Missaukee County Michigan

Natural Hazards Mitigation Plan

2015

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Northwest Michigan Council of Governments
Workforce • Business • Community

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I. ACKNOWLEDGEMENTS

The Plan is the culmination of the interdisciplinary and interagency planning effort that required the assistance and expertise of numerous agencies, organizations, and individuals. Without the technical assistance and contributions of time and ideas of these agencies, organizations, and individuals, this plan could not have been completed.

Each jurisdiction within Missaukee County is a continuing participant in the update of the Plan. The following is a list of key contributors who were instrumental in the development of the County's Natural Hazards Mitigation Plan:

Missaukee County Emergency Management Coordinator
Linda Hartshorne-Shafer

Missaukee Equalization Department

Missaukee County Planning Commission

Missaukee County Road Commission
Kelly Bekken

Missaukee County Sheriff Department

Others

- Aetna Township
- Clam Union Fire Department
- Lake Missaukee Fire Department
- Lake Township Supervisor
- McBain Fire Department
- Norwich Township Fire Department
- District Health Department #10
- Missaukee 911 Dispatch
- Sheriff's Department, MSP Houghton Lake Post
- Merritt Area Fire Department
- Lake City Area Fire Department
- Manton Fire Department
- DNR Fire Department
- Missaukee Conservation District
- Munson Cadillac
- Viking Energy

II. FEMA Letter of Approval

U.S. Department of Homeland Security
Region V
536 S. Clark St., 6th Floor
Chicago, IL 60605-1509

FEMA

Mr. Matt Schnepp
State Hazard Mitigation Officer
Michigan State Police
Emergency Management and Homeland Security Division
4000 Collins Rd
Lansing, MI 48910

Dear Mr. Schnepp:

Thank you for submitting the adoption documentation for the Missaukee County Hazard Mitigation Plan. The plan was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. Missaukee County met the required criteria for a multi-jurisdiction hazard mitigation plan and the plan is now approved for the County. Please submit the adoption resolutions for any remaining jurisdictions who participated in the planning process.

The approval of this plan ensures continued availability of the full complement of Hazard Mitigation Assistance (HMA) Grants. All requests for funding, however, will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted.

We encourage Missaukee County to follow the plan's schedule for monitoring and updating the plan, and continue their efforts to implement the mitigation measures. The expiration date of the Missaukee County Plan is five years from the date of this letter. In order to continue project grant eligibility, the plan must be reviewed, revised as appropriate, resubmitted, and approved no later than the plan expiration date.

Please pass on our congratulations to Missaukee County for this significant action. If you or the communities have any questions, please contact Kirstin Kuenzi at (312) 408-4460 or Kirstin.Kuenzi@fema.dhs.gov.

Sincerely,

for Alexa Purdy
Christine Stack, Director
Mitigation Division

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III. PREFACE

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. This procedure is an essential element of emergency management, along with preparedness, response, and recovery. Emergency management includes four phases: a community prepares for a disaster; responds when it occurs; and then there is a transition into the recovery process, during which mitigation measures are evaluated and adopted. The evaluation improves the preparedness posture of the County for the next incident, and so on. When successful, mitigation will lessen the impacts of natural hazards to such a degree that succeeding incidents will remain incidents and not become disasters.

The mission of the Missaukee County Natural Hazard Mitigation Plan is to permanently eliminate or reduce long-term risks to people and property from natural hazards so that county assets such as transportation, infrastructure, commerce, and tourism can be sustained and strengthened. This can be accomplished through collaborative efforts/activities amongst agencies within Missaukee County.

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. This process is needed to ensure 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.

Recognizing the importance of reducing community vulnerability to natural hazards, Missaukee County is actively addressing the issue through the development and implementation of this plan. The many benefits to be realized from this effort are:

Community Benefits of a Natural Hazard Mitigation Plan
Protection of the public health and safety
Preservation of essential services
Prevention of property damage
Preservation of the local economic base

This process will help ensure that Missaukee County remains a vibrant, safe, enjoyable place in which to live, raise a family, maintain a tourist base, and continue to conduct business.

IV. EXECUTIVE SUMMARY

In 2000, the Disaster Mitigation Act shifted the Federal Emergency Management Agency's (FEMA) scope of work to promoting and supporting prevention, or what is called hazard mitigation planning. FEMA now requires government entities to have natural hazards mitigation plans in place as a condition for receiving grant money, such as hazard mitigation grant program funds, in the future.

To meet this requirement, the Michigan State Police provided funding to regional planning agencies throughout the State of Michigan to work with individual counties in developing their Hazard Mitigation Plans. For northwest, lower Michigan the ***Northwest Michigan Hazard Mitigation Planning Project*** was coordinated by the Northwest Michigan Council of Governments (NWMCOG) and included the ten county area of Emmet, Charlevoix, Antrim, Kalkaska, Missaukee, Wexford, Grand Traverse, Leelanau, Benzie, and Manistee. NWMCOG worked with the Task Forces and developed plans for each of the counties. These plans included a general community profile, a comprehensive inventory of existing hazards, a hazard analysis, goals and objectives, and feasible mitigation strategies to address the prioritized hazards.

The Missaukee County Natural Hazards Mitigation Plan focuses on natural hazards such as drought, wildfires, flooding, thunderstorms and high winds, tornadoes, and severe winter weather, and was created to protect the health, safety, and economic interests of the residents and businesses by reducing the impacts of natural hazards through planning, awareness, and implementation. Through this Plan, a broad perspective was taken in examining multiple natural hazards mitigation activities and opportunities in Missaukee County. Each natural hazard was analyzed from a historical perspective, evaluated for potential risk, and considered for possible mitigative action.

The Plan serves as the foundation for natural hazard mitigation activities and actions within Missaukee County, and will be a resource for building coordination and cooperation within the community for local control of future mitigation and community preparedness around the following:

Table 1: Planning Goals for Missaukee County

Natural Hazards Mitigation Planning Goals for Missaukee County
Goal 1: Increase local participation in natural hazards mitigation
Goal 2: Integrate natural hazards mitigation considerations into the County's planning process
Goal 3: Utilize available resources and apply for others for natural hazards mitigation projects
Goal 4: Develop and complete natural hazards mitigation projects in a timely manner

Table 2: Priority Areas for Missaukee County

Natural Hazards Mitigation Priority Areas
Priority Area 1: (County) Potential of severe thunderstorms and high winds and severe winter storms throughout the County, also the concern regarding festivals and power outages. Mitigation Strategies: ***Thunderstorms, High winds, Tornado, Snow and Ice***
Priority Area 2: (Bloomfield, Holland, and Reeder Townships) Potential wildfire/urban interface area. Mitigation Strategies: ***Wildfire***
Priority Area 3: (Clam Union, Enterprise, and Norwich townships) Potential of Dam failures and flooding causing key public infrastructure (roads/bridge) failures. Mitigation Strategies: ***Flood/Flash Flooding***

Table 3: Mitigation Strategies for Missaukee County

Frequent Natural Hazard	Mitigation Strategies
Thunderstorms, Tornado and High Winds	
	• Public education activities such as programs and brochures for new construction and trailers, mobile homes, and modular homes regarding underground utilities, roofing materials, bracing, and anchoring and tie downs
	• Continue enforcement of building codes
	• Work with insurance companies regarding risk management
	• Update inventory of available shelters and propose to build additional ones if needed
	• Work with utility companies (Tree management, promotion of burying utility lines in new construction, burying power lines in high outage areas)
Snow Load	•
	• Develop and implement a data collection project regarding snow loads and structures in the county
	• Public education and awareness activities such as programs and brochures regarding structural system modifications and structural maintenance; new construction and trailers, mobile homes, and modular homes regarding underground utilities, roofing materials, and bracing
	• Continue enforcement of building code regarding snow load limits through the permitting process: State Building Code - Bloomfield Township and a small portion of Caldwell and Pioneer Townships require 60 lb. snow load and the remaining county is 50 lb. snow load
Wildfire	•
	Assess fire suppression access and make improvements
	• Research the Department of Natural Resources' State Forest wildfire/urban interface rules or plan
	• Public education and awareness activities such as programs and brochures regarding fuel management, proper vegetation, fire breaks
	• Continue enforcement of state fire codes regarding setback requirements
	• Public education utilizing the Michigan Department of Natural Resources flyers and the Federal Emergency Management Administration information at parks and campgrounds
	• Real estate and insurance agents to distribute information
Flooding	
	• Public education and awareness activities through radio and television
	• Continue enforcement of State building codes and soil erosion/sedimentation control regulations
	• Utilize information from Soil Conservation District, Michigan Department of Environmental Quality and the Department of Natural Resources

V. PURPOSE OF THE PLAN

In 2000, the Disaster Mitigation Act shifted the Federal Emergency Management Agency's (FEMA) scope of work to promoting and supporting prevention, or what is called hazard mitigation planning. FEMA requires government entities to have natural hazards mitigation plans in place and updated on a 5-year cycle as a condition for receiving grant money related to natural hazard remediation.

The **purpose of the Missaukee County Natural Hazards Mitigation Plan** is to find solutions to existing problems, anticipate future problems, prevent wasteful public and private expenditures, protect property values, and allocate land resources. The implementation of the Plan is to prevent injury, loss of life, property damage, breakdown in vital services like transportation and infrastructure, economic slumps, diminished tourist activity, liability issues, and damage to a community's reputation. For Missaukee County in the northwest region of the lower peninsula of Michigan, the **planning process** utilized the following steps in the development of the Plan. Emphasis was placed on natural hazards that have had significant impact on the community in the past.

Steps in the Planning Process
Identification of natural hazards and risks
Preparation of draft plan
Identification of natural hazards mitigation goals and objectives for emergency management programs
Selection of evaluation criteria
Selection of mitigation strategies using locally chosen criteria
Public Comment
Completion of the final plan

What is a Hazard?

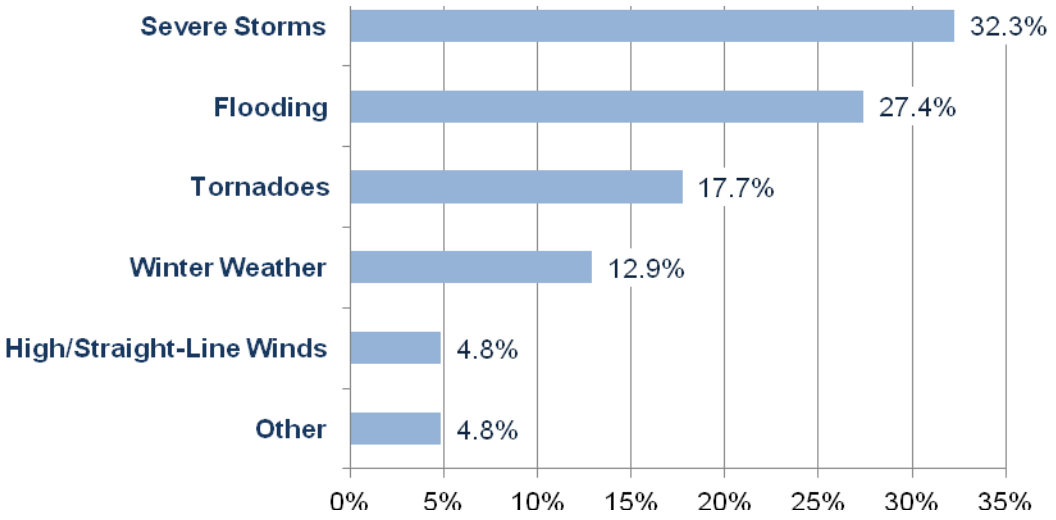
A **hazard** is an event or physical condition that has potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. This plan focuses on principle natural hazards that occur in the northern lower region (see Page 12). 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.

Principle Natural Hazards in Northern Lower Michigan
Severe Storms (Thunderstorms, Winter storms)
High Winds
Tornadoes
Extreme Temperatures
Flooding
Shoreline Hazards
Dam Failures
Drought
Wildfires
Invasive Species
Subsidence

Source: FEMA

Percent of natural hazard events for all formal disaster declarations in the State of Michigan (1953 – 2014)

Figure 1: Disaster Declarations for the State of Michigan



Source: FEMA

What is Mitigation?

Mitigation is the sustained action taken to lessen the impact from natural hazards and to work to reduce the long-term risk to human life and property, and their effects. This long-term planning distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery. This Plan can be used to lessen the impact, to support and be compatible with community goals, to lay out considerations in choosing and evaluating methods, and to look at the feasibility of mitigation strategies.

VI. COMMUNITY PROFILE

The community data located below is provided to describe Missaukee County for planning and implementing the mitigation strategies.

There has not been any major infrastructure development, nor major hazard mitigation efforts, in the county since the last adoption of the Plan in 2007.

Table 4: Geographic features for Missaukee County

Feature	Measure	Percentage
Water	4,800 acres	1.1%
Forest Lands	237,900 acres (65.6% of total land area)	55.1%
Wetlands	89,316 acres (24.6% of total land area)	20.7%
Farmland	99,510 acres	23.1%
Operating Farms	433 Operating farms in 2012	NA

Source: US Agricultural Census, 2012; County Data

The total County population is **14,849**. The projected growth for 2020 is 14,978 and for 2030 it is 15,027. The population numbers from the 2010 Census for the **15 Townships and 2 Cities** covered by this plan are:

Table 5: Missaukee County Population by Municipality

Township/City/Village	Population	Township/City/Village	Population
Aetna Township	413	Norwich Township	611
Bloomfield Township	531	Pioneer Township	451
Butterfield Township	489	Reeder Township	1,128
Caldwell Township	1,317	Richland Township	1,491
Clam Union Township	882	Riverside Township	1,179
Enterprise Township	194	West Branch Township	466
Forest Township	1,157	Lake City	836
Holland Township	248	McBain City	656
Lake Township	2,800		

Source: American Fact Finder, US Census, 2010

- There are approximately 9,112 *Housing Units* in Missaukee County with an average household size of 2.5 people per household.
- The percentage of residents 65 years is 17.4% of the population.
- The percentage of residents 19 years and under is 26.5% of the population.
- The percentage of residents over 65 with a disability was 14.7% of the population.
- The total number of residents with a disability was 2,776, or 16.2% of the population.
- The percentage of residents that speak English less than 'very well' is 0.9% of the population.
- February 2014 Income poverty level:
  - $19,790 Family of 3
  - $11,670 Family of 1

Table 6: Poverty Statistics for Missaukee County

Poverty	Statistics
Families in poverty with children:	12.0%
Income less than $15,000:	12.40%
Individuals in poverty:	15.5%

Source: U.S. Census Bureau, 2008-2012 American Community Survey 2012

Table 7: Economic Census for Missaukee County

Industry Description	Number of Establishments	Number of Employees
Manufacturing	21	330
Wholesale Trade	17	NA
Retail Trade	39	336
Real Estate and Rental and Leasing	3	5
Professional, Scientific, and Technical Services	11	NA
Administrative and Support and Waste Management	9	31
Health Care and Social Assistance	27	316
Arts, Entertainment, and Recreation	3	NA
Accommodation and Food Service	20	156
Other Services (except Public Administration)	34	112

Source: US Census Bureau: County Business Patters 2008-2012

VII. THE DEVELOPMENT OF THE PLAN

Data Methodology and Map Development

Missaukee County staff identified the critical facilities and infrastructure on the base map and provided updated GIS .shp files for mapping purposes.

Table 8: Critical Facilities and Infrastructure in Missaukee County

2	Airports
5	Banks/Credit Unions
79	Bridges 35 – < 20 feet long 16 – Primary 20 – Local 8 – Rated for load
31	Places of Worship
9	Communications Facilities
3	Dams
1	Emergency Management Services Facilities
1	Emergency Operations Center
6	Fire Stations
26	Government Buildings
3	Hazardous Materials Sites or Facilities
1	Historic Site
3	Industrial Sites
4	Medical Facilities
5	Nursing Homes and/or Assisted Living Facilities
1	Sheriff's Office/Jail
4	Post offices
12	Schools Lake City Area Schools: Elementary, Middle, High McBain Rural Agricultural School: Elementary, Middle, High Northern Michigan Christian: Elementary, Middle, High Head Start: Lake City, Falmouth, Merritt
2	Senior Center
3	Water and Sewage Treatment Facilities • Water: 28.9% public system or private company; approximately 70% individual wells; • Sewer: 18.6% public sewer; approximately 80% individual septic/cesspool;
10	Utilities • Wind Farm – 29 Turbines

Source: Missaukee County Data

Flood Data
Flood hazard information may be obtained from the Flood Insurance RateMaps (FIRM) available for jurisdictions. In order to delineate potential flood plain areas (seasonal floodplains) for each county, NWMCOG overlaid wetland, soils, and elevation data to determine the most likely flood prone areas. Once overlaid; isolated polygons (areas) were removed in order to show a more accurate representation of potential flood prone areas along lakes, rivers, and streams. Sources: Temporary/Seasonally Flooded Areas data are from the National Wetland Inventory of the US Fish and Wildlife Service; Hydric soils data are from the county digital soil surveys (where available); and Digital Elevation Model data are from the Center for Geographic Information, Michigan Department of Information Technology.

Natural Flood Insurance Program (NFIP) participants:
There are currently no communities in Missaukee County that participate in the National Flood Insurance Program (NFIP).

Fire Data
Modern forest fire data were obtained from the USDA forest service and the Departments of Natural Resources in Minnesota, Wisconsin, and Michigan. Fire regimes data (fire prone areas) were provided by the USDA Forest Service, North Central Research Station located in Wisconsin. Land type associations, and historical and modern fire rotations were used to identify the fire prone areas.

Tornadoes - National Weather Service

Damaging Winds - National Weather Service

Large Hail - National Weather Service

Winter Weather - National Weather Service

Landslide/Erosion
Shoreline erosion and landslide incident zones delineated by the US Geological Service. Digital Elevation Model data from the Center for Geographic Information, Michigan Department of Information Technology.

Other hazards such as earthquakes may occur in northwest Michigan communities but are not substantial risks in Missaukee County.

Natural Hazards Recorded Events

Data for weather events was compiled from the National Oceanic and Atmospheric Administration's (NOAA) website utilizing the following sections:

- Weather/Climate Events, Information, Assessments
- Climatology and Extreme Events
- NOAA Storm Event Database; 1950 to present, local storm reports, damage reports, events checked for Missaukee County included: Drought (Drought), Flood (Flash Flood, Flood, Lakeshore Flood), Hail (Hail), Extreme Winter Weather (Blizzard, Extreme Cold/Wind Chill, Freezing Fog, Frost/Freeze, Heavy Snow, Ice Storm, Lake-effect Snow, Sleet, Winter Storm, Winter Weather), Tornado (Tornado, Funnel Cloud), Thunderstorm and High Wind (Heavy Rain, High Wind, Lightning, Strong Wind, Thunderstorm Wind), Wildfire (Wildfire)

The following list includes the frequency, dates, and descriptions of the most severe natural hazard events that have occurred within Missaukee County, according to the NOAA Storm Even Database; January 1950 – August 2014. *Extreme Winter Weather* includes events with ice covering, property damage, and/or up to/over 12 in. of snow. *Severe Thunderstorms* include 50 knot winds + and property damage figures.

Hail: 20 events

Table 9: Hail Events

Month	Year	Location	Effect	Damage
August	1984	County	1.75 in.	NA
April	1993	Lake City	0.75 in.	NA
April	1993	Moorestown	1.0 in.	NA
August	1993	Stittsville	0.75 in.	NA
July	1994	Vogel Center	1.75 in.	$500,000 (crop)
April	1995	County	1.50 in.	NA
May	1996	County (East)	0.75 in.	NA
June	1996	Lucas	0.88 in.	NA
May	2000	Lake City	0.75 in.	NA
June	2003	McBain	0.75 in.	NA
July	2003	Falmouth	1.0 in.	NA
August	2003	McBain	1.0 in.	NA
July	2004	Lake City	1.0 in.	NA
June	2006	Lake City	0.75 in.	NA
June	2006	Merritt	0.75 in.	NA
October	2006	Merritt	0.75 in.	NA
October	2006	McBain	1.75 in.	NA
October	2007	McBain	1.0 in.	NA
June	2008	Stittsville	0.88 in.	NA
June	2008	Moorestown	0.75 in.	NA
July	2008	Missaukee Park	0.75 in.	NA
May	2011	Pioneer	0.88 in.	NA
May	2014	Moorestown	0.75 in.	NA

Flood/Flash Flood: 3 Events

Table 10: Flood Events

Month	Year	Location	Effect	Damage
May	2004	Falmouth	2 in. rain in an hour; Falmouth and Thirteen Mile Roads, and Prosper and Eight Mile Road, were inundated.	NA
June	2008	Lucas	3-6 in. rain, roads washed out	$150,000
July	2012	Lake City	2-3 in. rain in 2 hours/roads closed	$10,000
May	2014	Countywide*	State of Michigan declared disaster	NA

Extreme Winter Weather: 15 events

Table 11: Extreme Winter Weather Events

Month	Year	Location	Effect	Damage	Event
January	1993	Region	Snow depth not given	$50,000	
April	1993	Region	Snow depth not given	$50,000	
January	1994	Region	Snow depth not given	$5,000,000	Heavy Snow/Freezing rain
March	2002	Region	Trees and power lines down	NA	Winter Storm/Blizzard
November	2003	Region	Snow depth not given	$40,000	
January	2004	County	10-12 in. snow	NA	Alberta Clipper
January	2006	County	8-12 in. snow	NA	
December	2006	Lake City	10-18 in. snow	NA	Lake Effect Snow
February	2007	County	Wind chills 20-30 degrees below zero	NA	Extreme Cold/Wind Chill
December	2008	County	10-14 in. snow	NA	
December	2010	Region	6-15 in. snow	NA	
February	2011	Region	6-12 in. snow	NA	
March	2012	Region	6-14 in. snow/widespread power outages	NA	
December	2012	Region	5-18 in. snow/downed trees/power outages/travel disruption	$25,000	
January	2014	Region	Wind chills 30 degrees below zero	NA	Extreme Cold/Wind Chill

Severe Thunderstorm Events: 38 events

Table 12: Storm Events for Missaukee County

Month	Year	Location	Effect	Damage	Other Event
April	1981	County	NA	NA	
June	1983	County	NA	NA	
March	1991	County	NA	NA	
August	1993	Moddersville	trees downed/ damaged farm property	NA	
August	1993	Lake City	NA	NA	
August	1993	Lake City	NA	$5,000	
August	1993	Merritt	Trees downed/power outages	NA	
July	1994	Lake City	Window and roof damage to home	$5,000	
July	1994	Merritt	0 knots	NA	
July	1995	Lake City	Trees downed	NA	
July	1995	Merritt	Power lines downed	$5,000	

Severe Thunderstorm Events (continued):

Month	Year	Location	Effect	Damage	Other Event
June	1996	Lucas	55 knots/ tree limbs down	NA	
August	1996	Lake City	55 knots/ uprooted trees/ power lines down	NA	
June	1997	Lake City	52 knots/trees down	NA	
May	1998	Lake City	50 knots/trees down	NA	
May	1998	McBain	60 knots/ straight-line winds/ damaged silos	NA	
May	1998	Jennings	50 knots/trees down	NA	
May	1998	Lake City	78 knots/straight-line winds up to 90 mph/home and farm damages	NA	
November	1998	Region	70 knots/ trees and power lines down/damage to homes, cars, farms, and businesses	NA	
June	1999	McBain	50 knots	NA	
September	2000	County	1 fatality	NA	Lightning
April	2002	Moddersville	50 knots/ downed trees and power lines	NA	
August	2003	Arlene	2 injuries	NA	Lightning
June	2004	Falmouth	55 knots/trees downed, building damage	$10,000	
July	2005	Lake City	Utility pole and property damage	$1,000	Lightning
November	2005	County	52 knots/trees downed/home damage	$35,000	
June	2006	Lake City	55 knots/trees downed	$3,000	
October	2006	McBain	54 knots/trees downed/farm damage	$12,000	
June	2007	Lake City	56 knots/trees downed	$5,000	
June	2007	Lake City	56 knots/trees downed/home damage	$22,000	
June	2007	Pioneer	65 knots/trees downed/home damage	$10,000	
June	2008*	Lucas	65 knots/downed trees and power lines/building damage	$75,000	
October	2010	County	55 knots/ downed trees and power lines/building damage	$2,000	
April	2011	Lake Missaukee	78 knots/ trees downed/home damage	$25,000	
June	2012	Lake City	55 knots/ trees downed/home damage	$14,000	

Tornado: 7 Events

Table 13: Tornado Events for Missaukee County

Month	Year	Location	Effect	Damage
August	1955	County	F0, 17 miles long, 80 yards wide	$3,000
September	1964	County	F2	$250,000
July	1980	County	F0, 33 yards wide	NA
July	1983	County	F1, 9.2 miles long, 30 yards wide	$250,000
June	1994	Manton	F0, 0.2 miles long, 30 yards wide	$5,000
July	1994	Merritt	F0, 0.3 miles long, 20 yards wide	$5,000
May	1998	Lake City	F0, 0.3 miles long, 100 yards wide	NA

** Governor and Presidential Hazard Declaration*

Additional Information from County data:

- 7/17/2006: Thunderstorm/wind damage – trees down, some roads closed due to downed trees/power lines; approximately 15 homes received structural damage; widespread power outages.
- 6/6/08: T Storm wind damage – Power lines down, roof damage, barn silo damaged (top blown ½ mile away), two semis overturned; funnel cloud sighted
- 6/12-13/2008: Widespread flooding – mainly damage to roads and culverts (Presidential Disaster Declaration dated July 14th 2008 for time frame of June 6-13 2008)
- 4/10/11: Windstorm - Extensive damage along a line of approximately 1.35 miles on the south side of Lake Missaukee; resulted in roof and structural damage to homes and businesses from uprooted trees, downed tree limbs, toppled trees, and the wind itself. Many large pines were downed from west to east along Lakeshore Blvd, along with other trees in the area. NWS damage surveys estimated wind gusts up to 85mph.
- 3/2-7/2012: Winter Storm – Extensive Power outages; snowfall amounts per reporting from Road Commission ranged from 8 inches in the south to 16 inches in the north of wet, heavy snow which took trees, branches, and power lines down.

Drought

In Northern Michigan's forested regions, drought can adversely impact timber production and some tourism and recreational enterprises. This can also cause a drop in income, which impacts other economic sectors. The biggest problem drought presents, however, is the increased threat of wildfire. Many Northern Michigan counties are heavily forested and are therefore highly vulnerable to drought-related wildfire threats. The most extreme drought was in January 1931, when the Palmer index hit a record low of -8.07. Lengthy drought incidents took place in 1895-1896 (17 months), 1898-1899 (8 months), 1899-1901 (21 months), 1901-1902 (15 months), 1908-1911 (37 months), 1913-1914 (11 months), 1914-1915 (10 months), 1919-1920 (8 months), 1920-1922 (17months), 1925-1926 (17 months), 1929-1931 (28 months), 1935-1936 (20 months), 1955-1956 (13 months), and 1976-1977 (13 months).

Wildfires

344 wildfires occurred in Missaukee County from 1981 to 2010, affecting nearly 1,175 acres countywide

Pandemics or other Public Health Emergencies

Naturally occurring pandemics may cause widespread precautions around the world. District Health Department #10, which includes Missaukee County, created a pandemic plan that serves as a template for responding to a large-scale outbreak of influenza and other highly infectious respiratory diseases.

Probability of Natural Hazards

The probability that a natural hazard such as hail, thunderstorm and high wind, tornadoes, and snow and ice will affect this area of Michigan is an annual possibility. The magnitude and severity depends on the season, which determines temperature, moisture in the air, ice cover on the lakes, etc. Also, the severity of an event is connected with tourist activity during the year, the pace of developing second homes, and an increasing base population in northwest lower Michigan which in turn leads to more development. The events recorded by NOAA show that natural hazard events may be happening more frequently, but the geographic impact of the natural hazards' impact has remained the same in Missaukee County.

Areas where natural hazards overlap in Missaukee County may include heavy snow that causes trees and power lines down, and then melting, rain and flooding.

Missaukee County Natural Hazards Task Force

The Natural Hazards Task Force comprised of the County's Local Planning Team (LPT) which is a collection of first responders and local, regional, and state public entities that ensure the readiness of County entities by recommending equipment purchases, training and exercises, and public education on preparedness issues.

The Task Force meetings were scheduled monthly in 2014, held in various locations throughout the county, and open to the public. Participants analyzed and updated the hazard priority maps, goals & objectives, hazard priority areas, mitigation measures, and the action agenda items.

The general list of hazard priorities and locations of concern was also reviewed and updated by the Task Force:

- Wildfires
- Oil and Gas wells (164 total)
- Flooding affecting bridges dams infrastructure
- Severe winter weather
- High winds
- Power outages
- Severe storms impacting community festivals

Natural Hazards Priority Areas were narrowed to the top 3 significant according to the Task Force. There have been no changes in the identified or priority level of hazards since the previous plan was adopted.

Top Three Natural Hazards Priority Areas

1. **Potential of severe thunderstorms, high winds, and severe winter storms throughout the County, also the concern regarding festivals and power outages**

   There is a historical record of severe thunderstorms, high winds, and tornado events in the county. These weather events may produce lightning strikes, flash flooding, and hail that have the potential to cause severe injury or loss of life from infrastructure/property damage and exposure to flying/rapidly moving debris, especially in large gatherings such as a festival.

   Missaukee County experiences frequent heavy snow events due to its location in a "snow-belt" area. 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 may cause driving hazards.

2. **Bloomfield, Holland, Reeder, and Norwich Townships: Potential wildfire/urban interface areas**
   The forest types that have a potential to be fire prone are located in these areas – white/red pine, and white pine and hemlock. Additional factors that increase fire risk include dead or dying Ash trees as a result of disease/invasive species, lightning strikes, and human factors such as the number of persons residing, camping, or traveling through these areas.

3. **Norwich, Enterprise, and Clam Union Townships Dams: Potential flooding from Dam failure**

   Flash flood events have the potential to cause structural fatigue on nearby dams and bridges. The Michigan Hazard Analysis of 2012 identifies Reedsburg Dam as a "significant hazard" meaning structural failure may cause an uncontrollable high volume of water downstream, damaging bridges and other key infrastructure. This potential hazard may significantly affect the eastern edges of Enterprise, Butterfield, and Holland Townships due to its seasonal population fluctuation and M-55, a major east-west State highway.

   In addition to natural flooding in a riverine floodplain, other flooding may involve low-lying areas that collect runoff waters; flaws or shortcomings in existing sewer infrastructure; undersized or poorly designed stormwater control practices; collective effects of land use and development trends; illegal diversion of water, or actions that interfere with system function.

Emergency Warning System Coverage

There is a working siren warning system in McBain that covers a one (1) mile radius. The warning system in Lake City is currently obsolete and therefore, not available.

Economic Impact Analysis

The total Damaging Events' Costs recorded since 1950 with the National Oceanic and Atmospheric Administration for Missaukee County, the region, and the state are as follows:

Table 14: Damage Cost by Natural Hazard

Missaukee County	Property Damage Cost	Crop Damage Cost
Flood	$160,000	NA
Hail	NA	$500,000
Extreme Winter Weather	$35,000	NA
Tornado	$262,750	NA
Thunderstorm and High Wind	$324,000	NA
Wildfire	NA	NA

The Missaukee County Equalization Department calculated each Priority Area's economic value through the State Equalized Values (SEV) for real and personal property (residential and commercial). The following includes 2010 Census data and 2014 SEV dollar amount times two (estimated fair market values) for each priority area. According to the 2014 Northwest Michigan Season Population Analysis, assume a 13% increase to account for the average seasonal population within the county.

Table 15: Geographic Economic Value

Priority Area(s)	Geography	Population	State Equalized Value
	Missaukee County	14,478	$703,512,612
2	Lake City; Bloomfield, Reeder, and Holland Townships	2,733	$109,115,800
3	Norwich, Enterprise, and Clam Union Townships	1,722	$97,394,100

VIII. NATURAL HAZARDS MITIGATION GOALS AND OBJECTIVES

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

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

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, such as Timberwood Campground and LaFarge Inc., as well as other organizations who advocate for individuals with functional or access needs

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

- Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures
- Create or update ordinances to reflect building codes, shoreline protection rules, etc.
- Incorporate natural hazards mitigation into basic land use regulation mechanisms
- Develop community education programs and public warning systems
- Strengthen the role of the Local Emergency Planning Committee in the land development process
- Integrate natural hazards mitigation into the capital improvement planning process so that public infrastructure does not lead to development in natural hazards areas
- Encourage county agencies to assess local roads, bridges, dams, and related transportation infrastructure for natural hazards vulnerability

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

- Provide a list of desired community mitigation measures to the State
- 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

IX. IDENTIFICATION AND SELECTION OF MITIGATION STRATEGIES

Selection of Feasible Mitigation Strategies
A set of evaluation criteria was developed to determine which mitigation strategies were best suited to address the identified problems in Missaukee County.

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

By anticipating future problems, the County can reduce potential injury, structure losses, loss of power, such as electric and gas, and prevent wasteful public and private expenditures.

Priority Area 1: Potential of severe thunderstorms and high winds, and severe winter storms throughout the County, also the concern regarding festivals and power outages

Thunderstorm, High Winds, and Tornado Mitigation Strategies:

- Public education activities for new construction and mobile homes regarding underground utilities, roofing materials, bracing, and anchoring/tie downs
- Continue enforcement of building code
- Tree management (removing dead/dying trees/limbs)
- Maintain list of available shelters

Snow Load Mitigation Strategies:

- Public education and awareness regarding structural system modifications and structural maintenance
- Continue enforcement of building code regarding snow load limits through the permitting process
- Develop and implement a data collection project regarding snow loads and structures in the county, including mobile homes

Priority Area 2: Bloomfield, Holland, Reeder, and Norwich Townships: Potential wildfire/urban interface areas

Wildfire Mitigation Strategies:

- Public education and awareness regarding fuel management, proper vegetation
- Continue enforcement of state fire codes regarding setback requirements
- Public education utilizing the Michigan Department of Natural Resources flyers and the Federal Emergency Management Administration information at parks and campgrounds
- Assess fire suppression access in the potential areas
- Research the Department of Natural Resources' State Forest wildfire/urban interface rules or plan

Priority Area 3: Norwich, Enterprise, and Clam Union Townships Dams: Potential flooding from breakdown in any of these three dams

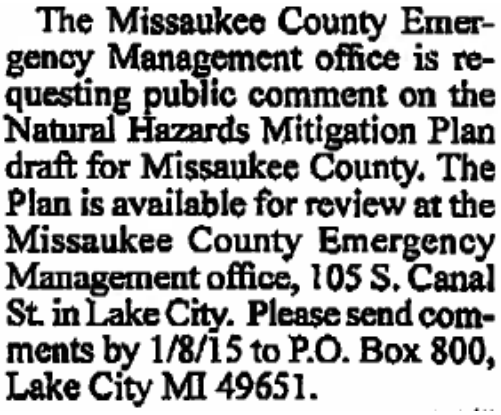
Flood Mitigation Strategies:

- Public education through radio and television
- Continue enforcement of building codes and soil erosion regulations which includes the state code of a 500 foot buffer
- Utilize the information from Soil Conservation District, Michigan Department of Environmental Quality and the Department of Natural Resources

X. Participation in the Development of the Missaukee County Natural Hazards Mitigation Plan

The opportunities for review by other governmental entities and the public included the following:

- Public Notices were published in the Missaukee Sentinel



The Missaukee County Emergency Management office is requesting public comment on the Natural Hazards Mitigation Plan draft for Missaukee County. The Plan is available for review at the Missaukee County Emergency Management office, 105 S. Canal St. in Lake City. Please send comments by 1/8/15 to P.O. Box 800, Lake City MI 49651.

- The Natural Hazards Mitigation Plan was presented to the Missaukee County Planning Commission where the meetings are posted in the newspaper and are open to the public.

- The Natural Hazards Mitigation Plan was presented to the Missaukee County Board of Commissioners where the meetings are posted in the newspaper and are open to the public.

- During development of the plan, all townships and villages were provided the opportunity to formally comment on plan drafts and other related materials. They were given the opportunity via mailings of both meeting notices and draft copies of the plan for comment. Notification was also provided to them that the plans were posted on the NWMCOG website and could be reviewed there. While no jurisdictions (other than the county) provided formal written comments, they did provide county staff (particularly the county emergency manager) with feedback via other informal means. This feedback took the form of phone calls, emails and conversations that occurred at various non-mitigation related meetings throughout the county. This information was provided back to NWMCOG staff by the county staff and used in development of the plan, including the risk assessment and community profile sections.

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

Community planning services are provided by the Missaukee County Planning Department. The Department assists communities in developing plans, provides resource information and technical assistance, and aids communities with land use issues of common interest. The Missaukee County Planning Commission coordinates and reviews local plans to ensure consistency across jurisdictional boundaries. Building permits are issued by the Missaukee County Building Department.

The Townships/Villages in the priority areas include:

Aetna Township	Forest Township	Pioneer Township
Bloomfield Township	Holland Township	Reeder Township
Butterfield Township	Lake Township	Richland Township
Caldwell Township	Lake City – zoning	Riverside Township
Clam Union Township	McBain – zoning	West Branch Township
Enterprise Township	Norwich Township	

Missaukee does not have count wide zoning, therefore townships without zoning ordinances must follow building codes and soil erosion measures when applicable per state law.

Table 16: Plan Participation

County/Township/Others	**Zoning**	**Participation**
Missaukee County	No	Task Force meetings, review of draft plans, approval to submit plan: County Commissioners Emergency Management Coordinator Emergency Services Equalization Department Planning Commissioners Planning Department Road Commission Sheriff Department
Aetna	No	See last bullet point paragraph, above
Bloomfield	No	See last bullet point paragraph, above
Butterfield	No	See last bullet point paragraph, above
Caldwell	No	See last bullet point paragraph, above
Clam Union	No	See last bullet point paragraph, above
Enterprise	No	See last bullet point paragraph, above
Forest	No	See last bullet point paragraph, above
Holland	No	See last bullet point paragraph, above
Lake	No	See last bullet point paragraph, above
Norwich	No	See last bullet point paragraph, above
Pioneer	No	See last bullet point paragraph, above
Reeder	No	See last bullet point paragraph, above
Richland	No	See last bullet point paragraph, above
Riverside	No	See last bullet point paragraph, above
West Branch	No	See last bullet point paragraph, above
Lake City	Yes	See last bullet point paragraph, above
City of McBain	Yes	See last bullet point paragraph, above
District Health Department #10	N/A	See last bullet point paragraph, above

N/A = Not applicable; these are non-governmental authority entities

XI. IMPLEMENTATION OF THE MISSAUKEE COUNTY NATURAL HAZARDS MITIGATION PLAN

Natural Hazards Mitigation Plan Managers and Technical Assistance

The County Board will lead the implementation of the Natural Hazards Mitigation Plan with assistance from the Emergency Management Coordinator. Inter- agency partnerships and collaboration are encouraged to accomplish the goals and objectives of the Plan.

- Missaukee County Government Staff
- Cities, Villages, and Townships,
- Missaukee County Conservation District
- Missaukee County Road Commission
- Michigan State University Extension
- Michigan Department of Environmental Quality
- Michigan Department of Natural Resources
- U.S. Environmental Protection Agency
- U.S. Department of Agriculture Natural Resources Conservation Service
- Insurance Companies
- Real Estate Companies

All natural hazards mitigation planning could be pursued with the new tool available to the local governments which is the Michigan Public Act 134 of 2010, the Enrolled House Bill Number 6152; and Michigan Public Act 226 of 2003, the Joint Municipal Planning Act. These Acts provides for joint land use planning by cities, villages, and townships and allows two or more municipalities' legislative bodies to create a single joint planning commission to address planning issues. This tool helps with planning for the "big picture" issues such as natural hazards that cross jurisdictional boundaries.

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

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

Funding the Implementation of the Plan

To assist with the funding of the proposed natural hazards mitigation strategies, here is a list of potential financial assistance entities to help fund the implementation projects of the Plan.

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

Action Agenda

Following is table summary for accomplishing the **recommended natural hazards mitigation actions** for Missaukee County.

Table 17: Recommended Mitigation Actions for Missaukee County

Priority and Action Strategies	Responsible Parties	Timeframe
Priority Area 1: Thunderstorm, High Winds, and Tornado Mitigation Strategies		
a. Update inventory of available shelters and develop a proposal to build additional ones if necessary	County Planning County Building Inspector Emergency Management Coordinator	Ongoing
b. Work with Utility Companies • Tree management • Promotion of burying utility lines in new construction • Burying power lines in high outage areas	County Building Inspector Emergency Management Coordinator	1-5 years from adoption of the plan
c. Public education activities such as programs and brochures for new construction and trailers, mobile homes, and modular homes regarding underground utilities, roofing materials, bracing, and anchoring and tie downs	County Building Inspector Emergency Management Coordinator Townships, City	1-3 years after adoption of the plan
d. Continue enforcement of Building codes	County Building Inspector	Ongoing
e. Work with insurance companies regarding risk management	County Building Inspector Emergency Management Coordinator	1-3 years from adoption of the plan
Snow Load Mitigation Strategies		
a. Develop and implement a data collection project regarding snow loads and structures in the county	County Planning County Building Inspector Emergency Management Coordinator	Ongoing
b. Public education and awareness activities such as programs and brochures regarding structural system modifications and structural maintenance; new construction and trailers, mobile homes, and modular homes regarding underground utilities, roofing materials, and bracing	County Building Inspector Emergency Management Coordinator Townships, City	1-3 years from adoption of the plan
c. Continue enforcement of building code regarding snow load limits through the permitting process: State Building Code - Bloomfield Township and a small portion of Caldwell and Pioneer Townships require 60 lb. snow load and the remaining county is 50 lb. snow load	County Building Inspector	Ongoing

Table 17: Recommended Mitigation Actions for Missaukee County (continued)

Priority Area 2: Wildfire Mitigation Strategies		
a. Assess fire suppression access and make improvements	Emergency Management Coordinator	1-3 years from adoption of the plan
b. Research the Department of Natural Resources' State Forest wildfire/urban interface rules or plan	County Planning County Building Inspector Emergency Management Coordinator	Ongoing
c. Public education and awareness activities such as programs and brochures regarding fuel management, proper vegetation, fire breaks	County Planning County Building Inspector Emergency Management Coordinator Townships, City	1-3 years from adoption of the plan
d. Continue enforcement of state fire codes regarding setback requirements	County Building Inspector	Ongoing
e. Public education utilizing the Michigan Department of Natural Resources flyers and the Federal Emergency Management Administration information at parks and campgrounds	County Planning County Building Inspector Emergency Management Coordinator Townships, City	1-3 years from adoption of the plan
f. Real estate and insurance agents to distribute information	County Planning County Building Inspector Emergency Management Coordinator	1-3 years from adoption of the plan
Priority Area 3: Flood Mitigation Strategies		
a. Public education and awareness activities through radio and television	County Planning County Building Inspector Emergency Management Coordinator Townships, City	1-3 years from adoption of the plan
b. Continue enforcement of building codes and soil erosion regulations which includes the state code of a 500 foot buffer	County Building Inspector	Ongoing
c. Utilize the information from Soil Conservation District, Michigan Department of Environmental Quality and the Department of Natural Resources	County Planning County Building Inspector Emergency Management Coordinator	Ongoing

Monitoring and Evaluation

The Missaukee County Natural Hazards Mitigation Plan will be monitored on a regular basis by the Emergency Management Coordinator/Planning Director. Because Missaukee County is a dynamic, changing county with population growth, it is expected that the plan should be reviewed on an annual basis.

To assess the effectiveness of the Plan, some questions to ask in the review include: 1) How many and which mitigation strategies were developed? Implemented? 2) Did any new natural hazards events take place the past year to report? This review will be administered by the Emergency Management Coordinator with the Local Emergency Planning Committee, the County Planning Commission, and the public. If changes are needed, the plan will be presented to the Task Force participants for revisions.

Although review of the plan will occur annually, and a formal revision may not be needed each year, a new edition of the plan will be expected within every five year period. A continual process for updates will take place with annual reviews, monitoring, evaluation, and an accumulation of official feedback and public input through public notices. When it is appropriate to publish a revised version of the plan, the Task Force participants shall again be involved in the revision process. Each new edition of the plan will again be officially adopted by the Missaukee County Board of Commissioners.

XII. NATURAL HAZARDS MITIGATION PLAN APPROVAL RESOLUTION

Hazardous Mitigation Resolution
2015-8

Missaukee County Board of Commissioners
HAZARD MITIGATION PLAN ADOPTION RESOLUTION

At a regular meeting of the Missaukee County Board of Commissioners held at the Missaukee County Courthouse Commissioner's room, 111 S. Canal Street, Lake City, Michigan, on the 14th day of July, 2015.
PRESENT: Bridson, Vanderwal, Cairy, Rogers, Vivian, Hughston, Zuiderveen.
ABSENT: None
The following resolution was offered by Cairy, and seconded by Vivian:

WHEREAS, the county of Missaukee has experience risks that may damage commercial, residential, and public properties, displace citizens and businesses, close streets and impair infrastructure, and present general public health and safety concerns; and

WHEREAS, the county of Missaukee has prepared a *Hazard Mitigation Plan* that outlines the community's options to reduce damages and impacts from natural and technological hazards; and

WHEREAS, the *Hazard Mitigation Plan* has been reviewed by community residents, business owners, and federal, state and local agencies, and has been revised where appropriate to reflect their concerns;

NOW, THEREFORE, BE IT RESOLVED THAT, The *Hazard Mitigation Plan* is hereby adopted as an official plan of Missaukee County;

BE IT FURTHER RESOLVED THAT, the Missaukee County Emergency Management Coordinator is charged with supervising the implementation of the Plan's recommendations within the funding limitations as provided by the Missaukee County Board of Commissioners or other sources.

STATE OF MICHIGAN)

COUNTY OF MISSAUKEE)

I, Carolyn Flore, County Clerk, do hereby certify that the foregoing is a true copy of a Resolution adopted by the Missaukee County Board of Commissioners at a regular meeting held on the 14th day of July, 2015 by the following vote:

YEAS: Bridson, Vanderwal, Cairy, Rogers, Vivian, Hughston, Zuiderveen
NAYS: None
NOT VOTING: None

I further certify that the foregoing Resolution is a true, correct and complete transcript of the original of said Resolution appearing on file and of record in my office. I further certify that the meeting was held and the minutes therefore were filed in compliance with Act No. 267 of the Public Acts of 1976.
IN WITNESS WHEREOF, I have hereunto set me hand and affixed the Seal of the County of Missaukee this 14th day of July, 2015.

CLERK OF THE COUNTY COMMISSION
MISSAUKEE COUNTY, MICHIGAN

Carolyn Flore, County Clerk

XIII. APPENDICES

Appendix A

Glossary of Mitigation Planning Terms

Alluvial fan: A gently sloping fan-shaped landform created over time by the deposition of eroded sediment and debris.

Base Flood: A flood having a one percent chance of being equaled or exceeded in any given year.

Coastal high hazard area: An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms.

Disaster: A major detrimental impact of a hazard upon the population and economic, social, and built environment of an affected area.

Exposure: The number, types, qualities, and monetary values of various types of property or infrastructure and life that may be subject to an undesirable or injurious hazard event.

Flood Insurance Rate Map: As defined under the National Flood Insurance Program, an official map of the community on which the administrator of the Flood Insurance Administration has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

Floodplain or flood prone area: Any land area susceptible to being inundated by water from any source.

Floodplain management: The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works, and floodplain management regulations.

Fuel: Combustible plant material, both living and dead, that is capable of burning in a wildland situation; any other flammable material in the built environment that feeds a wildfire.

Hazard: An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.

Hazard identification: The process of defining and describing a hazard, including its physical characteristics, magnitude and severity, probability and frequency, causative factors, and locations or areas affected.

Lifeline systems: Public works and utilities such as electrical power, gas and liquid fuels, telecommunications, transportation, and water and sewer systems.

Major disaster: As defined in the Stafford Act, “any natural catastrophe or, regardless of cause, any fire, flood, or explosion in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of states, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.”

Mitigation: Sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards and their effects. Note that this emphasis on long-term risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery.

Multiple-objective management: A holistic approach to floodplain management (or the management of other hazards) that emphasizes the involvement of multiple distinct interest in solving land use problems related to the hazardous area.

Natural hazard: Hurricanes, tornadoes, storms, floods, tidal wave, tsunamis, high or wind-driven waters, volcanic eruptions, earthquakes, snowstorms, wildfires, droughts, landslides, and mudslides.

One hundred year flood: The flooding event that has a one percent chance of occurring in a particular location in any given year. While this is the most common reference point statistically because it is used for regulatory purposes in the National Flood Insurance Program, the same language applies in referring to other actual or hypothetical events in terms of their statistical probabilities.

Risk: The potential losses associated with a hazard, defined in terms of expected probability and frequency, exposure, and consequences.

Risk assessment: A process or method for evaluating risk associated with a specific hazard and defined in terms of probability and frequency of occurrence, magnitude and severity, exposure, and consequences.

Special flood hazard area: Land in the floodplain within a community subject to one percent or greater chance of flooding in any given year.

Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288, as amended by P.L. 100-707), which provides the greatest single source of federal disaster assistance.

Structure: A walled and roofed building, including a storage tank for gas or liquid, that is principally above ground, as well as a manufactured home.

Tornado Classifications:

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys, breaks branches off trees, pushes over shallow-rooted trees, damages sign boards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed, peels surface off roofs, mobile homes pushed off foundations or overturned, moving autos pushed off the roads, attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses, mobile homes demolished, boxcars pushed over; large trees snapped or uprooted, light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses, trains overturned, most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled, structures with weak foundations blown off some distance, cars thrown

			and large missiles generated.
F5	**Incredible tornado**	**261-318 mph**	**Strong frame houses lifted off foundations and carried considerable distances to disintegrate, automobile sized missiles fly through the air in excess of 100 meters, trees debarked, steel reinforced concrete structures badly damaged.**
F6	**Inconceivable tornado**	**319-379 mph**	**These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies**

Urban Wildfire: A fire moving from a wildland environment, consuming vegetation as fuel, to an environment where the fuel consists primarily of buildings and other structures.

Urban/Wildland interface: A developed area, also known as the "I-zone," occupying the boundary between an urban or settled area and a wildland characterized by vegetation that can serve as fuel for a forest fire.

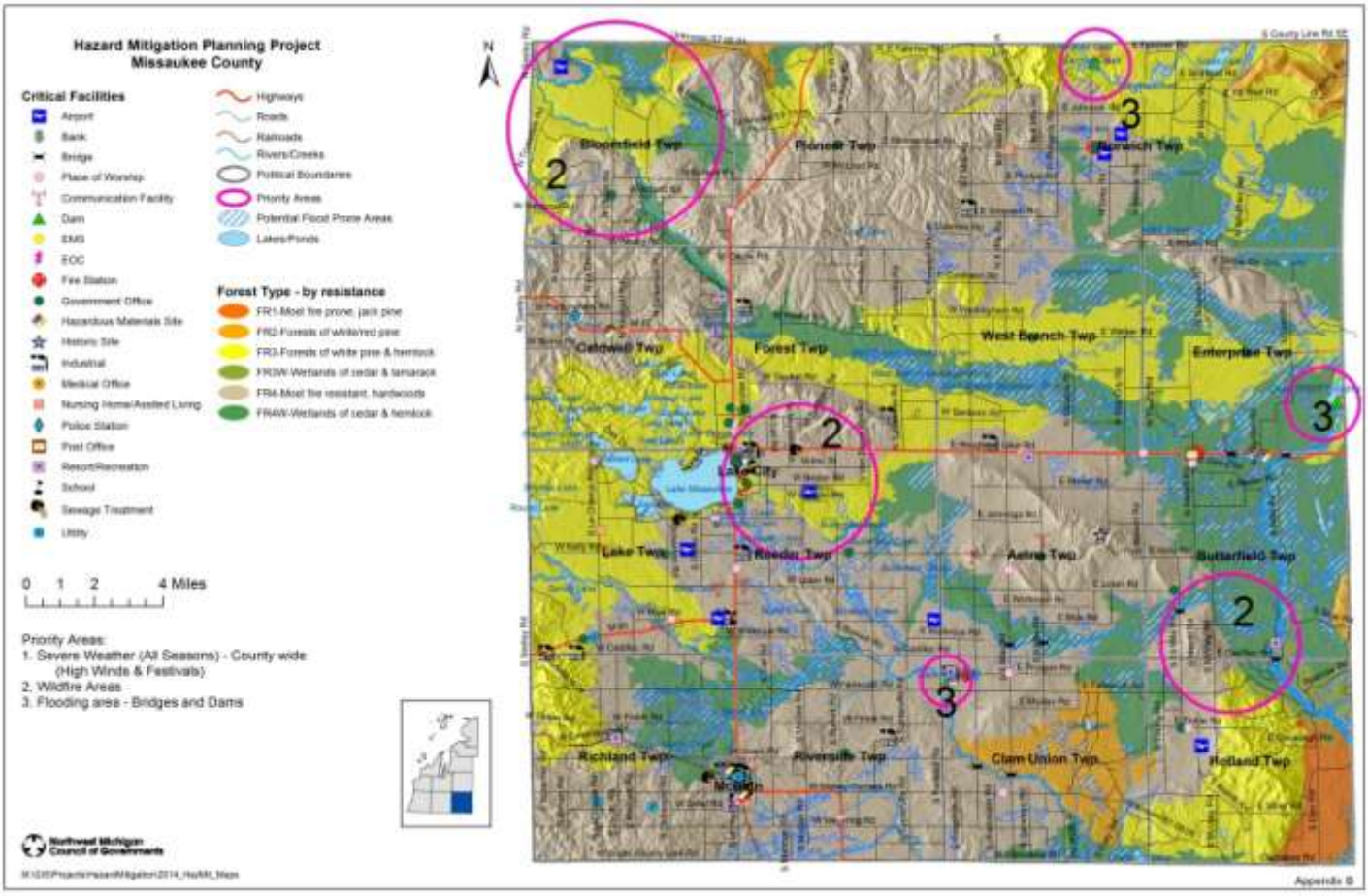
Vulnerability: The level of exposure of human life and property to damage from natural hazards.

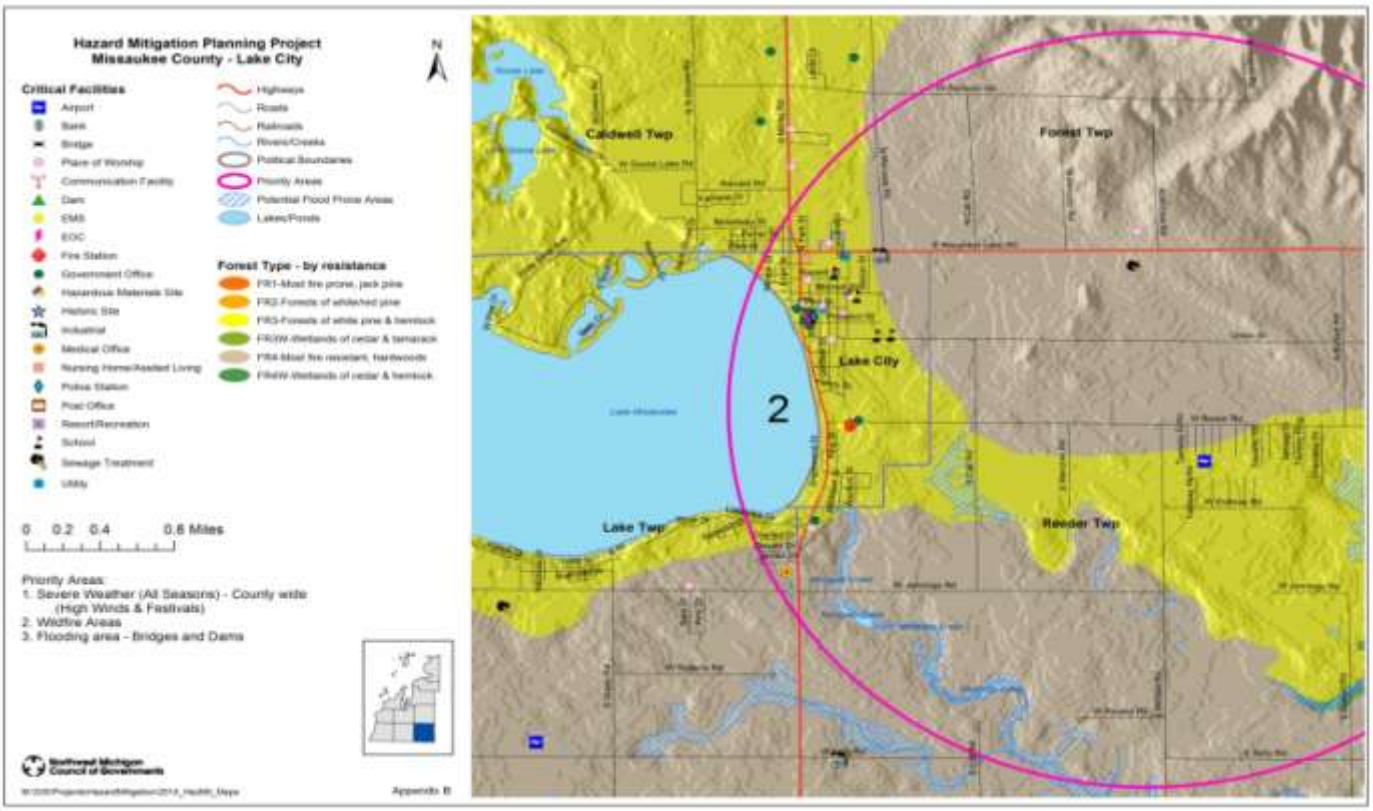
Watershed management: The implementation of a plan or plans for managing the quality of flow of water within a watershed, the naturally defined area within which water flows into a particular lake or river or its tributary. The aims of watershed management are holistic and concern the maintenance of water quality, the minimization of stormwater runoff, the preservation of natural flood controls such as wetlands and pervious surface, and the preservation of natural drainage patterns. Watershed management is, in many ways, an enlargement of most of the concerns that underlie floodplain management.

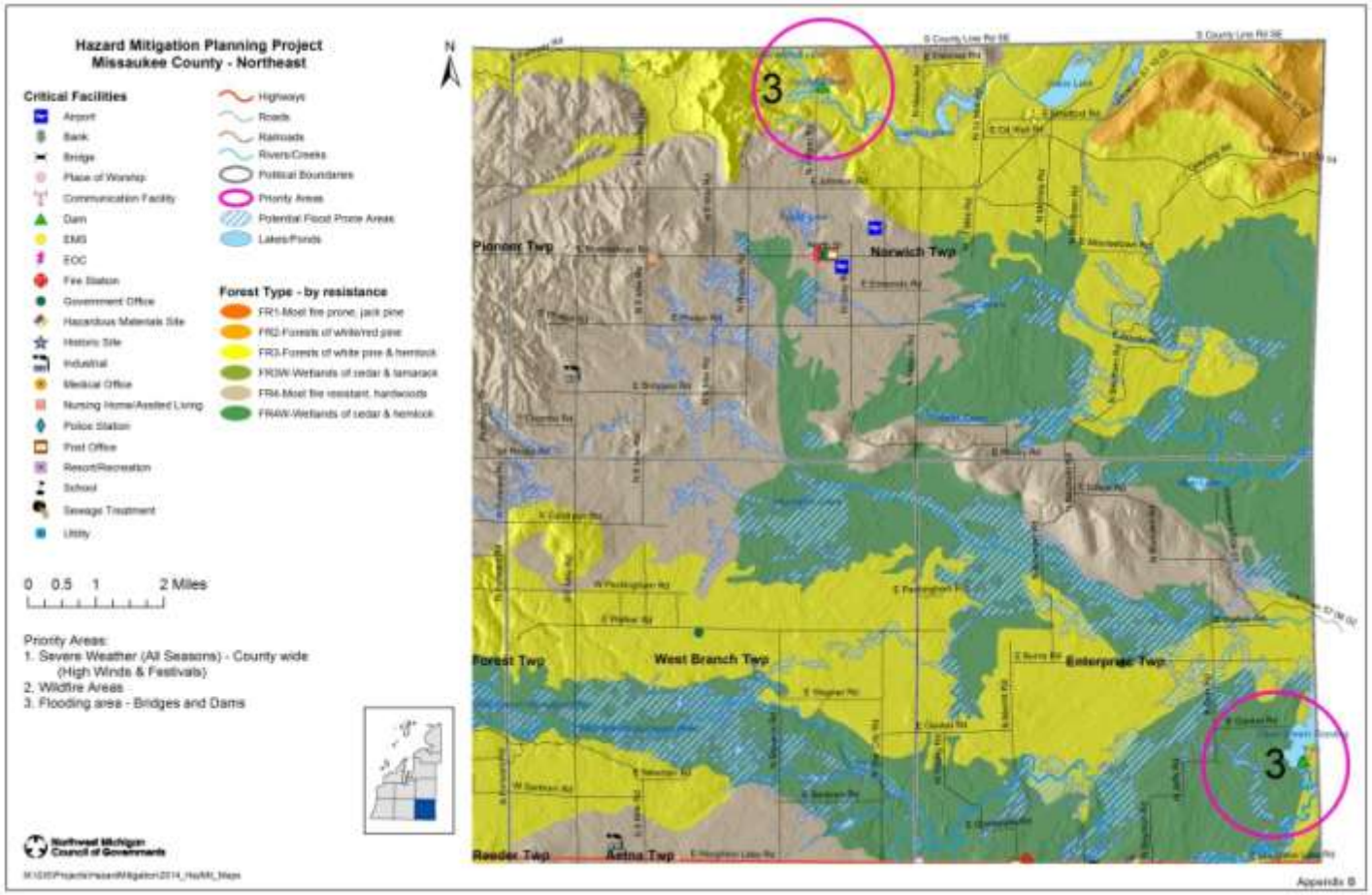
Wildland: An area in which development has not occurred with the exception of some minimal transportation infrastructure such as highways and railroads, and any structures that are widely spaced and serve largely recreational purposes.

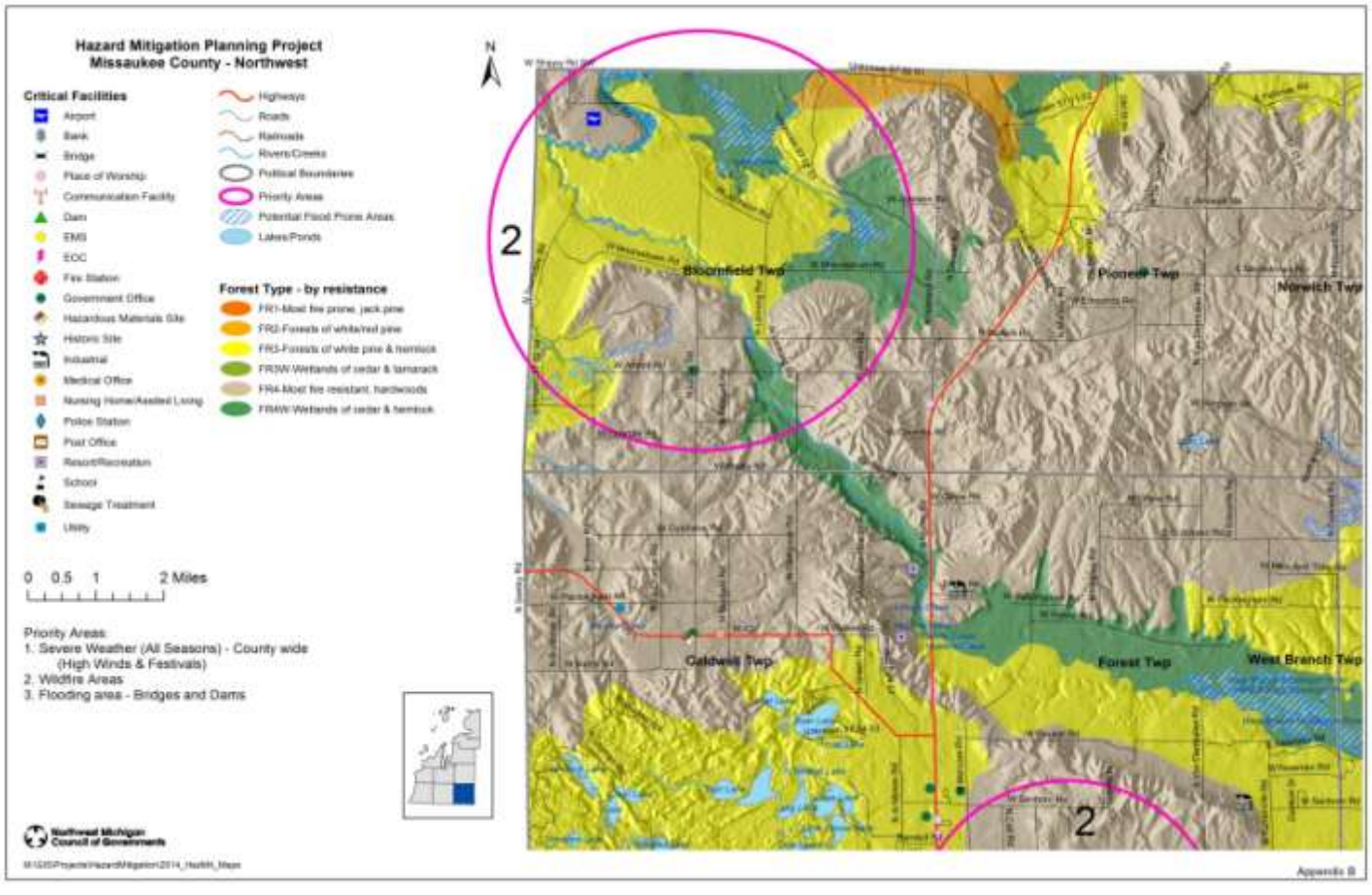
Appendix B

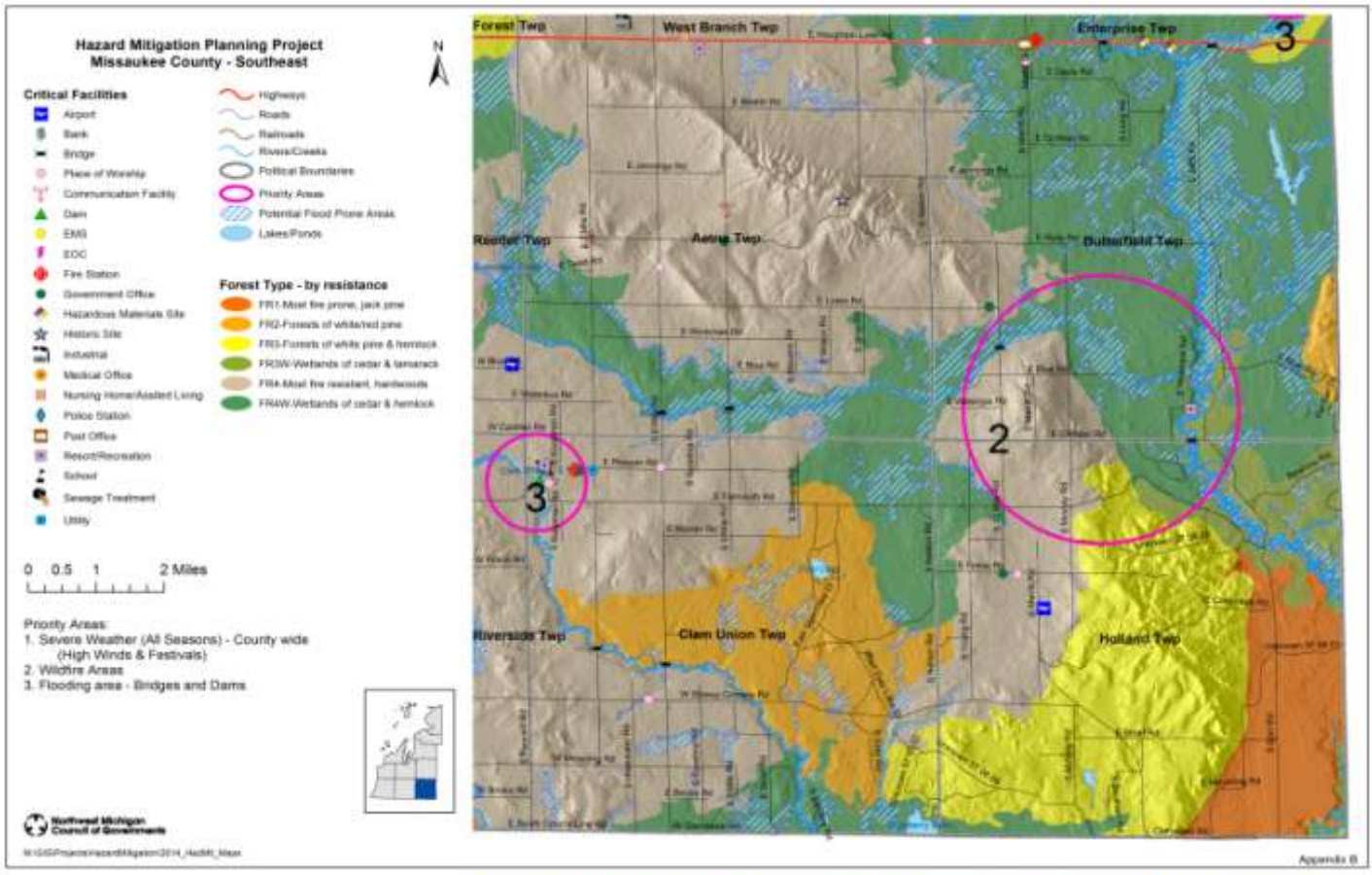
Hazard Priority Area Maps

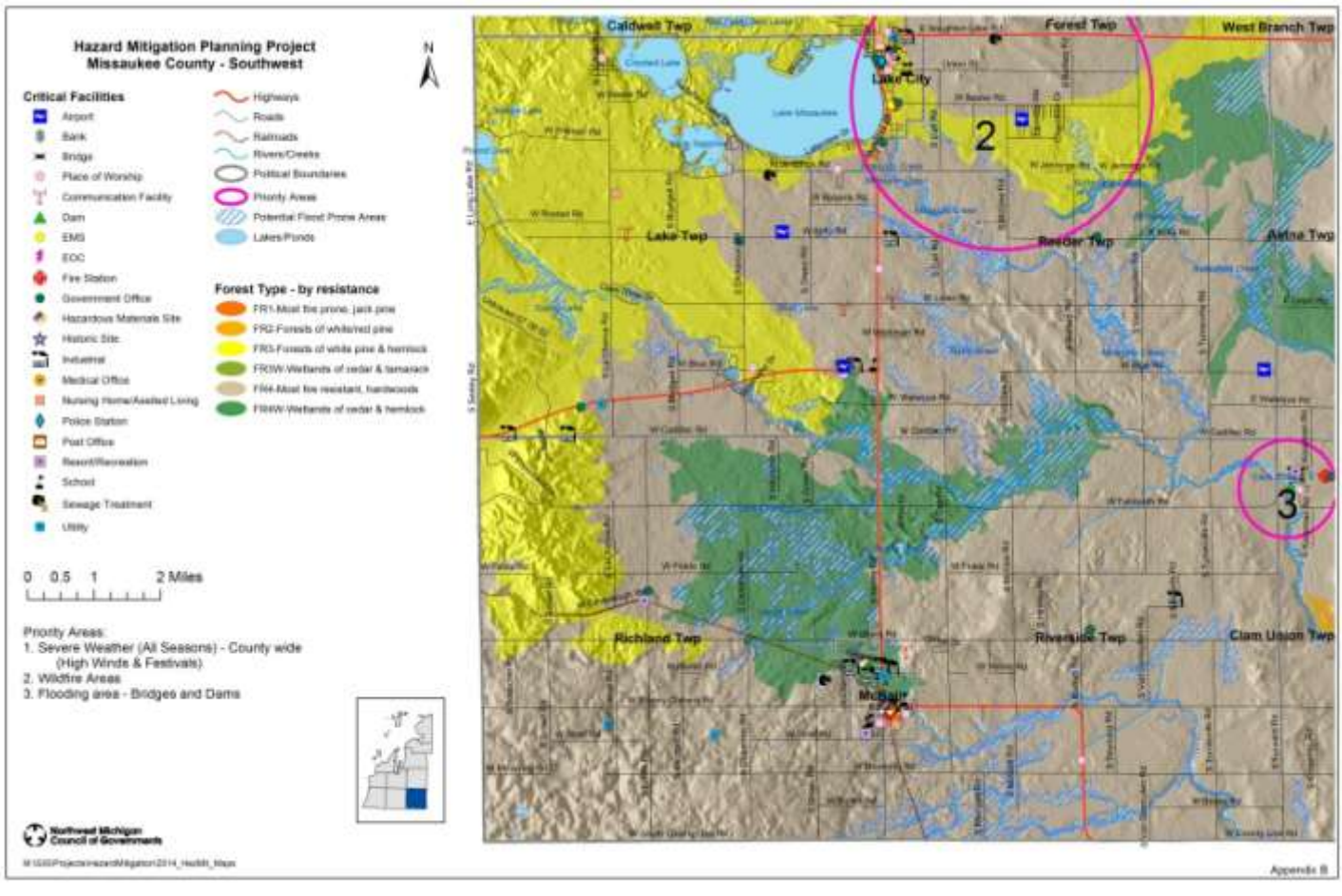





Hazard Mitigation Planning Project
Missaukee County - Northeast
Critical Facilities
Airport
Bank
Bridge
Place of Worship
Communication Facility
Dam
EMS
EOC
Fire Station
Government Office
Hazardous Materials Site
Historic Site
Industrial
Medical Office
Nursing Home/Assited Living
Police Station
Post Office
Resort/Recreation
School
Sewage Treatment
Utility
Highways
Roads
Railroads
Rivers/Creeks
Political Boundaries
Priority Areas
Potential Flood Prone Areas
Lakes/Ponds
Forest Type - by resistance
FR1-Most fire prone, jack pine
FR2-Forests of white/red pine
FR3-Forests of white pine & hemlock
FRSW-Wetlands of cedar & tamarack
FR4-Most fire resistant, hardwoods
FRAW-Wetlands of cedar & hemlock
0 0.5 1 2 Miles
Priority Areas:
1. Severe Weather (All Seasons) - County wide
(High Winds & Festivals)
2. Wildfire Areas
3. Flooding area - Bridges and Dams
N
3
Pioneer Twp
Norwich Twp
Forest Twp
West Branch Twp
Enterprise Twp
3
Reeder Twp
Aetna Twp
Northwest Michigan
Council of Governments
Appendix B


Hazard Mitigation Planning Project
Missaukee County - Northwest
Critical Facilities
Airport
Bank
Bridge
Place of Worship
Communication Facility
Dam
EMS
EOC
Fire Station
Government Office
Hazardous Materials Site
Historic Site
Industrial
Medical Office
Nursing Home/Assited Living
Police Station
Post Office
Resort/Recreation
School
Sewage Treatment
Utility
Highways
Roads
Railroads
Rivers/Creeks
Political Boundaries
Priority Areas
Potential Flood Prone Areas
Lakes/Ponds
Forest Type - by resistance
FR1-Most fire prone, jack pine
FR2-Forests of white/red pine
FR3-Forests of white pine & hemlock
FRSW-Wetlands of cedar & tamarack
FR4-Most fire resistant, hardwoods
FRAW-Wetlands of cedar & hemlock
0 0.5 1 2 Miles
Priority Areas:
1. Severe Weather (All Seasons) - County wide
(High Winds & Festivals)
2. Wildfire Areas
3. Flooding area - Bridges and Dams
N
2
Bloomfield Twp
Pioneer Twp
Norwich Twp
Caldwell Twp
Forest Twp
West Branch Twp
2
Northwest Michigan
Council of Governments
Appendix B


Hazard Mitigation Planning Project
Missaukee County - Southeast
N
Critical Facilities
Airport
Bank
Bridge
Place of Worship
Communication Facility
Dam
EMS
EOC
Fire Station
Government Office
Hazardous Materials Site
Historic Site
Industrial
Medical Office
Nursing Home/Assisted Living
Police Station
Post Office
Resort/Recreation
School
Sewage Treatment
Utility
Highways
Roads
Railroads
Rivers/Creeks
Political Boundaries
Priority Areas
Potential Flood Prone Areas
Lakes/Ponds
Forest Type - by resistance
FR1-Most fire prone, jack pine
FR2-Forests of white/red pine
FR3-Forests of white pine & hemlock
FRW-Wetlands of cedar & tamarack
FR4-Most fire resistant, hardwoods
FRW-Wetlands of cedar & hemlock
0 0.5 1 2 Miles
Priority Areas:
1. Severe Weather (All Seasons) - County wide
(High Winds & Festivals)
2. Wildfire Areas
3. Flooding area - Bridges and Dams
Northwest Michigan Council of Governments
Forest Twp
West Branch Twp
Enterprise Twp
Reeder Twp
Aetna Twp
Butterfield Twp
Riverside Twp
Clam Union Twp
Holland Twp
2
3
3
Appendix B


Hazard Mitigation Planning Project
Missaukee County - Southwest
N
Critical Facilities
Airport
Bank
Bridge
Place of Worship
Communication Facility
Dam
EMS
EOC
Fire Station
Government Office
Hazardous Materials Site
Historic Site
Industrial
Medical Office
Nursing Home/Assisted Living
Police Station
Post Office
Resort/Recreation
School
Sewage Treatment
Utility
Highways
Roads
Railroads
Rivers/Creeks
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Priority Areas
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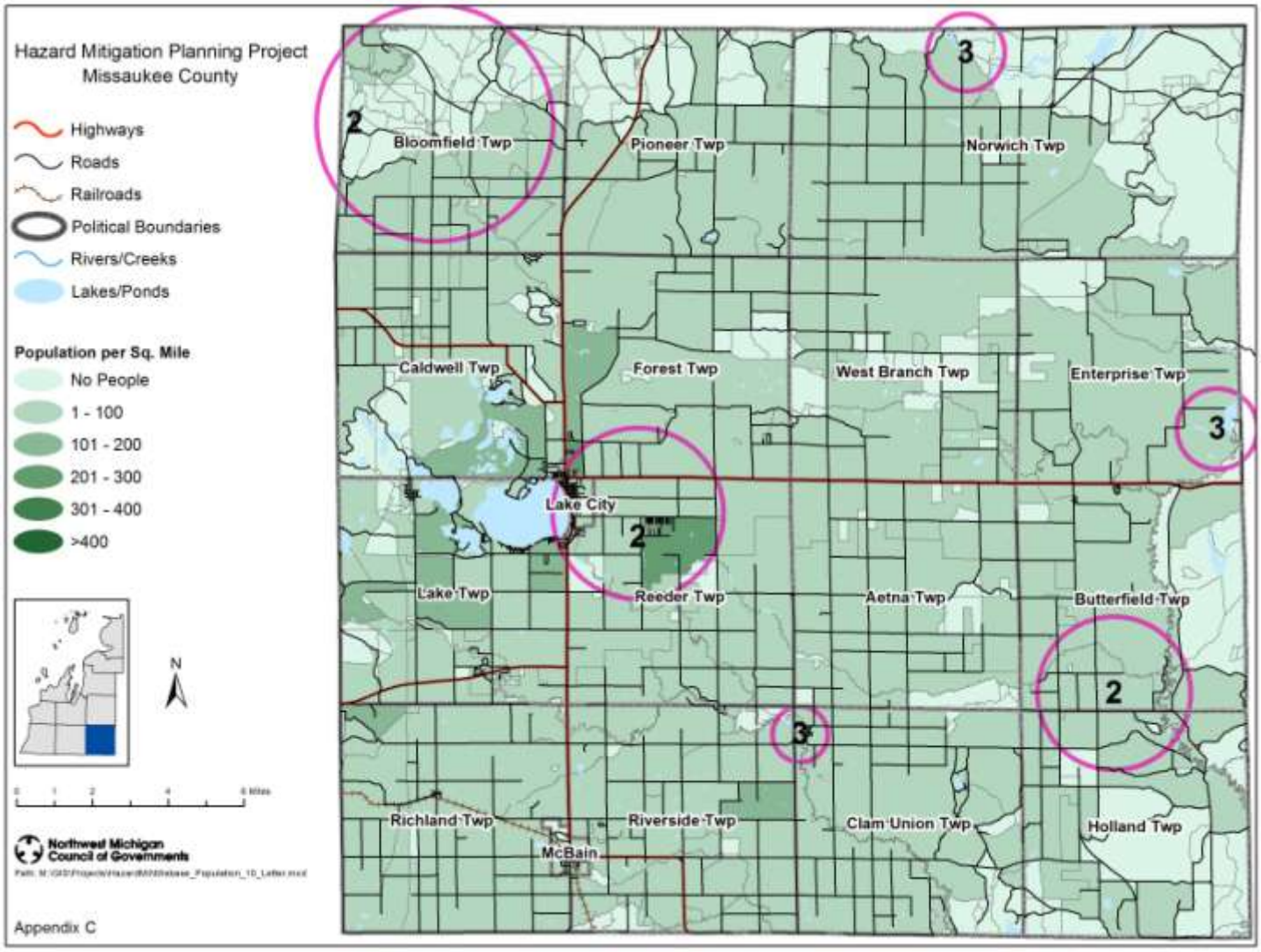
FR4-Most fire resistant, hardwoods
FRW-Wetlands of cedar & hemlock
0 0.5 1 2 Miles
Priority Areas:
1. Severe Weather (All Seasons) - County wide
(High Winds & Festivals)
2. Wildfire Areas
3. Flooding area - Bridges and Dams
Northwest Michigan Council of Governments
Caldwell Twp
Forest Twp
West Branch Twp
Lake City
Lake Twp
Reeder Twp
Aetna Twp
Richland Twp
Riverside Twp
Clam Union Twp
McBain
2
3
Appendix B

Appendix C

Population Density Map



Appendix D

Risk Assessment Summary Table: MISSAUKEE COUNTY

HAZARD (Years of Record)	Number of Events	Probability**	Geographic Size Affected	Population Impacted	Specific Priority Area	Detailed Damage and Estimated Costs
Flooding (2004 – 2012)	3	Frequent	Bridges and Dams (Clam Union, Reeder, Aetna, Butterfield, Enterprise, Richland, Riverside, Lake) Falmouth Flood (Clam Union)	> 8,500	**3**	$160,000
Hail (1984 – 2014)	20	Frequent	Countywide	> 14,000		1.75 inches Crop damage $500,000
Extreme Winter Weather (1993 – 2014)	15	Frequent	Countywide	> 14,000	**1**	$5,140,000
Severe Thunderstorm/ High Winds (1981 – 2012)	38	Frequent	Countywide	> 14,000	**1**	$229,000
Tornadoes (1955 – 1998)	7	Occasional	Countywide	> 14,000		$561,300
Wildfires (1981 – 2010)	344	Frequent	Countywide	> 14,000	**2**	

***Rare* - Hazard event is likely to occur less than once every 30 years.
Occasional - Hazard event is likely to occur less than once every 5 years, but more often that once every 30 years.
Frequent - Hazard event is likely to occur more than once every 5 years.

Appendix E

Examples of Past Mitigation Projects

Flood Projects	Tornado/Wind Projects	Extreme Cold/Winter/Infrastructure Failure Projects
Replace culvert with bridge	Modify roof ballast system on airport	Insulate municipal water tower
Install stormwater relief drain	Construct storm shelters in public buildings	Insulate city infrastructure
Upgrade road culvert	Construct storm shelters for homes, facilities	Insulate sanitary/storm sewer mains
Elevate floors of homes	Wind bracing for microwave/radio towers	Insulate water mains
Acquire of floodway properties	Construct mobile home park storm shelter	Bury utility lines
Create retention basin	Wind retrofitting for municipal buildings	Relocate sewer mains
Construct new dike	Wind bracing for school facilities	Reroute power lines under a river
Upgrade bridge over a creek (for greater stream flow)	Upgrade warning sirens**	Install plumbing devices to prevent sewer backup
Install sea wall	Install warning sirens**	Elevate and build casing for generator for EOC
Install rip rap to protect roadway	Purchase/Distribute NOAA radios**	Living snow fences for highways and roadways
Re-route various county drains	Severe weather monitoring systems**	
Purchase back-flow prevention valves	Implement long-term community outreach**	
Construct new drains for flood relief		
Flood study for home acquisition		
Flood study of community's flood risk	**Thunderstorm/Lightning Projects**	**Wildfire Projects**
Flood study for stream, roadways		
Elevate electrical equipment in basements	Lightning protection (grounding/phasing)	Vegetation management for roadways
Floodproof wastewater treatment plant	Purchase/Distribute NOAA radios**	Vegetation mgmt. for urban interface areas of city
Warning sensor for creek/river	Install weather alert monitors**	Vegetation mgmt. for homes in fire prone areas
Warning sensor for dam		Urban Interface Education Program**
Raise manholes above 100-Yr floodplain		
Expand storm sewer network for subdivision		
Excavate floodway channel bypass		
Establish permanent flood elevation benchmarks**		
Increase pump capacity for pump stations		
Remove abandoned dam		
Construct emergency floodway		
Install plumbing devices to prevent sewer backup		

***Denotes Hazard Mitigation Grant Program State*
Discretionary projects (only 5-10% set aside of HMGP funding)

Appendix F

Resources

Benchmarks 2014, Northwest Michigan Council of Governments

Integrating Human-Caused Hazards Into Mitigation Planning, State and Local Mitigation Planning how-to guide: Federal Emergency Management Agency, September 2002, FEMA 386-7 CD.

Local Hazard Mitigation Planning Workbook: EMD-PUB 207, February 2003, Emergency Management Division, Michigan Department of State Police.

Michigan Hazard Analysis 2012, EMD-PUB 103, March 2006, Emergency Management and Homeland, Security Division / Michigan Department of State Police

National Oceanic and Atmospheric Administration: Weather/Climate Events, Information, Assessments; Climatology and Extreme Events; U.S. Storm Events Data Base; 1950-present, local storm reports, damage reports, etc. from various sources. www.ncdc.noaa.gov

Northwest Michigan County Profiles 2010, Northwest Michigan Council of Governments, November 2002.

Northwest Michigan Council of Governments Website Data, nwm.org.

Planning for a Disaster-Resistant Community: A One-Day Workshop for City and County Planners, Planning Officials, and Consultants: American Planning Association Research Department, American Planning Association, 2002 in cooperation with the Federal Emergency Management Agency, Planning and Mitigation Branch (materials only).

State and Local Mitigation Planning how to guide: Understanding Your Risks, identifying hazards and estimating losses: Federal Emergency Management Agency, August 2001, FEMA 386-2.