

Leelanau County Hazard Mitigation Plan Update

February 10, 2022



**Networks
Northwest**

Talent / Business / Community



Welcome

- Thank you for joining us!
- We will be discussing the following:
 - Results of the Community Survey
 - Historic Weather Events
 - Hazard Identification



Introductions

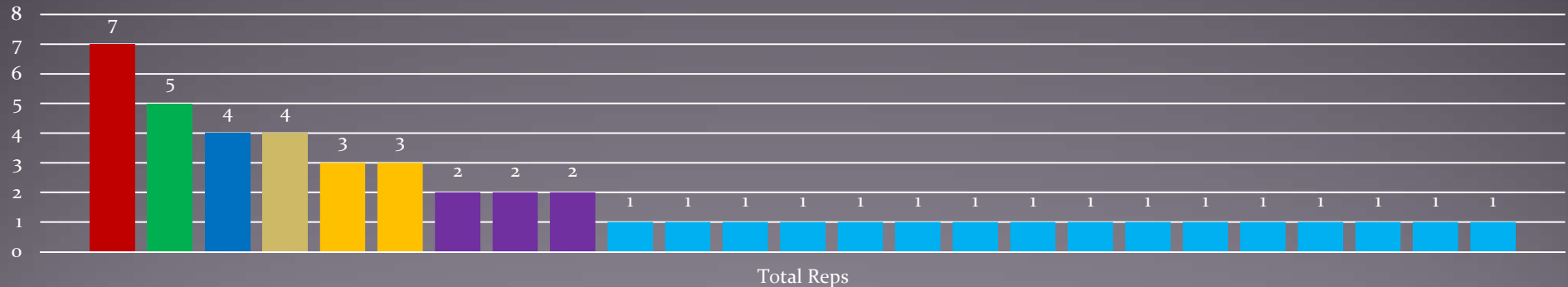
- Networks Northwest Staff
 - Jennifer Neal, AICP
 - Stephanie Loria
- Community Partners

Project Meeting Attendance Table

Participating Agency or Jurisdiction	Representative	Completed Survey (as of 2/4/2022)	Meeting Attended	
			Kick-off Meeting 7/1/2021 (In person and via Zoom)	LEPC Meeting October 21, 2022 (In person)
Networks Northwest	Jennifer Neal, Stephanie Loria		x	x
Michigan State Police	Mike Sobocinski		x	
Leelanau County EM/911	Matt Ansorge, Kelly LaCross	x	x	x
Leelanau County Sheriff's Office	Lt. Jim Kiessel	x		x
Leelanau County Road Commission	Brendan Mullane	x		
Leelanau County Board of Commissioners	William Bunek			x
Benzie-Leelanau District Health Dept.	Bobbi Scott	x		x
Grand Traverse Band of Ottawa and Chippewa Indians	Jolanda Murphy	x	x	x
Michigan State Police	Tpr. Jason Tropf	x		x
American Red Cross of Northern MI	Meghan Powers	x		
City of Traverse City		x		
Village of Empire		x		
Village of Northport		x		
Village of Suttons Bay		x		
Bingham Township		x		
Centerville Township		x		
Cleveland Township		x		
Elmwood Township		x		
Empire Township				
Glen Arbor Township		x		
Kasson Township		x		
Leelanau Township				
Leland Township		x		
Solon Township		x		
Suttons Bay Township		x		
Leelanau Conservancy		x		
Leelanau Sands Casino		x		
Leland Public Schools		x		
Heartland-ProMedica Hospice	Barb MacGregor	x		x
The Watershed Center - Grand Traverse Bay	Christine Crissman			

Leelanau County Hazard Mitigation Community Survey

Leelanau County HM Survey Oct 2021-January 2022
49 responses

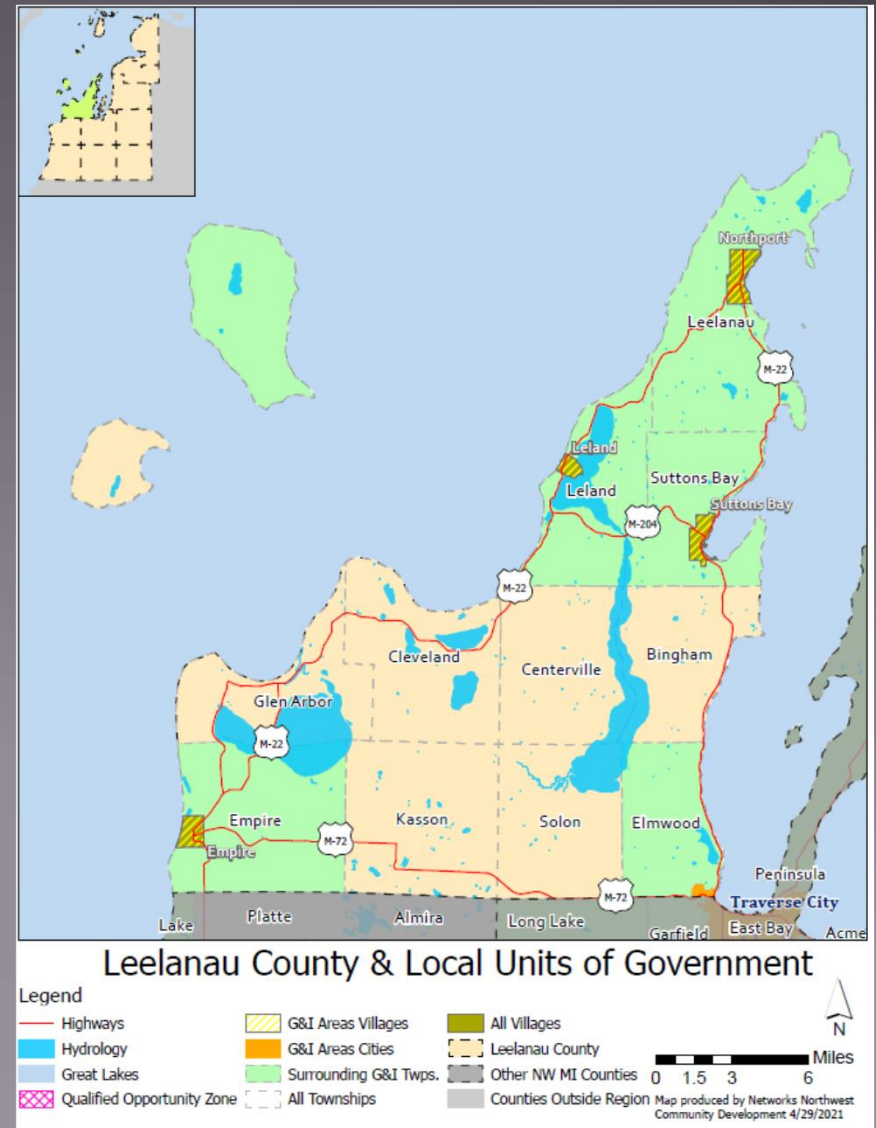


- Total Reps
- Grand Traverse Band of Ottawa & Chippewa Indians
 - Suttons Bay Township
 - Leelanau County Road Commission
 - Unknown
 - Centerville Township
 - Village of Empire
 - Benzie Leelanau District Health Department
 - Solon Township
 - Leelanau County Emergency Management/911
 - American Red Cross of Northern Michigan
 - Charter Township of Elmwood
 - Cleveland Township
 - Heartland-ProMedica Hospice
 - Leelanau Conservancy
 - Bingham Township
 - City of Traverse City
 - Glen Arbor Township
 - Kasson Township

Community Survey Responses from 10/4/21 to 2/4/22

We did not get survey participation from the following communities:

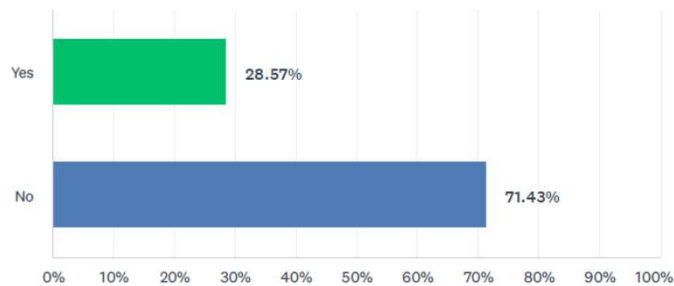
- Empire Township
- Leelanau Township



Community Survey Results

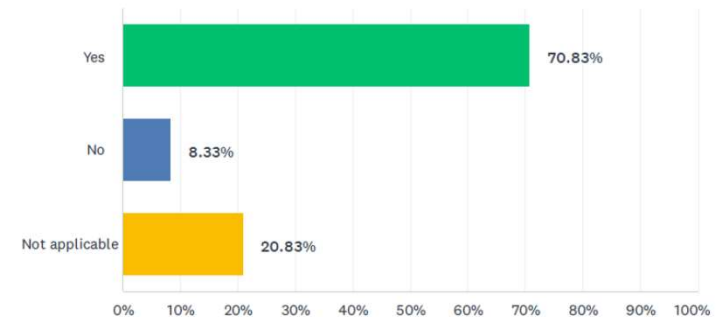
Q3 Are you familiar with the county's Natural Hazard Mitigation Plan?

Answered: 49 Skipped: 0



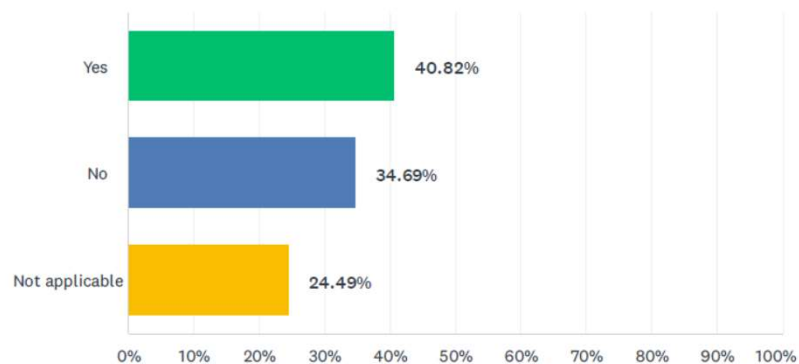
Q4 Does the community you represent have an adopted Master Plan?

Answered: 48 Skipped: 1



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

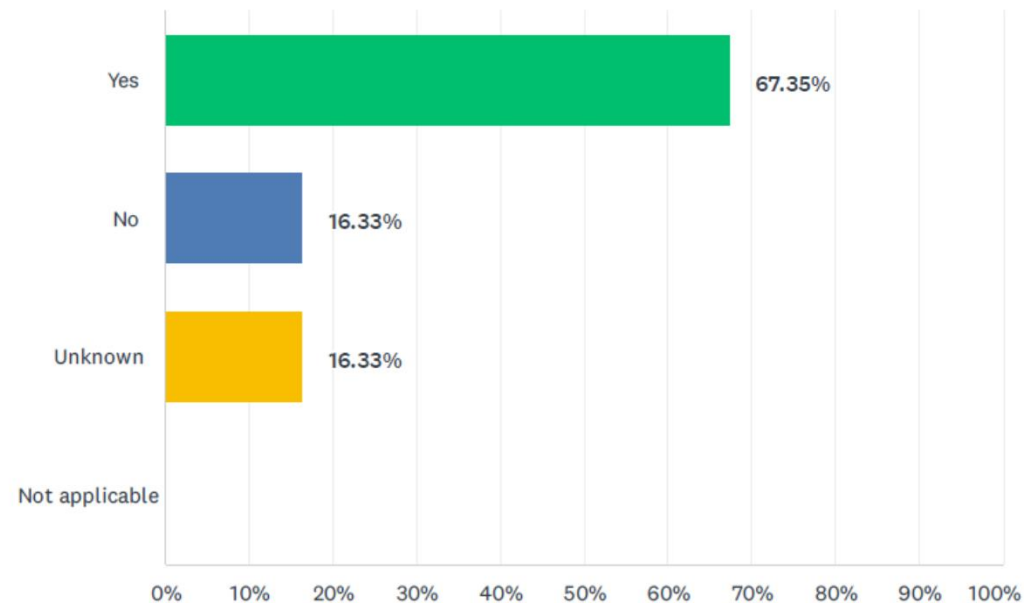
Answered: 49 Skipped: 0



Community Survey Results

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

Answered: 49 Skipped: 0



Community Survey Results

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

Straight Line Winds/Windstorm/Severe Storm (19)

- August 2, 2015 - Straight-line wind event which lead to a Governor's Disaster Declaration. The storm brought "straight line" winds that acted like a tornado taking out hundreds of trees and caused power losses that lasted several days.
- August 2016 – straight line wind damages. Glen Arbor heavily impacted and unsure direct impact to Centerville
- August 2018 – straight line wind event
- Multiple extended power outages over the past 10 Years

Pandemic/COVID-19 Pandemic (7)

Winter Storms (Snow, Ice, Blizzard, etc.) (7)

- Short-term electricity loss
- March 2012 Winter Storm in Leelanau County

Community Survey Results

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

Lakeshore Erosion/High Lake Water Levels (6)

- Erosion of bluff to within eight inches of Lee Point. The township participated financially in emergency repair to erosion area to shore up road. Winter storm out of south forcing high waves to erode bluff.
- Lakeshore erosion undermining adjacent infrastructure
- Our beach was torn apart by high water and wind activity.
- High Water on our beach which also affects high water table in the Village.

Flooding (5)

- 2020
- Regular flooding in Cedar.
- Road Flooding on Lee Point Road due to 6.5" on one occasion this year.

Dam Failure (1)

- Earthen dam failure at Vlacks park.

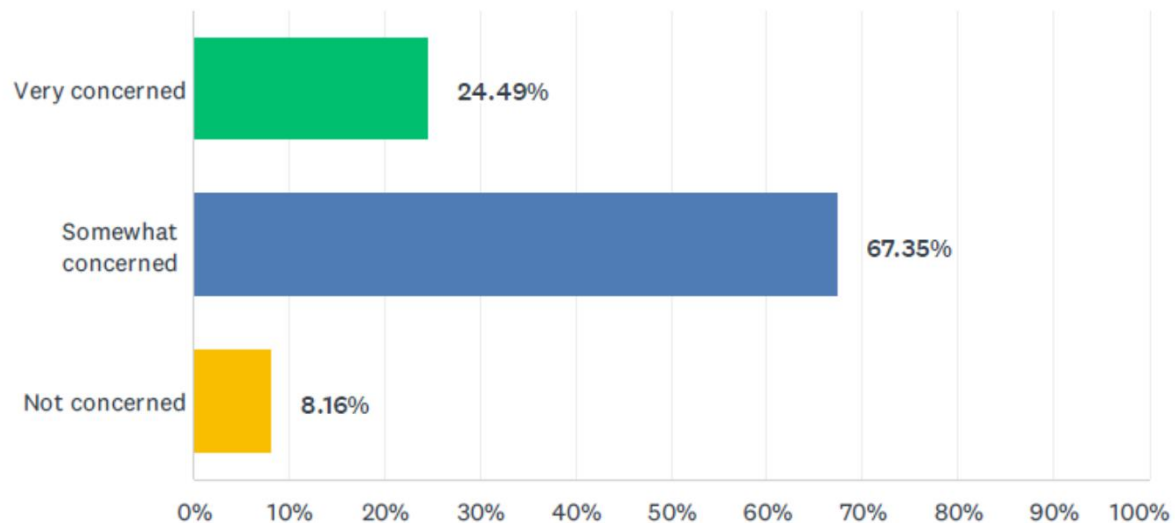
Wildfires (1)

Unknown/ N/A (3)

Community Survey Results

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

Answered: 49 Skipped: 0



Community Survey Results

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

1 Flood (23)

2 COVID-19 Pandemic/ Illness Outbreak (22)

- The illness outbreak has had the most significant impact on our community, government and businesses as a whole.
- Another pandemic
- Continued pandemic
- Local health system capacity

3 Winter Storms (blizzard, heavy snow, ice storm, protracted winter storm) (19)

#4. Wildfire (15)

#5. High Winds/ Straight-line Winds (14)

#6. High Lake (Lake MI and inland lakes) Water Levels/Shoreline Erosion (6); Severe/Hazardous/Extreme Weather Event (6); and Utility Outages (6)

#7. Tornado (4)

#8. Drought (2); Impassable Road from storm damage (2)

#9 Agricultural Disease (1) and Invasive species (1)

Civil Unrest (1) (not part of the scope of this plan)

Community Survey Results

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

Answered: 44 Skipped: 5

Respondents who indicated “yes” and/or provided a description: (27 / 44 = 61%)

Roads, Culverts & Bridges (20)

- Erosion and flood and dams/bridges in county for direct routes impacts and structural damage
- The road bridge over the Cedar River is too small and is not in good repair.
- Flooding has to potential to washout roads, especially at creek crossings that become overwhelmed
- Culverts are old and failing causing unnecessary erosion and changes in rivers path
- Road edge drains and culverts, interior ditching, insufficient for anticipated future water handling
- There is currently a drainage district being considering by County Drain Commissioner including an inland lake outlet that [flows] under a road.
- High waters create a concern for erosion and flooding of roads along the shorelines and creeks.
- Shoreline erosion could undermine a paved parking lot.
- If erosion or high water threatened erosion that impacted M-22 (circles the County), that infrastructure would have a lasting impact.
- Road blockage

Utility Outages (11)

- Possibly ice storm. Our county is isolated and has only few transmissions lines and roads entering from the south only.
- When we have a power outage we can't even use the stove
- Utility infrastructure during long-term outage; Glen Arbor power grid had to be rebuilt after August 2nd Storm, 7-10 days without power in middle of summer, many concerns for that to recur.
- Utilities are frequently damaged by even fairly minor wind and ice events

Community Survey Results

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

Answered: 44 Skipped: 5

Dams (3)

- Union Street dam in Traverse City. Taking steps now to monitor for planned replacement in near future.
- Dams & bridges do not pose threat to loss of life, very minimal at best. Would create an inconvenience for transportation via temporary detours.

Public Beach Impacts (2)

- We have several areas on our public beach that are not reinforced and could be lost when future high water and wind events occur.
- Our public beach facilities were under siege with the high water in 2018/2019 (as were all of our Lake Michigan coast cities and villages. We must be better prepared to cope with those events

Water and sewer (2)

- Concerns about our ability to manage storm water drainage issues.

Fire (1)

- Fire in the wildland urban interface is an increasing hazard.

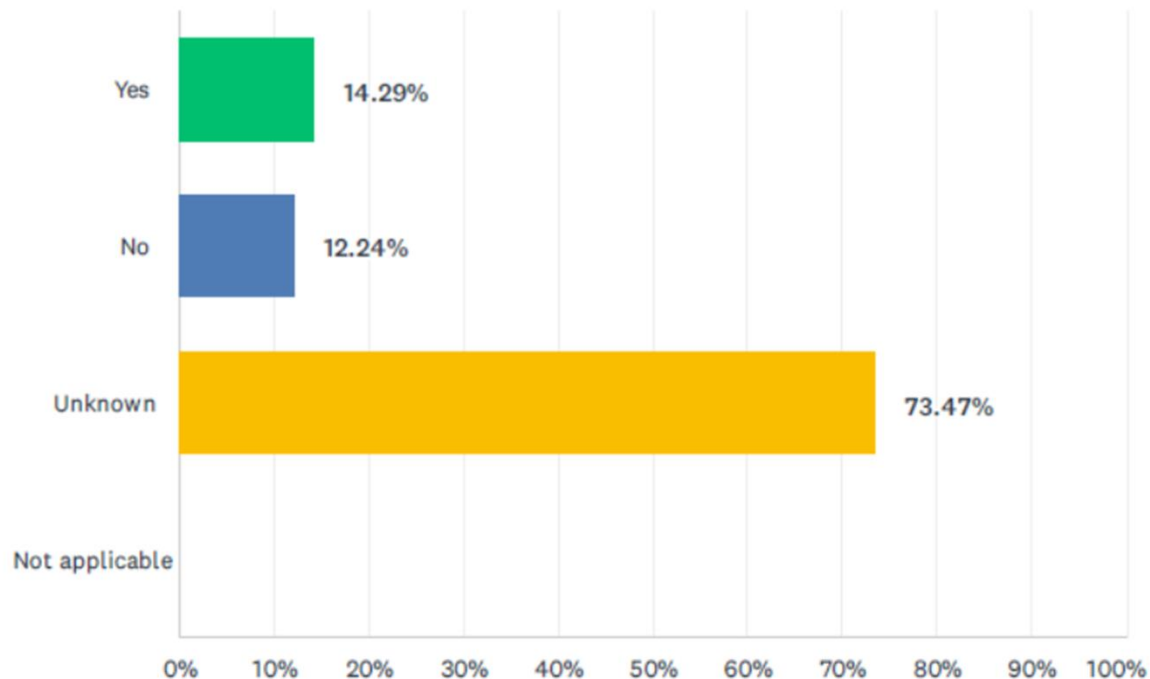
Other

- Yes. Please refer to the GTB Natural Hazard Mitigation Plan
- Climate change is warming northern Michigan, especially the last 10 to 15 years.
- [From Leland Public Schools:] Not really. We just completed an extensive construction project and upgraded our fire suppression system, electrical system, water holding and septic systems, and all HVAC/Mechanical systems.

Community Survey Results

Q12 Has your community requested assistance for mitigation projects in the past?

Answered: 49 Skipped: 0



Community Survey Results

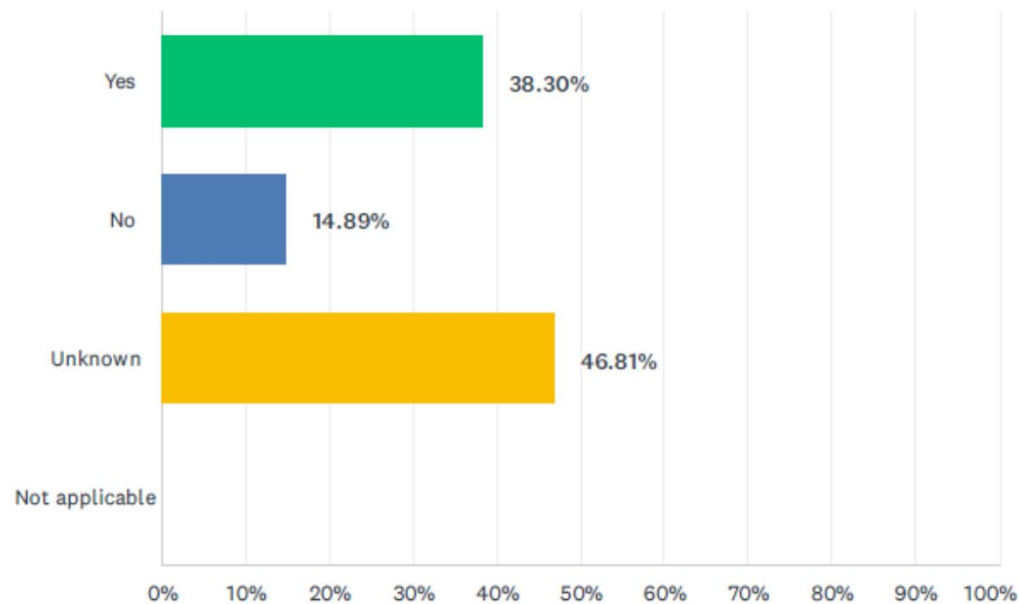
Q12 Has your community requested assistance for mitigation projects in the past?

- **Suttons Bay Twp:** costs were shared with other county entities to help remove Phragmites on shorelines and inland areas; Costs were shared with the LCRC and Village to add shoreline protection rocks to South Shore Drive in Suttons Bay.
- **City of Traverse City:** assistance from outside agencies in determining risk.
- **GTB:** Natural hazard projects
- **Leelanau County Road Commission:** yes – coordination with law enforcement
- **Village of Empire:** we received a grant, however, the Village Council voted to not accept the grant. The grant would have rebuilt our boat launch and reinforced the infrastructure in front of our lighthouse.
- **Solon Twp.:** No, it wasn't granted – it was to expand the Cedar Community Park and make it more user friendly.

Community Survey Results

Q14 Has your community considered mitigation strategies for potential or current hazards?

Answered: 47 Skipped: 2



Community Survey Results

Q15 If so, please identify potential strategies you would like to explore in the near future.

Answered: 26 Skipped: 23

Benzie-Leelanau District Health Dept.

- We lack facilities to provide extended large scale medication distribution or medical care

Grand Traverse Band Tribe

- Increased access to the rural area regarding high speed internet as this has impacted students and families with the current pandemic. This is a very rural county and lack of internet has affected families and students ability to work and learn from home.
- Climate change and weather related strategies
- Generators, snow removal equipment
- Infrastructure, reduction of weather hazards and support to utilities.

Traverse City Fire Dept.

- Protection of above-ground electric service grid. Protection of stream and river banks. Protection of infrastructure and property affected by high water levels adjacent to the Great Lakes.

Community Survey Results

Q15 If so, please identify potential strategies you would like to explore in the near future.

Answered: 26 Skipped: 23

Leland Public Schools

- We have a state required emergency operations plan that addresses all manner of natural and other emergencies.

Elmwood Twp.

- We need to look at drainage issues/flooding issues in our Twp. Area

Leelanau County

- Shoreline erosion from high water levels concerned villages and marinas. Shoreline wrap or stone seawall applications would be considered. Also raising marina docks would be necessary.

Leelanau County Road Commission

- How to mitigate flooding that comes from outside the R-O-W, where we have little or no control
- Lists, plans, proper equipment
- Communication and proper dispatch schedule

Village of Empire

- Ideas that will help us plan to safeguard our beach infrastructure without causing damage to properties that surround our public beach.
- We have, as a council, very briefly discussed coastal resilience management grants – but have not gone further. We have, also, very informally discussed some of our storm water drainage issues with our village engineer, but we have not taken any formal action on either.

Solon Twp.

- Improving the Cedar Community Park area. Also install a Cedar Community Septic System.

Community Survey Results

Q16 Is there any additional information you would like us to consider as we update the county's Natural Hazard Mitigation Plan?

Answered: 28 Skipped: 21

- Individuals that are home bound due to health issues and/or lack access to transportation.
- Power outages during storms continue to be an issue in the county. We have many elders and retirees, it can be dangerous in the winter months.
- Sustainment of infrastructure, utilities due to power outages.
- Consider ice storms
- Better cellular service coverage and communication towers are a must. I'm not sure that all areas of this County could be alerted fast enough if a disaster was to happen.
- Forest fires, drought and heavy wind/extreme weather events are the most critical.
- Solon Twp. Needs to be included and also needs a workshop with the board to identify our community needs and go through this process.
- Look for funds that can be used to put in a community septic system in Cedar.
- Address erosion
- Up-to-date accurate pandemic information
- Participation in any planning.
- Climate change is increasing all risks.



Presidential and Governor Declared Emergencies/Disasters

- **March 10, 2020: Governor Whitmer declared a State of Emergency** in Michigan to address the COVID-19 pandemic.
- **March 13, 2020: the U.S. made a National Emergency Declaration** regarding the COVID-19 virus outbreak. The Federal government began developing a sweeping relief package.
- **March 23, 2020: Governor Whitmer announced an order for all Michigan businesses and operations to temporarily suspend in-person operations** that are not necessary to sustain or protect life, and to stay home unless they are part of the critical infrastructure workforce, engaging in outdoor activities, or performing necessary tasks (e.g. going to the grocery store).
- **March 26, 2020: Governor Whitmer requested a Major Disaster Declaration for the State of Michigan due to the Coronavirus Disease 2019 (COVID-19) pandemic beginning on January 20, 2020, and continuing.** The Governor requested a declaration for Individual Assistance (all programs) statewide; Public Assistance (Categories A-G), including direct Federal assistance, statewide; and Hazard Mitigation statewide. The Governor also requested that the cost-sharing requirement be waived for this disaster.
- **March 27, 2020: President Trump approved Governor Whitmer's request for a Major Disaster Declaration in Michigan,** which allows Michigan to participate in FEMA programming.

Presidential and Governor Declared Emergencies/Disasters

Date of Incident	Type of Incident	Affected Area	Type of Declaration/ Fed ID #	Notes
1/29/2019	Extreme Cold	Statewide	Governor Declared Emergency	
8/2/2015	Thunderstorms	Grand Traverse County and Leelanau County	Governor Declared Disaster	
9/4/2005 and 9/7/2005	Hurricane (Katrina) Evacuation	Statewide	Governor Declared Disaster and Presidential Declared Emergency (3225)	Declared due to the emergency conditions in the State of Michigan, resulting from the influx of evacuees from states impacted by Hurricane Katrina beginning on August 29, 2005.
1/26-27/1978	Blizzard, Snowstorm	Statewide	Presidential Declared Emergency (3057); Governor Declared Disaster	
3/2/1977	Drought	44 Counties, including Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Kalkaska, Leelanau , Manistee, Missaukee, Otsego, Roscommon and Wexford.	Presidential Declared Emergency (3035)	
4/5/1956	Tornado	4 Counties: Benzie, Leelanau , Manistee and Ottawa	Presidential Declared Major Disaster (53)	

Historic Weather Events

- **Extreme Winter Weather Events** (events with ice covering, property damage, and/or up to/over 12 in. of snow)

Year	# Severe Winter Storms	Damages/Notes
2012	2	\$37,500 in crop damage in Leelanau County from a killing frost/freeze in April
2013	0	
2014	3	1 storm with high winds; 1 with extreme cold
2015	3	1 storm with extreme cold
2016	5	1 storm with high winds
2017	0	
2018	2	1 storm with high winds
2019	3	2 storms with high winds
2020	0	
2021*	2	1 storm with high winds
Total	20**	

*NOAA's National Centers for Environmental Information will provide weather data through Dec 2021 by Mid-March or April 2022.

** Thirty-nine (39) Extreme Winter Weather Events occurred between 1993 and 2011. A historic blizzard occurred in the state in 1978.

Historic Weather Events, contd.

- Severe T-Storm/High Wind Events (14) 2015-2021

Month	Year	Location	Effect	Damage	Storm Notes
August	2015	Lake Leelanau to Suttons Bay	55 knot winds. Numerous trees and power lines downed in central Leelanau County	\$18,000	Multiple waves of severe t-storms crossed the region with straight-line wind damage
August	2015	Glen Haven to Rennies (Orchard in Acme Twp.?)	Winds gusting to 78 knots/ >80 mph crossing much of southern Leelanau County. Thousands of trees were downed in this swath, from the Sleeping Bear Dunes to Grand Traverse Bay. Many homes and vehicles were damaged by falling trees. Area roads were closed for days, in some cases weeks. Glen Arbor was inaccessible via road for two days, until M-22 could be cleared of trees and reopened. The county established drop points for residents to leave storm debris; these remained open for seven weeks after the storm. Across Leelanau County, two homes were destroyed, and over 700 were damaged in some way.	\$18.8 million	Multiple waves of severe t-storms crossed the region with straight-line wind damage
August	2015	Leland to Suttons Bay	60 knots. Trees and power lines were downed in northern Leelanau County, though the damage was not as extensive as further south. Still, multiple vehicles and homes were damaged by falling trees.	\$5.2 million	Multiple waves of severe t-storms crossed the region with straight-line wind damage
December	2015	Region	51 knots/gusts > 60 mph. Scattered tree damage and power outages.		
June	2017	Lake Leelanau	50 knots. A boat was flipped, and the dock it was attached to was destroyed on lake Leelanau, along S. Sandy Beach Dr.	\$20,000	
June	2017	Maple City	54 knots. Multiple trees downed, some onto power lines. One grass fire resulted.	\$13,000	
June	2017	Isadore	50 knots. Two trees downed on Good Harbor Trail south of Gatzke Rd.	\$3,000	
June	2017	Solon	54 knots. Several trees downed near Hoxie and Lautner Roads.	\$5,000	

Historic Weather Events, cont'd.

- Severe T-Storm/High Wind Events (14) 2015-2021*

Month	Year	Location	Effect	Damage	Storm Notes
August	2018	Glen Haven	54 knots. Multiple trees downed in Glen Haven.	\$8,000	
August	2018	Leland	56 knots.		
August	2018	Northport	50 knots. One large tree was downed at Carlson Rd. and M-22.	\$2,000	
August	2018	Empire Airport	50 knots. One large tree downed on S. Plowman Rd. near Breeman Rd.	\$2,000	
July	2019	Burdickville	52 knots. A road was blocked by fallen trees.	\$6,000	
July	2019	Cedar	52 knots. Trees downed across a road	\$5,000	
July	2019	Suttons Bay to Peshawbestown	52 knots. Several trees downed. One large downed tree blocked M-22 north of Suttons Bay.	\$8,000	
September	2019	Leland	52 knots. Several downed trees. Some power lines downed by falling trees near the Leland Library.	\$10,000	
November	2020	County/Region	50 knots/gusts up to 58 mph at Leland. Spotty wind damage and lakeshore flooding on parts of Lake MI coastline.		
November	2020	Region	51 knots/gusts up to 55 mph along Lake MI coastline; reached a peak gust of 59 mph at Grand Traverse Lighthouse in Leelanau Twp.		
August	2021	Region/County/Empire	50 knots; trees and powerlines down countywide	\$10,000	Heavy rainfall and flash flooding in the region
August	2021	Bingham	51 knots;		Heavy rainfall and flash flooding in the region

*NOAA's National Centers for Environmental Information will provide weather data through Dec 2021 by Mid-March or April 2022.

Thirty-three (33) T-Storm/High Wind Events occurred between 1995-2014

Historic Weather Events, cont'd.

- Hail (20) 1998-2010

Month	Year	Location	Effect	Damage	Storm Notes
June	1998	Suttons bay	0.75 in.	NA	
May	2000	Leland	1.00 in.	NA	
May	2000	Suttons bay	1.00 in.	NA	
May	2000	Maple City	1.00 in.	NA	
June	2000	Northport	0.88 in.	NA	
May	2001	Suttons Bay	1.75 in.	NA	
May	2001	Leland	1.00 in.	NA	
May	2002	Leland	0.75 in.		
August	2003	Greilickville	0.88 in.	NA	
June	2004	Leland	0.75 in.	\$5,000	
August	2004	Glen Haven	0.75 in.	NA	
September	2005	Cedar	0.88 in.	NA	
July	2006	Leland	1.00 in.	\$50,000	
October	2007	Empire Airport	1.00 in.	NA	
June	2008	Empire	0.88 in.	NA	
June	2008	Hatchs	1.0 in.	NA	
July	2008	Cedar	0.88 in.	NA	
July	2008	Suttons Bay	0.75 in.	NA	
September	2008	Leland	0.88 in.	NA	
April	2009	Suttons Bay	0.75 in.	NA	

Historic Weather Events, cont'd.

- Hail (13) from 2011-2021

Month	Year	Location	Effect	Damage	Storm Notes
April	2011	Maple City	0.88 in.	NA	
April	2011	Empire	1.00 in.	NA	
April	2011	Maple City	1.00 in.	NA	
June	2011	Countywide	0.88-1.00 in.	NA	
May	2013	Greilickville	1.00 in.	NA	
May	2013	Northport	1.00 in.	NA	
August	2013	Northport	1.50 in.	NA	
August	2015	Lake Leelanau	1.0 in.	NA	Widespread straight-line wind damage
July	2016	Empire to Glen Arbor	3 in.	\$2,000,000 crop damage; \$85,000 in property damage	Empire saw golf ball-sized hail, and up to 3" diameter hail in Glen Arbor. Some damaged vehicles; a few homes lost windows and skylights. Considerable damage done to area orchards and vineyards. Approx. 60% of the cherry crop in the region was damaged.
July	2016	BOCUS (?)	1.5 in.	\$500,000 in crop damage	Considerable damage done to area fruit crops, cherries in particular.
July	2016	Suttons Bay	1.0 in.	\$500,000 in crop damage	Considerable damage done to area fruit crops, cherries in particular.
April	2017	Leland	0.88 in.	NA	
August	2021	Greilickville	0.75 in.	NA	Thunderstorms with damaging winds producing heavy rainfall and flash flooding in multiple locations in the region.

Historic Weather Events, cont'd.

- Tornadoes (4)

Month	Year	Location	Effect	Damage
July	1956	Suttons Bay	NA	NA
July	1977	Glen Arbor Twp.	EF1. 8.4 miles long, 167 yards wide. Touched down on Glen Lake, just south of Glen Arbor. Ended just east of Little Traverse Lake, between M-22 and E. Traverse Lake Road.	\$25,000
August	1978	Leland Twp. and Suttons Bay Twp.	EF0. 2.3 miles long, 160 yards wide. Touched down on M-22, south of Leland and skipped to 1 mile ENE of Suttons Bay. Damaged 4 homes and 2 mobile homes, blocking roads with felled trees. Most of damaged homes were on Dumas Rd. Many boats on Lake Leelanau broke loose from their moorings with several boats capsizing.	\$250,000
June	2011	Leland Twp.	EF0. 0.35 miles long, 75 yards wide. Touched down near west shore of Lake Leelanau, then moved out onto the lake and quickly dissipated. Docks and boats damaged along short stretch of shoreline. Few downed trees.	\$20,000

Historic Weather Events, cont'd.

- Flood/ Flash Flood (12) 1993-2021

Month	Year	Location	Effect	Damage	Notes
April	1993	County/Region	NA	\$5,000,000	
July	1999	Countywide	Secondary roads washed out	NA	
September	2000	Countywide	Roads and basements flooded	\$50,000	
April	2004	Countywide	Secondary roads washed out	NA	
Spring	2014	Countywide	High water tables cause localized flooding	NA	
Fall	2014	S. Lk Leelanau	Flooding caused by heavy rains	NA	
May	2019	Leland/ Fishtown	Seiche/localized flooding caused by the combination of the sudden relaxation of a gusty E wind, and quick transition to a NW wind, combined with Great Lakes water levels at near-record highs.	\$5,000	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.
October	2019	County/Region/ Coastline Communities	Lakeshore flood. NW to N. winds produced high waves and elevated water levels along the NW MI coastline. With Great Lakes water levels at near-record highs, significant coastal flooding and beach erosion resulted.	\$4,000	The parking lot of the Grand Traverse Yacht Club in Greilickville was flooded.
October	2019	County/Region/ Coastline Communities	Lakeshore flood. Strong northerly to easterly winds resulted in another round of substantial coastal flooding and beach erosion, this time on both Lake MI and Lake Huron.	\$175,000	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, 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.
April	2020	County/Region/ Coastline Communities	Lakeshore flooding along portions of the Lake MI coastline. Gusty W to NW winds (40-50 mph).	NA	Localized power outages.
August	2021	Empire Twp. /Region	Flash flood caused by heavy rain.	NA	Water up to 6 in. deep flowing over some roads around Empire.
August	2021	Solon Twp. /Region	Flash flood caused by heavy rain.	NA	Water rushing over the road about 6 in. deep at the intersection of Gallivan and Alpine Rd.



Historic Weather Events (cont'd)

- Extreme Heat (2)

- **6/30/2018** The month of June closed with one of the hottest days in recent memory. Highs were well into the 90s, including 99 at Alpena, and 98 at Traverse City and Gaylord. The National Weather Service office near Gaylord also hit 98; that was (by several degrees) the warmest reading recorded at that location since observations began there in the late 1990s. Heat indices exceeded 105 degrees across most of northern lower Michigan, and some locations exceed 110. The warmest reported heat index on the day was 114 near Indian River. There were estimated to be between 25 and 30 individuals who visited local hospitals due to heat-related illnesses.
- **08/01/2001** Excessive Heat was also a problem the first two weeks in August across all of northern Michigan. Temperatures reach the mid to upper 90s, on average, a few days each year; however, for a 5 day (8/5 - 8/9) stretch overnight low temperatures failed to fall below the lower 70s in most areas. This very humid air mass was unusual for northern Michigan, an area which typically sees cool nighttime temperatures and for this reason has very few homes with air conditioners. No heat related deaths or injuries were reported; however, most outdoor events were modified due to the forecasts of hot and humid conditions. County fairs sent animals home, yet still there were livestock losses at fairs in Otsego and Alcona counties. Attendance at county fairs was well below normal and this was attributed to the heat.



Historic Weather Events (cont'd)

- Wildfires

- 60 wildfires occurred on lands under MDNR jurisdiction within Leelanau County from 1981-2018, resulting in 267.6 acres burned. (compared to 35 wildfires from 1981-2010)
- = **average of 16.6 acres burned and 1.6 wildfires per year** on MDNR land in Leelanau County.
- No other wildfires recorded for Leelanau County between Jan. 1, 1996 to Apr. 30, 2017

Wildfire Risk

- Higher risk areas
 - Western dune areas
 - Parts of Manitou Islands
 - SW area of the county

Legend

■ Cities

□ County Boundaries

Fire Risk w/ Dry Soils

□ No Risk

■ Low Risk

■ Moderate Risk

■ High Risk

■ Very High Risk

■ Extreme Risk

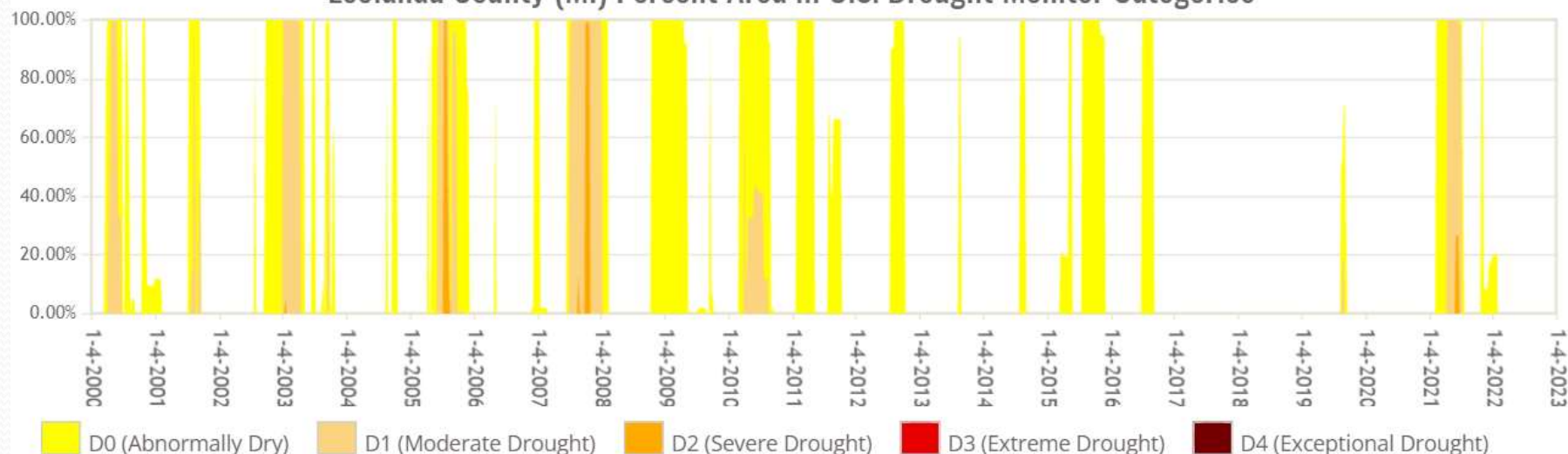
Data includes Land Cover Type, Canopy Cover, Township Scaled Fire Risk, and Dry Soil types from SSURGO data.



Source: Wildfire Risk Map - MDNR Forest Resources Division

Drought Risk

Leelanau County (MI) Percent Area in U.S. Drought Monitor Categories



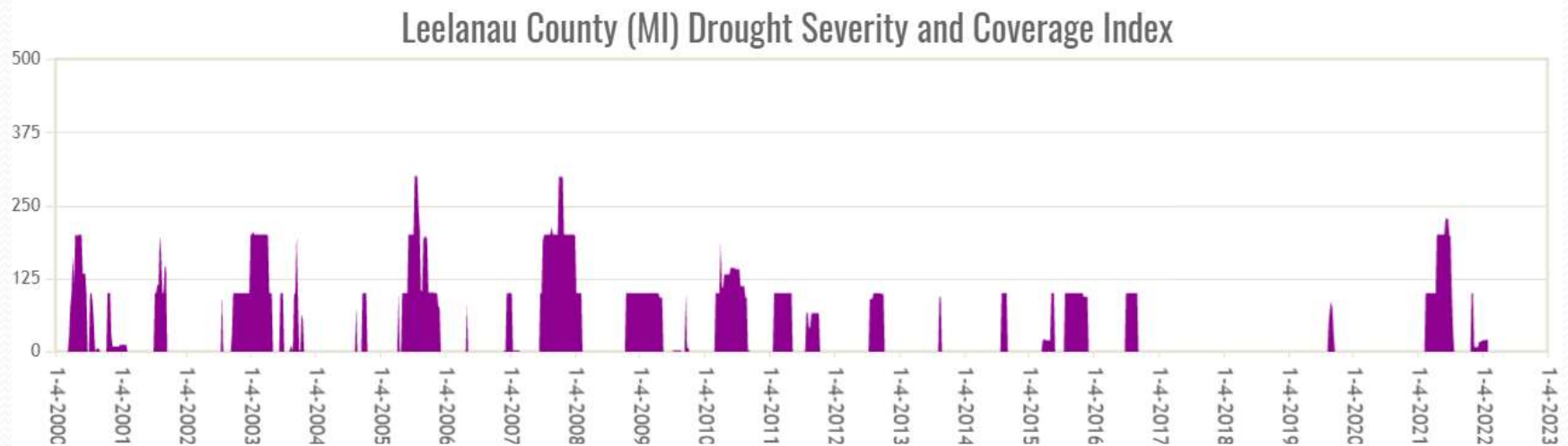
Michigan ▼

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: U.S. Drought Monitor <https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx>

Drought Risk

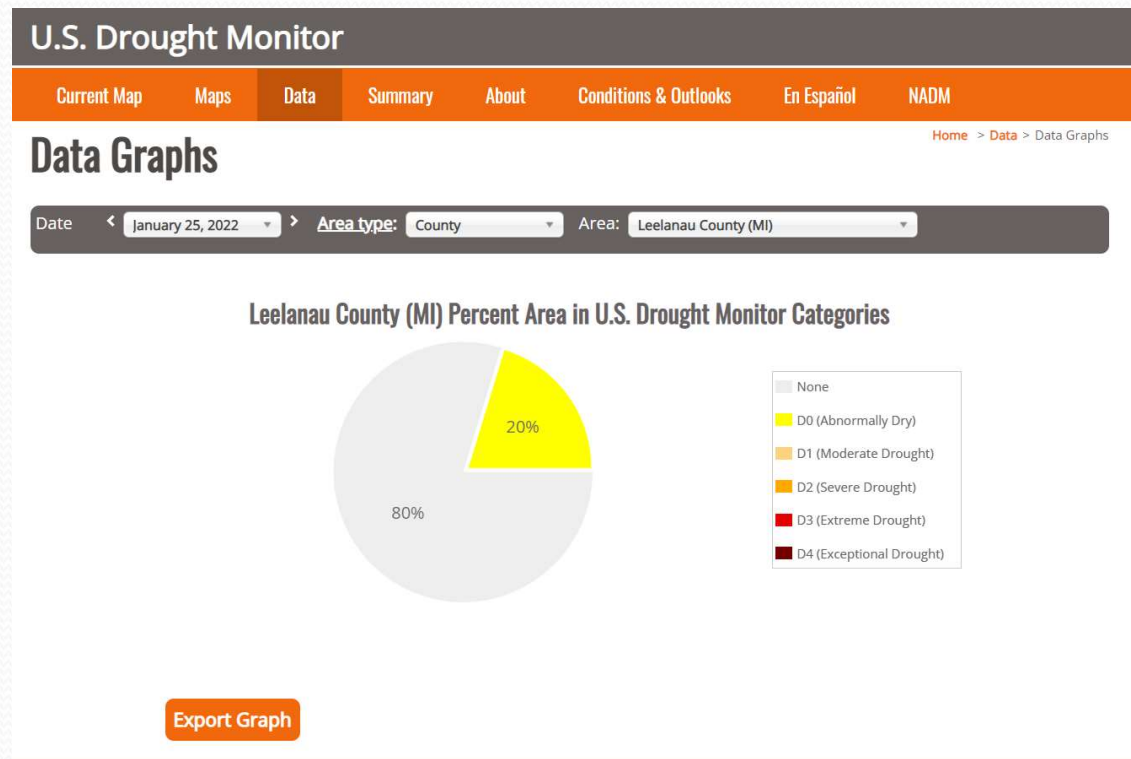
- Drought severity and frequency appears to be lessening over the past 10 years



The Drought Severity and Coverage Index is an experimental method for converting drought levels from the U.S. Drought Monitor map to a single value for an area. DSCI values are part of the U.S. Drought Monitor data tables. Possible values of the DSCI are from 0 to 500. Zero means that none of the area is abnormally dry or in drought, and 500 means that all of the area is in D4, exceptional drought.

Drought Risk

- Check your area drought status!
<https://droughtmonitor.unl.edu/CurrentMap.aspx>
- 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).

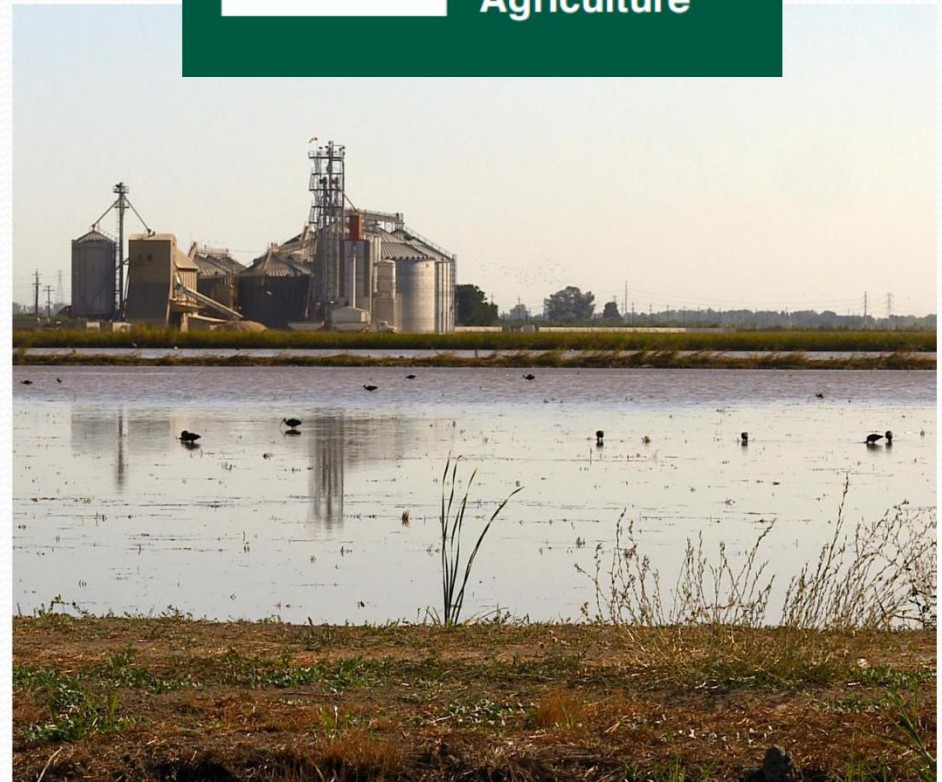


The Drought Monitor has been a team effort since its inception in 1999, produced jointly by the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture (USDA). The NDMC hosts the web site of the drought monitor and the associated data, and provides the map and data to NOAA, USDA and other agencies. It is freely available at droughtmonitor.unl.edu.

The USDA uses the drought monitor to trigger disaster declarations and eligibility for low-interest loans. The Farm Service Agency uses it to help determine eligibility for their Livestock Forage Program, and the Internal Revenue Service uses it for tax deferral on forced livestock sales due to drought. State, local, tribal and basin-level decision makers use it to trigger drought responses, ideally along with other more local indicators of drought.

Disaster Impacts on Agriculture

- The USDA Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency (EM) loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county.
- In addition to EM loan eligibility, other emergency assistance programs, such as Farm Service Agency (FSA) disaster assistance programs, have historically used disaster designations as an eligibility trigger.
- Agriculture-related disasters and disaster designations are quite common. Many counties in the United States have been designated as disaster areas in the past several years, even in years of record crop production.
- The USDA Farm Service Agency (FSA) administers four types of disaster designations:
 - U.S. Department of Agriculture (USDA) Secretarial disaster designation;
 - Presidential major disaster and Presidential emergency declaration;
 - FSA Administrator's Physical Loss Notification (APLN); and
 - Quarantine designation by the Secretary under the Plant Protection Act or animal quarantine laws.



Disaster Impacts on Agriculture

Leelanau County - Disaster Designation From the US Secretary of Agriculture, Crop Disaster Years 2012-2021

Event	# of Incidents 2012-2021	Crop Years Affected*
Drought	9	2012 (2), 2013-2016, 2020 (2), 2021
Excessive rain, moisture, humidity	8	2012-2015, 2017-2019, 2021
Frost, Freeze	8	2012-2015, 2017, 2020 (2), 2021
Cool/Cold, below-normal temperatures	6	2013 (2), 2014 (2), 2015, 2019
Wind, High Winds	5	2012, 2014 - 2016, 2018
Hail	4	2012, 2015, 2016, 2018
Winter Storms, Ice Storms, Snow, Blizzard	3	2012, 2014, 2015
Flood/Flash Flooding	2	2012, 2019
Heat, Excessive Heat, High temp. (incl. low humidity)	2	2012 (2)
Tornadoes	1	2012
Lightning	1	2012
Cold, wet weather	1	2014
		<i>*() numbers indicate more than one of this type of disaster for that year</i>

Leelanau County Dams

Name	Height (ft)	Storage (acre-feet)	Location	City/Township	Owner	Regulatory Agency	Dam Type	Year Completed	Dam Purpose	Hazard Potential
Belanger Dam	21	50	Belangers Creek	Peshawbestown	Ignatius Belanger	-	Gravity	1864	Recreation	Low
Cedar Lake Dam	16	1600	Cedar Lake Outlet	Cherry Bend	Elmwood Township	State	Earth	1856	Recreation	Significant
Leland Dam	19	86950	Lake Michigan Tributary	Leland	Leelanau County Drain Commission	State	Concrete, Earth	1910	Recreation	High
Meeuwenberg Dam	42	193	Cedar Lake Tributary	Cherry Bend	Cherry Bend Lake Owners	State	Earth	1968	Recreation	High

Antrim County Dams –

Listed on the National Inventory of Dams

4 Dam(s) Found

Meeuwenberg Dam

Hazard Potential Classification: High
Emergency Action Plan: Yes
Owner Name: Cherry Bend Lake Owners
Primary Purpose: Recreation

Leland Dam

Hazard Potential Classification: High
Emergency Action Plan: Yes
Owner Name: Leelanau County Drain Commissioner
Primary Purpose: Recreation

Cedar Lake Dam

Hazard Potential Classification: Significant
Emergency Action Plan: Yes
Owner Name: Elmwood Township
Primary Purpose: Recreation

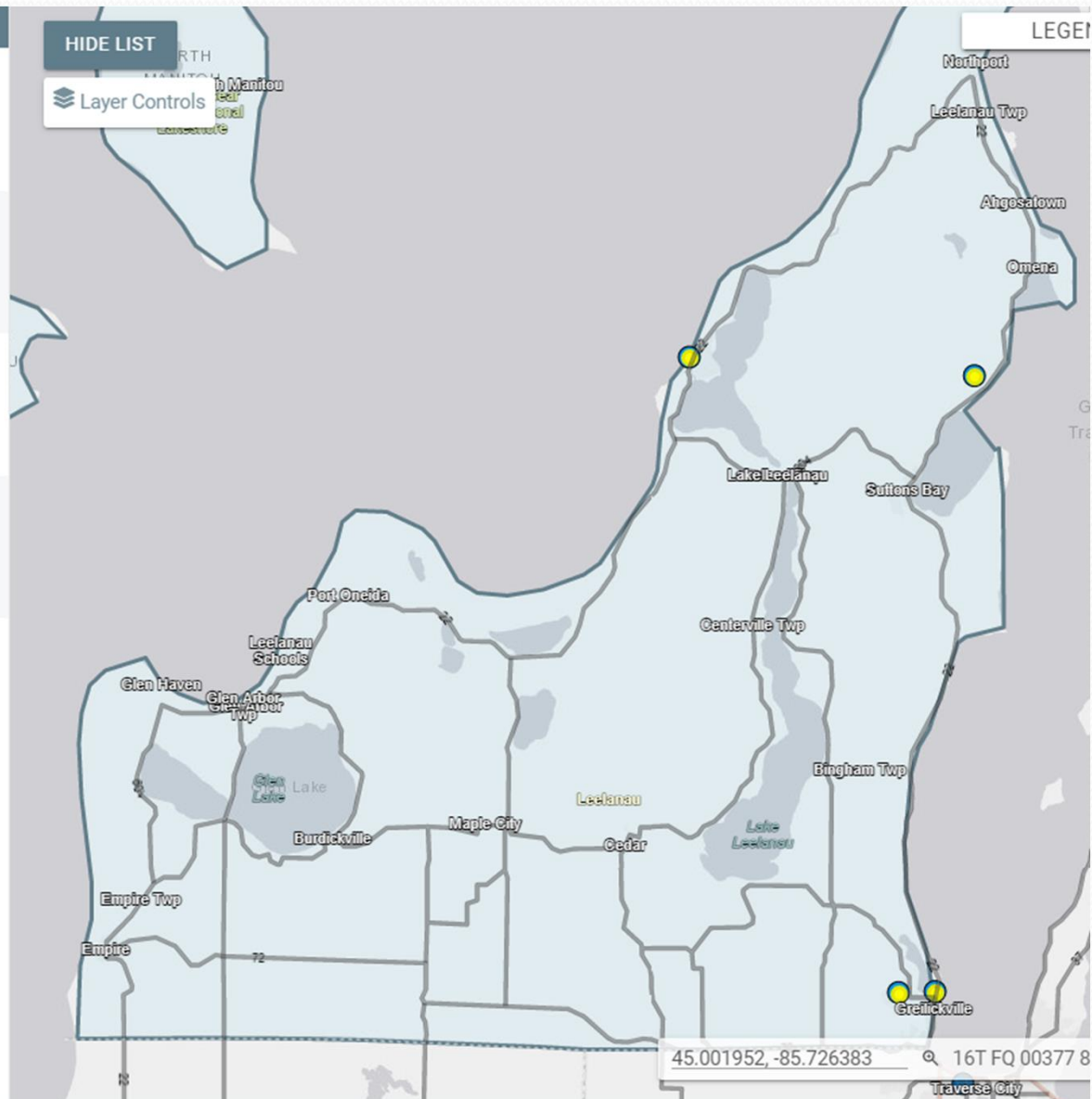
Belanger Dam

Hazard Potential Classification: Low
Emergency Action Plan: Not Required
Owner Name: Ignatius Belanger
Primary Purpose: Recreation

HIDE LIST

Layer Controls

LEGEND



RIVER RESTORATION in Northern Michigan



About River Restoration

Watersheds

Counties

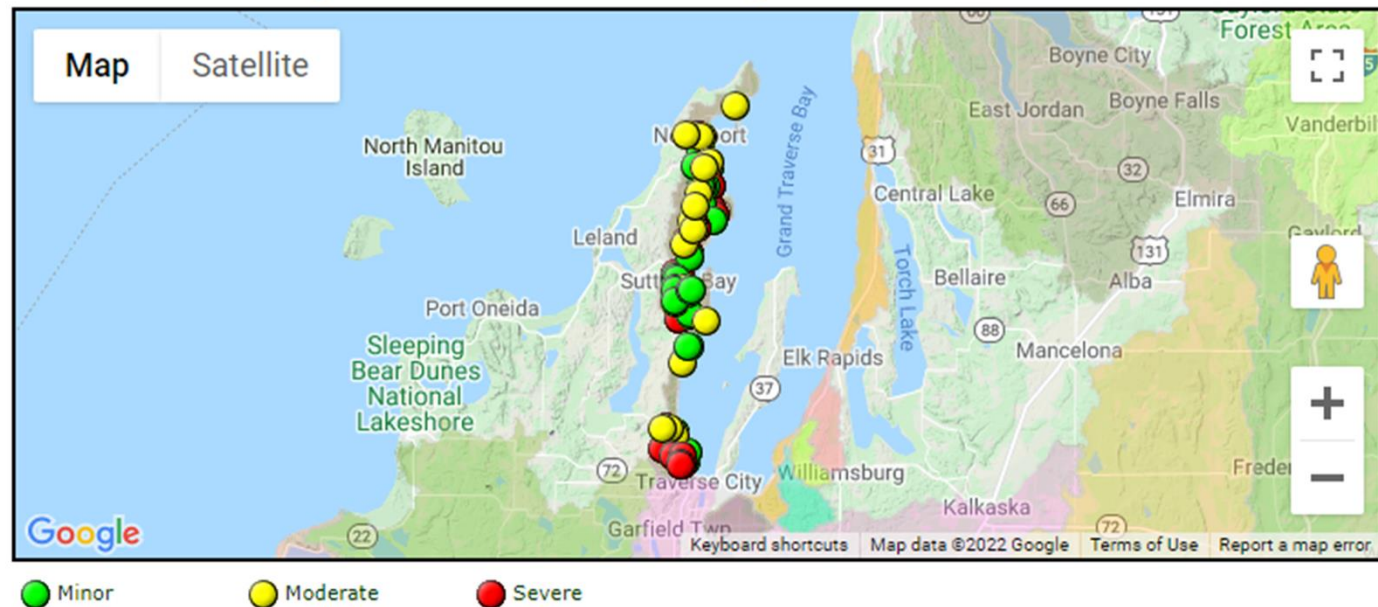
Partners

Home | Log In | Search: Go

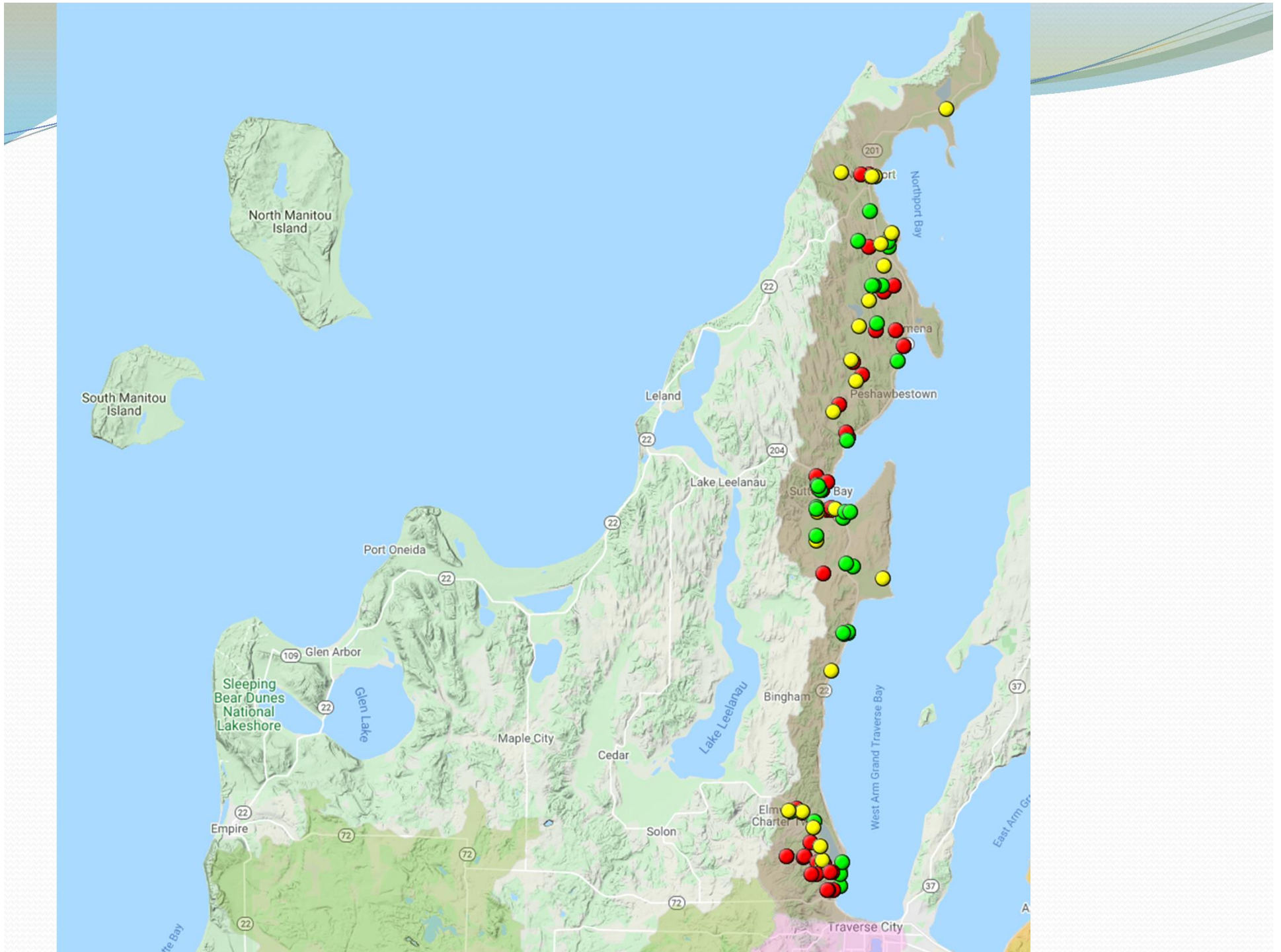
[Home](#) > [Counties](#) > [Leelanau](#) > Road Stream Crossings

Leelanau County Road Stream Crossings

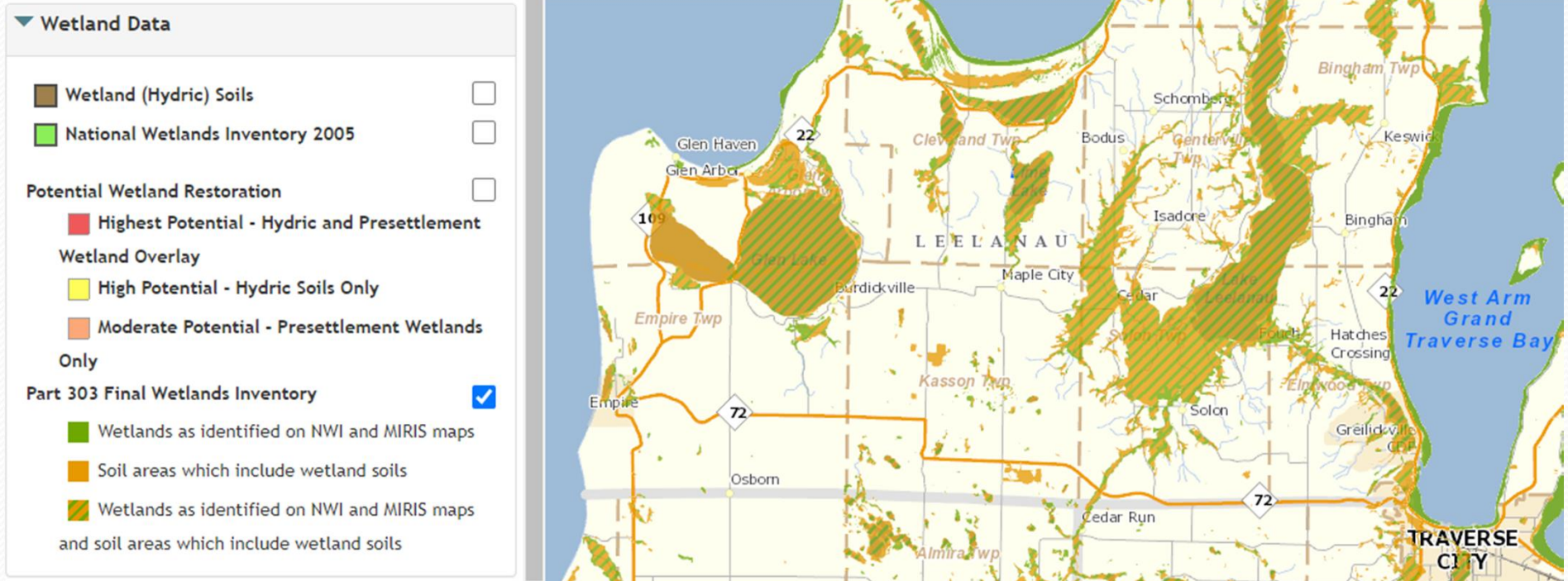
Leelanau County
Road Stream Crossings



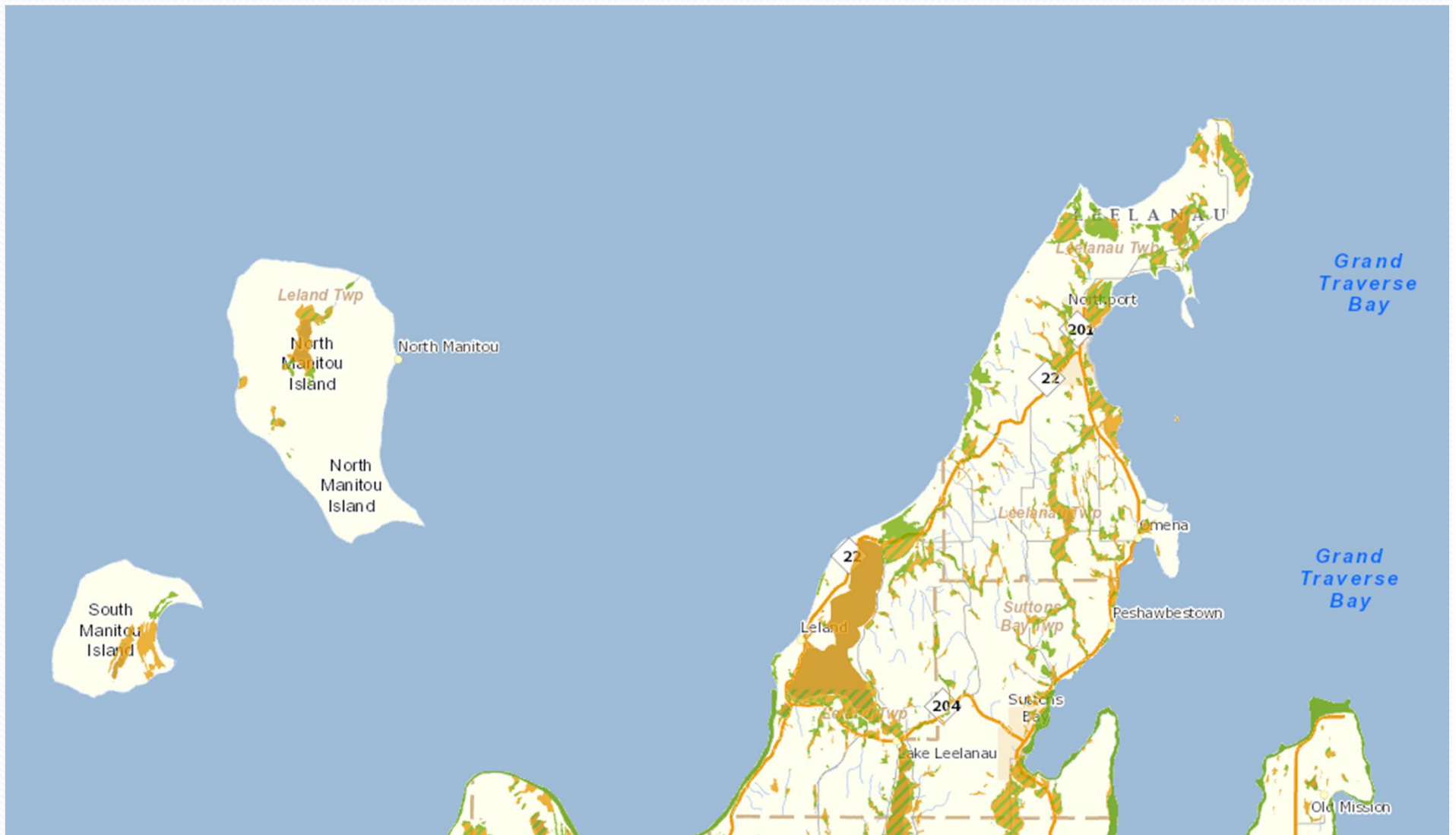
- 103 West Bay Shoreline and Tributaries locations listed
- 30 Minor
- 30 Moderate
- 43 Severe



County Wetlands

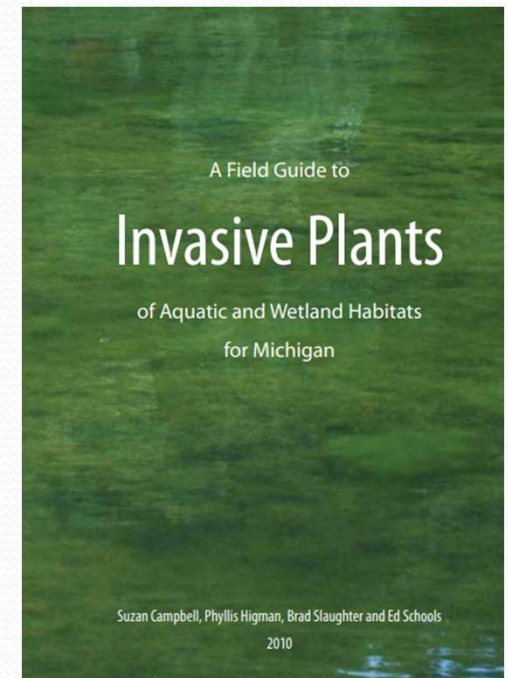


County Wetlands



Invasive Species

- Only a small fraction of non-native plants are invasive
- Invasives is a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm
- Lake-moderated climates along Lake Michigan, Lake Erie, Saginaw Bay, Thumb, and Lake St. Clair are milder and have high potential to harbor species typically found to the south.



Invasive Species



Baby's breath



Japanese and common barberry



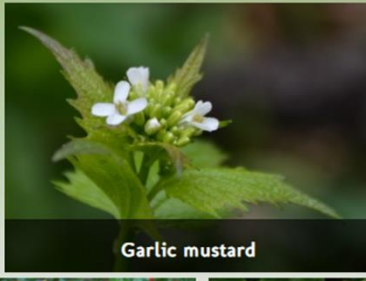
Blue lyme grass



Glossy and common buckthorn



Callery/Bradford/Cleveland Pear



Garlic mustard



Invasive honeysuckles



*Knotweeds



Invasive bittersweet



*Invasive Phragmites

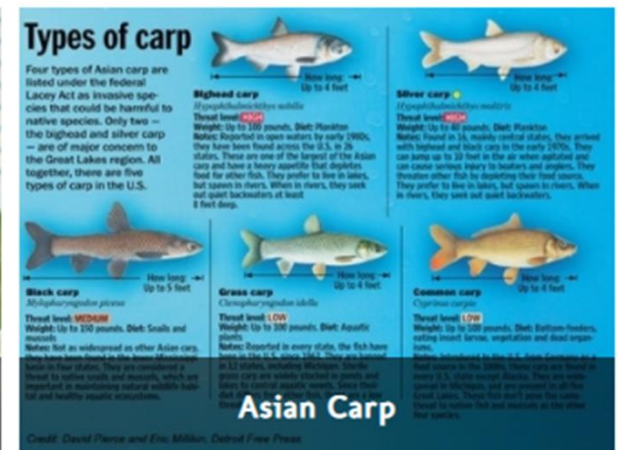
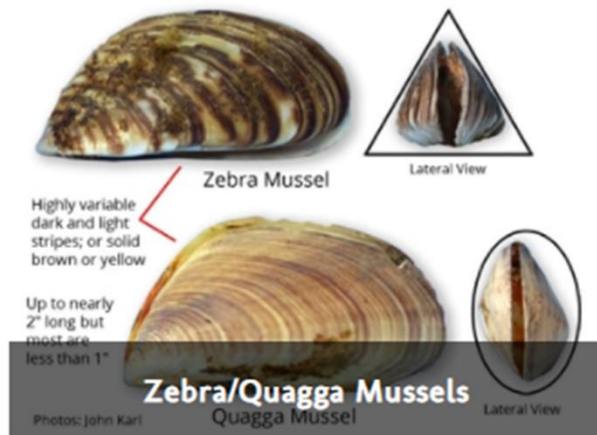


*Purple loosestrife



Tree-of-Heaven

Invasive Species



Local NFIP Status

FLOOD INSURANCE STUDY



LEELANAU COUNTY, MICHIGAN (ALL JURISDICTIONS)

<i>Community Name</i>	<i>Community Number</i>
---------------------------	-----------------------------

BINGHAM, TOWNSHIP OF	260772
CENTERVILLE, TOWNSHIP OF	260625
CLEVELAND, TOWNSHIP OF	260302
ELMWOOD, TOWNSHIP OF	260113
EMPIRE, TOWNSHIP OF	260765
EMPIRE, VILLAGE OF	260605
GLEN ARBOR, TOWNSHIP OF	260604
GRAND TRAVERSE BAND OF OTTAWA AND CHIPPEWA INDIANS	261803
*KASSON, TOWNSHIP OF	261509
LEELANAU, TOWNSHIP OF	260114
LELAND, TOWNSHIP OF	260760
NORTHPORT, VILLAGE OF	260580
SOLON, TOWNSHIP OF	261510
SUTTONS BAY, TOWNSHIP OF	260770
SUTTONS BAY, VILLAGE OF	260283
TRAVERSE CITY, CITY OF	260082

Leelanau County



*NO SPECIAL FLOOD HAZARD AREAS IDENTIFIED

EFFECTIVE: August 28, 2018

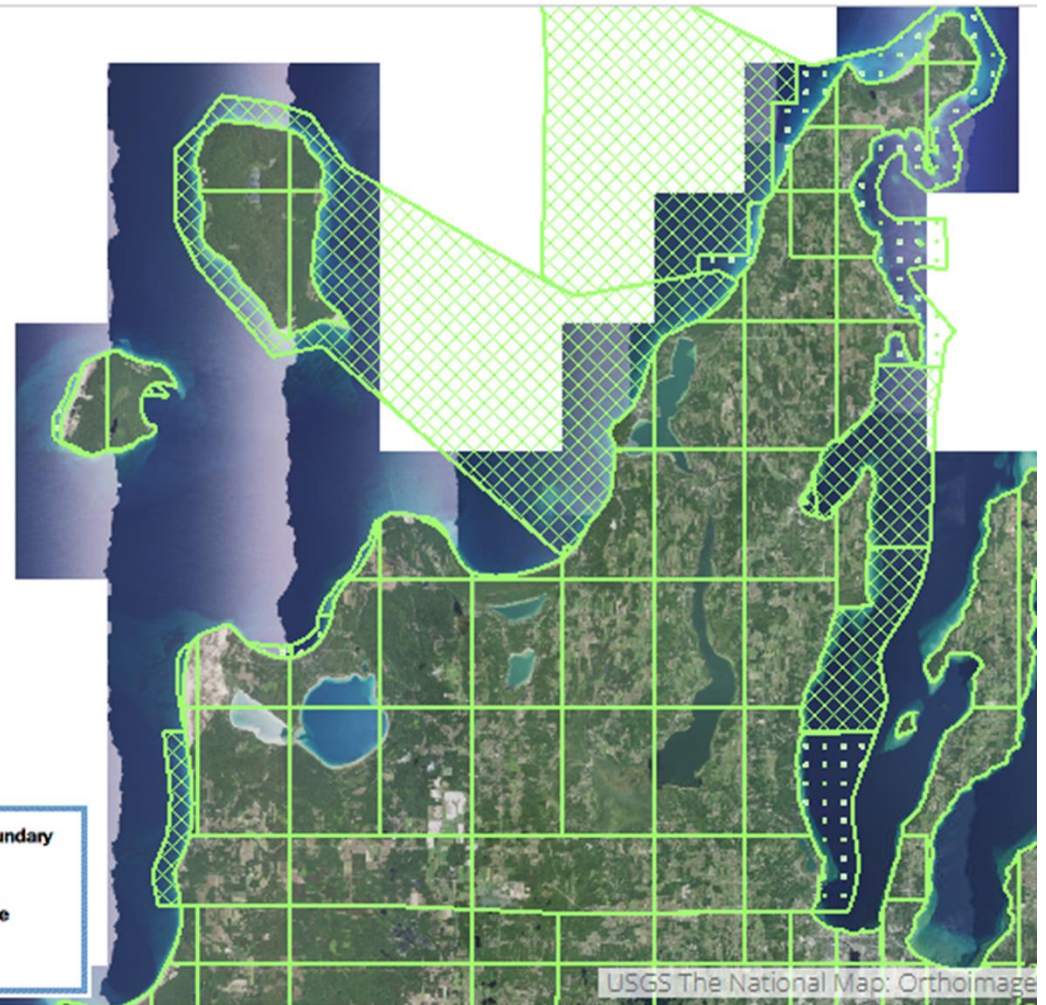


Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
26089CV000A

Local NFIP Status

Municipality	NFIP	FIRM Effective Date
City of Traverse City	Y	8/28/2018
Village of Empire	Y	8/28/2018
Village of Northport	Y	8/28/2018
Village of Suttons Bay	Y	8/28/2018
Bingham Township	Y	8/28/2018
Centerville Township	Y	8/28/2018
Cleveland Township	Y	8/28/2018
Elmwood Township	Y	8/28/2018
Empire Township	Y	8/28/2018
Glen Arbor Township	Y	8/28/2018
Kasson Township	N	
Leelanau Township	Y	8/28/2018
Leland Township	Y	8/28/2018
Solon Township	Y	8/28/2018
Suttons Bay Township	Y	8/28/2018



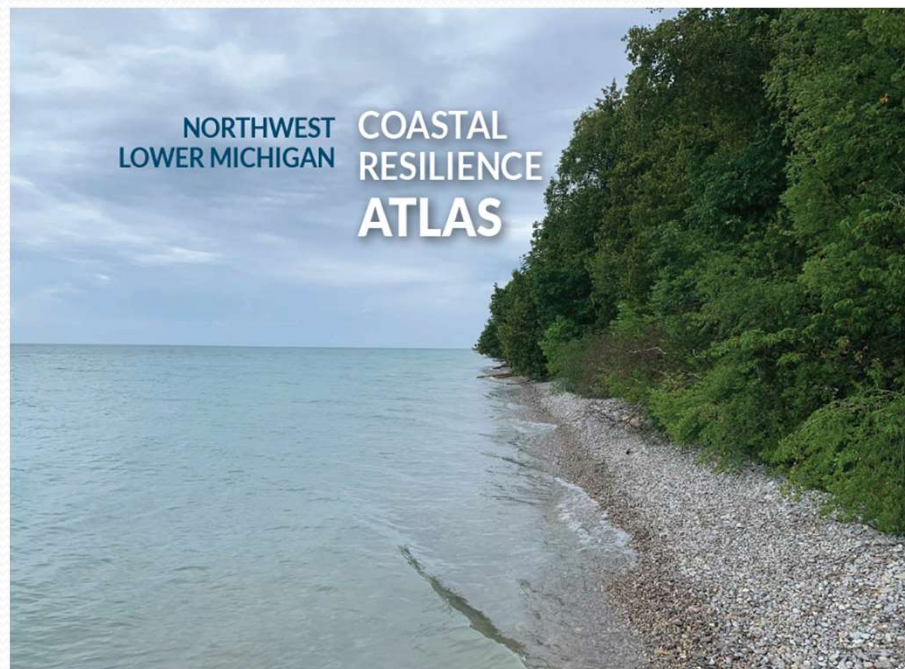


CRS Participating Communities

- The Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the NFIP
- In CRS communities, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community's efforts that address the three goals of the program:
 - Reduce and avoid flood damage to insurable property
 - Strengthen and support the insurance aspects of the National Flood Insurance Program
 - Foster comprehensive floodplain management

Coastal Flooding / Coastal Recession

- http://www.resilientmichigan.org/nw_atlas.asp



ACKNOWLEDGMENTS

Financial assistance for this project was provided, in part, by the Michigan Coastal Zone Management Program, Department of Environment, Great Lakes, and Energy, and is supported through a grant under the National Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration. The statements, findings, conclusions and recommendations in this report are those of the researchers and do not necessarily reflect the views of the Michigan Department of Environment, Great Lakes, and Energy and the National Oceanic and Atmospheric Administration.



This Atlas was prepared by the Land Information Access Association (LIAA) in cooperation with the Great Lakes Research Center at Michigan Technological University and the Taubman College of Architecture and Urban Planning at the University of Michigan, July 2019.

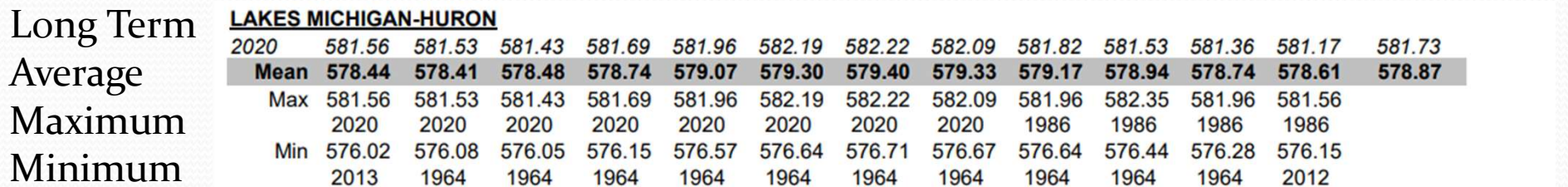




Coastal Dynamics

- Changing water levels
- Water Energy and Height
 - Erosion
 - Changing conditions
- Climate change on the Great Lakes
 - Increased precipitation and storminess
 - Variability of lake water levels
 - Water temperature

US Army Corp of Engineers



Coastal Flooding

http://www.resilientmichigan.org/nw_atlas.asp

Leelanau County

- Lucky ~ 3%
- Expected ~ 7.5%
- Perfect Storm ~ 17%

Coastal Flooding Scenario Impacts

Leelanau County			
Total SEV	Lucky	Expected	Perfect Storm
\$ 3,402,236,245.00	\$ 114,536,520.00	\$ 255,435,310.00	\$ 585,910,250.00





Coastal Flooding

http://www.resilientmichigan.org/nw_atlas.asp

To develop the scenario planning framework, the research team had to establish assumptions regarding future climate conditions that could affect northwest Lower Michigan. These varying “climate futures” — all of which are reasonably anticipated possibilities — are arranged from a least impactful (“Lucky”) to a most impactful (“Perfect Storm”) condition in terms of the potential for wave damage and flooding hazards they would bring.

The following descriptions outline the key assumptions made in defining each of the climate futures as compared to the others. The maps in this chapter show the estimated land areas that would be affected by waves and flooding under these three climate futures.

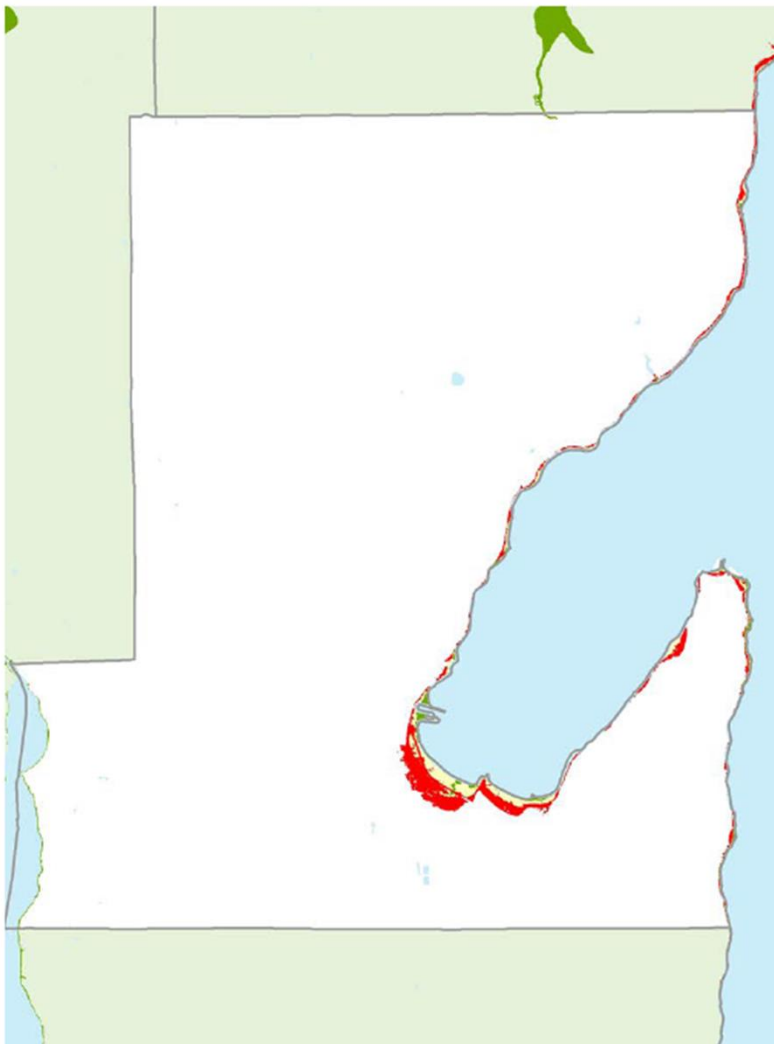
“Lucky” Future: Under the Lucky Climate Future, Great Lakes water levels will continue to stay relatively low. Although there will be wave and wind action, major storm events and wave impacts will not encroach on properties landward of current beaches. A Lucky Future projection, indicating the land areas 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.

Taken together on the maps, the three climate futures are progressively cumulative; that is, the Expected Future is cumulative of all the green (Lucky) and yellow areas put together, and the Perfect Storm Future encompasses all green, yellow and red areas. It is important to note that this flooding analysis is only complete for Lake Michigan coastal areas; inland rivers, streams and other waterbodies may show little or no data.

Coastal Flooding



Suttons Bay Twp./ Suttons Bay



Coastal Flooding Scenario Impacts

Suttons Bay Twp

Total SEV	Lucky	Expected	Perfect Storm
\$ 210,405,570.00	\$ 6,259,620.00	\$ 17,482,500.00	\$ 40,173,740.00

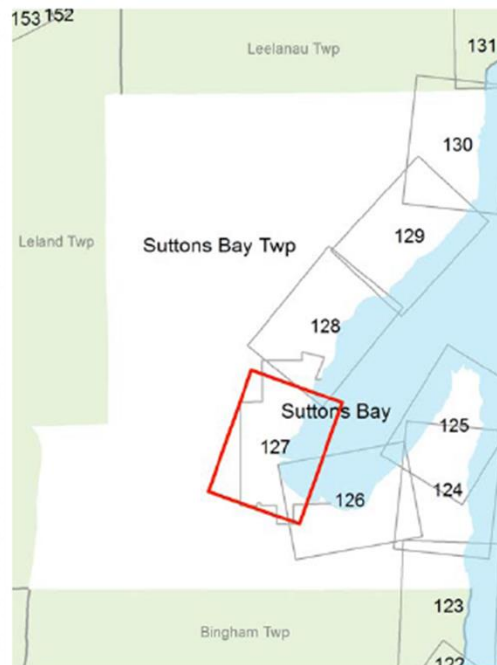
Coastal Flooding Scenario Impacts

Suttons Bay

Total SEV	Lucky	Expected	Perfect Storm
\$ 85,486,600.00	\$ 3,392,400.00	\$ 18,739,210.00	\$ 27,962,210.00

- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario

Coastal Flooding



- Lucky Flooding Scenario
- Expected Flooding Scenario
- Perfect Storm Flooding Scenario



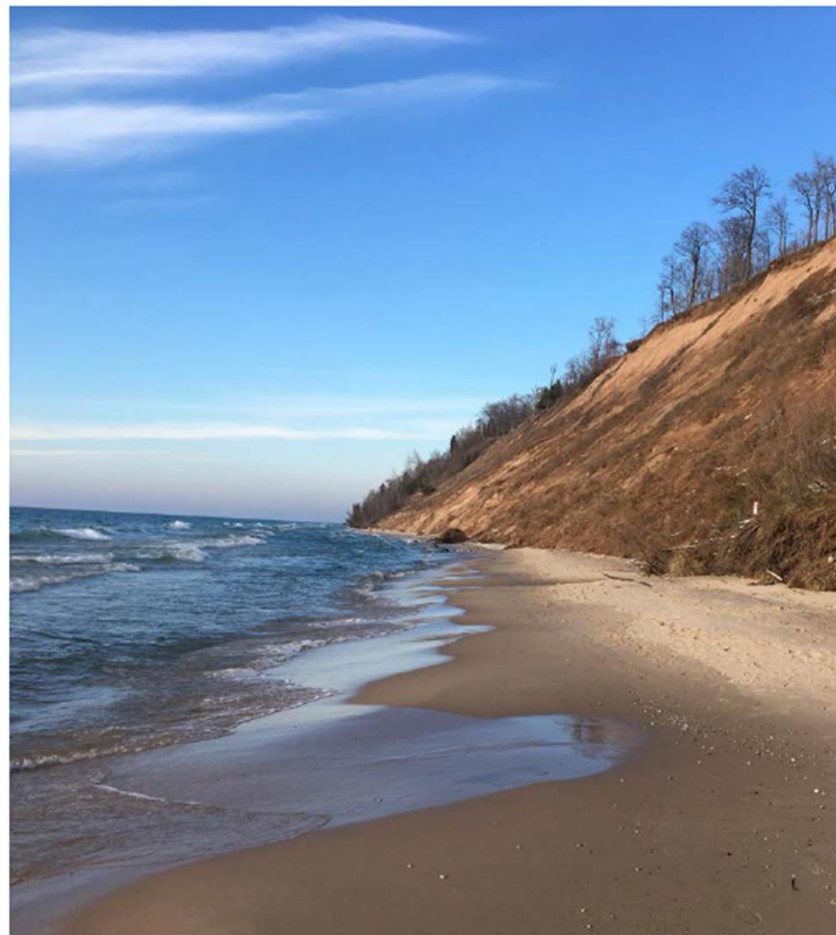
Coastal Recession

http://www.resilientmichigan.org/nw_atlas.asp

CHAPTER 4 Coastal Recession

As previously discussed, Great Lakes water level fluctuations do not result from the moon's gravitational pull like oceans, but from cyclical changes in rainfall, evaporation, and riverine and groundwater inflows. These factors work together to raise and lower the water levels of the Great Lakes in small increments daily, and larger increments seasonally and over the course of years and decades.

Unlike our nation's ocean coasts (which change in shoreline level over a 24-hour tidal period), the significantly longer time spans of mean water level change on the Great Lakes give the beach and nearshore region significant time to readjust to new water levels and wave characteristics. During multiple years of high-water levels, wave base moves landward, coastal erosion (bluff and beach) is accelerated, and the nearshore profile steepens. Conversely, during prolonged years of low water levels the reverse happens, although not completely. As the wave base moves offshore, coastal erosion decreases but it does not always stop completely, and the beach area grows larger. Because the beach readjustment from high water episodes to low water episodes is not complete (due to losses of beach sediment to offshore and into longshore sediment traps), there exists a net shoreline retreat over several cycles. For most Great Lakes shoreline, this is on the order of one foot per year of coastal retreat.



Coastal Recession

http://www.resilientmichigan.org/nw_atlas.asp

494 Chapter 4 | Coastal Recession | Leelanau County

Northwest Lower Michigan Coastal Resilience Atlas

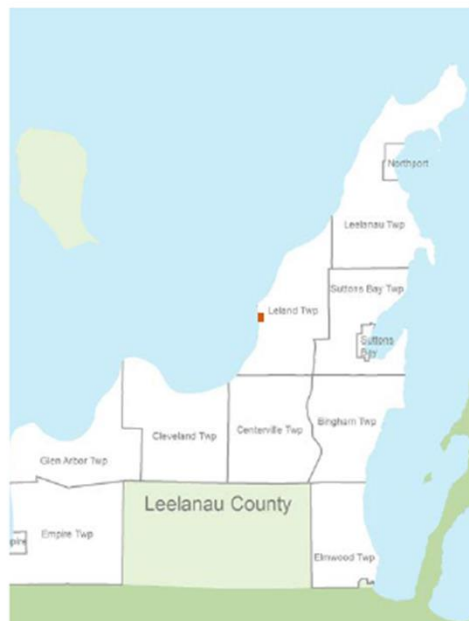
BLUFF RECESSION DETAIL

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

Bluff Detail, Panel 156, Leland Twp.



Shoreline 1938
Bluffline 1938
Bluffline 2016
Predicted 30
yr bluff





Next Steps

- Hazard mapping
- Review 2016 prioritized hazards
- Prepare hazard analysis
- Small group meetings



Thank you!

- Any questions??