Wexford County Michigan

Natural Hazards Mitigation Plan

2015

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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 Wexford County is a continuing participant in the update of the Plan. The following is a list of the key contributors to the update of the Plan:

Wexford County Emergency Management Coordinator
Sarah Benson

Wexford County Administrator
Ken Hinton

Wexford County Road Commission
Alan Cooper

Wexford County Equilization & GIS
Sarah Merz

Cadillac/Wexford Transit Authority
Vance Edwards

District Health Department #10
Bret Haner

Others

- Wexford County Board of Commissioners
- Wexford County Administrator
- Wexford County Sheriff's Department
- Munson Healthcare Cadillac Hospital
- City of Cadillac DPW
- Cadillac Police Department
- Cadillac Fire Department
- Mesick Rescue
- North Flight EMS
- American Red Cross

II. FEMA Letter of Approval

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

FEMA

AUG 31 2015

RECEIVED
SEP 08 2015
EMHSD-FINANCIAL SECTION

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 Wexford 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. Montmorency 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 Wexford 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 Wexford 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 Wexford 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,

Christine Stack

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 Wexford 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 Wexford 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, Wexford 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 Wexford County remains a vibrant, safe, enjoyable place in which to live, raise a family, continue to conduct business, and maintain a tourist base.

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 encourage regional cooperation in the development of individual county Natural Hazards Mitigation Plans. The ***Northwest Michigan Hazard Mitigation Planning Project*** **update** was coordinated by the Northwest Michigan Council of Governments (NWMCOG) with Leelanau County being the Fiduciary. The update included Antrim, Kalkaska, Missaukee, Wexford, Grand Traverse, Leelanau, Benzie, and Manistee counties. NWMCOG worked with the Task Forces to update plans for these counties, which includes 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 Wexford County Natural Hazards Mitigation Plan focuses on natural hazards such as drought, earthquakes, wildfires, flooding, subsidence, 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 Wexford 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 Wexford 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

Natural Hazards Mitigation Planning Goals for Wexford County
Goal 1: Increase local participation in natural hazards mitigation
Goal 2: Integrate natural hazards mitigation considerations into the County's comprehensive 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

Natural Hazards Mitigation Priority Areas
Priority Area 1: Extreme Winter Weather – Countywide heavy snow and extreme temperatures. Potential for ice damage specifically along lakeshores Mitigation Strategies: ***Extreme Winter Weather***
Priority Area 2: Countywide potential wildfire/urban interface Mitigation Strategies: ***Wildfire***
Priority Area 3: Countywide Severe Weather (Thunderstorms, High Winds, Tornados) – High damage potential affecting seasonal population influx and festivals held in various towns and villages throughout Wexford Mitigation Strategies: ***Severe Weather***
Priority Area 4: Potential flash flooding in the Lake Mitchell, Muskegon River, and Manistee River watersheds Mitigation Strategies: ***Flooding***

Table 3: Mitigation Strategies

Frequent Natural Hazard	Mitigation Strategies
Wildfire	
	• Acquire appropriate fire suppression equipment for response
	• Prescribed burns and surface fuels management projects
	• Public education utilizing programs such as the National Fire Protection Association FireWise program, and Michigan DNR resources
	• Consider Wildland fire hazard reduction in building and zoning requirements
	• Acquire appropriate fire suppression equipment for response
Extreme Winter Weather	
	• Improve public buildings ability to shed, or hold, snow load
	• Work with utility companies to clear vegetation near power lines and infrastructure
	• Continue enforcement of building code regarding snow load limits through the permitting process
Severe Weather	
	• Establish additional sirens for early warning weather systems
	• Establish storm shelters, especially at campgrounds, trailer parks, modular homes
	• Promote the anchoring of trailers and modular homes
	• Work with utility companies (tree management, promotion of burying utility lines in new construction, burying power lines in high outage areas, increase utility right of ways)
Flood	
	• Drainage improvements such as larger culverts, clean-up of river debris
	• Continue enforcement of building codes and soil erosion regulations
	• Promote flood proofing of structures and damage reduction techniques
Various	
	• Incorporating the Plan's natural hazards mitigation concepts, strategies, and policies into existing elements Master Plan
	• Public education and awareness activities
	• Work with other governmental entities, organizations, businesses, and the public

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 referred to as 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 Wexford 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 Wexford 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?

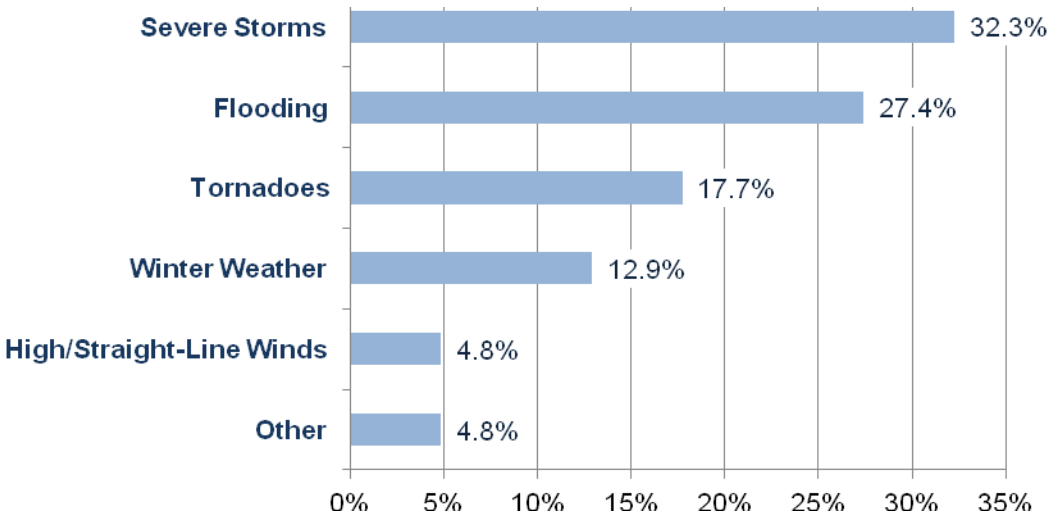
A **hazard** is an event or physical condition that has potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. This plan focuses on principle natural hazards that occur in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

Wexford County is located in the northwestern lower peninsula of Michigan and was founded by John Lennington, a general storekeeper. Prior to 1843, the county was known as Kautawauket, meaning "Land of Water" after a Chippewa chief. In 1843, the present name Wexford, taken from a county in Ireland, was adopted. Settlement of the county began at Sherman in 1857 with the completion of the first state road in the area, and this village was the first county seat. The official founding of the county occurred in 1869 with Cadillac now being the county seat.

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.

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

Table 4: Geographic features

Feature	Measure
Area in Water	6,912 acres – two major watersheds, the Big Manistee River and the Pine River
Forest Lands	281,700 acres
Wetlands	83,785 acres
Farmland (2012)	40,333 acres
Operating Farms (2012)	357

Source: US Agricultural Census, 2012; County Data

The total County population is **32,735**. The projected growth for 2020 is 35,148. The population numbers from the 2010 Census for the **16 Townships, 3 Villages,** and **2 Cities** covered by this plan include:

Table 5: Population by Municipality

Township/City/Village	Population	Township/City/Village	Population
Antioch Township	815	Selma Township	2,093
Boon Township	557	Slagle Township	490
Cedar Creek Township	1,757	South Branch Township	383
Cherry Grove Township	2,377	Springville Township	1,361
Clam Lake Township	2,467	Wexford Township	1,072
Colfax Township	840	Village of Buckley	697
Greenwood Township	587	Village of Harrietta	143
Hanover Township	863	City of Manton	1,287
Haring Township	3,173	Village of Mesick	394
Henderson Township	163	City of Cadillac	10,355
Liberty Township	861		

Source: U.S. Census Bureau, 2009-2013 American Community Survey

- There are approximately 16,740 *Housing Units* in Wexford County with an average household size of 2.63 people per household.
- The number of residents 65 years and over is 16.9% of the population.
- The number of residents 19 years and under is 26.5% of the population.
- The number of residents over 65 with a disability is 40.9% of the population.
- The total number of residents with a disability is 16.0% of the population.
- The number of residents that have a language barrier or are linguistically is 0.8% of the population.
- February 2014 Poverty level
    - $19,790 Family of 3
    - $11,670 Family of 1

Table 6: Poverty Statistics

Poverty	Statistics
Families in poverty	12.7%
Income less than $15,000	9.1%
Population in poverty	17.7%

Source: U.S. Census Bureau, 2009-2013 American Community Survey

Table 7: Economic Census

Industry Description	Number of Establishments	Number of Employees
Manufacturing	48	3,568
Wholesale trade	29	467
Retail trade	167	1,934
Information	16	147
Real estate, rental, leasing	35	100
Professional, scientific, technical services	58	NA
Administrative, support, waste management, remediation services	27	1,070
Educational services	5	351
Health care, social assistance	97	1,970
Arts, entertainment, recreation	16	110
Accommodation and food services	77	1,016
Other services (except public administration)	95	399

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

VII. THE DEVELOPMENT OF THE PLAN

Data Methodology and Map Development

Wexford 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

2	Airports
21	Bridges
15	Communications Facilities
3	Emergency Management Service facilities
12	Fire Stations
23	Government Buildings
1	Hazardous Materials Sites or Facilities
1	Hospital and Medical Facilities
3	Mobile Home Parks
3	Police Stations
12	Resort/Recreation
13	Schools
3	Waste/Water/Sewage Treatment Facilities • 43.5% public sewer • 55.5% individual septic/ cesspool • 1.0% other
4	Utilities • 43.5% public system or private company • 61.8% individual wells

Source: Wexford County Data

Flood Data
Flood hazard information may be obtained from the Flood Insurance Rate Maps (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 deleted 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 (were available); and Digital Elevation Model data are from the Center for Geographic Information, Michigan Department of Information Technology.

Natural Flood Insurance Program (NFIP) participants:
Haring Township has flood maps, however is not currently participating in the NFIP. Selma Township, Cherry Grover Township, and the City of Cadillac are currently participating in the NFIP with flood maps:

According to an official database associated with the National Flood Insurance Program, Wexford County has no properties currently designated as suffering from repetitive losses in insured flood events.

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

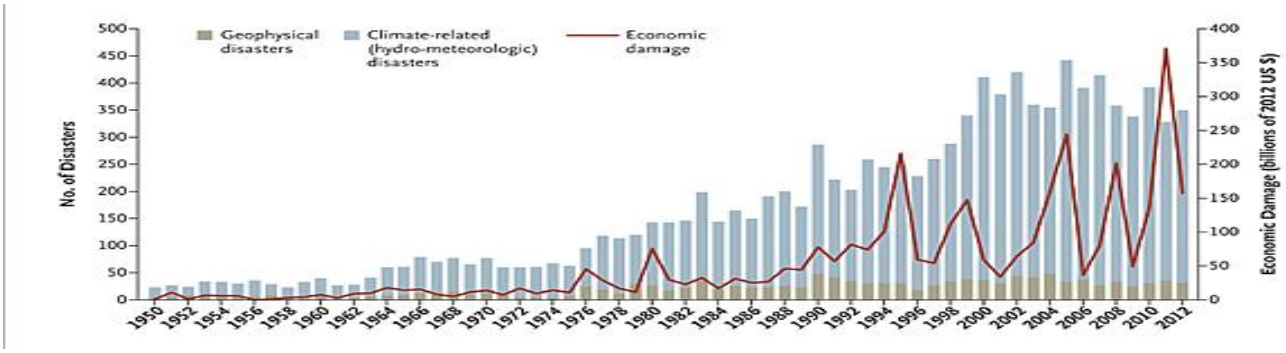
Landslide/Erosion
Shoreline erosion and landslide incident zones are delineated by the US Geological Service. Digital Elevation Model data is from the Center for Geographic Information, Michigan Department of Information Technology.

Other hazards such as earthquakes and subsidence were considered but are not substantial risks in Wexford County.

Potential Impacts from Climate Change

According to the New England Journal of Medicine, around 217 million people are affected by natural disasters each year since 1990. The study separates natural disasters into two categories: geophysical; which include earthquakes, volcanoes, landslides, and avalanches, and climate-related; which include meteorological storms, flooding, heat/cold waves, drought, and wildfires. The number of geophysical disasters has remained constant since the 1970's, while climate-related disasters greatly increased. There were three times as many natural disasters between 2000-2009 as there were between 1980-1989, and the report goes on to state that natural disasters, primarily flooding and storms, will become more frequent and severe due to climate change.

Figure 2: 2012 Economic Damages for Disasters in the US



Northwest Lower Michigan depends heavily on groundwater, on freshwater from Lake Michigan, and on rainfall for agriculture, drinking, and industrial uses. As the population in this region continues to grow, the demand for water for all needs increases. The projected changes in rainfall, evaporation, and groundwater recharge rates from climate changes will affect ecosystems and all freshwater users. *Please note that these are predictions from the most recent data available regarding climate change and that many feel that any natural hazard events cannot be predicted on a yearly basis.*

- Impacts of extreme water levels on Domestic, Municipal, and Industrial Water uses can include compromised or unusable water intakes, sedimentation problems, increased operation and maintenance requirements, and reduction in water quality.
- Historically, the most serious impact to coastal property occurred when water levels were extremely high, as a result of flooding or erosion from severe storms.
- If water levels rise above historic thresholds coastal wetland habitats could be threatened because land beyond a coastline may not be available to transition into new wetland habitats.
- Development and climate change will degrade the flood-absorbing capacities of wetlands and floodplains, resulting in increased erosion, flooding, and runoff polluted with nutrients, pesticides, and other toxins.

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 Wexford 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 Wexford County, according to the NOAA Storm Event 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 Thunderstorm* include 50 knot winds + and property damage figures.

Flooding/Flash Flood: 11 Events

Table 10: Flood Events

Month	Year	Location	Effect	Damage
May	2000	Cadillac	6 in. water covering streets	NA
April	2001	Countywide	Water rose into yards	NA
May	2001	Countywide	Localized flooding on secondary roads	NA
May	2001	County/West	Water rose on to private property	NA
May	2004	Cadillac	Water over 1 ft. deep on Mitchell St. in Cadillac	$20,000
June	2008	Hoxeyville	3 - 6 in. rainfall/ roads washed out/ 150 homes damaged	$750,000
June	2008	Harrietta Bunch Airport	Manistee River at Sherman establishes new flood record at 16.4 ft. / homes evacuated	$40,000
July	2012	Haring	4 in. rain/ roads washed out	$40,000
July	2012	Cadillac Wexford Airport	4 in. rain/ 1 - 2 ft. water in intersections/ water entered businesses	$12,000
November	2013	Lake Mitchell	Urban flooding in Cadillac/ streets impassible	$10,000
April	2014	Lake Cadillac	Road closures/ water entered homes	$110,000

Hail: 23 events

Table 11: Hail Events for Wexford County

Month	Year	Location	Effect	Damage
June	1984	Countywide	0.75 in.	NA
July	1988	Countywide	0.88 in.	NA
March	1991	Countywide	1.75 in.	NA
August	1993	Cadillac	0.75 in.	NA
May	1996	County/ South	0.75 in.	NA
June	1996	Cadillac	0.88 in.	NA
April	1997	Buckley	0.75 in.	NA
July	1997	Manton	1.50 in.	NA
August	1998	Cadillac	0.75 in.	NA
August	1998	Cadillac	1.00 in.	NA
May	2000	Cadillac	0.75 in.	NA
June	2003	Cadillac	0.75 in.	NA
June	2003	Cadillac	0.75 in.	NA
May	2004	Manton	0.88 in.	NA
June	2006	Cadillac	1.50 in.	NA
July	2006	Cadillac	0.75 in.	NA
October	2006	Cadillac	0.75 in.	NA
May	2007	Baxter	0.88 in.	NA
October	2007	Cadillac	0.75 in.	NA
June	2008	Mesick	1.75 in.	NA
June	2008	Manton	0.75 in.	NA
June	2008	Cadillac	0.88 in.	NA
June	2008	Lake Cadillac	0.75 in.	NA
July	2010	Cadillac	0.75 in.	NA
April	2011	Lake Cadillac	0.75 in.	NA
May	2011	Manton	0.88 in.	NA
July	2012	Manton	2.00 in.	NA

Extreme Winter Weather: 62 Events

Table 12: Winter Weather Events for Wexford County

Month	Year	Location	Effect	Damage	Other Event
January	1997	County/Region	25-35 mph wind gusts/ wind chills -30 to -50 at times	NA	Blizzard
February	1997	County/Region	8 - 12 in. snow	NA	
March	1998	County/Region	8-12 in. snow/ 45 mph wind gusts	NA	Blizzard
January	1999	County/Region	8-20 in. snow/ 40-50 mph wind gusts	NA	Blizzard

Extreme Winter Weather (continued)

Month	Year	Location	Effect	Damage	Other Event
March	2002	County/Region	10-16 in. snow	NA	
December	2002	County/Region	1/4 in. ice covering	NA	Ice Storm
January	2004	Countywide	10-12 in. snow	NA	
January	2004	County/Region	4-12 in. snow/ 40 mph wind gusts	NA	
January	2005	County/Region	1/4 in. ice	NA	Ice Storm
January	2005	County/Cadillac	10-12 in. snow	NA	
March	2005	County/Cadillac	10-12 in. snow	NA	
November	2005	County/Region	10-17 in. snow	NA	
January	2006	County/Region	10-12 in. snow	NA	
February	2006	County/Region	6-15 in. snow/ 1/4 to 1/2 in. ice accumulation/ 35 mph wind gusts	NA	
November	2006	County/Region	Heavy snow/ trees and power lines down/ power outages	$10,000	
February	2007	County/Region	-20 to -30 wind chills	NA	Extreme Temp
February	2007	County/Region	6-15 in. snow; multiple vehicles sliding off roads	NA	
March	2007	Cadillac	1/4 in. ice accumulation	$3,000	
April	2007	County/Region	6-18 in. snow	NA	
January	2008	County/Region	Wind gusts 40-50 mph	NA	
December	2008	County/Region	10-14 in. snow	NA	
December	2008	County/Region	8-23 in. snow	NA	
February	2009	County/Region	6-16 in. snow	NA	
December	2009	County/Region	6-12 in. snow	NA	
December	2010	County/Region	6-12 in. snow	NA	
December	2010	Cadillac	12-15 in. snow	NA	
February	2011	County/Region	6-12 in. snow	NA	
March	2011	County/Region	6-15 in. snow/ freezing rain	NA	
January	2012	Cadillac	8-12 in. snow	NA	
March	2012	County/Region	6-14 in. snow/ widespread power outages	NA	
December	2012	County/Region	10-20 in. snow/trees and power lines down/ widespread power outages	$20,000	
January	2014	County/Region	-30 and colder wind chills	NA	Extreme Temp

Severe Thunderstorm and High Wind: 48 Events

Table 13: Severe Thunderstorm and High Wind events

Month	Year	Location	Effect	Damage
September	1964	Countywide	62 knot winds	NA
May	1965	Countywide	69 knot winds	NA
June	1990	Countywide	56 knot winds	NA
July	1995	Cadillac	52 knot winds/ trees and power lines down	$2,000
August	1995	Hoxeyville	52 knot winds/ trees and power lines down	NA
August	1996	Cadillac	55 knot winds/ trees and power lines down	NA
May	1998	Cadillac	50 knot winds/ trees down	NA
May	1998	Mesick	50 knot winds/ trees down	NA
May	1998	Harrietta	50 knot winds/ trees and power lines down	NA
November	1998	Countywide	50 knot winds/ trees and power lines down/ widespread power outages	NA
June	1999	Mesick	50 knot winds/ trees down	NA
June	1999	Cadillac	56 knot winds/ 40-50 mph wind gusts/ power lines down/ sign damage	NA
July	1999	Cadillac	50 knot winds/ trees and power lines down	NA
July	1999	Cadillac	50 knot winds/ trees down	NA
July	1999	Cadillac	50 knot winds/ power lines down	NA
August	2001	Cadillac	50 knots winds/ trees power lines down	NA
April	2002	Sherman	50 knot winds/ trees down	NA
April	2002	Cadillac	50 knot winds/ power pole damaged	NA
July	2002	Buckley	50 knot winds/ trees down	NA
August	2003	Mesick	50 knot winds/ tree down	NA
November	2003	County/Region	55 knot winds/ trees and power lines down/ widespread power outages	$15,000
September	2005*	Mesick	55 knot winds/ trees and power lines down	$5,000
November	2005	County/Region	52 knot winds/ trees down	$5,000
November	2005	County/Region	50 knot winds/ trees and power lines down	$10,000
July	2006	Manton	50 knot winds/ trees down/ building destroyed	$20,000
October	2006	Mesick	55 knot winds/ trees and power lines down	$5,000
October	2006	Cadillac	52 knot winds/ trees and power lines down/ sign damage	$7,000
June	2007	Manton	55 knot winds/ trees down	$6,000
June	2007	Cadillac	56 knot winds/ trees and power lines down/ vehicles and structures damaged	$35,000

Severe Thunderstorm and High Wind (continued)

Month	Year	Location	Effect	Damage
June	2007	Manton	50 knot winds/ trees down	$500
October	2007	Cadillac	55 knot winds/ trees down/ structure destroyed	$35,000
October	2010	Sherman	58 knot winds/ trees down/ vehicles damaged	$30,000
April	2008	Cadillac	35 knot winds/ 40 mph wind gusts/ trees and power lines down/ widespread power outages	$9,000
April	2008	Manton	52 knot winds/ 60 mph wind gusts	NA
June	2008*	Mesick	52 knot winds/ 60 mph wind gusts/ trees down/ structure damage	$12,000
August	2009	Cadillac	52 knot winds/ trees and power lines down/ vehicle damage	$4,500
October	2010	County/Region	55 knot winds/ trees and power lines down/ power outages/ vehicle and structure damage	$28,000
April	2011	Hobart	55 knot winds/ trees down/ structure damage	$12,000
May	2001	Countywide	50 knot winds/ trees and power lines down/ vehicle damage	$20,000
September	2001	Baxter	52 knot winds/ trees down	$4,000
March	2012	Missaukee JCT	55 knot winds/ 63 mph wind gusts/ structure damage	$9,000
July	2012	Manton	52 knot winds/ trees down	$3,000
July	2012	Haring	50 knot winds/ trees down	$4,000
August	2013	Hobart	52 knot winds/ trees down	$5,000

Tornado: 8 Events

Table 14: Tornado Events for Wexford County

Month	Year	Location	Effect	Damage
July	1963	Countywide	F2/ 19.6 miles long/ 50 yards wide	$250,000
August	1968	Countywide	F1/ 0.3 miles long/ 20 yards wide	$2,500
June	1974	Countywide	F2/ 1.2 miles long/ 70 yards wide	$25,000
June	1976	Countywide	F1/ 0 miles long/ 133 yards wide	$25,000
July	1980	Countywide	F0/ 0 miles long/ 33 yards wide	NA
October	1989	Countywide	F1/ 1 miles long/ 40 yards wide	$250,000
October	2006	Benson	F1/ 0.1 miles long/ 70 yards wide/ structure damage	$260,000
July	2010	Lake Cadillac	EF0/ 0.08 miles long/ 100 yards wide/ 65 mph winds/ structure damage	$8,000

** Governor and Presidential Hazard Declaration*

Wildfires
The Michigan Hazard Analysis of 2012 identified around 428 wildfires occurred in Wexford County from 1981 to 2010, by far the most of any county in the Northwest lower peninsula.

Other Possible Natural Hazard Events

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).

Pandemics or other Public Health Emergencies
Naturally occurring pandemics may cause widespread precautions around the world. The District Health Department #10, which includes Wexford 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 has remained the same in Wexford County.

The areas where natural hazards overlap in Wexford County can include heavy snow that causes trees and power lines down, and then melting, rain and flooding.

Wexford County Natural Hazards Task Force and Public Input

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:

- Severe winter weather; ice events and snowbelt areas
- Flooding areas – Lake Cadillac, Silver Creek, Fletcher Creek; drainage improvements
- High wind areas
- Potential wildfires and defensible space
- Planned burns
- Snowloads on government and school buildings
- Shelters and anchoring residential structures for high winds and tornados
- Power outages
- Education/Hazard awareness
- Ice damage

Natural Hazards Priority Areas were narrowed to the top 4 significant according to the Task Force and the priority levels have not changed since the original adoption of the plan in 20017.

Top Four Natural Hazards Priority Areas

1. Extreme Winter Weather throughout the County

Wexford 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 cause driving hazards. Ice damage may occur when high winds push lake water and ice past the shoreline, causing damage to public infrastructure and residential property. Extreme cold has a damaging effect on critical infrastructure, such as potable water facilities, and may become a community- wide public health issue.

2. Wildfire/Urban Interface throughout the County

The most fire prone areas are populated with pines and hemlocks located in around the perimeter of Wexford County and encompassing the City of Cadillac. Other 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. High Winds damaging critical infrastructure

There is a historical record of high wind events and tornadoes in Wexford County. Damage from straight line winds usually affects multiple counties through the loss of electricity from trees/tree limbs downing power lines, causing widespread property damage, and potentially exposing the public to severe injury or fatality due to flying debris. Ice damage may occur when high winds push lake water and ice past the shoreline, affecting public infrastructure and residential areas.

4. Flooding in the Lake Mitchell, Muskegon River, and Manistee River watersheds

There is a high probability of flooding in Wexford County due to the presence of three (3) regionally significant watersheds that flow through the County. Damages to private property will be greater from flash flood types of events than they would from gradual floodplain inundation. Dam failure may cause an uncontrollable high volume of water downstream, damaging bridges and other key infrastructure. The Michigan Hazard Analysis of 2012 identifies two (2) dams in the County as a "significant hazard" (development should be discouraged in areas that would increase the risks from potential dam failures).

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 are three (3) sirens located in the City of Cadillac and one (1) siren in the Village of Manton.

Economic Impact Analysis

Table 15: Natural Hazard Cost Breakdown for Wexford County

Wexford County	Property Damage Cost	Crop Damage Cost
Drought	NA	NA
Flood	$982,000	NA
Hail	NA	NA
Extreme Winter Weather	$33,000	NA
Tornado	$820,500	NA
Thunderstorm and High Wind	$286,000	NA
Wildfire	NA	NA

The Wexford County Equalization Department calculated $2,415,215,748 through the State Equalized Values (SEV) for real and personal property (residential and commercial) as the total economic value of the County. According to the 2014 Northwest Michigan Season Population Analysis, assume a 10% increase to account for the annual average seasonal population within the county.

VIII. NATURAL HAZARDS MITIGATION GOALS AND OBJECTIVES

The mission of the Wexford 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, posting of the draft plan with a request for comments in the local newspaper and on the NWMCOG website, and the presentation of the plan to the Wexford 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
    - Include Member of Understanding (MOUs) between local government and county agencies
- Encourage public and private organizations to participate

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

Objectives:

- 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 Wexford 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 Extreme winter weather throughout the County

Extreme Winter Weather Mitigation Strategies:

- Improve public buildings ability to shed, or hold snow load
- Work with Utility Companies to clear vegetation near power lines and infrastructure
- Continue enforcement of building code regarding snow load limits through the permitting process

Priority Area 2: Potential Wildfire/Urban interface throughout the County

Wildfire Mitigation Strategies:

- Acquire appropriate fire suppression equipment for response
- Prescribed burns and surface fuels management projects
- Public education utilizing programs such as the National Fire Protection Association FireWise program, and Michigan DNR resources
- Consider wildland fire hazard reduction in building and zoning requirements
- Acquire appropriate fire suppression equipment for response

Priority Area 3: Potential Severe Weather damaging critical infrastructure

Thunderstorm, High Winds, and Tornado Mitigation Strategies:

- Establish additional sirens for early warning weather systems
- Establish storm shelters, especially at campgrounds, trailer parks, modular homes
- Promote the anchoring of trailers and modular homes
- Work with Utility Companies
    - Tree management
    - Promotion of burying utility lines in new construction
    - Burying power lines in high outage areas
    - Increase utility right of ways

Priority Area 4: Potential Flooding in the Lake Mitchell, Muskegon River, and Manistee River watersheds

Flood Mitigation Strategies:

- Drainage improvements such as larger culverts, clean up of river debris
- Continue enforcement of building codes and soil erosion regulations
- Promote flood proofing of structures and damage reduction techniques

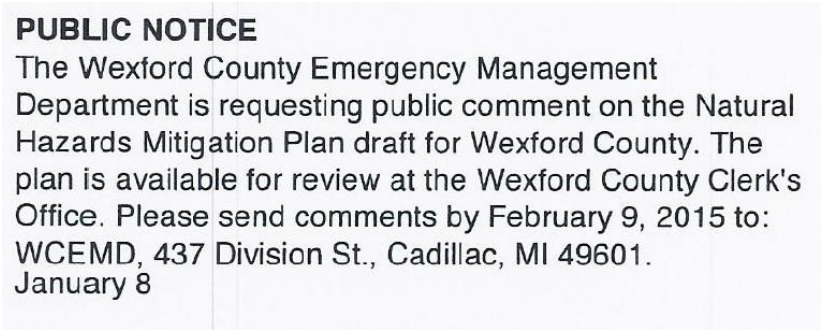
Other mitigation strategies:

- Incorporating the Plan's natural hazards mitigation concepts, strategies, and policies into existing elements Master Plan
- Public education and awareness activities
- Work with other governmental entities, organizations, businesses, and the public

X. PARTICIPATION IN THE DEVELOPMENT OF THE WEXFORD COUNTY NATURAL HAZARDS MITIGATION PLAN

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

- A Public Notice was published in the *Cadillac News*



PUBLIC NOTICE
The Wexford County Emergency Management Department is requesting public comment on the Natural Hazards Mitigation Plan draft for Wexford County. The plan is available for review at the Wexford County Clerk's Office. Please send comments by February 9, 2015 to: WCEMD, 437 Division St., Cadillac, MI 49601.
January 8

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

- During the development of the plan, all townships, city, 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 some jurisdictions did not provide 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 the 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, city and villages 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.

Although Wexford County does not contain a traditional Planning Department, the Zoning Department issues zoning permits for all unincorpated areas of the county (areas outside the boundaries of cities or villages) except for Haring and Cedar Creek Townships.

The Wexford County Building Department issues construction code permits (building, electrical, mechanical, and plumbing permits) for all areas of Wexford County except for Cedar Creek Township & City of Manton, which issues building permits locally.

The Townships/City/Villages in the priority areas include:

Antioch Township
Boon Township
Cedar Creek Township- Zoning
Cherry Grove Township
Clam Lake Township
Colfax Township
Greenwood Township
Hanover Township
Haring Township – Zoning
Henderson Township
Liberty Township
Selma Township
Slagle Township
South Branch Township
Springville Township - Zoning
Village of Buckley - Zoning
City of Cadillac – Zoning
Village of Harrietta
Village of Mesick – Zoning

Table 17: Plan Participation

County/Township/Village/City/Others	**Zoning**	**Participation**
Wexford County	Yes	Task Force meetings, review of draft plans: County Commissioners Emergency Management Coordinator Geographic Information Services (GIS) Planning and Zoning Road Commission
Antioch Township	No	See last bullet point paragraph, above
Boon Township	No	See last bullet point paragraph, above
Cedar Creek Township	Yes	See last bullet point paragraph, above
Cherry Grove Township	No	See last bullet point paragraph, above
Clam Lake Township (2)	No	See last bullet point paragraph, above
Colfax Township	No	See last bullet point paragraph, above
Greenwood Township	No	See last bullet point paragraph, above
Hanover Township	No	See last bullet point paragraph, above
Haring Township	Yes	See last bullet point paragraph, above
Henderson Township	No	See last bullet point paragraph, above
Liberty Township	No	See last bullet point paragraph, above
Village of Manton	No	See last bullet point paragraph, above
Selma Township	No	See last bullet point paragraph, above
Slagle Township	No	See last bullet point paragraph, above
South Branch Township	No	See last bullet point paragraph, above
Springville Township	Yes	See last bullet point paragraph, above
Wexford Township	No	See last bullet point paragraph, above
Village of Buckley	Yes	See last bullet point paragraph, above
Village of Harrietta	No	See last bullet point paragraph, above
City of Cadillac	Yes	See last bullet point paragraph, above
Village of Mesick	Yes	See last bullet point paragraph, above
District Health Department #10	N/A	Task Force meeting; review of draft plan
MSU Extension Service	N/A	Task Force meeting; review of draft plan

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

XI. IMPLEMENTATION OF THE WEXFORD COUNTY NATURAL HAZARDS MITIGATION PLAN

Natural Hazards Mitigation Plan Managers and Technical Assistance
The leader for implementing the Natural Hazards Mitigation Plan is the Wexford County Board of Commissioners, with the staff leader being the Emergency Management Coordinator. Working partnerships can be established with the following to provide technical assistance to accomplish the goals and objectives of the Plan.

Wexford County Government Staff
Townships, cities, and villages
Wexford County Conservation District
Wexford 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

The following is a summary for accomplishing the **recommended natural hazards mitigation actions** for Wexford County.

Table 18: Recommended Mitigation Actions for Wexford County

Priority and Action Strategies	Responsible Parties	Timeframe
Priority Area 1: Extreme Winter Weather Mitigation Strategies		
a. Improve public buildings ability to shed, or hold, snow load	County Planning County Building Inspector Emergency Management Coordinator School Administrators and Staff	1-3 years from adoption of the plan
b. Work with Utility Companies to clear vegetation near power lines and infrastructure	County Building Inspector Emergency Management Coordinator	1-5 years from adoption of the plan
c. Continue enforcement of building code regarding snow load limits through the permitting process	County Building Inspector	Ongoing
Priority Area 2: Wildfire Mitigation Strategies		
a. Acquire appropriate fire suppression equipment for response	Emergency Management Coordinator Fire and Emergency Departments MI Department of Natural Resources	1-3 years from adoption of the plan
b. Prescribed burns and surface fuels management projects	Emergency Management Coordinator County Planning Fire and Emergency Departments MI Department of Natural Resources	1-5 years from adoption of the plan
c. Public education utilizing programs such as the National Fire Protection Association FireWise program, and Michigan DNR resources	County Planning County Building Inspector Emergency Management Coordinator Townships, City, Villages	1-3 years from adoption of the plan
d. Consider wildland fire hazard reduction in building and zoning requirements	County Building Inspector	Ongoing
Priority Area 3: Severe Weather Strategies (Thunderstorm, High Winds, Tornado Mitigation)		
a. Establish additional sirens for early warning weather systems	Emergency Management Coordinator Townships, City, Villages	1-3 years from adoption of the plan
b. Establish storm shelters, especially at campgrounds, trailer parks, modular homes	Emergency Management Coordinator County Planning County Building Inspector Townships, City, Villages	1-5 years from adoption of the plan
c. Promote the anchoring of trailers and modular homes	County Building Inspector Emergency Management Coordinator	Ongoing
d. Work with Utility Companies • Tree management • Promotion of burying utility lines in new construction • Burying power lines in high outage areas • Increase utility right of ways	County Building Inspector Emergency Management Coordinator County Planning	1-5 years from adoption of the plan

Priority and Action Strategies	Responsible Parties	Timeframe
Priority Area 4: Flooding Mitigation Strategies		
a. Drainage improvements such as larger culverts, clean up of river debris	Road Commission County Planning County Conservation District County Drain Commissioner MI Department of Natural Resources	1-5 years from adoption of the plan
b. Continue enforcement of building codes and soil erosion regulations	Building Inspector County Soil Erosion Officer County Drain Commissioner MI Department of Environmental Quality	Ongoing
c. Promote flood proofing of structures and damage reduction techniques	Building Inspector County Soil Erosion Officer County Drain Commissioner MI Department of Environmental Quality	Ongoing

Other mitigation strategies:

- Incorporating the Plan's natural hazards mitigation concepts, strategies, and policies into existing elements Master Plan
- Public education and awareness activities
- Work with other governmental entities, organizations, businesses, and the public

The County should consider the following key land use issues and the relationship to natural hazards mitigation:

- Safe, beneficial uses for natural hazards prone areas
- Concentration issues
- Proximity issues
- Location of public facilities and infrastructure
- Development standards for public facilities and infrastructure
- Effect of accumulated development on community systems and facilities

Monitoring and Evaluation

The Wexford County Natural Hazards Mitigation Plan will be monitored on a regular basis by the Emergency Management Staff and Planning Staff. Because Wexford 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 Wexford County Board of Commissioners.

XII. NATURAL HAZARDS MITIGATION PLAN ADOPTION RESOLUTION

Minutes of a regular meeting of the Wexford County Board of Commissioners, held at the Wexford County Courthouse, 437 E. Division St., Cadillac, Michigan on the fifth day of August, 2015, at 5:30 p.m.

PRESENT: Michael MacCready, Leslie Housler, Robert Hilty, Mark Howie, Gideon Mitchell, Julie Theobald, Gary Taylor and John Fuscone;

ABSENT: Bill Goodwill

The following preamble and resolution were offered by Commissioner Theobald and supported by Commissioner Taylor.

Resolution No. 15-17

Wexford County Hazard Mitigation Plan Adoption Resolution

WHEREAS, Wexford County, Michigan has experienced 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 community of Wexford County 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 Wexford County. The Wexford County Emergency Management Coordinator is charged with supervising the implementation of the Plan's recommendations within the funding limitations as provided by the Wexford County Board of Commissioners, Local Planning Team, or other sources.

A ROLL CALL VOTE WAS TAKEN AS FOLLOWS:

AYES: MacCready, Housler, Hilty, Howie, Mitchell, Theobald, Taylor, and Fuscone;

NAYS: None

RESOLUTION DECLARED ADOPTED.

Gideon Mitchell

Gideon Mitchell, Chairman, Wexford County Board of Commissioners

Elaine Richardson

Elaine Richardson, County Clerk

STATE OF MICHIGAN)
) ss.
COUNTY OF WEXFORD)

I hereby certify that the foregoing is a true and complete copy of Resolution 15-17 adopted by the County Board of Commissioners of Wexford County at a regular meeting held on August 5, 2015, and I further certify that public notice of such meeting was given as provided by law.

Elaine Richardson

Elaine Richardson, 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.

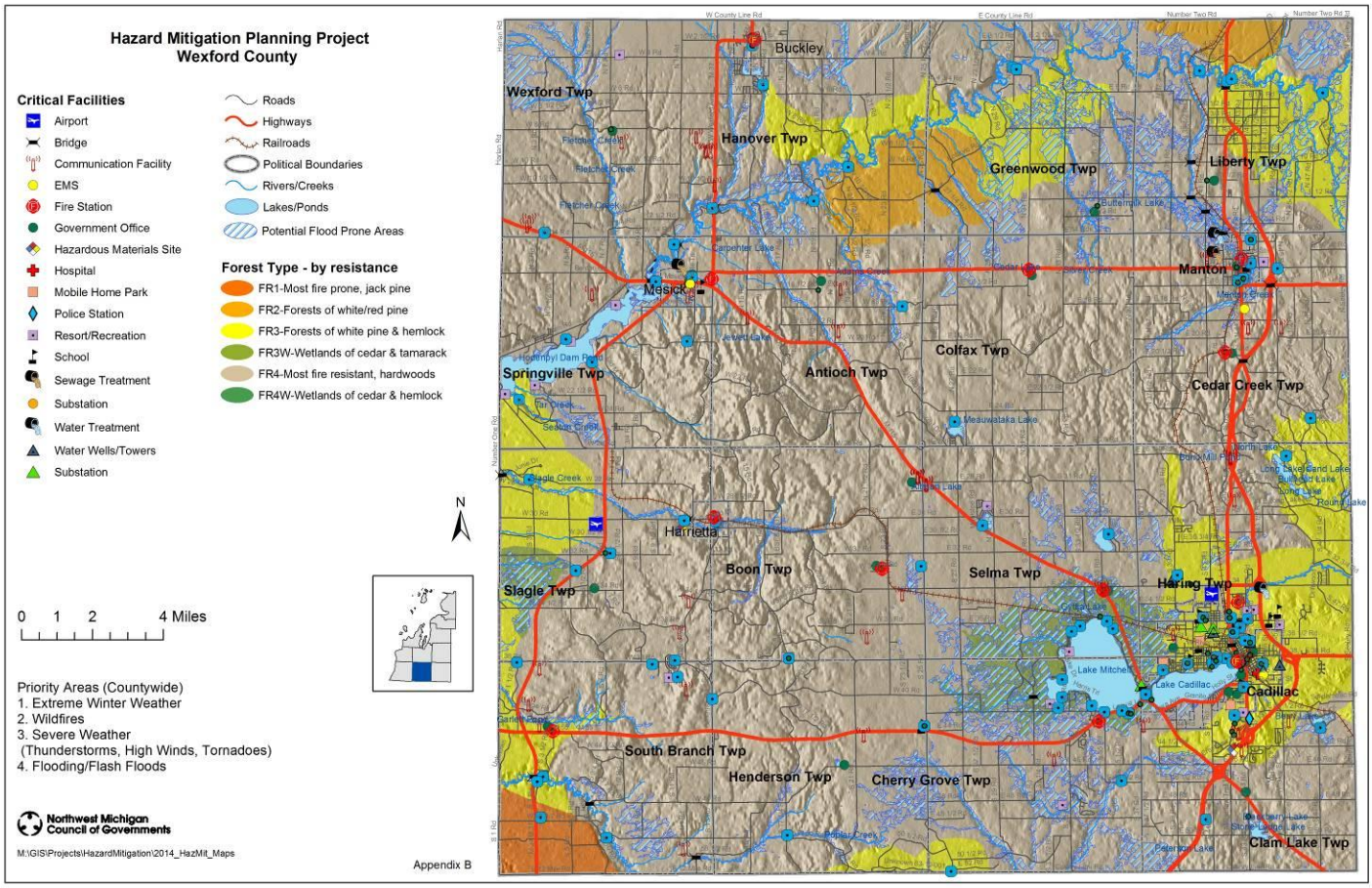
Vulnerability: The level of exposure of human life and property to damage from natural hazards.

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

Detailed Maps



Hazard Mitigation Planning Project
Wexford County - Northeast

Critical Facilities
- Airport
- Bridge
- Communication Facility
- EMS
- Fire Station
- Government Office
- Hazardous Materials Site
- Hospital
- Mobile Home Park
- Police Station
- Resort/Recreation
- School
- Sewage Treatment
- Substation
- Water Treatment
- Water Wells/Towers
- Substation

- Roads
- Highways
- Railroads
- Political Boundaries
- Rivers/Creeks
- Lakes/Ponds
- Potential Flood Prone Areas

Forest Type - by resistance
- FR1-Most fire prone, jack pine
- FR2-Forests of white/red pine
- FR3-Forests of white pine & hemlock
- FR3W-Wetlands of cedar & tamarack
- FR4-Most fire resistant, hardwoods
- FR4W-Wetlands of cedar & hemlock

N

0 0.5 1 2 Miles

Priority Areas (Countywide)
1. Extreme Winter Weather
2. Wildfires
3. Severe Weather
(Thunderstorms, High Winds, Tornadoes)
4. Flooding/Flash Floods

Northwest Michigan Council of Governments

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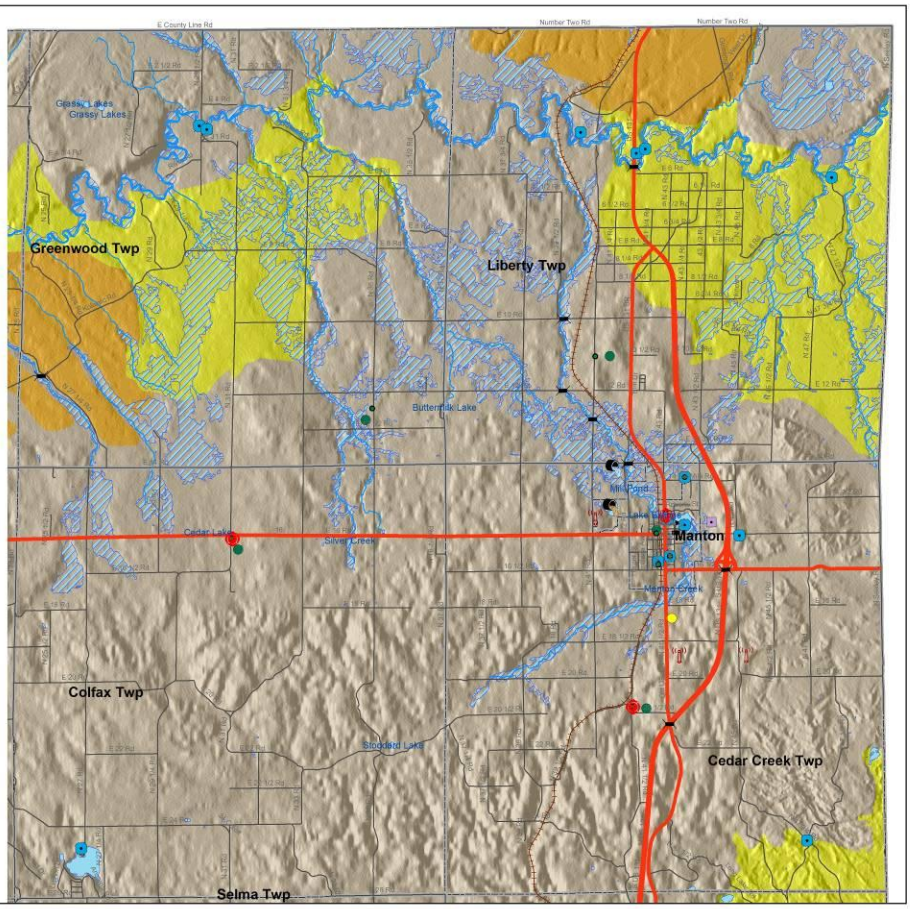

Hazard Mitigation Planning Project
Wexford County - Northwest

Critical Facilities
- Airport
- Bridge
- Communication Facility
- EMS
- Fire Station
- Government Office
- Hazardous Materials Site
- Hospital
- Mobile Home Park
- Police Station
- Resort/Recreation
- School
- Sewage Treatment
- Substation
- Water Treatment
- Water Wells/Towers
- Substation

- Roads
- Highways
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- Political Boundaries
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- FR4W-Wetlands of cedar & hemlock

N

0 0.5 1 2 Miles

Priority Areas (Countywide)
1. Extreme Winter Weather
2. Wildfires
3. Severe Weather
(Thunderstorms, High Winds, Tornadoes)
4. Flooding/Flash Floods

Northwest Michigan Council of Governments

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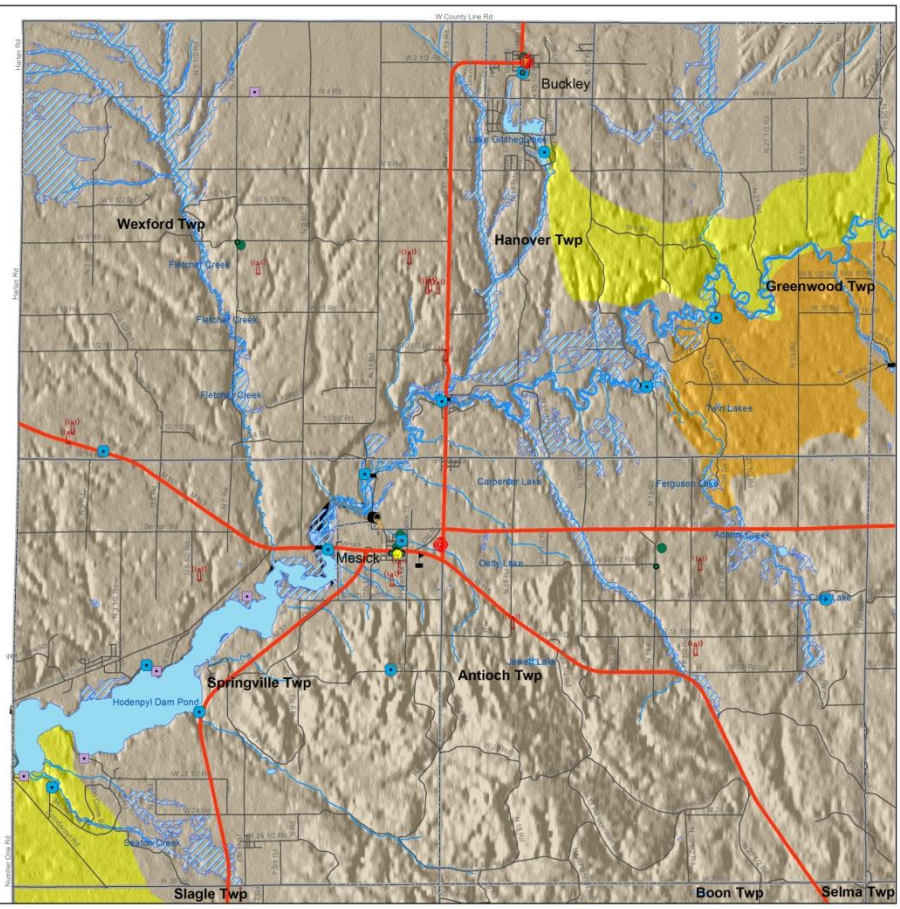

Hazard Mitigation Planning Project
Wexford County - Southeast

Critical Facilities
- Airport
- Bridge
- Communication Facility
- EMS
- Fire Station
- Government Office
- Hazardous Materials Site
- Hospital
- Mobile Home Park
- Police Station
- Resort/Recreation
- School
- Sewage Treatment
- Substation
- Water Treatment
- Water Wells/Towers
- Substation

- Roads
- Highways
- Railroads
- Political Boundaries
- Rivers/Creeks
- Lakes/Ponds
- Potential Flood Prone Areas

Forest Type - by resistance
- FR1-Most fire prone, jack pine
- FR2-Forests of white/red pine
- FR3-Forests of white pine & hemlock
- FR3W-Wetlands of cedar & tamarack
- FR4-Most fire resistant, hardwoods
- FR4W-Wetlands of cedar & hemlock

N

0 0.5 1 2 Miles

Priority Areas (Countywide)
1. Extreme Winter Weather
2. Wildfires
3. Severe Weather
(Thunderstorms, High Winds, Tornadoes)
4. Flooding/Flash Floods

Northwest Michigan Council of Governments

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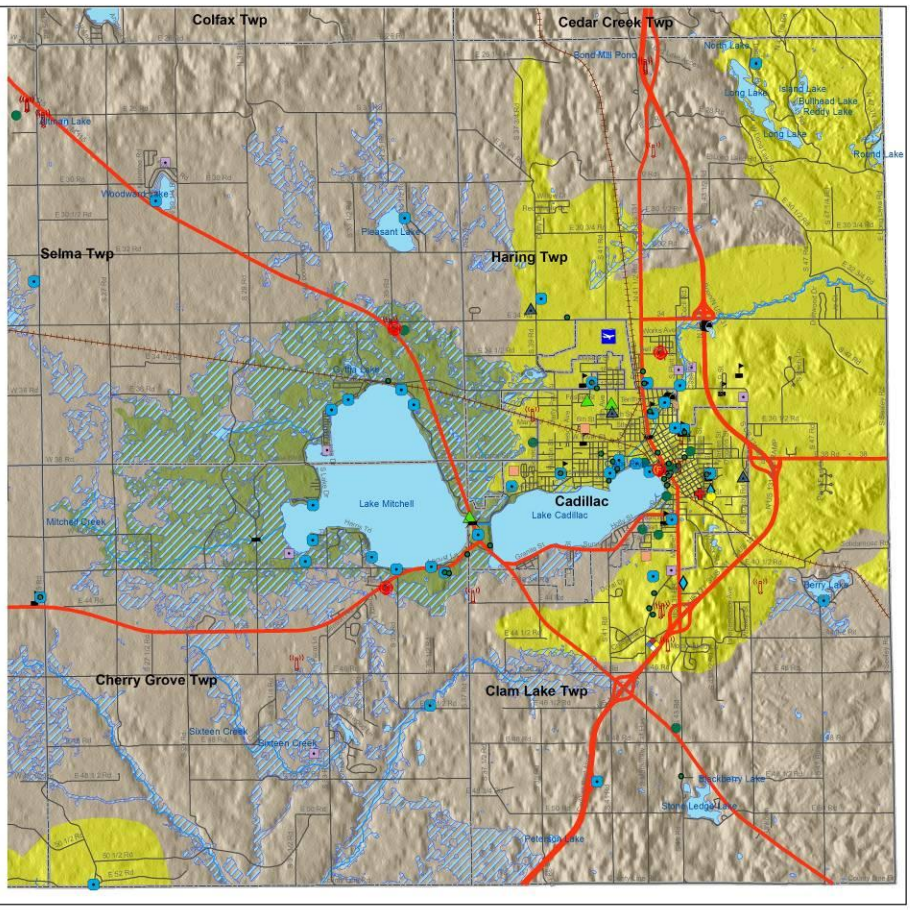

Hazard Mitigation Planning Project
Wexford County - Southwest

Critical Facilities
- Airport
- Bridge
- Communication Facility
- EMS
- Fire Station
- Government Office
- Hazardous Materials Site
- Hospital
- Mobile Home Park
- Police Station
- Resort/Recreation
- School
- Sewage Treatment
- Substation
- Water Treatment
- Water Wells/Towers
- Substation

- Roads
- Highways
- Railroads
- Political Boundaries
- Rivers/Creeks
- Lakes/Ponds
- Potential Flood Prone Areas

Forest Type - by resistance
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- FR3-Forests of white pine & hemlock
- FR3W-Wetlands of cedar & tamarack
- FR4-Most fire resistant, hardwoods
- FR4W-Wetlands of cedar & hemlock

N

0 0.5 1 2 Miles

Priority Areas (Countywide)
1. Extreme Winter Weather
2. Wildfires
3. Severe Weather
(Thunderstorms, High Winds, Tornadoes)
4. Flooding/Flash Floods

Northwest Michigan Council of Governments

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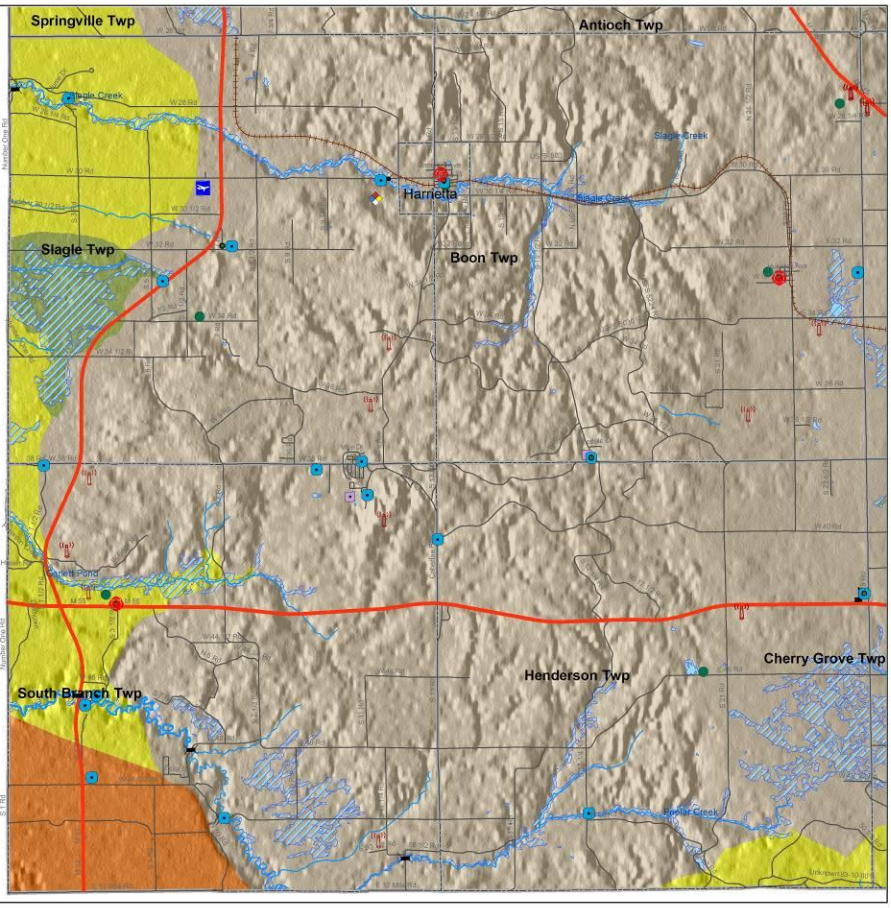

Hazard Mitigation Planning Project
Wexford County - Cadillac

Critical Facilities
- Airport
- Bridge
- Communication Facility
- EMS
- Fire Station
- Government Office
- Hazardous Materials Site
- Hospital
- Mobile Home Park
- Police Station
- Resort/Recreation
- School
- Sewage Treatment
- Substation
- Water Treatment
- Water Wells/Towers
- Substation

- Roads
- Highways
- Railroads
- Political Boundaries
- Rivers/Creeks
- Lakes/Ponds
- Potential Flood Prone Areas

Forest Type - by resistance
- FR1-Most fire prone, jack pine
- FR2-Forests of white/red pine
- FR3-Forests of white pine & hemlock
- FR3W-Wetlands of cedar & tamarack
- FR4-Most fire resistant, hardwoods
- FR4W-Wetlands of cedar & hemlock

N

0 0.1750.35 0.7 Miles

Priority Areas (Countywide)
1. Extreme Winter Weather
2. Wildfires
3. Severe Weather
(Thunderstorms, High Winds, Tornadoes)
4. Flooding/Flash Floods

Northwest Michigan Council of Governments

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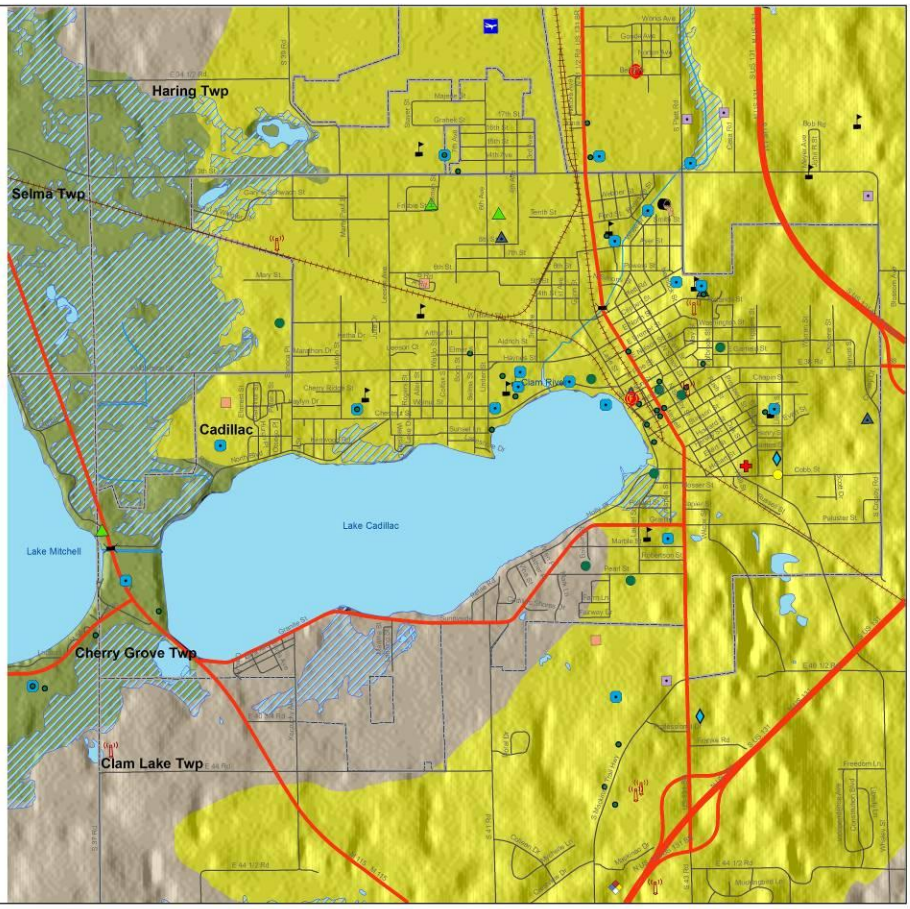

Hazard Mitigation Planning Project
Wexford County - Manton

Critical Facilities
- Airport
- Bridge
- Communication Facility
- EMS
- Fire Station
- Government Office
- Hazardous Materials Site
- Hospital
- Mobile Home Park
- Police Station
- Resort/Recreation
- School
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- Substation

- Roads
- Highways
- Railroads
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- Rivers/Creeks
- Lakes/Ponds
- Potential Flood Prone Areas

Forest Type - by resistance
- FR1-Most fire prone, jack pine
- FR2-Forests of white/red pine
- FR3-Forests of white pine & hemlock
- FR3W-Wetlands of cedar & tamarack
- FR4-Most fire resistant, hardwoods
- FR4W-Wetlands of cedar & hemlock

N

0 0.1250.25 0.5 Miles

Priority Areas (Countywide)
1. Extreme Winter Weather
2. Wildfires
3. Severe Weather
(Thunderstorms, High Winds, Tornadoes)
4. Flooding/Flash Floods

Northwest Michigan Council of Governments

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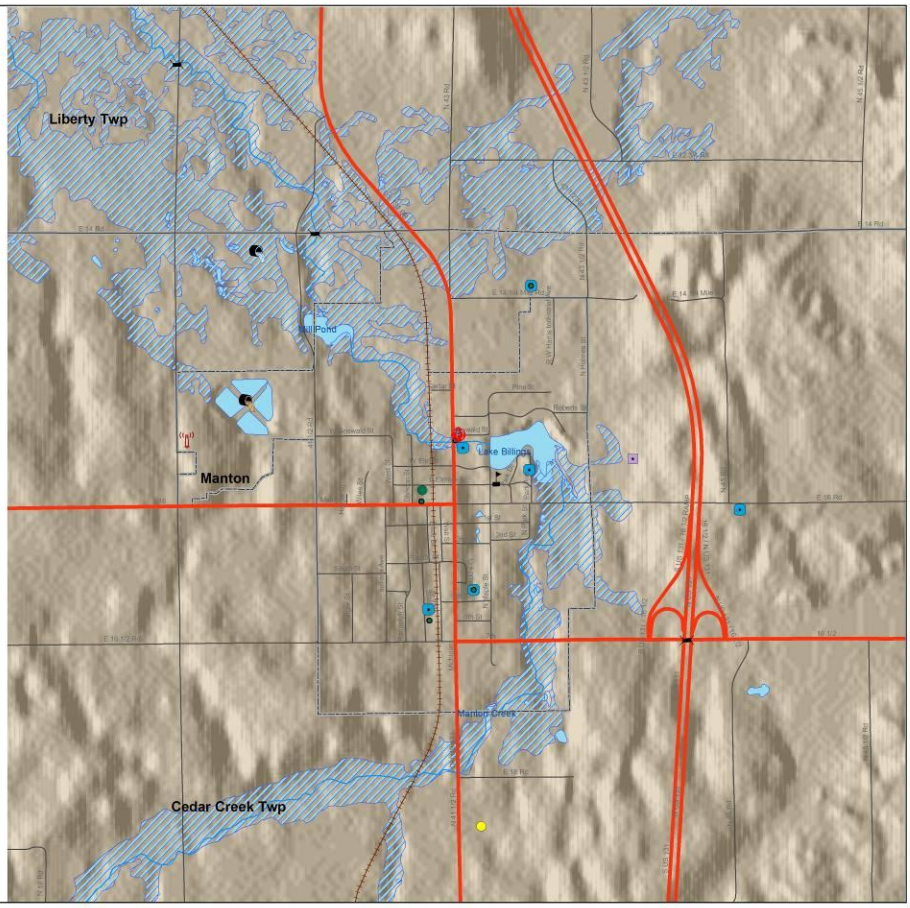
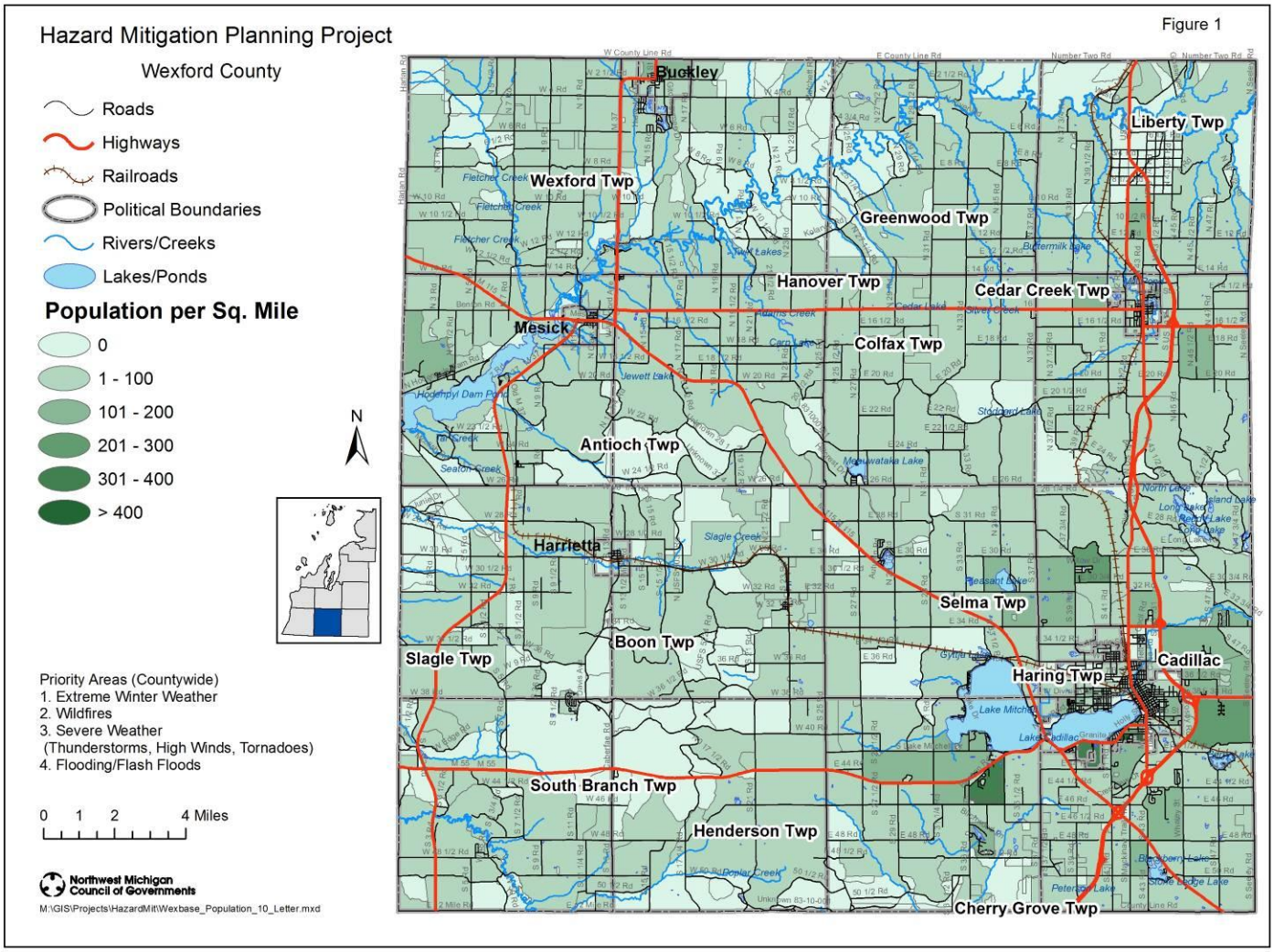


Appendix C

Population Density Map



Appendix D

Risk Assessment Summary Table: WEXFORD COUNTY

HAZARD (Years of Record)	Number of Events	Probability**	Geographic Size Affected	Population Impacted	Specific Priority	Estimated Damage Known Costs
Flooding, Flash Floods (2000 – 2014)	11	Frequent	Countywide	32,735	**4**	$982,000
Extreme Winter Weather (1997 – 2014)	62	Frequent	Countywide	32,735	**1**	$33,000
Hail (1984 – 2014)	23	Frequent	Countywide	32,735	2/3	NA
Severe Weather - High Winds/ Thunderstorms (1964 – 2014)	48	Frequent	Countywide	32,735	**3**	$286,000
Tornadoes (1963 – 2014)	8	Rare	Countywide	32,735	**3**	$1,612,500
Wildfires	428	Frequent	Countywide	32,735	**2**	NA

***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

Confronting Climate Change in the Great Lakes Region, Michigan fact sheet, Union of Concerned Scientists and the Ecological Society of America, April 2003.

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, July 2012, 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).

Platte River Watershed Management Plan, Benzie County Conservation District, April 2002.

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.