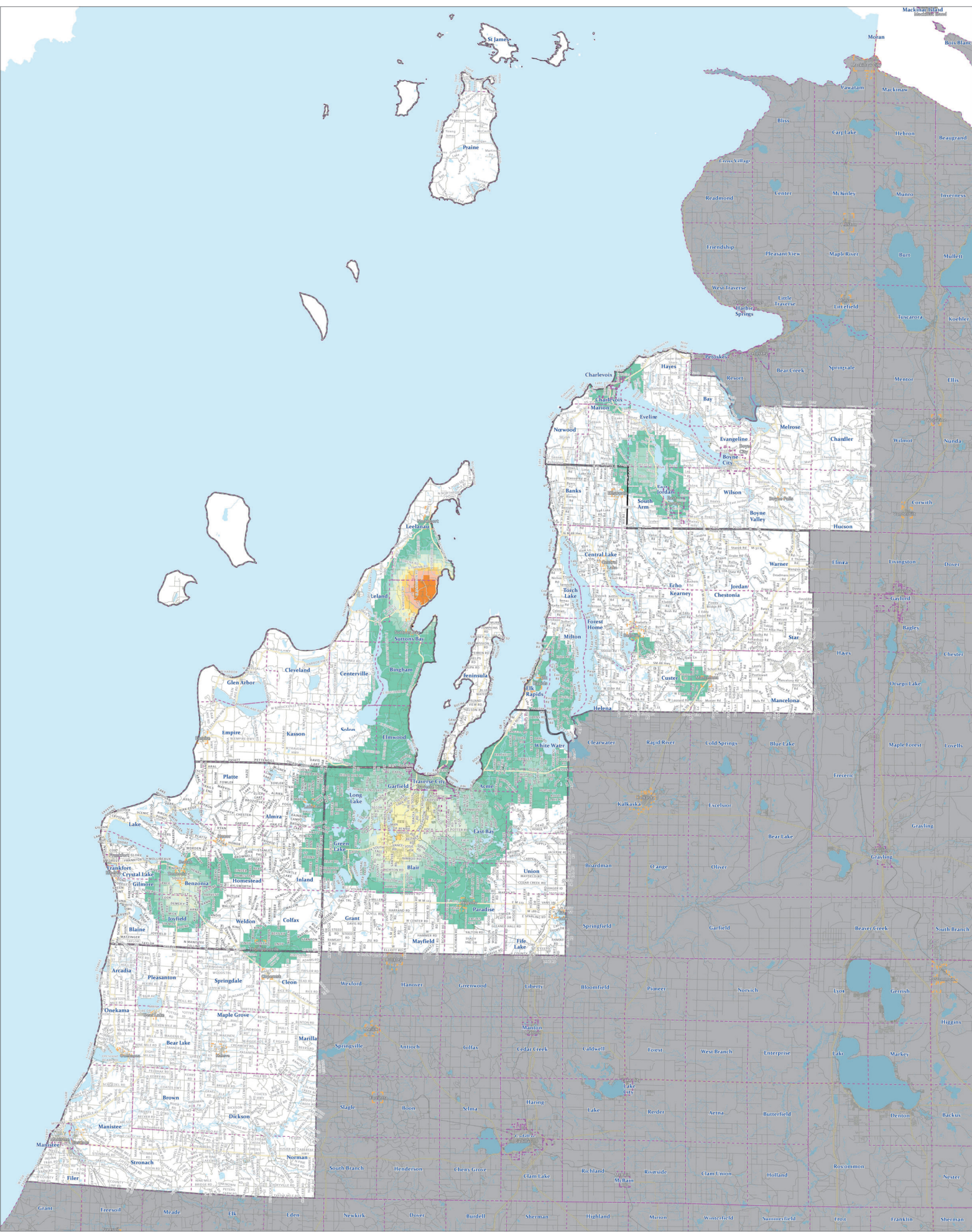
# Grand Traverse Band of Ottawa & Chippewa Indians Hazard Areas & Critical Infrastructure Points 2023 Hazard Mitigation Plan

- Legend**
- |   |   |   |   |  |
|---|---|---|---|--|
| <ul style="list-style-type: none"> <li>Highways</li> <li>All Roads</li> <li>Railroad</li> <li>Rivers/Streams</li> <li>Water Bodies</li> </ul> | <p><b>Critical Infrastructure Points</b></p> <p><b>Sector</b></p> <ul style="list-style-type: none"> <li>Commercial</li> <li>Communications</li> <li>Emergency Services</li> <li>Energy</li> <li>Government Facilities</li> </ul> | <p><b>Hazard Areas</b></p> <p><b>Type</b></p> <ul style="list-style-type: none"> <li>Flood</li> <li>Shoreline Erosion</li> <li>Fire</li> <li>Wind Tree Damage</li> <li>Road Shutdown</li> <li>Tornado Path</li> </ul> | <ul style="list-style-type: none"> <li>1836res</li> <li>1855res</li> <li>OTB Service Area</li> <li>Non-Service Area</li> <li>Tribal Parcels</li> <li>Trust</li> </ul> | <ul style="list-style-type: none"> <li>Villages</li> <li>Cities</li> <li>County Boundaries</li> <li>Township Boundaries</li> </ul> |
|---|---|---|---|--|



Grand Traverse Band of Ottawa and Chippewa Indians  
Hazard Mitigation Planning Process  
Map produced by Networks Northwest Community Development 2023.  
Map data sources: State of Michigan, Esri, NOAA, USGS, USGS,  
Emergency Management & Natural Planning Team





# Grand Traverse Band of Ottawa & Chippewa Indians Vulnerable Population

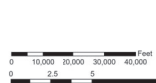
2023 Hazard Mitigation Plan

### Legend

- Highways
- All Roads
- Railroad
- Water Bodies
- Rivers/Streams

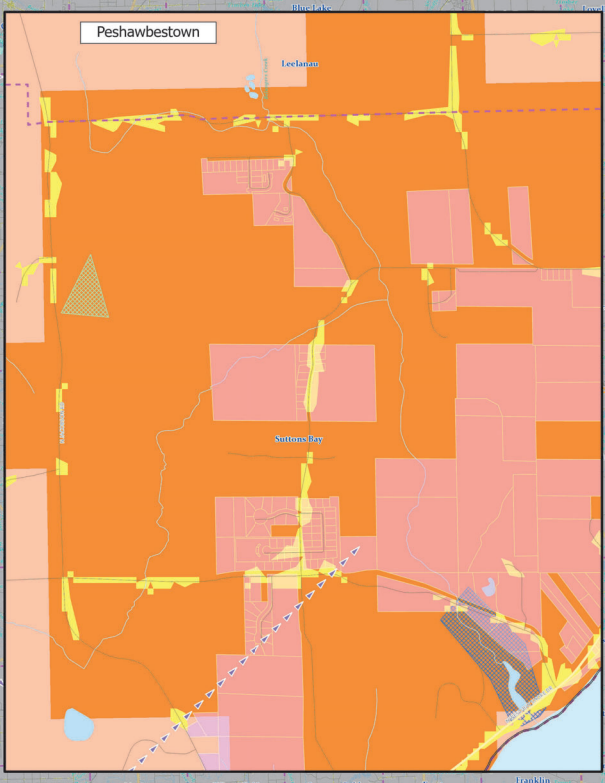
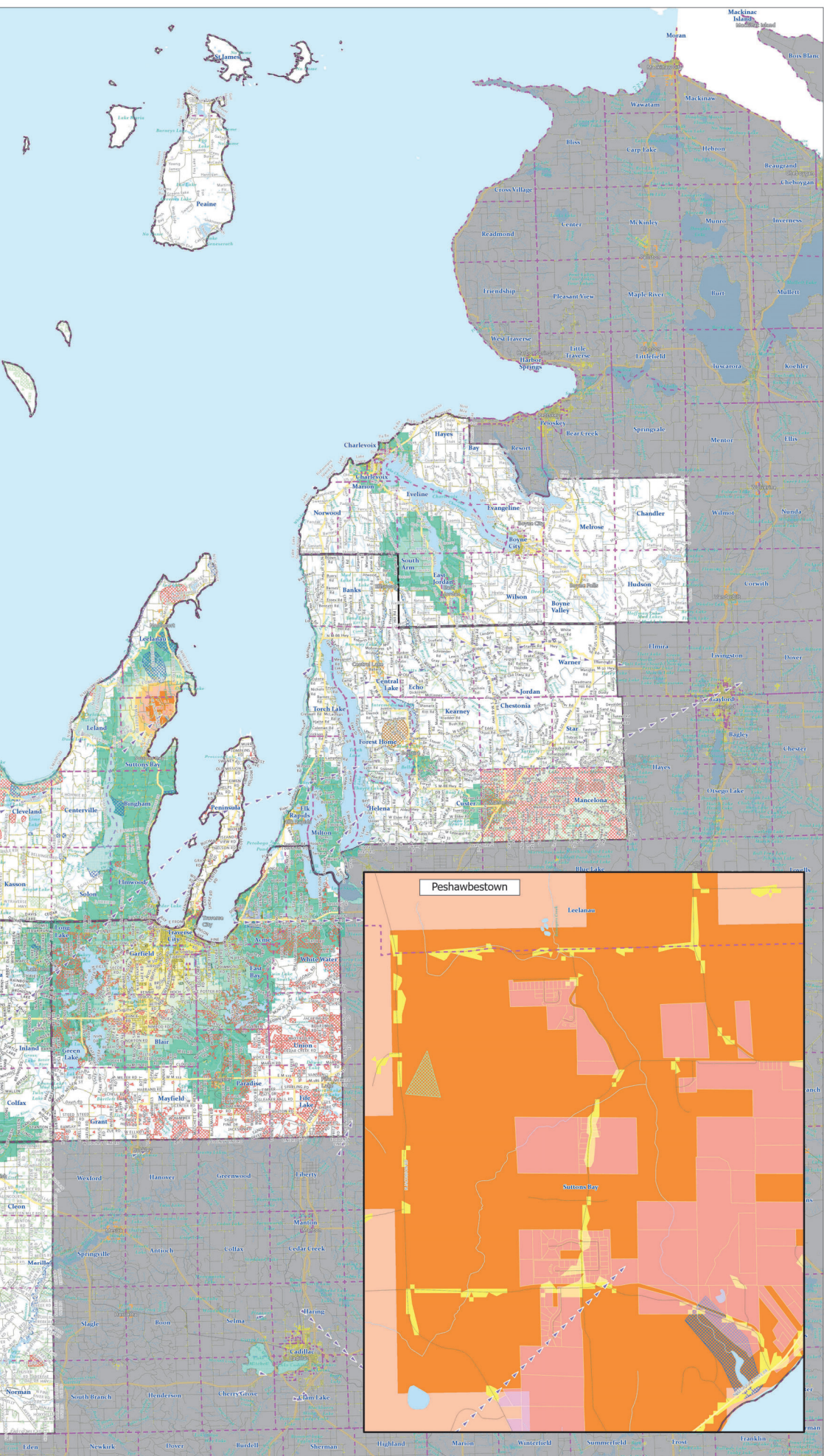
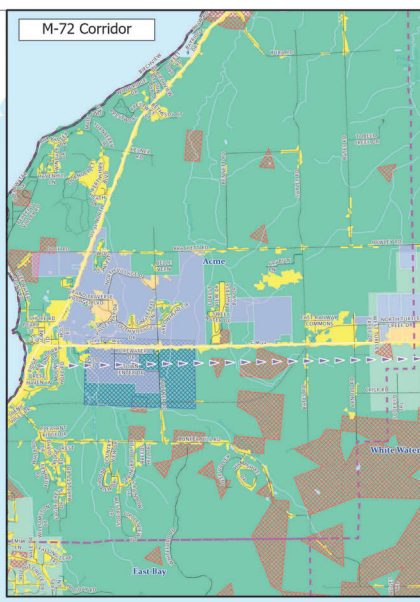


- KTB Service Area
- Township Boundaries
- Villages
- Cities
- Non-Service Area



Grand Traverse Band of Ottawa and Chippewa Indians  
Hazard Mitigation Planning Project  
Map produced by Networks Northwest Community Development 2023.  
Map data sources: State of Michigan, Esri, NOAA, USGS, USGS,  
Emergency Management & Natural Priority Team





**Grand Traverse Band  
of Ottawa & Chippewa Indians  
Hazard Areas & Vulnerable Population**  
2023 Hazard Mitigation Plan

**Legend**

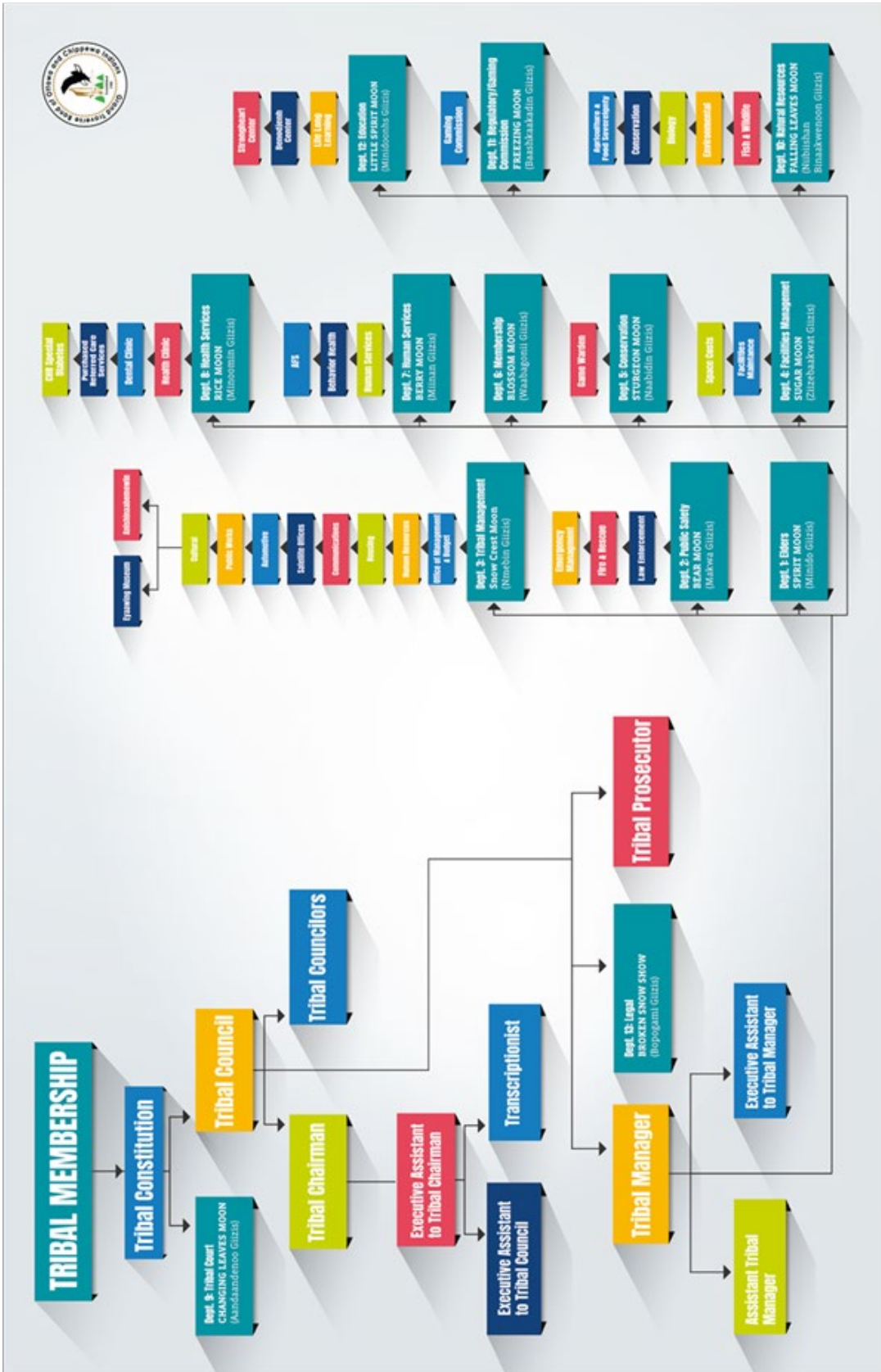
<ul style="list-style-type: none"> <li> Highways</li> <li> All Roads</li> <li> Railroad</li> <li> Rivers/Streams</li> <li> Water Bodies</li> <li> Part 303 Wetlands</li> </ul>	<ul style="list-style-type: none"> <li> Flood</li> <li> Shoreline Erosion</li> <li> Fire</li> <li> Wind Tree Damage</li> <li> Road Washout</li> </ul>	<ul style="list-style-type: none"> <li> Tribal Member Address Density</li> <li>Less Dense</li> <li>More Dense</li> </ul>	<ul style="list-style-type: none"> <li> High, Medium &amp; Low Density</li> <li> 475 Service Area</li> <li> Non-Service Area</li> <li> Villages</li> <li> Cities</li> <li> Township Boundaries</li> </ul>
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Scale: 0 10,000 20,000 30,000 40,000 Feet  
0 2.5 5 10 15 20 Miles

North Arrow: N, S, E, W

Grand Traverse Band of Ottawa and Chippewa Indians  
Hazard Mitigation Planning Process  
Map produced by Networks Northwest Community Development 2023.  
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# APPENDIX B: TRIBAL GOVERNMENT ORGANIZATIONAL STRUCTURE



**APPENDIX C: COMMUNITY SURVEY RESULTS**



Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

Q1 What is your role in the GTB community? (i.e, citizen, police officer, government employee, etc.)

Answered: 121 Skipped: 0

#	RESPONSES	DATE
1	Citizen & Government employee	1/14/2022 10:27 AM
2	Government Employee - Housing	11/17/2021 8:47 AM
3	on call receptionist	11/5/2021 9:39 AM
4	Citizen	10/28/2021 11:36 AM
5	Citizen	10/27/2021 7:39 PM
6	Government Employee	10/27/2021 4:21 PM
7	Na	10/26/2021 1:58 PM
8	Citizen	10/24/2021 4:59 PM
9	Citizen	10/23/2021 3:27 PM
10	Citizen	10/23/2021 1:04 PM
11	Citizen	10/23/2021 8:41 AM
12	Citizen	10/22/2021 8:48 PM
13	Tribal member	10/22/2021 7:00 PM
14	Citizen	10/22/2021 5:29 PM
15	Citizen an employee	10/22/2021 3:02 PM
16	Citizen.	10/22/2021 2:35 PM
17	Citizen	10/22/2021 2:24 PM
18	Judge	10/22/2021 2:17 PM
19	Citizen	10/22/2021 1:36 PM
20	Citizen	10/22/2021 1:36 PM
21	Citizen	10/22/2021 1:32 PM
22	Leelanau Sands Casino employee	10/22/2021 1:01 PM
23	Government employee	10/22/2021 12:44 PM
24	Government employee	10/22/2021 12:44 PM
25	Citizen	10/22/2021 12:35 PM
26	Citizen	10/22/2021 12:32 PM
27	Citizen	10/22/2021 12:30 PM
28	Employee	10/22/2021 12:29 PM
29	Citizen	10/22/2021 12:27 PM
30	Citizen	10/21/2021 6:57 PM
31	Citizen	10/21/2021 2:43 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

32	government employee (natural resources)	10/21/2021 12:50 PM
33	Employee	10/21/2021 12:09 PM
34	Citizen	10/21/2021 11:26 AM
35	Tribal member	10/21/2021 9:00 AM
36	Tribal member	10/20/2021 6:02 PM
37	Citizen	10/20/2021 4:15 PM
38	Citizen	10/20/2021 11:58 AM
39	on call receptionist	10/20/2021 8:12 AM
40	Government employee	10/20/2021 7:40 AM
41	Citizen, part-time government employee, care giver to neighbor.	10/19/2021 3:58 PM
42	Citizen	10/19/2021 3:18 PM
43	Gaming employee	10/19/2021 11:57 AM
44	Government employee	10/19/2021 11:13 AM
45	Citizen, government employee	10/19/2021 10:12 AM
46	Government employee	10/19/2021 10:08 AM
47	government employee	10/19/2021 9:30 AM
48	Citizen and government employee	10/18/2021 8:44 PM
49	Tribal member	10/18/2021 6:45 PM
50	Citizen	10/18/2021 4:32 PM
51	Tribal citizen	10/18/2021 4:28 PM
52	Citizen	10/18/2021 4:27 PM
53	Community Member and Government Employee	10/18/2021 4:20 PM
54	citizen	10/18/2021 3:59 PM
55	Citizen	10/18/2021 2:55 PM
56	Citizen	10/18/2021 2:38 PM
57	Tribal elder	10/18/2021 2:34 PM
58	citizen	10/18/2021 2:17 PM
59	Citizen	10/18/2021 2:05 PM
60	GTB Agricultural Coordinator	10/18/2021 2:01 PM
61	Citizen	10/18/2021 1:53 PM
62	Citizen	10/18/2021 1:40 PM
63	Citizen	10/18/2021 1:31 PM
64	Member	10/18/2021 1:27 PM
65	Citizen	10/18/2021 1:21 PM
66	Citizen	10/18/2021 12:57 PM
67	citizen	10/18/2021 12:54 PM
68	Citizen	10/18/2021 12:53 PM
69	Citizen	10/18/2021 12:49 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

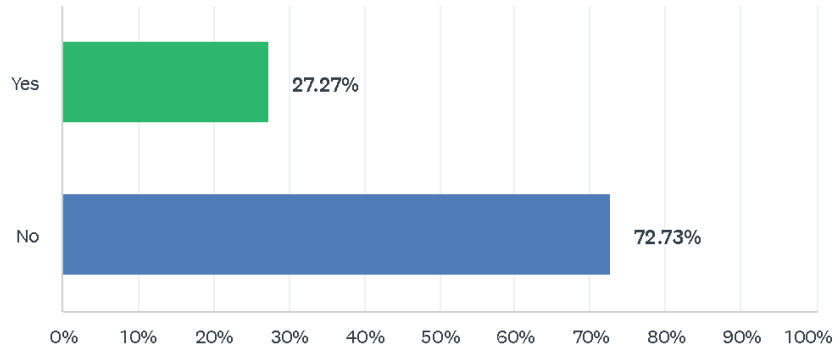
70	Citizen	10/18/2021 12:49 PM
71	Citizen	10/18/2021 12:48 PM
72	Tribal members	10/18/2021 12:47 PM
73	Citizen	10/18/2021 12:47 PM
74	Government Employee	10/18/2021 11:27 AM
75	Public Works Director	10/18/2021 11:03 AM
76	Employee	10/18/2021 10:52 AM
77	government employee	10/18/2021 10:45 AM
78	gov employee	10/18/2021 10:37 AM
79	Citizen and government employee	10/18/2021 10:16 AM
80	government employee	10/18/2021 10:05 AM
81	Tribal Member resident and government employee	10/18/2021 9:49 AM
82	government employee	10/18/2021 9:45 AM
83	citizen/government employee.	10/18/2021 9:35 AM
84	citizen	10/18/2021 9:28 AM
85	Government employee	10/18/2021 9:20 AM
86	citizen and executive employee	10/18/2021 9:18 AM
87	citizen, government employee	10/18/2021 9:16 AM
88	Government Employee	10/18/2021 9:16 AM
89	citizen and employee	10/18/2021 9:14 AM
90	Tribal Prosecutor	10/18/2021 9:12 AM
91	Government Employee	10/18/2021 9:11 AM
92	government employee	10/15/2021 2:46 PM
93	government employee	10/13/2021 10:33 AM
94	Government employee	10/12/2021 4:41 PM
95	Grand Traverse Band Economic Development Corporation	10/12/2021 3:06 PM
96	government employee	10/12/2021 10:21 AM
97	Government Employee	10/12/2021 10:21 AM
98	Lead Great Lakes Fisheries Biologist	10/12/2021 9:21 AM
99	citizen & government employee	10/12/2021 8:50 AM
100	I am a government employee.	10/12/2021 8:44 AM
101	Government employee	10/12/2021 8:19 AM
102	citizen	10/11/2021 5:01 PM
103	government employee	10/11/2021 4:10 PM
104	Government Employee	10/11/2021 3:52 PM
105	government employee	10/11/2021 3:47 PM
106	employee	10/11/2021 3:43 PM
107	government employee	10/11/2021 3:41 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

108	government employee	10/11/2021 3:17 PM
109	Behavioral health counselor	10/11/2021 3:10 PM
110	Employee	10/8/2021 4:29 PM
111	Government employee, public safety	10/8/2021 2:31 PM
112	Teacher	10/8/2021 1:48 PM
113	employee, gtb member	10/8/2021 1:32 PM
114	government employee	10/8/2021 1:17 PM
115	Fire	10/6/2021 1:34 PM
116	Police Officer	10/6/2021 12:59 PM
117	police	10/6/2021 8:03 AM
118	Police	10/5/2021 6:22 PM
119	government employee	10/5/2021 4:11 PM
120	Housing Manager	10/5/2021 1:20 PM
121	Registered Nurse in the clinic	10/5/2021 11:18 AM

## Q2 Are you familiar with the Tribe's Natural Hazard Mitigation Plan?

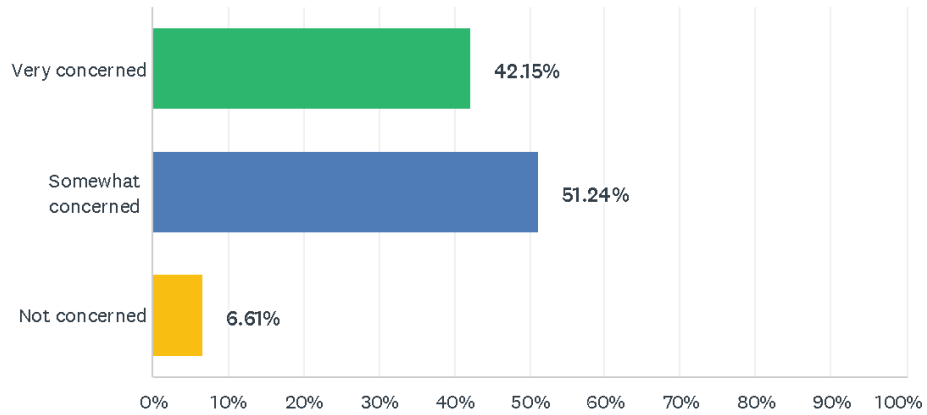
Answered: 121 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	27.27%	33
No	72.73%	88
TOTAL		121

### Q3 How concerned are you about future natural hazard events impacting your community?

Answered: 121 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very concerned	42.15%	51
Somewhat concerned	51.24%	62
Not concerned	6.61%	8
TOTAL		121

Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

Q4 What type of natural hazard events are likely to have the largest impact on your community (for example: fire, flood, drought, illness outbreak, etc.)?

Answered: 120 Skipped: 1

#	RESPONSES	DATE
1	Fire, tornado, illness outbreak	1/14/2022 10:27 AM
2	I don't know New to area.	11/17/2021 8:47 AM
3	n/a	11/5/2021 9:39 AM
4	Illness outbreak	10/28/2021 11:36 AM
5	Floods and fires. Along with illness as seen with the COVID pandemic	10/27/2021 7:39 PM
6	illness outbreak has proven to have a negative impact on our community	10/27/2021 4:21 PM
7	Fire illness	10/26/2021 1:58 PM
8	Outbreak, flooding.	10/24/2021 4:59 PM
9	Flood	10/23/2021 3:27 PM
10	Illness outbreak, indigenous life style	10/23/2021 1:04 PM
11	Illness outbreak	10/23/2021 8:41 AM
12	Flood	10/22/2021 8:48 PM
13	All the above	10/22/2021 7:00 PM
14	Illness outbreak, loss of jobs and people losing there homes	10/22/2021 5:29 PM
15	Power outage, drought	10/22/2021 3:02 PM
16	Illness outbreak.	10/22/2021 2:35 PM
17	Illness	10/22/2021 2:24 PM
18	All of those referenced in the question	10/22/2021 2:17 PM
19	Fire, illness, tornadoes, power outages	10/22/2021 1:36 PM
20	Outbreak	10/22/2021 1:36 PM
21	Illness outbreak	10/22/2021 1:32 PM
22	Covid Outbreak	10/22/2021 1:01 PM
23	Illness outbreak	10/22/2021 12:44 PM
24	Illness outbreak	10/22/2021 12:44 PM
25	Outbreak. Fire. Blizzard that takes election out for days	10/22/2021 12:35 PM
26	Illness	10/22/2021 12:32 PM
27	Bad water	10/22/2021 12:30 PM
28	Blizzard	10/22/2021 12:29 PM
29	Illness	10/22/2021 12:27 PM
30	Fire and Illness outbreak	10/21/2021 6:57 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

31	Illness outbreak	10/21/2021 2:43 PM
32	heavy precipitation and severe storms such as: rain events with more than 1" per hour downfall, storm events that exceed the 100 year or 500 year floods, heavy snowfall/ice events that cut off power and make travel difficult or impossible. Similarly, we've also seen intense storm cells that produce straight line winds events (derecho) similar to damage from tornados. The current COVID pandemic/ and future illness outbreaks are an issue, including those that are the result of pest/pathogens like mosquito and tick born illnesses	10/21/2021 12:50 PM
33	Illness - Covid-19 impact on Community and Business Operations producing challenges in provision of services and economic challenges. Active Assailant Concerns -hyper local/national terrorism Behavioral Health Snow impacting infrastructure - heavy line damage/communications/energy availability	10/21/2021 12:09 PM
34	Outbreak	10/21/2021 11:26 AM
35	Drought, illness out break, lack of food lack of medical care	10/21/2021 9:00 AM
36	Drought and illness outbreak	10/20/2021 6:02 PM
37	Illness outbreak	10/20/2021 4:15 PM
38	Line 5 breaking and polluting lake michigan	10/20/2021 11:58 AM
39	Illness	10/20/2021 7:40 AM
40	illness outbreak	10/19/2021 3:58 PM
41	Illness outbreak	10/19/2021 3:18 PM
42	Power outages with storms, storm damages.	10/19/2021 11:57 AM
43	blizzard, illness	10/19/2021 11:13 AM
44	Fire, drought, wind and weather events	10/19/2021 10:12 AM
45	Wind, illness	10/19/2021 10:08 AM
46	illness outbreak	10/19/2021 9:30 AM
47	Outbreak, power outages related to weather	10/18/2021 8:44 PM
48	Illness outbreak	10/18/2021 6:45 PM
49	Illness outbreak, flooding, snowed in, power outage, no heat.	10/18/2021 4:32 PM
50	Blizzards and power outages	10/18/2021 4:28 PM
51	Heavy snow	10/18/2021 4:27 PM
52	Storms (winter or otherwise) knocking-out electricity to homes. Floods.	10/18/2021 4:20 PM
53	illness outbreak	10/18/2021 3:59 PM
54	Illness outbreak & natural weather disaster like a harsh winter with tons of snow fall	10/18/2021 2:55 PM
55	Illness outbreak	10/18/2021 2:38 PM
56	Our fresh water would be impacted by companies dumping hazardous Waste and materials in our Great Lakes. Breaks in the pipe lines in the water system and surrounding areas need to be stopped.	10/18/2021 2:34 PM
57	the loss of all possession from any disaster	10/18/2021 2:17 PM
58	Illness outbreak and loss of shelter	10/18/2021 2:05 PM
59	Flood	10/18/2021 2:01 PM
60	Illness, outbreak	10/18/2021 1:53 PM
61	Illness of all diffrent kinds having a outbreak of it.	10/18/2021 1:40 PM
62	Fire, flood, tornado	10/18/2021 1:31 PM



## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

63	Fire	10/18/2021 1:27 PM
64	Fire, illness outbreak, animal attacks, and bitter cold	10/18/2021 1:21 PM
65	Illness outbreak	10/18/2021 12:57 PM
66	Flooding	10/18/2021 12:54 PM
67	Illness	10/18/2021 12:53 PM
68	Any, they can happen anywhere.	10/18/2021 12:49 PM
69	Illness	10/18/2021 12:49 PM
70	Illness outbreak, any natural disasters that may cause our members to become homeless and/or unable to food for their families	10/18/2021 12:48 PM
71	Fire	10/18/2021 12:47 PM
72	Loss of power.	10/18/2021 12:47 PM
73	COVID outbreak, flood	10/18/2021 11:27 AM
74	Flood, tornado, fire	10/18/2021 11:03 AM
75	Illness outbreak, Tornado-severe storm.	10/18/2021 10:52 AM
76	illness outbreak	10/18/2021 10:45 AM
77	drought, floods	10/18/2021 10:37 AM
78	Illness breakout, natural disaster-erosion, oil spills.	10/18/2021 10:16 AM
79	blizzard or severe cold	10/18/2021 10:05 AM
80	Drugs!	10/18/2021 9:49 AM
81	snow fall	10/18/2021 9:45 AM
82	I think the tribe is doing a great job an preparing us for whatever may come, I have faith in our tribe to help our people when its time.	10/18/2021 9:35 AM
83	Ice Storm and loss of electricity and closure of roads	10/18/2021 9:28 AM
84	illness outbreak	10/18/2021 9:20 AM
85	storms, illness outbreak	10/18/2021 9:18 AM
86	fire, illness outbreak,	10/18/2021 9:16 AM
87	Illness outbreak, rising water level over road near water, tree damage, power outage due to weather i.e. snow storms or thunderstorms	10/18/2021 9:16 AM
88	illness and snow events	10/18/2021 9:14 AM
89	Pandemic.	10/18/2021 9:12 AM
90	illness outbreak, fire, tomado, active shooter,	10/18/2021 9:11 AM
91	weather related impacts on roads and utilities such as wind damage and snow storms. outbreaks of communicable airborne disease	10/15/2021 2:46 PM
92	flood / severe weather / illness outbreak	10/13/2021 10:33 AM
93	climate change induced impacts, severe weather fluctuations causing flooding, drought, groundwater impacts, transportation infrastructure impacts, forestry impacts, illness outbreaks and a number of other social impacts related to disruptions in supply chains, resource availability and general disruption of economic stability.	10/12/2021 4:41 PM
94	Flood	10/12/2021 3:06 PM
95	drought	10/12/2021 10:21 AM
96	Illness	10/12/2021 10:21 AM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

97	* High water erosion problems. * Tree/Plant mortality due to invasive organisms (i.e. Oak wilt, Emerald ash borers, etc.) * Invasive species introduction (i.e. Asian/Invasive carp, Eurasian water milfoil, fragmites, etc.)	10/12/2021 9:21 AM
98	illness	10/12/2021 8:50 AM
99	Illness outbreak.	10/12/2021 8:44 AM
100	Illness outbreak, fire,	10/12/2021 8:19 AM
101	unknown	10/11/2021 5:01 PM
102	snow storm-blizzard	10/11/2021 4:10 PM
103	Fire, illness, food shortage	10/11/2021 3:52 PM
104	I think illness or winter storms	10/11/2021 3:47 PM
105	fire, illness outbreak	10/11/2021 3:43 PM
106	illness outbreak	10/11/2021 3:41 PM
107	in my area blown down trees, old bridges washing out	10/11/2021 3:17 PM
108	civil unrest	10/11/2021 3:10 PM
109	Either fire or flooding, possibly drought. I feel that the climate changes could pose threats of any kind	10/8/2021 4:29 PM
110	illness outbreak and power outages	10/8/2021 2:31 PM
111	Flood, tornado, pandemic	10/8/2021 1:48 PM
112	tomados	10/8/2021 1:32 PM
113	illness outbreak	10/8/2021 1:17 PM
114	severe weather, wildland fire	10/6/2021 1:34 PM
115	Illness	10/6/2021 12:59 PM
116	power outage due to sever weather.	10/6/2021 8:03 AM
117	Illness, flood, freeze	10/5/2021 6:22 PM
118	fire	10/5/2021 4:11 PM
119	Blizzard, illness	10/5/2021 1:20 PM
120	Freezing weather with a loss of electricity. Snow events that shut down roads. Oil spills destroying fresh water.	10/5/2021 11:18 AM

Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

Q5 Does your community have concerns about the condition of existing infrastructure (dams, bridges, utilities, etc.) being able to withstand a natural hazard event in the future? Please describe.

Answered: 118 Skipped: 3

#	RESPONSES	DATE
1	Unsure	1/14/2022 10:27 AM
2	unknown	11/17/2021 8:47 AM
3	n/a	11/5/2021 9:39 AM
4	Not aware of a shortfall	10/28/2021 11:36 AM
5	Yes, all of my neighbors and family are on the same page with trying to prevent any of our land from any sort of disaster. We recently rebuilt a dam in Walton Junction after seeking help from the DNR for years because of our pond drying up. It has since been saved by the beavers a family friend trapped and released into the pond.	10/27/2021 7:39 PM
6	The GTB Natural Hazard Mitigation Plan covers the risks as a result of a natural hazard event.	10/27/2021 4:21 PM
7	No	10/26/2021 1:58 PM
8	Yes, especially flooding of river and Lake Michigan inlets in our surrounding area.	10/24/2021 4:59 PM
9	The underground pipe system that drains water from homes and streets seems to get worse every year. I feel that the drainage system in place works well for small amounts of rain water but not with all this climate change rain.	10/23/2021 3:27 PM
10	Utilities	10/23/2021 1:04 PM
11	Utilities	10/23/2021 8:41 AM
12	Somewhat	10/22/2021 8:48 PM
13	All the above	10/22/2021 7:00 PM
14	Utilities like people loosing electricity, bridges need to be rebuilt. We need more hospitals because ours are all filling up	10/22/2021 5:29 PM
15	There should be a community building built out at the Antrim County that could be used as a storm shelter for that community.	10/22/2021 3:02 PM
16	Winter storms and being able to keep housing units warm without power and in extreme heats trying to keep them cool.	10/22/2021 2:35 PM
17	No	10/22/2021 2:24 PM
18	Not sure	10/22/2021 2:17 PM
19	We have dams, bridges , etc	10/22/2021 1:36 PM
20	I'm not sure	10/22/2021 1:36 PM
21	Not sure	10/22/2021 1:32 PM
22	Not sure	10/22/2021 1:01 PM
23	No nothing like that	10/22/2021 12:44 PM
24	Not sure	10/22/2021 12:44 PM
25	Electric going out during storms	10/22/2021 12:35 PM
26	Idk	10/22/2021 12:32 PM

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27	I don't know	10/22/2021 12:30 PM
28	No	10/22/2021 12:29 PM
29	Utilities	10/22/2021 12:27 PM
30	Trees on Roubal Rd with no shoulder on either side of lanes. There is no fire hydrant in the solar neighbor hood. Kitigan and Ninatigo Rd.	10/21/2021 6:57 PM
31	No at the moment	10/21/2021 2:43 PM
32	Yes, we've seen these issues already. In the summer of 2021, a section of Alden Highway at Finch Creek washed out completely because culverts at the creek failed during a severe thunderstorm. This occurred on a main road and prevented normal traffic flow as well as first responders. Undersized culverts and aging dams are risks to the community as are aging bridges or other municipal infrastructures.	10/21/2021 12:50 PM
33	Yes, Belanger (sp?) bridge - flooding potential, utility continuance during heavy ice and snow events/tornados	10/21/2021 12:09 PM
34	Yes bridge and natural disasters	10/21/2021 11:26 AM
35	I don't know. I would assume they have them in place.	10/21/2021 9:00 AM
36	N/A	10/20/2021 6:02 PM
37	Back up power generators would be nice for winter storms	10/20/2021 4:15 PM
38	Unknown	10/20/2021 11:58 AM
39	Whether is always different here.	10/20/2021 7:40 AM
40	From my perspective, the only large hazard I see is the dangers to our waters due to the greed of large corporations, and it is not a natural hazard event. We, as a people have been able to withstand "natural" hazard, it is the "unnatural" hazards which we will have to learn to withstand. Our natural resources is where our lives depend on, and they are being destroyed by "Big Business" greed.	10/19/2021 3:58 PM
41	No	10/19/2021 3:18 PM
42	No	10/19/2021 11:57 AM
43	not sure if the community has concerns, I do have a concern on the Belanger creek bridge.	10/19/2021 11:13 AM
44	Power lines in weather events have shut things down for up to a week a few times in the last decade or so with no power.	10/19/2021 10:12 AM
45	Communication can be taken out making it difficult to coordinate repairs	10/19/2021 10:08 AM
46	Utilities	10/18/2021 8:44 PM
47	N/A	10/18/2021 6:45 PM
48	???	10/18/2021 4:32 PM
49	Electrical outages	10/18/2021 4:28 PM
50	Yes, existing structures	10/18/2021 4:27 PM
51	Utility concerns are high amongst community members, especially during storms when our electricity frequently goes out. No electricity means no electricity to power the heaters that heat our homes. Wmter electrical outages are hard; especially for our Elders, who may have medical equipment at home and no way to power their medical devices when electricity goes out.	10/18/2021 4:20 PM
52	no	10/18/2021 3:59 PM
53	No	10/18/2021 2:55 PM
54	Tornadoes	10/18/2021 2:38 PM
55	Solar systems are a cleaner environment.	10/18/2021 2:34 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

56	yes extremely so, because for example the structure of our home is deminishing, foundation cracks , the quality was not great feom the beginning	10/18/2021 2:17 PM
57	Utilities	10/18/2021 2:05 PM
58	No roads tend to be cleared quickly of debris and power outages don't last long	10/18/2021 2:01 PM
59	Yes - dams and utilities	10/18/2021 1:53 PM
60	No	10/18/2021 1:40 PM
61	Yes	10/18/2021 1:31 PM
62	Bridges	10/18/2021 1:27 PM
63	Cold may impact due to LP gas tanks being empty or unaccessible	10/18/2021 1:21 PM
64	In Benzonia on the reservation here we live quite high so we're not worried about flooding maybe this may be storms in the winter	10/18/2021 12:57 PM
65	no	10/18/2021 12:54 PM
66	Charlevoix has a drawbridge that connects the cities North & South ends which requires constant maintenance.	10/18/2021 12:49 PM
67	No	10/18/2021 12:49 PM
68	Utilities and our administrative building within the GTB Government Community	10/18/2021 12:48 PM
69	Bridge	10/18/2021 12:47 PM
70	I don't know.	10/18/2021 12:47 PM
71	We are surrounded by water, so I would think this would definitely be a concern.	10/18/2021 11:27 AM
72	yes - there is always concern that there may me hazards that take out our utilities.	10/18/2021 11:03 AM
73	I have occasionally engaged in conversations with regards to old bridges, antiquated drainage systems and the need for above ground power to be moved underground to withstand winter weather.	10/18/2021 10:52 AM
74	no	10/18/2021 10:45 AM
75	not sure	10/18/2021 10:37 AM
76	erosion is a concern for community areas, fiberoptics is an issue for outer lying families. river bank stability.	10/18/2021 10:16 AM
77	utilities, particularly electricity	10/18/2021 10:05 AM
78	Old trees on Stallman Road hills that have potential to fall in the road on cars during inclement weather. Already occurred and will reoccur, but I believe this land may be private land.	10/18/2021 9:49 AM
79	no	10/18/2021 9:45 AM
80	I don't know that for sure.	10/18/2021 9:35 AM
81	Electricity is lost every winter due to weather; consequent loss of house water pipes due to freezing and bursting.	10/18/2021 9:28 AM
82	Not that I am aware of	10/18/2021 9:20 AM
83	yes, power.	10/18/2021 9:18 AM
84	not sure, maybe utilities because we are a rural community. bridges too because we have many waterways to cross.	10/18/2021 9:16 AM
85	Not sure	10/18/2021 9:16 AM
86	unknown	10/18/2021 9:14 AM
87	There are not a lot of natural disasters in our area. Occasionally heavy rain/snow storms may knock out power, but it is usually restored within a reasonable time.	10/18/2021 9:12 AM

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88	utilities	10/18/2021 9:11 AM
89	not sure	10/15/2021 2:46 PM
90	No	10/13/2021 10:33 AM
91	Yes. Many local dams and road stream crossings were designed and constructed decades ago and under hydrologic regimes that are now rapidly shifting towards more frequent and of higher intensity. Further, many stormwater and wastewater systems are also rapidly becoming outdated given these climate related hydrologic regime shifts. Much more funding needs to be directed towards assessment and re-design and construction of substandard infrastructure.	10/12/2021 4:41 PM
92	Not sure	10/12/2021 3:06 PM
93	yes	10/12/2021 10:21 AM
94	Not sure	10/12/2021 10:21 AM
95	I don't know. The only one that I am aware of locally would be Union Street Dam on the Boardman River in downtown Traverse City.	10/12/2021 9:21 AM
96	we lose power easy	10/12/2021 8:50 AM
97	Not that I am aware of.	10/12/2021 8:44 AM
98	utilities	10/12/2021 8:19 AM
99	Yes, utilities go out easily and it seems that our community is not priority in que of importance; also internet access is low	10/11/2021 5:01 PM
100	yes-all of the above	10/11/2021 4:10 PM
101	i would have to say all of the power outages due to tress on lines and such.	10/11/2021 3:52 PM
102	Not sure	10/11/2021 3:47 PM
103	no	10/11/2021 3:43 PM
104	no	10/11/2021 3:41 PM
105	yes, bridges washing out and high winds downing trees	10/11/2021 3:17 PM
106	I am uncertain	10/11/2021 3:10 PM
107	I am not sure what concerns the community has, as I have not spoken with very many members of the community. I think people are concerned about the roads in and out of the area should major damage occur to main roads	10/8/2021 4:29 PM
108	Power outage is a huge concern due to lack of generators in tribal facilities and overhead utility lines coming down during weather events. Loss of power for businesses, homes, critical healthcare services, etc.	10/8/2021 2:31 PM
109	Yes, poor water management/drainage. Unwilling to mitigate illness outbreak.	10/8/2021 1:48 PM
110	power going out	10/8/2021 1:32 PM
111	bridges	10/8/2021 1:17 PM
112	Power lines	10/6/2021 1:34 PM
113	None that I am aware of	10/6/2021 12:59 PM
114	yes we have seen power outages in our community and elders are unable to get out or have special needs.	10/6/2021 8:03 AM
115	Yes	10/5/2021 6:22 PM
116	possibly electrical outages	10/5/2021 4:11 PM
117	unknown	10/5/2021 1:20 PM
118	Yes, the aging oil pipeline going through the Straits of Mackinaw is vulnerable to many potential hazards, and would devastate the habitat, impacting tribal fishermen directly. Our tribe joins in with other tribes to voice our concerns.	10/5/2021 11:18 AM

Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

Q6 Does your community have concerns that a natural hazard event in the future would require investment in new and/or upgraded infrastructure and technology (renewable energy, improved stormwater management, internet/cellular, etc.)? Please describe.

Answered: 117 Skipped: 4

#	RESPONSES	DATE
1	internet/cellular there are a several areas within downtown Lake Leelanau that do not have cellular connection due to topography as well as along M204 and 22.	1/14/2022 10:27 AM
2	unknown	11/17/2021 8:47 AM
3	n/a	11/5/2021 9:39 AM
4	Internet	10/28/2021 11:36 AM
5	I believe so in a world that has become so reliable on technology.	10/27/2021 7:39 PM
6	We've already seen how the COVID-19 pandemic has affected our community and shown how we need upgraded infrastructure and technology, and the pandemic isn't over.	10/27/2021 4:21 PM
7	Internet	10/26/2021 1:58 PM
8	They are currently working on helping citizens get grants and access to funds to help with improvements.	10/24/2021 4:59 PM
9	Definitely would need new drainage network and roads would need to be replaced or repaired.	10/23/2021 3:27 PM
10	Internet/cellular,water managemnt,	10/23/2021 1:04 PM
11	Renewable energy	10/23/2021 8:41 AM
12	Yes	10/22/2021 8:48 PM
13	All the above	10/22/2021 7:00 PM
14	Improved storm water management and renewable energy we need more of to help save the earth from the damage we've done to it. Storm drains always flood and clog up during storms	10/22/2021 5:29 PM
15	Please start using fluoride in our water. Do your homework you're killing us slowly And making us dumb.I don't know who's getting a kickback but it's not good for us. If you can't swallow your toothpaste why are you swallowing the water that has fluoride.?	10/22/2021 3:02 PM
16	Renewable energy could help reduce the cost of the poor insulation/materials used for building the housing.	10/22/2021 2:35 PM
17	No	10/22/2021 2:24 PM
18	Not sure	10/22/2021 2:17 PM
19	In process of fixing bridges	10/22/2021 1:36 PM
20	Probably	10/22/2021 1:36 PM
21	Not sure	10/22/2021 1:32 PM
22	Not sure	10/22/2021 1:01 PM
23	Yes all of them	10/22/2021 12:44 PM
24	Probably	10/22/2021 12:44 PM
25	Yeah	10/22/2021 12:35 PM

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26	I would think, you fukn tard	10/22/2021 12:32 PM
27	I don't know	10/22/2021 12:30 PM
28	Not sure	10/22/2021 12:29 PM
29	Renewable energy	10/22/2021 12:27 PM
30	Street drains are clogged with leave.	10/21/2021 6:57 PM
31	I hope that they would upgrade	10/21/2021 2:43 PM
32	Yes. Roads and culverts may need to be repaired, as well as electrical grid and other power supplies after severe storms occur. Upgraded infrastructure or renewable energy supplies that offer backup power during grid failure are important to consider. We should shift stormwater management to be more forward focused on an increasing number severe storms such as 1000 year flood events in mind rather than 100 year events. We should do everything we can to INCREASE the number of functioning wetlands and focus on wetland and riparian restoration and connectivity to help absorb the effects of severe storms and reduce erosion, runoff and pollution.	10/21/2021 12:50 PM
33	Fiber replacement of above ground lines, Cell tower improvements	10/21/2021 12:09 PM
34	Unsure	10/21/2021 11:26 AM
35	I'm not sure where my community stands on this .	10/21/2021 9:00 AM
36	Renewable energy and internet/cellular	10/20/2021 6:02 PM
37	No	10/20/2021 4:15 PM
38	Na	10/20/2021 11:58 AM
39	Renewable energy.	10/20/2021 7:40 AM
40	As a community we have come to depend on technology and health wise the renewable energy and stormwater management are an important part of our comfort.	10/19/2021 3:58 PM
41	Maybe	10/19/2021 3:18 PM
42	Yes, the Tribe should explore developing renewable energy objectives into its long term strategy, especially as a back up in case of a natural disaster or something along those lines, installing elements into existing infrastructure, and should have the best in broadband available on the reservation land.	10/19/2021 11:57 AM
43	I am not sure what the community thinks, I do not have a concern. Leelanau county has plenty of money to fix things or upgrade infrastructure. 2nd richest county in Michigan.	10/19/2021 11:13 AM
44	Yes, newaygo county got larger power towers to run lines above the trees. Renewable energy in the form of solar, wind, or wave energy is not a bad idea. It's nice having dead zones with no cell service here, I would like that to continue or even get larger dead zones with no internet or cellular service, we don't need those services everywhere	10/19/2021 10:12 AM
45	Internet and cellular access is vital and impacted by power outages	10/18/2021 8:44 PM
46	N/A	10/18/2021 6:45 PM
47	Renewable energy	10/18/2021 4:32 PM
48	Should have generator's and renewable energy (solar, wind, geothermal) for each Tribal community in our service area.	10/18/2021 4:28 PM
49	Yes, all of the above	10/18/2021 4:27 PM
50	It would be a great benefit to the community to have all Rental and Elder housing connected to the natural gas lines with a back-up generator, in case of winter storm electrical outages. It would also be beneficial to GTB Citizens who don't rent from GTB, but who own their own homes - to have help in funding such generators for their homes to be connected to the natural gas lines. Funding solar energy would be beneficial, as well. Emergency radios would be helpful too.	10/18/2021 4:20 PM
51	no	10/18/2021 3:59 PM



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52	Yes, keeping technology available during storms.	10/18/2021 2:55 PM
53	Affordable	10/18/2021 2:38 PM
54	Invest in renewable energy.	10/18/2021 2:34 PM
55	yes, extremely so, all aspects need attention	10/18/2021 2:17 PM
56	Renewable energy and internet/cellular	10/18/2021 2:05 PM
57	Yes, relying on centralized fossil fuels is not sustainable and not a long term secure source	10/18/2021 2:01 PM
58	Renewable energy	10/18/2021 1:53 PM
59	Only lack of not helping our members	10/18/2021 1:40 PM
60	Yes, electricity	10/18/2021 1:31 PM
61	Renewable energy	10/18/2021 1:27 PM
62	Natural gas upgrade is readily available. A buried gas line (extension) into our neighborhood. Would make the homes and tribal community building safer during snow & temperature extremes. Planting trees to identify the curvature of the roads would keep vehicles clear of ditches and approaches during times of heavy, blowing snow.	10/18/2021 1:21 PM
63	No	10/18/2021 12:57 PM
64	no	10/18/2021 12:54 PM
65	Yes, if our bridge collapses or breaks it would be a huge inconvenience.	10/18/2021 12:49 PM
66	No	10/18/2021 12:49 PM
67	All listed	10/18/2021 12:48 PM
68	Technoolgy	10/18/2021 12:47 PM
69	I'm sure they do.	10/18/2021 12:47 PM
70	Possibly.	10/18/2021 11:27 AM
71	yes	10/18/2021 11:03 AM
72	I have occasionally engaged in conversations with regards to old bridges, antiquated drainage systems and the need for above ground power to be moved underground to withstand winter weather.	10/18/2021 10:52 AM
73	a need for more locally grown food due to issues with shipping across the country and pandemic shortages	10/18/2021 10:45 AM
74	yes	10/18/2021 10:37 AM
75	yes-under maintained structures need updating.	10/18/2021 10:16 AM
76	yes. sturdier electrical transmission; alternative energy; better internet and cellular coverage; roads	10/18/2021 10:05 AM
77	Internet and cellular capabilities for the community during natural hazard events need to be invested in. Current companies cannot withstand the natural hazards to keep the community informed as these events occur.	10/18/2021 9:49 AM
78	no	10/18/2021 9:45 AM
79	I don't know I have not heard anything on it.	10/18/2021 9:35 AM
80	last mile digital fiber to houses needs to be extended	10/18/2021 9:28 AM
81	Not sure	10/18/2021 9:20 AM
82	yes, IT, power generation.	10/18/2021 9:18 AM
83	not sure	10/18/2021 9:16 AM
84	I do think we need universal Internet since it is needed for everything and is not a luxury	10/18/2021 9:16 AM

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	anymore. I think we need to continue protecting our waters. And renewable energy is important as well.	
85	yes	10/18/2021 9:14 AM
86	Some concern, but nothing major.	10/18/2021 9:12 AM
87	yes, internet and electrical lines, water lines upgrade, sewer lines upgrade	10/18/2021 9:11 AM
88	unknown	10/15/2021 2:46 PM
89	Yes, internet service needs to be improved in Peshawbestown as well as other rural areas. Renewable energy / energy independence would benefit the tribe. Existing buildings are older and may not be the most energy efficient.	10/13/2021 10:33 AM
90	Yes. Communication systems continue to evolve but still tend to be outstripped by demand. Power distribution infrastructure remains vulnerable to severe weather events. The recent pandemic clearly demonstrated a much broader need for high speed internet networks in rural and non coastal areas locally and regionally.	10/12/2021 4:41 PM
91	Concerned with flooding or torrential rains that the sewer system might not be able to handle	10/12/2021 3:06 PM
92	yes	10/12/2021 10:21 AM
93	Not sure	10/12/2021 10:21 AM
94	Uncertain	10/12/2021 9:21 AM
95	we need homes for the homeless	10/12/2021 8:50 AM
96	Not that I am aware of.	10/12/2021 8:44 AM
97	renewable energy, internet/cellular	10/12/2021 8:19 AM
98	unknown	10/11/2021 5:01 PM
99	yes-all of the above	10/11/2021 4:10 PM
100	Natural gas would be a great asset.	10/11/2021 3:52 PM
101	Not sure	10/11/2021 3:47 PM
102	yes	10/11/2021 3:43 PM
103	yes, storm water management	10/11/2021 3:41 PM
104	if the trees blew down i would put in solar panels in my own area.	10/11/2021 3:17 PM
105	I am uncertain	10/11/2021 3:10 PM
106	Some community members have expressed concerns about the climate and how the weather is impacting things; it seems most people would want secure housing, medical facilities, temporary/emergency housing if needed, internet, electricity, etc., should there be some type of event.	10/8/2021 4:29 PM
107	Improved internet/cellular coverage and upgraded infrastructure and communication tower are critical needs to sustain power and services in rural location across GTB 6-county service areas.	10/8/2021 2:31 PM
108	Need to improve drainage and building restrictions to mitigate flooding.	10/8/2021 1:48 PM
109	internet, renewable energy	10/8/2021 1:32 PM
110	yes, not planned in budget or strategic plan to upgrade or rebuild the infrastructure/tech	10/8/2021 1:17 PM
111	renewable energy, internet/cellular, emergency radio communications	10/6/2021 1:34 PM
112	Always room for improvement	10/6/2021 12:59 PM
113	all the above.	10/6/2021 8:03 AM
114	We have no real back up	10/5/2021 6:22 PM
115	unsure	10/5/2021 4:11 PM

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116	unknown	10/5/2021 1:20 PM
117	During freezing weather the major concern would be loss of heat and electricity. Loss of life could result from lack of heat.	10/5/2021 11:18 AM

Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

**Q7 Have there been any negative impacts on the public health and/or natural environment of your community that you attribute to climate change?**

Answered: 118 Skipped: 3

#	RESPONSES	DATE
1	Unknown	1/14/2022 10:27 AM
2	Covid?	11/17/2021 8:47 AM
3	n/a	11/5/2021 9:39 AM
4	Don't know	10/28/2021 11:36 AM
5	Not that I have personally noticed or been informed about no.	10/27/2021 7:39 PM
6	Not that I'm aware of, although when we are getting smoke that has traveled from the California wildfires then I would think that this would have a negative impact on those suffering from asthma or other breathing/lung issues.	10/27/2021 4:21 PM
7	No	10/26/2021 1:58 PM
8	No	10/24/2021 4:59 PM
9	Yes, with more water sitting in roadways and yards due to poor drainage and excess of rain from the climate change, the mosquito population has boomed out of control which makes getting bit by one a high chance of catching dengai fever or malaria	10/23/2021 3:27 PM
10	None	10/23/2021 1:04 PM
11	Public health	10/23/2021 8:41 AM
12	Yes	10/22/2021 8:48 PM
13	N/A	10/22/2021 7:00 PM
14	Yes people getting sick and dying from contaminated water sources, air, people dieing from covid because we don't have enough hospitals or people who are in the medical field. People getting cancer more and more	10/22/2021 5:29 PM
15	Electric/heat cost	10/22/2021 3:02 PM
16	Benzie is in a big sandy/weed filled field so it gets really hot in the summer and cold in the winter months. A pond or body of water could help reduce the temperature for the reservation during the summer months. Helping reduce cost of bills as well as reducing our elders from overheating.	10/22/2021 2:35 PM
17	Yes	10/22/2021 2:24 PM
18	Yes	10/22/2021 2:17 PM
19	I don't know	10/22/2021 1:36 PM
20	Yes	10/22/2021 1:36 PM
21	Loss of shoreline	10/22/2021 1:32 PM
22	Water levels are decreasing	10/22/2021 1:01 PM
23	No	10/22/2021 12:44 PM
24	Unsure	10/22/2021 12:44 PM
25	No	10/22/2021 12:35 PM

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26	Idk	10/22/2021 12:32 PM
27	I wouldn't know.i think what they tell us is a lie.	10/22/2021 12:30 PM
28	No	10/22/2021 12:29 PM
29	Yes	10/22/2021 12:27 PM
30	Dying trees.	10/21/2021 6:57 PM
31	No	10/21/2021 2:43 PM
32	Yes. Species ranges are changing as a result of climate change (fewer cold weather dependent species, southern species moving north). The frequency of natural disturbance (wind, severe weather) is increasing, which adds stress to the local ecosystems. Summers are warmer which adds stress to human health (and other species). Indoor air conditioning is relatively rare here but is becoming more needed with hotter summers. Additionally, western wildfires [climate change] are negatively impacting air quality in the Great Lakes region.	10/21/2021 12:50 PM
33	Unknown = White fish are being bruised by Lake Trout per Tribal Fishing Community comments - Lake Trout are territorial - so something happened to place both species within close proximity to one another - could be water temperature related.	10/21/2021 12:09 PM
34	No	10/21/2021 11:26 AM
35	No	10/21/2021 9:00 AM
36	Drought and coronavirus pandemic issues	10/20/2021 6:02 PM
37	No	10/20/2021 4:15 PM
38	Colder winters	10/20/2021 11:58 AM
39	Always worried about this	10/20/2021 7:40 AM
40	Many worries about our health and environment is being caused by the denial of large corporations that they are endangering the natural resources, which in turn causes climate change.	10/19/2021 3:58 PM
41	No	10/19/2021 3:18 PM
42	Yes, I believe the fishing habitats, types of fish in Great lakes and amounts of fish have changed due to changes in the climate. The water clarity seems to change year after year and seems much clearer in lake MI. It seems warmer temperatures also are effecting the supplies of wild edible mushrooms and herbs as well.	10/19/2021 11:57 AM
43	The Rice beds are depleting. Not sure the cause, maybe climate change.	10/19/2021 11:13 AM
44	Not really climate change caused for sure, but invasive species coming in and destroying what was here thirty years ago has had an impact (emerald ash borer, zebra and quagga mussels, and probably dozens of others). Some say climate change is amplifying these species ability to alter our ecosystem, I tend to believe it.	10/19/2021 10:12 AM
45	No	10/19/2021 10:08 AM
46	Weather changes have impacted the environment and caused power outages and had negative consequences for agriculture.	10/18/2021 8:44 PM
47	Super hot i. Summer, causes AC to run non stop and hike of electric bills from companies	10/18/2021 6:45 PM
48	Not sure	10/18/2021 4:32 PM
49	Whitefish decline, trees dying from invasive insects	10/18/2021 4:28 PM
50	Erosion of lakeshore	10/18/2021 4:27 PM
51	Although we all should do our part in helping to reduce our carbon footprint on Mother Earth; climate change is a naturally occurring phenomenon and is going to happen with or without humans actions or interventions. Mother Earth has evolved through several Ice Ages. No - I don't feel there have been any negative impacts on public health and/or natural environments of our community that can be attributed to climate change. The only public health issues have	10/18/2021 4:20 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

been those 'created' by man and inflicted upon the Indigenous Peoples (smallpox) and today - nCovid-19 (lab-created), upon all.

52	no	10/18/2021 3:59 PM
53	Erosion is a very serious problem caused by rising water due to climate change	10/18/2021 2:55 PM
54	God is in control	10/18/2021 2:38 PM
55	The natural environment of our Fishing and hunting our negatively contributed by climate change because of the oil greed	10/18/2021 2:34 PM
56	yes, climate changes impacts our everything everyday it gets worse n worse	10/18/2021 2:17 PM
57	Yes	10/18/2021 2:05 PM
58	Yes, late heat causing loss of agricultural crop and disease issues. Lack of cold winters killing off pest insects in both agricultural and forestry species	10/18/2021 2:01 PM
59	Yes	10/18/2021 1:53 PM
60	Yes. Our tribe don't care about us!	10/18/2021 1:40 PM
61	No	10/18/2021 1:31 PM
62	No	10/18/2021 1:27 PM
63	Rising fuel costs, drought and bitter cold winters	10/18/2021 1:21 PM
64	No	10/18/2021 12:57 PM
65	no	10/18/2021 12:54 PM
66	Less snow equals less work for seasonal workers.	10/18/2021 12:49 PM
67	No	10/18/2021 12:49 PM
68	Not sure, but would like more information	10/18/2021 12:48 PM
69	No	10/18/2021 12:47 PM
70	Storms causing power outages.	10/18/2021 12:47 PM
71	Not that I am aware of.	10/18/2021 11:27 AM
72	yes	10/18/2021 11:03 AM
73	Not that I am aware of	10/18/2021 10:52 AM
74	growing seasons for local fruit	10/18/2021 10:45 AM
75	not sure	10/18/2021 10:37 AM
76	more invasive species with warmer climates.	10/18/2021 10:16 AM
77	yes, more shoreline erosion; extreme cold from polar vortexes; premature spring thaws that damage crops	10/18/2021 10:05 AM
78	Yes, with unpredictable weather due to climate change or global warming, there is a need for more funding in Human Services to help with higher utility bills and loss of food during a Vortex, thunder and lightening storms, blizzards, which cause outages with no way to recover the loss completely.	10/18/2021 9:49 AM
79	no	10/18/2021 9:45 AM
80	Ive seen a lot of used masks down by our eagle town an in the parking lots of some of our buildings.	10/18/2021 9:35 AM
81	yes;	10/18/2021 9:28 AM
82	No	10/18/2021 9:20 AM
83	yes, more intense and number (frequency) storms.	10/18/2021 9:18 AM
84	not sure	10/18/2021 9:16 AM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

85	Not sure	10/18/2021 9:16 AM
86	unknown	10/18/2021 9:14 AM
87	Nothing that I could point to as being due to climate change, as it's difficult to show that as a causing factor.	10/18/2021 9:12 AM
88	yes, snow levels and water run offs	10/18/2021 9:11 AM
89	increased flooding and erosion	10/15/2021 2:46 PM
90	Yes, shoreline erosion and more precipitation have negatively impacted our region. Warmer temps are harming the ecosystem.	10/13/2021 10:33 AM
91	Yes. Previous responses describe many of these.	10/12/2021 4:41 PM
92	Warmer than usual winters	10/12/2021 3:06 PM
93	not sure	10/12/2021 10:21 AM
94	More drought and fire risk	10/12/2021 10:21 AM
95	Unknown...Although there has been a change to the fish and plankton communities in Lake Michigan (and the rest of the upper Great Lakes), it is primarily attributed to invasive species, but climate change could be a contributing factor.	10/12/2021 9:21 AM
96	all of those rich beach houses may fall in the water because people are melting the polar ice caps and oil drilling is draining in our soil and fresh water	10/12/2021 8:50 AM
97	I am uncertain.	10/12/2021 8:44 AM
98	no, I haven't seen anything	10/12/2021 8:19 AM
99	No	10/11/2021 5:01 PM
100	Yes	10/11/2021 4:10 PM
101	not yet	10/11/2021 3:52 PM
102	Coastal erosion from wave energy with higher water levels	10/11/2021 3:47 PM
103	no	10/11/2021 3:43 PM
104	yes	10/11/2021 3:41 PM
105	no not at this time.	10/11/2021 3:17 PM
106	Not that I can personally note.	10/11/2021 3:10 PM
107	Asthma and allergies are worse due to climate change and fires; some people may suffer from increased cardiovascular issues; there could be food and water borne illnesses (also, and briefly - COVID/SARS - originated in animals, mutated to humans (possibly related to deforestation - which is actually a huge issue; some scientists believe that different versions of SARS could present as deforestation continues or escalates)	10/8/2021 4:29 PM
108	Hotter and more volatile weather, reduced water in Great Lakes changes affecting environment and wildlife, insects, and pandemic impacts on humans.	10/8/2021 2:31 PM
109	Flooding events	10/8/2021 1:48 PM
110	no	10/8/2021 1:32 PM
111	floods, water change can't drink it at times	10/8/2021 1:17 PM
112	Unk	10/6/2021 1:34 PM
113	Not that I am aware of	10/6/2021 12:59 PM
114	not that i know of.	10/6/2021 8:03 AM
115	I don't know	10/5/2021 6:22 PM
116	not that I know of	10/5/2021 4:11 PM

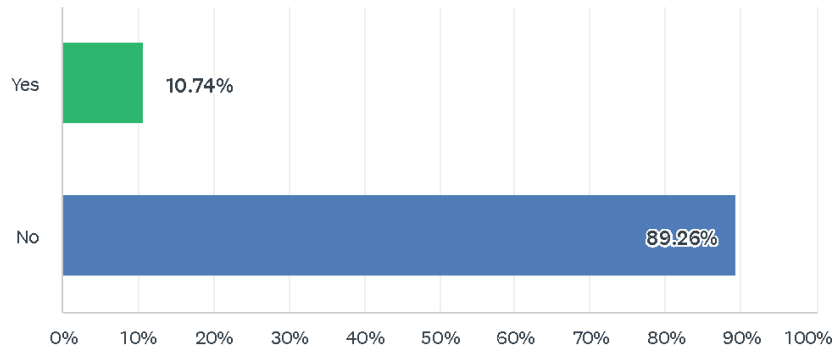
## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

117	No	10/5/2021 1:20 PM
118	When we don't have an adequate freeze it affects our agriculture. All the perennial crops require a freeze. Also invasive species survive when we don't freeze, and kill off our woodlands.	10/5/2021 11:18 AM



### Q8 Have you been involved in a natural hazard mitigation planning process before?

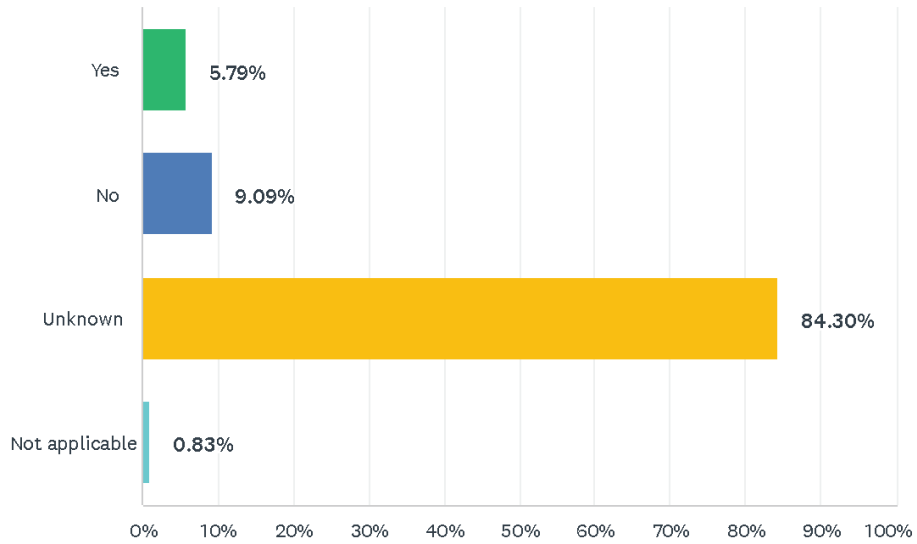
Answered: 121 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	10.74%	13
No	89.26%	108
TOTAL		121

### Q9 Has your community requested assistance for mitigation projects in the past?

Answered: 121 Skipped: 0



ANSWER CHOICES	RESPONSES
Yes	5.79% 7
No	9.09% 11
Unknown	84.30% 102
Not applicable	0.83% 1
<b>TOTAL</b>	<b>121</b>

Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

Q10 If so, was your request granted and what type of project did the request include?

Answered: 93 Skipped: 28

#	RESPONSES	DATE
1	unknown	11/17/2021 8:47 AM
2	n/a	11/5/2021 9:39 AM
3	Unknown	10/28/2021 11:36 AM
4	I told the pond story a few questions back and that to me would be the closest thing to a grant being denied. We have also asked for help with our road in the past due to freeze and thaw seasons.	10/27/2021 7:39 PM
5	We requested generators for main tribal governmental buildings through FEMA but weren't funded.	10/27/2021 4:21 PM
6	Na	10/26/2021 1:58 PM
7	There was no request.	10/24/2021 4:59 PM
8	Unsure as to if any request was made or granted	10/23/2021 3:27 PM
9	Water filtration	10/23/2021 1:04 PM
10	Unknown	10/23/2021 8:41 AM
11	Unknown	10/22/2021 8:48 PM
12	N/A	10/22/2021 7:00 PM
13	N/A	10/22/2021 5:29 PM
14	Not sure if it's applicable but requests were made to put a pool in Benzie county somewhere in the early 2000's to keep cool during the summer months, but it was ultimately denied.	10/22/2021 2:35 PM
15	N/a	10/22/2021 2:24 PM
16	Unk	10/22/2021 2:17 PM
17	I don't know	10/22/2021 1:36 PM
18	Unknown	10/22/2021 1:36 PM
19	Not applicable	10/22/2021 1:32 PM
20	Unknown to me	10/22/2021 12:44 PM
21	Not sure	10/22/2021 12:35 PM
22	Fuk if I know	10/22/2021 12:32 PM
23	Don't know	10/22/2021 12:30 PM
24	Not sure	10/22/2021 12:29 PM
25	N/a	10/22/2021 12:27 PM
26	Not sure	10/21/2021 2:43 PM
27	Yes - 2015 - Generators x 6	10/21/2021 12:09 PM
28	NA	10/21/2021 11:26 AM
29	N/A	10/21/2021 9:00 AM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

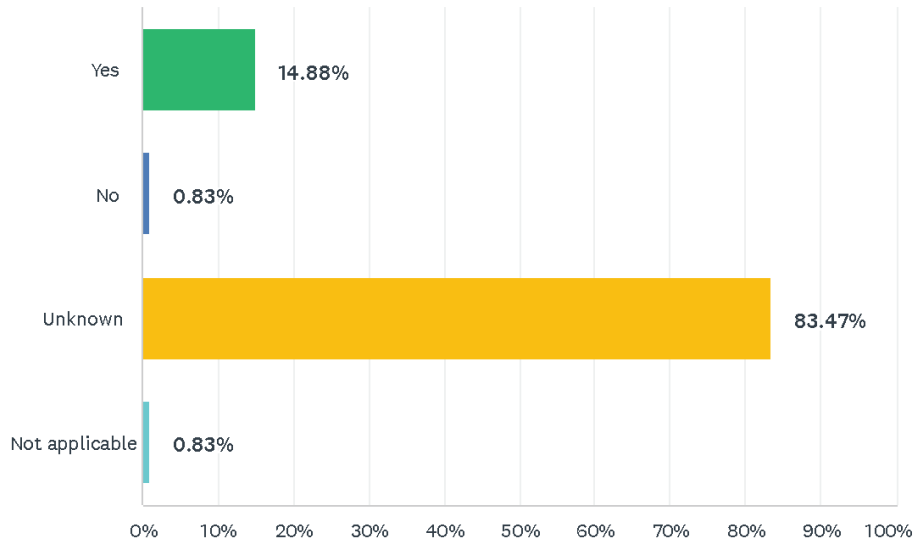
30	N/A	10/20/2021 6:02 PM
31	No	10/20/2021 4:15 PM
32	NA	10/20/2021 11:58 AM
33	NA	10/19/2021 3:58 PM
34	Unknown	10/19/2021 3:18 PM
35	n/a	10/19/2021 11:57 AM
36	not known, have not live here very long.	10/19/2021 11:13 AM
37	NA	10/19/2021 10:12 AM
38	Na	10/18/2021 6:45 PM
39	???	10/18/2021 4:32 PM
40	N/A	10/18/2021 4:28 PM
41	N/a	10/18/2021 4:27 PM
42	Unknown	10/18/2021 4:20 PM
43	?	10/18/2021 3:59 PM
44	Didn't make a request	10/18/2021 2:55 PM
45	None in our area that comes to my attention	10/18/2021 2:38 PM
46	???	10/18/2021 2:34 PM
47	i don't know	10/18/2021 2:17 PM
48	Unknown	10/18/2021 2:05 PM
49	No	10/18/2021 2:01 PM
50	Unknown	10/18/2021 1:53 PM
51	GTB leaves us out of everything so the members are clueless	10/18/2021 1:40 PM
52	N/a	10/18/2021 1:31 PM
53	NA	10/18/2021 1:21 PM
54	Unknown	10/18/2021 12:57 PM
55	n/a	10/18/2021 12:54 PM
56	N/A	10/18/2021 12:49 PM
57	No	10/18/2021 12:49 PM
58	N/A	10/18/2021 12:48 PM
59	Members loose there place 2 llive due 2 the weather n fire or other thing	10/18/2021 12:47 PM
60	.	10/18/2021 12:47 PM
61	I am unsure.	10/18/2021 11:27 AM
62	na	10/18/2021 11:03 AM
63	N/A	10/18/2021 10:52 AM
64	unknown	10/18/2021 10:45 AM
65	not known	10/18/2021 10:37 AM
66	NA	10/18/2021 10:16 AM
67	Don't recall but may include solar energy and gas or diesel generators	10/18/2021 10:05 AM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

68	n/a	10/18/2021 9:45 AM
69	na	10/18/2021 9:28 AM
70	unknown	10/18/2021 9:18 AM
71	Not sure	10/18/2021 9:16 AM
72	N/A	10/18/2021 9:14 AM
73	Unknown.	10/18/2021 9:12 AM
74	unknown	10/18/2021 9:11 AM
75	unknown	10/15/2021 2:46 PM
76	N/A	10/12/2021 10:21 AM
77	Unknown	10/12/2021 9:21 AM
78	people should at least recycle and compost maybe use solar panels for when we do lose electricity	10/12/2021 8:50 AM
79	NA	10/12/2021 8:44 AM
80	I didn't have any requests	10/12/2021 8:19 AM
81	NA	10/11/2021 5:01 PM
82	Unknown	10/11/2021 4:10 PM
83	I don't know	10/11/2021 3:52 PM
84	Not sure	10/11/2021 3:47 PM
85	n/a	10/11/2021 3:41 PM
86	N/A	10/11/2021 3:10 PM
87	Unknown	10/8/2021 4:29 PM
88	After numerous grant denials, awarded Covid funds through ICDBG for four generators for health dept, three tribal community centers and fire dept.	10/8/2021 2:31 PM
89	Generators	10/6/2021 1:34 PM
90	?	10/6/2021 8:03 AM
91	County assistance	10/5/2021 6:22 PM
92	unknown	10/5/2021 1:20 PM
93	I don't really know	10/5/2021 11:18 AM

### Q11 Has your community considered mitigation strategies for potential or current hazards?

Answered: 121 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	14.88%	18
No	0.83%	1
Unknown	83.47%	101
Not applicable	0.83%	1
<b>TOTAL</b>		<b>121</b>

Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

Q12 If so, please identify potential strategies you would like to explore in the near future.

Answered: 88 Skipped: 33

#	RESPONSES	DATE
1	unknown	11/17/2021 8:47 AM
2	n/a	11/5/2021 9:39 AM
3	I am not sure.	10/27/2021 7:39 PM
4	Periodic community surveys to keep the Plan updated as climate change results in a change in our environmental landscape.	10/27/2021 4:21 PM
5	Na	10/26/2021 1:58 PM
6	Unknown as to community plans at this time	10/24/2021 4:59 PM
7	How to rid the yards of excess stagnate water, clearing roadways of water. Less power outages	10/23/2021 3:27 PM
8	Water	10/23/2021 1:04 PM
9	More education	10/23/2021 8:41 AM
10	Unknown	10/22/2021 8:48 PM
11	N/A	10/22/2021 7:00 PM
12	N/A	10/22/2021 5:29 PM
13	Renewable energy would be great to implement in our outlying communities, not just in Leelanau county.	10/22/2021 2:35 PM
14	N/a	10/22/2021 2:24 PM
15	Unk	10/22/2021 2:17 PM
16	I don't know	10/22/2021 1:36 PM
17	Unknown	10/22/2021 1:36 PM
18	Building lasting infrastructure	10/22/2021 1:32 PM
19	Unknown	10/22/2021 12:44 PM
20	Emergency assistance needs to be lighter nobody likes asking for help when you have to fill out your whole autobiography	10/22/2021 12:35 PM
21	Idk	10/22/2021 12:32 PM
22	Idk	10/22/2021 12:30 PM
23	Na	10/22/2021 12:29 PM
24	N/a	10/22/2021 12:27 PM
25	Not sure	10/21/2021 2:43 PM
26	Improvement to communication systems EOC improvement with County Support - NIMS training Active Assailant Training, Emergency Plan Improvements and Future Live Exercises - Leelanau Sands Casino and Hotel, Government Campus - GTB Administration	10/21/2021 12:09 PM
27	NA	10/21/2021 11:26 AM
28	N/A	10/20/2021 6:02 PM
29	No	10/20/2021 4:15 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

30	NA	10/20/2021 11:58 AM
31	Planning for desalter that could happen.	10/20/2021 7:40 AM
32	Removal of all oil pipelines, Less plastic manufacturing, more environmental safeguards in place.	10/19/2021 3:58 PM
33	Unknown	10/19/2021 3:18 PM
34	n/a	10/19/2021 11:57 AM
35	unknown	10/19/2021 11:13 AM
36	NA	10/19/2021 10:12 AM
37	Na	10/18/2021 6:45 PM
38	???	10/18/2021 4:32 PM
39	Replanting Black Ash trees Try to eradicate emerald ash borer. Try to increase Whitefish population, and bring bee hives to the orchards...	10/18/2021 4:28 PM
40	Renewable energy	10/18/2021 4:27 PM
41	Flood mitigation strategies; finding alternative power - solar and/or wind; back-up generators for rentals, Elders and homeowner GTB Citizens. Emergency communication services if satellite/internet goes down. Expanding agricultural program to grow own food, in case of future food shortages.	10/18/2021 4:20 PM
42	?	10/18/2021 3:59 PM
43	Plans for future erosion along the great lakes	10/18/2021 2:55 PM
44	Involvement and communication skills	10/18/2021 2:38 PM
45	Not sure	10/18/2021 2:34 PM
46	we all need to know what the backup plan is for any circumstance	10/18/2021 2:17 PM
47	Programs on becoming a more self efficient community	10/18/2021 2:05 PM
48	No	10/18/2021 2:01 PM
49	Unknown	10/18/2021 1:53 PM
50	Does it matter. GtB council don't care what we think.	10/18/2021 1:40 PM
51	N/a	10/18/2021 1:31 PM
52	Buried natural gas line. Trees to identify the roads during deep blowing snow. Community building upgrades to ensure shelter during power or heating fuel outages	10/18/2021 1:21 PM
53	If there is a loss of phone service	10/18/2021 12:57 PM
54	n/a	10/18/2021 12:54 PM
55	N/A	10/18/2021 12:49 PM
56	Yes	10/18/2021 12:49 PM
57	N/A	10/18/2021 12:48 PM
58	No	10/18/2021 12:47 PM
59	.	10/18/2021 12:47 PM
60	Illness outbreaks.	10/18/2021 11:27 AM
61	na	10/18/2021 11:03 AM
62	N/A	10/18/2021 10:52 AM
63	not known	10/18/2021 10:37 AM



## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

64	NA	10/18/2021 10:16 AM
65	electricity generation and transmission; crop protection; sturdier roads	10/18/2021 10:05 AM
66	n/a	10/18/2021 9:45 AM
67	NA	10/18/2021 9:28 AM
68	unknown	10/18/2021 9:18 AM
69	not sure	10/18/2021 9:16 AM
70	Unknown.	10/18/2021 9:12 AM
71	active shooter, bomb threat, natural disasters	10/18/2021 9:11 AM
72	unknown	10/15/2021 2:46 PM
73	N/A	10/12/2021 10:21 AM
74	Unknown	10/12/2021 9:21 AM
75	NA	10/12/2021 8:44 AM
76	I don't know	10/12/2021 8:19 AM
77	NA	10/11/2021 5:01 PM
78	unknown	10/11/2021 4:10 PM
79	I don't know	10/11/2021 3:52 PM
80	Not sure	10/11/2021 3:47 PM
81	n/a	10/11/2021 3:41 PM
82	renewable energy at a price homeowners can afford	10/11/2021 3:17 PM
83	Unknown	10/11/2021 3:10 PM
84	Not sure but I would like to know more about all of it then offer potential strategies	10/8/2021 4:29 PM
85	Underground utility lines to reduce power outages, installation of generators for tribal businesses, preservation of public health and essential services. Increased solar energy to decrease climate change. Reduce blackout areas to increase communication tower coverage for essential services (police, fire, EMS, etc.)	10/8/2021 2:31 PM
86	maintaining and increase wetlands, streams, and drainage paths.	10/8/2021 1:48 PM
87	Power source back up, police manpower backup	10/5/2021 6:22 PM
88	Definitely we need to foster preparedness within the community. And within the incident responders we should be performing exercises which reflect any potential events/incidents.	10/5/2021 11:18 AM

Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

**Q13 Is there any additional information you would like us to consider as we update the Tribe's Natural Hazard Mitigation Plan?**

Answered: 99 Skipped: 22

#	RESPONSES	DATE
1	Yes, addressing county tornado notification system. Unless you were standing outside in Lake Leelanau it couldn't be heard on the west side of town. I haven't heard the notification in near Suttons Bay.	1/14/2022 10:27 AM
2	n/a	11/5/2021 9:39 AM
3	Specifically age related circumstances	10/28/2021 11:36 AM
4	I cannot think of anything no.	10/27/2021 7:39 PM
5	I would like to see a component for an assessment of falling trees that create hazards, both for public buildings and for private land owners.	10/27/2021 4:21 PM
6	No	10/26/2021 1:58 PM
7	I wud like to be more informed as to future plans concerning directives when looking at outbreak containment and resolution	10/24/2021 4:59 PM
8	Better ways to control the issue of power outages for residents and better drainage for homes from flooding	10/23/2021 3:27 PM
9	None	10/23/2021 1:04 PM
10	Not at this time	10/23/2021 8:41 AM
11	None	10/22/2021 8:48 PM
12	Not right now	10/22/2021 7:00 PM
13	Save our tribe and stand up for saving the environment before we keep losing people. Fix our roads and make it more affordable for native Americans struggling to keep a roof over there heads. Open more schools and jobs.	10/22/2021 5:29 PM
14	It would be wonderful if somebody could do A video explaining everything that people can access on our website.	10/22/2021 3:02 PM
15	Just to include our whole 6 county areas.	10/22/2021 2:35 PM
16	No	10/22/2021 2:24 PM
17	Not at this time	10/22/2021 2:17 PM
18	No	10/22/2021 1:36 PM
19	I'm sure we need some assistance but I am not on the reservation to know what we need.	10/22/2021 1:36 PM
20	Not now	10/22/2021 1:32 PM
21	Not knowledgeable on the Tribal needs	10/22/2021 1:01 PM
22	Not at this time	10/22/2021 12:44 PM
23	Not at this time	10/22/2021 12:44 PM
24	Making sure everyone gets the help they need	10/22/2021 12:35 PM
25	Do what you want	10/22/2021 12:32 PM
26	No	10/22/2021 12:30 PM
27	No	10/22/2021 12:29 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

28	No	10/22/2021 12:27 PM
29	Clean up strategy when a heavy snow storm displaces community.	10/21/2021 6:57 PM
30	Not at the moment	10/21/2021 2:43 PM
31	Impact Covid 19 has on services for the community and businesses and the inter-linked economic impact. Concerns about Economic stability of the area - losing employee base due to inability to provide competitive wages due to revenue loss and OSHA compliance with Vaccine/weekly testing mandate amid housing bubble - locals and other potential candidates from other states can not afford to work where they can no longer afford to live.	10/21/2021 12:09 PM
32	No	10/21/2021 11:26 AM
33	No just more information about it.	10/21/2021 9:00 AM
34	No	10/20/2021 6:02 PM
35	Nope	10/20/2021 4:15 PM
36	NA	10/20/2021 11:58 AM
37	Keep planning.	10/20/2021 7:40 AM
38	no	10/19/2021 3:58 PM
39	No	10/19/2021 3:18 PM
40	no	10/19/2021 11:57 AM
41	The Belanger creek bridge, if a crop dusting plane hit the water tower and flooded the creek, the bridge may washout.	10/19/2021 11:13 AM
42	No	10/19/2021 10:12 AM
43	No	10/18/2021 8:44 PM
44	Na	10/18/2021 6:45 PM
45	No	10/18/2021 4:32 PM
46	Make Housing communities in all 5 counties energy efficient. Also have generator's ready and available for power outages along with alternative energy like wind and solar...	10/18/2021 4:28 PM
47	Send to members	10/18/2021 4:27 PM
48	Incorporate Traditional Anishinaabek values when considering future endeavors and how the long-term impacts will affect Mother Earth. We, as Anishinaabek, truly are living in two worlds - as most have become accustomed to today's modern conveniences; however, we must strive to never forget our connection to Mother Earth and all life around us.	10/18/2021 4:20 PM
49	no	10/18/2021 3:59 PM
50	No	10/18/2021 2:55 PM
51	Jesus Loves Yuns and So Do We	10/18/2021 2:38 PM
52	No	10/18/2021 2:34 PM
53	let the people know the plan ans points of contact	10/18/2021 2:17 PM
54	Educating the public on agriculture and water filtration and irrigation and renewable energy sources to insure the growth of the community.	10/18/2021 2:05 PM
55	As we aim towards the long term goal of food sovereignty at GTB, a plan set aside resources and allocate funding to develop strong, sustainable and economically viable agricultural development is vital	10/18/2021 2:01 PM
56	No	10/18/2021 1:53 PM
57	Everything and getting a new council in.	10/18/2021 1:40 PM
58	No	10/18/2021 1:31 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

59	A community coordinator who could educate and help elderly community members of potential or imminent natural threats....in person. A place in the community building to gather during natural threats	10/18/2021 1:21 PM
60	No	10/18/2021 12:57 PM
61	no	10/18/2021 12:54 PM
62	Our climate environment is very important for everyone's future.	10/18/2021 12:49 PM
63	No	10/18/2021 12:49 PM
64	I think there should be a lot more info out there for members about this, I was unaware that there was a plan.	10/18/2021 12:48 PM
65	Y3s	10/18/2021 12:47 PM
66	Whole house generators.	10/18/2021 12:47 PM
67	Be transparent about any mitigation plans put in place so that the community is fully aware of them.	10/18/2021 11:27 AM
68	no	10/18/2021 11:03 AM
69	Not at this time	10/18/2021 10:52 AM
70	None at this time	10/18/2021 10:16 AM
71	no	10/18/2021 9:45 AM
72	famer pesticide impact on water table	10/18/2021 9:28 AM
73	no	10/18/2021 9:18 AM
74	not sure	10/18/2021 9:16 AM
75	chains established to check on vulnerable people in the community	10/18/2021 9:14 AM
76	No.	10/18/2021 9:12 AM
77	water erosion from Lake Michigan on shoreline	10/18/2021 9:11 AM
78	n/A	10/15/2021 2:46 PM
79	no	10/12/2021 10:21 AM
80	Unsure	10/12/2021 10:21 AM
81	Not that I am aware of.	10/12/2021 9:21 AM
82	No.	10/12/2021 8:44 AM
83	NO	10/12/2021 8:19 AM
84	no	10/11/2021 5:01 PM
85	No	10/11/2021 4:10 PM
86	unknown	10/11/2021 3:52 PM
87	No	10/11/2021 3:47 PM
88	no	10/11/2021 3:41 PM
89	no	10/11/2021 3:17 PM
90	Common dissemination of the details submitted to members	10/11/2021 3:10 PM
91	We would want to identify any possible issues (obviously) ; are we working with FEMA? The community needs to be included with the issues, the plans, preventative measures, community involvement, etc. Escape routes would need to be planned; protecting the forests, protecting the water, having another source of water in the event of drought or contamination, educating the public on how they can help and why they should help, new structures should be as environmentally friendly as possible and use sustainable products and use as much natural	10/8/2021 4:29 PM

## Grand Traverse Band of Ottawa and Chippewa Indians Hazard Mitigation Community Survey

power as possible (solar and wind, for example); reducing plastic use as much as possible; have a structure Tribal members can go to in the event of loss of power and extreme heat or cold, increase building code standards to include more naturally powered homes and structures, bridges should be built higher in the event of flooding.... those are some ideas

92	Include public health prevention strategies to save lives, increase ventilation/HVAC units in buildings, install redundancies and loop feeds to sustain new technology and underground utilities and generators for long-term sustainability.	10/8/2021 2:31 PM
93	Interesting and culturally relevant and attractive informative videos on the GTB website. create an interest in learning about the causes and prevention strategies that individuals can participate in.	10/8/2021 1:48 PM
94	A place to go if power goes out in the middle of the winter	10/8/2021 1:32 PM
95	clean up all the Tribal parks water line to make sure safe for tribal members with easy access	10/8/2021 1:17 PM
96	no	10/6/2021 8:03 AM
97	None	10/5/2021 6:22 PM
98	no	10/5/2021 4:11 PM
99	It is very important to gather the communities input. This will give them a voice, but also raise awareness in the importance of being prepared for adverse events. Also I think every employee (and possibly every interested community member) take the FEMA ICS classes.	10/5/2021 11:18 AM

## APPENDIX D: CURRENT STATUS OF 2016 HAZARD MITIGATION PLAN STRATEGIES

The following table provides the feasible mitigation strategies that were identified in the GTB's 2016 Natural Hazard Mitigation Plan, along with the current status of any progress on these strategies and how they may have been incorporated into the 2023 plan. The lead department responsible for implementing the strategies was listed as the GTB Emergency Management Office.

2016 Priority Area and Mitigation Strategies	Cost Estimate	Timeframe	Priority Level	2023 Status/EM Comments	Related Strategies in the 2023 Plan and Priority Level
<b>Priority Area 1: Extreme Winter Weather – heavy snow, extreme temperatures and concerns regarding power and agricultural loss. Snow Load Mitigation Strategies.</b>					
a. Snow load design standards – develop planning grant for a study of snowfall patterns and occurrence of damage	\$10,000 - \$50,000	3 years from adoption of the plan	2	This strategy is no longer included as a feasible or necessary strategy in the 2023 plan. Snow load design standards follow that of the current State of MI Building code, enforced by county building departments.	Related strategies would be #35 and 36 in the new plan: “Educate developers and property owners about best building practices to mitigation impacts of natural hazards” and “As new buildings are built or buildings are modified, use new technology and/or natural techniques to create or increase structural stability” (Med)
b. Public education and awareness (Free NWS Weather Spotter classes are offered at the Emergency Operations Center)	\$2,000- \$10,000	1 year from adoption of the plan	1	NWS Weather alert messages are relayed to community members by the “Regroup” alert mass notification system	#1 (High), #1g (Medium)
c. Building code enforcement for new construction	\$50,000- \$100,000	5 years	3	County Building Departments currently enforce current building construction codes (issued by the State of MI) for GTB properties. GTB Natural Resources staff enforce the Tribal Soil Erosion and Stormwater Runoff Control ordinance.	#31, #32, #36 (Medium)
<b>Priority Area 2: Severe Weather (High Winds and Tornadoes) – highlighting seasonal population influx and local festivals. High Winds and Tornado Mitigation Strategies</b>					
a. Develop and implement mutual support and aid practices with surrounding communities	\$2,000- \$10,000	5 Years	2	Emergency Services Agencies have current Mutual Aid Agreements in place. Fire & EMS part of MI Mutual Aid Box Alarm System (MABAS)	Related strategy #13: “Continue interdepartmental cooperation and coordination of police, fire and rescue services to achieve service area coverage availability” (Medium)
b. Tree management by power companies on power line easements	\$10,000 - \$50,000	3 Years	3	Utility companies continue to perform emergency and preventative tree work	Continued in strategies #40 (High) and #42 (Medium)
c. Public education	\$2,000 - \$5,000	1 Year	1	Messaging via GTB social media and community outreach programs supported for Severe Weather Awareness Weeks	#1, 1a -1h, #2 (High to Low)
d. Suggest that events have an evacuation plan	\$2,000 - \$10,000	3 Years	4	GTB has a mass notification alert system (Regroup) to announce evacuation routes and receives emergency alerts through county 911, local, tribal, state Law Enforcement /Fire agencies. GTB issues Pre-Event Plans for large public events held on tribal lands.	#16 (Medium), #23 (High)
e. Building Code enforcement for new construction	\$10,000 - \$50,000	5 years	6	Same as #1c in this table.	#31, #32, #36 (Medium)

2016 Priority Area and Mitigation Strategies	Cost Estimate	Timeframe	Priority Level	2023 Status/EM Comments	Related Strategies in the 2023 Plan and Priority Level
<b>Priority Area 3: Severe Heat</b>					
a. Increased tree plantings around buildings to shade parking lots and along public rights-of-way.	\$10,000 - \$50,000	3 Years	1	<p>All new facilities are designed to include shade trees on south side of the building, including shade tree islands in parking lots. A zoning ordinance has been drafted but has not been approved by Tribal Council. The proposed zoning ordinance will be amended and submitted to Tribal Council for approval after the Peshawbestown Master Plan is completed in early 2024. All site plans include Low Impact Design.</p> <p>Tribal Council voted to retract the 2012 Peshawbestown Master Plan but are working on a new 2024 plan to include trees and shade areas.</p> <p>Natural Resource Department constructed some rain gardens and the like at the Tribal park next to Eyaawing Museum.</p>	<p>Although this particular strategy was not continued in the 2023 plan, it is represented on page 125 of the Peshawbestown Master Plan: "Because its sovereign status exempts the Tribe from state zoning and planning enabling legislation, the preparation of a site and building guidelines code should be considered to regulate development activity in the future. This action would ensure that as properties are developed that the same site amenities (lighting, parking, signage, landscaping, etc.) and architectural details would be followed. This will provide some uniformity and consistency when build-out occurs. It is suggested that separate guidelines be prepared for the business and entertainment district, residential neighborhoods, and the commercial district at Putnam and M-22. To encourage the use of sustainable design techniques the guidelines should include provisions for low impact stormwater design, dark-sky lighting, reduction of heat islands (parking lots), convenient transit stops, and non-motorized connections."</p>
b. Encouraging installation of green roofs, which provide shade and remove heat from the roof surface and surrounding air.	\$2,000 - \$10,000	1 Year	2	<p>A large portion of the roof on the GTB Turtle Creek Hotel consists of a green roof. Future green roofs will be considered based on construction costs.</p> <p>Construction on Herkner Rd. in Grand Traverse County is following the Enterprise Green Communities standards. This includes but is not limited to: Integrative Design, Sensitive Site Protection, Compact Development, Passive Solar Heating/Cooling, Environmental Remediation, Ecosystem Services/Landscape, Moving to Zero Energy, Ventilation, Dehumidification, and including a Resident Manual.</p>	<p>While these specific strategies were not incorporated into the 2023 plan, related strategies would be #34, #35 and #36 (Medium)</p>
c. Using cool roofing products that reflect sunlight and heat away from a building.		1 Year	3	<p>All new facilities with flat or low sloped roof are designed with membrane roofing systems with a white color to reflect heat gain from the sun.</p>	



2016 Priority Area and Mitigation Strategies	Cost Estimate	Timeframe	Priority Level	2023 Status/EM Comments	Related Strategies in the 2023 Plan and Priority Level
<b>Priority Area 3, Continued: Severe Heat Mitigation Strategies</b>					
d. Educate citizens regarding the dangers of extreme heat and cold and the steps they can take to protect themselves when extreme temperatures occur.	\$2,000 - \$10,000	1 Year	4	GTB issues Regroup mass notification alerts on weather advisories from NOAA and NWS. Emergency preparedness awareness information is provided to the tribal community in the monthly GTB Newsletter. GTB opens community centers as needed for extreme heat or cold. Use of social media to notify/ educate community.	#1 (High), #1b (High), 1h (Low), #34, #35,
e. Organizing outreach to vulnerable populations, including establishing and promoting accessible heating or cooling centers in the community.	\$2,000 - \$10,000	1 Year	5	GTB installed 5 generators 2023 at Strong Heart Center, Benzie and Charlevoix Satellite Buildings, Medicine Lodge and Fire Station to support heating/cooling centers for community. Starting 2024 a generator will be installed at the Herkner Rd. development's Community Center. Use of social media to notify and educate community.	This strategy is continued as Strategy #26 in the 2023 plan (Medium)
f. Requiring minimum temperatures in housing/landlord codes.	\$10,000 - \$50,000	5 years	6	Current building on Herkner is following the Enterprise Green Communities standards. This includes but is not limited to: Integrative Design, Sensitive Site Protection, Compact Development, Passive Solar Heating/Cooling, Environmental Remediation, Ecosystem Services/Landscape, Moving to Zero Energy, Ventilation, Dehumidification, and including a Resident Manual.	This strategy was not continued in the 2023 plan due to lack of feasibility.
g. Encouraging utility companies to offer special arrangements for paying heating bills, if not already required by state law.	\$2,000 - \$10,000	3 years	7	The state has adopted a Winter Protection Plan that protects seniors and low income families that receive services from MPSC-regulated natural gas and electric companies from having their electric or heat shut off during winter months. Also, income-eligible GTB households can receive emergency heating assistance from the GTB Human Services Dept.	Related strategy #34 (Medium)
h. Creating a database to track those individuals at high risk of death, such as the elderly or homeless.	\$2,000 - \$10,000	3 Years	8	Elders Department, Goodwill, and Ending Homelessness Collation have tracking documentation of the Elderly and Homeless population.	Related strategy: #7 (High)

2016 Priority Area and Mitigation Strategies	Cost Estimate	Timeframe	Priority Level	2023 Status/EM Comments	Related Strategies in the 2023 Plan and Priority Level
<b>Priority Area 4: Potential wildfire/urban interface Wildfire Mitigation Strategies</b>					
a. Public education and awareness activities such as programs and brochures regarding fuel management, proper vegetation, fire breaks	\$2,000 - \$10,000	1 Year	1	Fire Wise awareness events have been held at the nearby Cedar Area Fire & Rescue Department (in Leelanau County). Townships, villages, GTB Tribe members are a regular part of County LEPC/LPT meetings.	#1f (Medium), #14 (Medium),
b. Continue enforcement of state fire codes regarding setback requirements	\$2,000 - \$10,000	1 Year	2	County Building Departments enforce setbacks in building permitting process.  The GTB Fire and Rescue Department issues directives to individuals employed by the GTB, its enterprises, businesses and subsidiaries to act in compliance of the National Fire Protection Association Code (adopted by the GTB) for all GTB structures certified for occupancy.	#32 (Medium)
c. Public education utilizing the Michigan Department of Natural Resources flyers and FEMA information at parks and campgrounds	\$2,000 - \$10,000	1 Year	3	MDNR places public educational flyers in place at State Park area and campground	Related strategy #1c (High)
d. Assess fire suppression capabilities and make improvements	\$10,000 - \$50,000	3 Years	4	Tribal Fire Chief oversees routine assessments of staff, facilities, equipment.	This strategy has been continued as #3 (High)
e. Research the Department of Natural Resources' State Forest wildfire/urban interface rules or plan	\$10,000 - \$50,000	3 Years	5	Local DNR Fire Supervisor has active role in our monthly County Fire Chief's Association meetings	This strategy was not included in the 2023 plan due to the regular participation of MDNR Fire staff in local fire chief meetings; a related strategy would be #5 "Annually update the Tribe's basic Wildfire Operations Plan (coordinate with the MDNR)" (High).

**Additional 2016 Mitigation Strategies and 2023 Status**

Mitigation Strategies	2023 Status/EM Comments	Related Strategies in the 2023 Plan and Priority Level
Collaborate with governmental entities such as counties, townships and villages; organizations, businesses and the public.	<p>Ongoing. GTB staff from Public Safety are a regular part of County LEPC/LPT meetings.</p> <p>GTB Natural Resources Staff continue to:</p> <ul style="list-style-type: none"> <li>• Develop and foster working relationships with Federal and State agencies to improve management efficiency,</li> <li>• Develop resource use agreements, and improve productive communication with other resource management agencies.</li> <li>• Conduct Public Outreach and Education (including Natural Resources Fair and Feast, Kids Free Fishing Days, fishery survey reports to membership, lake associations, and watershed committees)</li> <li>• Perform grant writing and administration for resource protection, restoration, and enhancement projects with particular emphasis on collaborative projects</li> </ul>	#1b, #2, #5, #6, #8-10, #11c, #13, #15, #24, #30, #32, #40, #43, #47, #51d
Develop a multi-hazard warning plan and strategies for festivals/events.	Completed. The GTB Tribe now offers the “Regroup” mass notification system for emergency or hazardous conditions.	#1 (High)
Incorporate the Plan’s hazard mitigation concepts, strategies and policies into existing elements of GTB Plans.	Ongoing. See subsection “Tribal Laws and Planning Mechanisms” of Section VII (Mitigation Strategies and Priorities) of the 2023 Plan.	#10 (High)

**APPENDIX E: CONSIDERATION OF ALTERNATIVE STRATEGIES FOR 2023 PLAN**

## Hazard Mitigation Alternatives Considered for the GTB Tribe

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

<b>Hazard Mitigation Alternatives for General Thunderstorm Hazards, Hail, and/or Lightning</b>	
✓	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.

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

<b>Hazard Mitigation Alternatives for the Extreme Temperatures Hazard</b>	
✓	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 the GTB Tribe

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

<b>Hazard Mitigation Alternatives for Winter Weather Hazards (Includes snowstorms, ice &amp; sleet storms)</b>	
✓	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.

<b>Hazard Mitigation Alternatives for Fluvial (Riverine) Flooding</b>	
✓	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 the GTB Tribe

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

<b>Hazard Mitigation Alternatives for Urban Flooding</b>	
✓	Stormwater management—Adequate design, installation, maintenance, and monitoring of municipal storm sewer systems. Ordinances or amendments to assist in stormwater management (e.g. forbidding illicit discharges). Planning for and regulating areas prone to flooding (acceptable uses and development restrictions through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, purchased or transferred development rights, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
	Homeowner's and rental insurance that includes coverage of damages and cleanup of sewer backflow impacts.
✓	Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, flood gates and pumps, wetlands protection and restoration).
✓	Higher engineering standards for drain and sewer capacity, or the expansion of infrastructure to higher capacity.
✓	Drainage easements (allowing the planned and regulated public use of privately owned land for temporary water retention and drainage).
✓	Installing (or re-routing or increasing the capacity of) storm drainage systems, including the separation of storm and sanitary sewage systems.
✓	Farmland and open space preservation.
	Elevating mechanical and utility devices above expected flood levels.
	Flood warning systems and the monitoring of water levels with stream gauges and trained monitors.
✓	Increased coverage and use of NOAA Weather Radio.
	Anchoring of manufactured homes to a permanent foundation in flood areas, but preferably these structures would be readily movable if necessary or else permanently relocated outside of flood-prone areas and erosion areas.
✓	Control and securing of debris, yard items, or stored objects (including oil, gasoline, and propane tanks, and paint and chemical barrels) in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs. <i>(Advice to be provided in public outreach efforts).</i>
✓	Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure clear drainage infrastructure.
	Detection and prevention/discouragement of illegal discharges into storm-water sewer systems, from home footing drains, downspouts and sump pumps.
✓	Increasing the function and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance), including possible separation of combined storm/sanitary sewer systems, if appropriate.
✓	Wetlands protection regulations and policies.
	Use of check valves, sump pumps and backflow preventers in homes and buildings.
	Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
✓	Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
✓	Protection (or restoration) of wetlands and natural water retention areas.
	Landslide mitigation ideas: Do not build houses, buildings, parks, or playgrounds close to steep slopes; install flexible pipe fittings to avoid gas and water line breakage.

## Hazard Mitigation Alternatives Considered for the GTB Tribe

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

<b>Hazard Mitigation Alternatives for Dam Failures</b>	
✓	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.

<b>Mitigation Alternatives for Drought Hazard</b>	
✓	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 Considered for the GTB Tribe

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

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

## Hazard Mitigation Alternatives Considered for the GTB Tribe

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

<b>Hazard Mitigation Alternatives for Invasive Species</b>	
	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.

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

<b>Hazard Mitigation Alternatives for Shoreline Flooding and Erosion</b>	
✓	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 private flood insurance.
	Participate in the Community Rating System (CRS) for NFIP.
✓	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).

### Hazard Mitigation Alternatives Considered for the GTB Tribe

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

	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. <i>(Advice to be provided in public outreach efforts).</i>
✓	Increased coverage and use of NOAA Weather Radio.
✓	Locating structures and infrastructure landward of the established setbacks.

## APPENDIX F: PARTICIPATION TABLE

## APPENDIX G: MEETING AND PARTICIPATION DOCUMENTATION