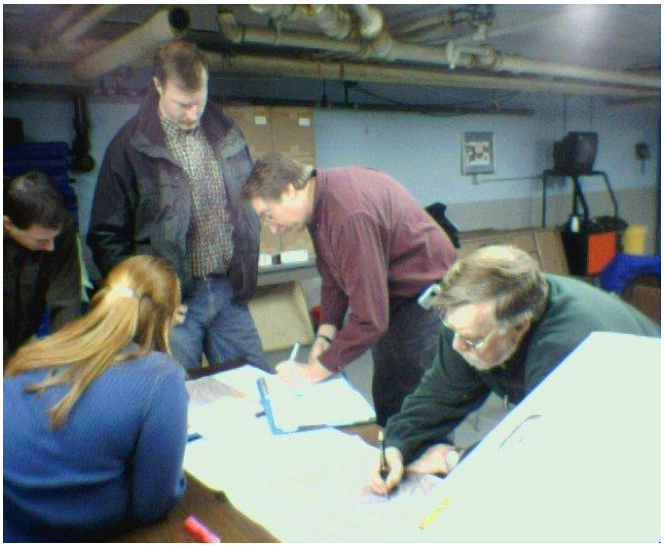
Natural Hazards Mitigation Plan

2007

Wexford County, Michigan



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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.

Following is a list of the key contributors to the Plan, who participated in the development of the Wexford County Natural Hazards Mitigation Plan:

Wexford County Emergency Management Coordinator
Dan McPherson

Wexford County Geographic Information Services (GIS)
Chad Collins

Wexford County Planning and Zoning
Mike Haner

Wexford County Road Commission
Jerry Hawkins
Bob Lindbeck

Boon Township
John Okoren

Clam Lake Township
Robert Mackey
Darrell Kelley

District Health Department #10
Karen Schaper

Michigan Department of Transportation
David Widrig

Michigan State University Extension Service
Kurt Schindler

II. LETTER OF TRANSMITTAL

Mike Sobocinski
Michigan State Police Emergency Management Division
4000 Collins Road
PO Box 30636
Lansing MI 48909-8136

Dear Mr. Sobocinski:

Enclosed, please find the Wexford County natural Hazards Mitigation Plan. This Plan has been developed in conjunction with the County Emergency Management Staff, County Planner, Task Force Members, the public, and the State of Michigan. The Plan lays out the process of evaluating the potential natural hazards, land use, and mitigation strategies to protect lives and property in the County.

This transmittal letter serves notice that all future development decisions in Wexford County will consider hazard vulnerability reduction as a standard practice. The intent of the Natural Hazards Mitigation Plan is not to limit development, but to ensure that all development occurs in a manner that minimizes the possibility of damage from potential natural hazards to the greatest extent possible.

Thank you for your time and consideration. If you have any questions, please feel free to contact the Wexford County Emergency Management Staff, Dan McPherson at 231.775-7602.

Sincerely,

County Board of Commissioners

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.

Reducing the impact of natural hazards on people and property through the coordination of resources, programs, and authorities prevents communities from contributing to the increasing severity of the problems. 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:

1. Protection of the public health and safety;
2. Preservation of essential services;
3. Prevention of property damage; and
4. 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 regional planning agencies throughout the State of Michigan to work with individual counties in developing their Natural Hazards 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 the counties. These plans included a general community profile, a comprehensive inventory of existing natural hazards, a natural hazards 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:

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 community'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

The Wexford County Task Force participants designated the following top Natural Hazards Mitigation Priority Areas:

1. *County: Severe winter weather*
2. *County: Potential wildfire/urban interface*
3. *State Highway M-115: High Winds*
4. *Lake Cadillac, Silver Creek (Greenwood Township), Fletcher Creek (Wexford Township): Potential Flooding*

And, recommended the following mitigation strategies:

Priority Area 1. Potential of severe winter weather throughout the County

Snow Load Mitigation Strategies:

a. Re-analyze government and school buildings
b. Work with Utility Companies
c. 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:

a. Purchase fire suppression equipment for response
b. Planned burns
c. Public education and awareness activities such as programs and brochures regarding fuel management, proper vegetation, fire breaks
d. Continue enforcement of state fire codes regarding setback requirements
e. Public education utilizing the Michigan Department of Natural Resources FireWise Program

Priority Area 3. Potential high winds along M-115

Thunderstorm, High Winds, and Tornado Mitigation Strategies:

a. Establish additional sirens for early warning weather systems
b. Establish storm shelters, especially at campgrounds, trailer parks, modulars
c. Promote the anchoring of trailers and modulars
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

Priority Area 4. Potential of flooding in the areas of Lake Cadillac, Silver Creek, and Fletcher Creek

Flood Mitigation Strategies:

a. Drainage improvements such as larger culverts, clean up of river debris
b. Continue enforcement of building codes and soil erosion regulations

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*

V. PURPOSE OF THE PLAN

The Disaster Mitigation Act of 2000 shifted the Federal Emergency Management Agency's (FEMA) scope of work to promoting and supporting prevention, or what is called Hazard Mitigation Planning. FEMA has now required government entities to create natural hazards mitigation plans as a condition of receiving grant money, such as hazard mitigation grant program funds. To meet this requirement, the Michigan State Police funded regional planning agencies to work with individual counties to develop the Natural Hazards Mitigation Plans. The Northwest Michigan Council of Governments was the agency to develop this Plan.

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.

1. Identification of natural hazards and risks
2. Preparation of draft plan
3. Identification of natural hazards mitigation goals and objectives for emergency management programs
4. Selection of evaluation criteria
5. Selection of mitigation strategies using locally chosen criteria
6. Public Comment
7. Completion of the final plan

The Plan also lays out the implementation of the plan, and the monitoring and periodic revision of the 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 natural hazards such as drought, earthquakes, extreme temperatures, wildfires, urban and riverine flooding, high or wind driven waters that cause shoreline flooding and erosion, ground subsidence/ landslides, thunderstorms and high winds, tornadoes, and winter weather hazards. 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.

In the State of Michigan, the **principle natural hazards** are:

- ❒ Tornadoes
- ❒ Flooding
- ❒ Lightning
- ❒ Severe winds
- ❒ Severe winter weather (snow, ice, sleet)

These principle natural hazards events have caused the top impacts to be erosion/debris flow, frozen pipes, and floods.

Governor Declarations for major disasters in the State of Michigan that occurred from 1977 to 2001 include:

- Thirteen (13) severe storms
- Eleven (11) floods
- Eight (8) winter storms
- Six (6) tornadoes
- Three (3) fires

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.

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

Major Geographic Features of Wexford County

Area in Water	6,912 acres – two major watersheds, the Big Manistee River and the Pine River
Forest Lands	281,700 acres 77.9% of total land area
Wetlands	83,785 acres 23.2% of total land area
Operating Farms (2002)	395
Farmland (2002)	45,852 acres

The total County population is **30,484**. The projected growth for 2010 is 33,868 and for 2020 it is 35,731. The population numbers from the 2000 Census for the **16 Townships, 4 Villages, and 1 City** covered by this plan are:

Townships/Cities/Villages	Population
Antioch Township	810
Boon Township	670
Cedar Creek Township	1,489
Cherry Grove Township	2,328
Clam Lake Township	2,238
Colfax Township	763
Greenwood Township	542
Hanover Township	1,200
Haring Township	2,962
Henderson Township	176
Liberty Township	800
Selma Township	1,915
Slagle Township	569
South Branch Township	300
Springville Township	1,673
Wexford Township	798
Village of Buckley	550

Village of Harrietta	169
Village of Manton	1,221
Village of Mesick	447
City of Cadillac	10,000

County Resident Profile

1. There are approximately 15,556 *Housing Units* in Wexford County with an average household size of 2.55 people per household. 36.2% of the households have 2 persons.
2. The number of residents 65 years and over is 4,278, or 14% of the population.
3. The number of residents 19 years and under 8,990, or 29% of the population.
4. The number if residents over 65 with a disability is 1,846, or 6% of the population.
5. The total number of residents with a disability is 5,789, or 19% of the population.
6. The number of residents that have a language barrier or are linguistically isolated is 111, or less than 1% of the population.
7. Percent below poverty level:
   February 2004 Poverty level: $15,670 Family of 3 and $9,310 Family of 1
   - Families in poverty with children: 464
   - Income less than $15,000: 16.5%
   - Individuals in poverty: 3,096

2002 Economic Census

Industry Description	Number of Establishments	Number of Employees
Manufacturing	62	2,500-4,999
Wholesale trade	29	350-499
Retail trade	191	2,290
Information	15	100-249
Real estate, rental, leasing	30	109
Professional, scientific, technical services	52	403
Administrative, support, waste management, remediation services	23	292
Educational services	3	0-19
Health care, social assistance	91	1,794
Arts, entertainment, recreation	18	100-249
Accommodation and food services	84	1,384
Other services (except public administration)	70	341

*Information provided above was retrieved from the Northwest Michigan Council of Governments' *Benchmarks 2004, Northwest Lower Michigan County Profiles 2000,* and reports on the Northwest Michigan Council of Governments' website.

VII. THE DEVELOPMENT OF THE PLAN

A. Data Methodology and Map Development

Wexford County staff identified the critical facilities and infrastructure on the base map with the Northwest Michigan Council of Governments' GIS staff then digitizing the facilities as point files. Natural hazards points, polygons, and population centers data was then added to the base maps utilizing the following data:

Critical Infrastructure

2	Airports
21	Bridges
15	Communications Facilities
3	Emergency Management Services Facilities
12	Fire Stations
23	Government Buildings
1	Hazardous Materials Site
1	Hospital • Primary physicians per 100,000 population 1998 is 78.9
3	Mobile Home Parks
3	Police Stations
12	Resort/Recreational
13	Schools
3	Sewage Treatment Facilities • 43.5% public sewer • 55.5% individual septic/cesspool • 1.0% other
4	Utilities (water) • 43.5% public system or private company • 61.8% individual wells

Flood Data

Flood hazard information can usually be derived from the Flood Rate Insurance 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 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.

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 considered to be substantial risks.

The detailed Wexford County Map is presented in Appendix B. #1.

B. Natural Hazards Information

1. Natural Hazards and Climate Change

Scientists are now convinced that human activity, primarily the burning of fossil fuels to produce electricity and drive cars, is changing the climate. These activities emit gases, primarily carbon dioxide, that blanket the planet and trap heat. Some of the signs of climate changes we are seeing already throughout the Great Lakes region include increasing average annual temperatures; more frequent severe rainstorms; shorter winters; and duration of lake ice cover. In general, Michigan's climate will grow considerably warmer and probably drier during this century, especially in the summer.

Potential Impacts from Climate Change

Northwest, lower Michigan depends heavily on groundwater, freshwater from Lake Michigan, and rainfall for agriculture, drinking, and industrial uses. As the population in this region continues to grow, the demand for water for all the needs increases. The projected changes in rainfall, evaporation, and groundwater recharge rates from climate change events may affect ecosystems and freshwater users.

- Lower summer water levels are likely to diminish the recharge of groundwater, cause small streams to dry up, and reduce the area of wetlands, resulting in poorer water quality and less habitat for wildlife.
- Lake levels are expected to decline in both inland lakes and the Great Lakes, as more moisture evaporates due to warmer temperatures and less ice cover.
- Pressure to increase water extraction from the Great Lakes will grow, exacerbating an already contentious debate in the region.

- 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.

2. 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
- U.S. Storm Events Data Base: 1950 to present, local storm reports, damage reports, etc. from various sources – events checked for Wexford County included drought, flooding, funnel clouds, hail, lightning, snow and ice, thunderstorms and high winds, tornadoes, wild/forest fires.

The most severe events recorded for Wexford County are listed below, including the number of events, dates, and descriptions of the most severe.

1. Drought – August 2001 (county); stress on the crops was most noted for corn, but also hit hay crops to a lesser extent.

2. Wildfires – 319 events between1981 and 2005; 15 events 10 acres or more:
   - 1987: 13 acres, Liberty Township
   - 1988: 17 acres, Henderson Township
   - 1988: 13 acres, Liberty Township
   - 1989: 21 acres, Haring Township
   - 1989: 10 acres, Liberty Township
   - 1992: 18 acres, Liberty Township
   - 1993: 15 acres, Liberty Township
   - 1994: 43 acres, Liberty Township
   - 1994: 22 acres, Haring Township
   - 1996: 70 acres, Henderson Township
   - 1996: 10 acres, Cherry Grove Township
   - 1997: 43 acres, South Branch Township
   - 1998: 15 acres, Boon Township
   - 1999: 26 acres, Liberty Township
   - 2000: 10 acres, Selma Township

3. Flood – 6 events
   - May 2000 (Cadillac); flash flood, up to six inches of water covered some city streets
   - April 2001 (county); flood, water rose into backyards with no structural damage on the Manistee River
   - May 2001 (county); flash flood, localized flooding on secondary roads; (west portion) water rose into backyards with no structural damage on the Manistee River
   - May 2004 (Cadillac); $20,000 property damage; flash flood, water over a foot deep on Mitchell Street

4. Funnel Cloud – July 1995 (Manton) funnel cloud sighted

5. Hail – 16 events
   - March 1991 (county) 1.75 inches
   - May 2000: .75 inches, greatest impact during the storm
   - May 2004: (Manton) .88 inches; nickel sized hail near Chase Creek Camp
   - June 2004: (Cadillac) 1.50 inches; hailstones as large as ping-pong balls fell
   - July 2006: (Cadillac) .75 inches

6. Snow and Ice – 32 events (12 inches or more of snow)
   - January 1993: $50,000 property damage (region) heavy snow
   - April 1993: $50,000 property damage (region) heavy snow
   - December 1993: (region) heavy snow, 10 to 15 inches of snow with numerous auto accidents around Cadillac and several injuries reported
   - January 1994: $5 million property damage (region) heavy snow/freezing rain
   - February 1997: (county) winter storm, 1 to 2 inches per hour with totals between 8 and 12 inches, strong winds caused significant blowing and drifting
   - March 2002: (region) heavy snow, 10 to 16 inches of snowfall; winter storm (region); strong winds and lake effect snow showers caused blizzard conditions, major highways were closed and several shelters were opened to house stranded travelers
   - December 2002: (region) ice storm, rainfall/freezing rain with a quarter inch of ice, icy roads and sidewalks
   - April 2003: (region) winter storm, mix of freezing rain, sleet, and snow, numerous downed tree limbs and power lines
   - January 2004: (region/county) heavy snow, 10 to 12 inches of snow

7. Thunderstorm and High Wind – 37 events
   - August 1993: thunderstorm/wind (Cadillac) large tree limbs up to 10 inches in diameter
   - July 1995: thunderstorm/winds (Cadillac) $2,000 property damage, trees and power lines down
   - August 1995: thunderstorm/winds (Hoxeyville) trees and power lines down
   - August 1996: thunderstorm/winds (Cadillac) 55 knots, uprooted trees and power lines down
   - May 1998: thunderstorm/wind (Cadillac) 50 knots, downed trees; (Mesick) downed trees; (Harrietta) trees and power lines down, trees toppled onto homes; (Mesick) trees and power lines down, trees toppled onto homes
   - November 1998: high wind (region) 82 knots, one of the strongest storms ever recorded in the Great Lakes, large number of trees were uprooted or snapped off with many branches also torn off, power lines down with widespread power outages, many roads were blocked by fallen trees and several accidents were reported, several homes and cars received damage
   - June 1999: thunderstorm/wind (Mesick) 50 knots, trees down; (Cadillac) 56 knots, billboards and power lines down
   - July 1999: thunderstorm/wind (Cadillac) 50 knots, trees and power lines down; (Cadillac) 50 knots, trees down; (Cadillac) 50 knots, power lines down
   - August 2001: thunderstorm/wind (Cadillac) 50 knots, trees and power lines down

- April 2002: thunderstorm/wind (Sherman) 50 knots, numerous trees and power lines down; (Cadillac) 50 knots, power poles snapped in half, trees and power lines down
- July 2002: thunderstorm/wind (Buckley) 50 knots, numerous trees and power lines down
- August 2003: thunderstorm/wind (Mesick) $155,000 property damage, 50 knots, trees down near M-42
- November 2003: high wind (region) 68 knots, trees and power lines down
- September 2005: thunderstorm/wind (Mesick) $5,000 property damage, 55 knots, numerous power lines and trees were knocked down
- July 2006: thunderstorm/wind (Manton) $20,000 property damage, 50 knots, a falling tree destroyed the office of the Lake Billings Campground

8. Tornadoes – 6 events
   - July 1963: (county) F2, 20 miles long, 50 yards wide, $250,000 property damage
   - August 1968: (county) F1, 20 yards wide, $3,000 property damage
   - June 1974: (county) F2, 1 mile long, 70 yards wide, $25,000 property damage
   - June 1976: (county) F1, $25,000 property damage
   - October 1989: (county) F2, 1 miles long, 40 yards wide, $250,000 property damage

Other

9. Earthquakes
   There has been no occurrence of earthquakes in the county in recent history and the closest ones have been in Ohio and Indiana which are about five hours from Wexford County.

10. Subsidence
    The Michigan Hazard Analysis of 2006 and local information indicate that there have been no significant subsidence events in the county. The southeast corner of the county is in the Michigan coal basin area. Given the geological structure below most of the county, no significant subsidence issues are expected in the future and there are no active coal mines.

3. 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 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.

Please see Appendix C: Risk Assessment Summary Table.

C. Wexford County Natural Hazards Task Force and Public Input

To create the Wexford County Natural Hazards Task Force, **invitations for the meetings** were sent to the following entities requesting their participation:

County Administrator/Coordinator
County Board of Commissioners
County Sheriff/Emergency Services (911 Services Coordinators, Public Safety)
County Emergency Manager/Coordinator
County Public Works Director
County Health Department Director
County Planning or Community Development Director
County Drain Commissioner/Soil Erosion Officers
County Road Commission Director
County Conservation District Director/Soil Erosion Officers
Township elected and appointed officials
Township Supervisors
Township Clerks
Michigan State Police
Michigan Department of Environmental Quality
Michigan Department of Natural Resources
Michigan Department of Transportation
U.S. Coast Guard
Hospitals
City/Village Maintenance/Utilities
Environmental/Conservation Groups/Organizations
American Red Cross
Groundwater Protection Organizations
Housing Associations
Chambers of Commerce
National Weather Service (Gaylord)
Michigan Family Independence Agencies

The Task Force meeting was held on **January 18th, 2005** to identify the natural hazards priority areas and to develop the mitigation strategies for the priority issues. The following organizations/individuals participated in these meetings:

Wexford County Emergency Management Coordinator
Dan McPherson

Wexford County Geographic Information Services (GIS)
Chad Collins

Wexford County Planning and Zoning
Mike Haner

Wexford County Road Commission
Jerry Hawkins
Bob Lindbeck

Boon Township
John Okoren

Clam Lake Township
Robert Mackey

District Health Department #10
Karen Schaper

Michigan Department of Transportation
David Widrig

Michigan State University Extension Service
Kurt Schindler

At the Task Force meeting, the NWMCOG staff presented the background of the required project; the principle natural hazards in Michigan; what mitigation planning is; the purpose of the plan; suggested goals; and the political process. A full county natural hazards map was available for review with four separate quadrant maps. These sectional maps were for the participants to review the areas of the county they were most familiar with.

The group analyzed the map areas for the top natural hazards priority areas by documenting the most threatening. They did a qualitative assessment of points and concerns where they saw potential conflicts with and the relationship to critical facilities and population centers. The general list created included:

1. Severe winter weather; snowbelt area
2. Flooding areas – Lake Cadillac, Silver Creek, Fletcher Creek; drainage improvements
3. High wind areas
4. Potential wildfires and defensible space
5. Planned burns
6. Snowloads on government and school buildings
7. Shelters for high winds, tornadoes – trailer parks, modulars, anchoring
8. Power outages
9. Education
10. Ice damage

The participants then took the complete list above and developed their Top Five Natural Hazards Priority Areas. Due to the rural nature of the county, there has not been a lot of property damage, injuries, or deaths due to natural hazards. Please refer to Figure 1.

The Wexford County Task Force participants designated the following top Natural Hazards Mitigation Priority Areas:

1. Potential of severe winter weather throughout the County
Snowstorms can be very dangerous for a community for short periods of time. Heavy snows can shut down towns and businesses for a period of a few days if the snow is falling faster that it can be cleared in a timely fashion. Blowing and drifting with blizzard conditions cause driving hazards.

2. Potential wildfire/urban interface throughout the County

The forest types that have a potential to be fire prone are located throughout the county – white/red pine, and white pine and hemlock. Additional factors that increase fire risk include lightning and human factors are the number of persons residing in (trash burning), camping in, or traveling through an area.

3. Potential of high winds in the State Highway M-115

There is a historical record of severe thunderstorms, high winds, and tornado events in the county. Thunderstorms are natural hazards that bring a variety of problems during the spring, summer, and fall seasons. They can bring potential lightning, flash flooding, hail, strong winds, and even tornadoes. Severe winds, or straight line winds that sometimes occur during severe thunderstorms can be very damaging to a community. Severe winds have the potential to cause loss of life from property damage and flying debris. Damage from straight line winds is more widespread than tornadoes and usually affects multiple counties. There is also risk of infrastructure damage from downed power lines due to falling trees and limbs.

4. Potential Flooding in the Lake Cadillac, Silver Creek (Greenwood Township), Fletcher Creek (Wexford Township) areas

Damages will be greater from flash flood types of events than they would from gradual floodplain inundation, especially regarding the bridges.

In addition to "regular" 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.

Please refer to Appendix B. #2 Priority Area Maps.

D. Emergency Warning System Coverage

There are four (4) sirens located in the City of Cadillac and one (1) siren in the Village of Manton.

E. Economic Impact Analysis

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

1.	Snow and Ice -	$5,100,000
3.	Thunderstorm and High Wind -	$157,000
4.	Tornadoes -	$553,000

NWMCOG staff worked with the Wexford County Equalization Department to calculate each Priority Area's economic value through the State Equalized Values (SEV) for real and personal property (residential and commercial). The following includes the 2000 Census data for the priority area and the SEV dollar amount times two (estimated fair market values) for each priority area.

1. *Wexford County: Severe winter weather*

   Population: **30,484**
   Total: $2,415,215,748

2. *Wexford County: Wildfires*

   Population: **30,484** plus seasonal influx in the summer
   Total: $2,415,215,748

3. *M-115 Area – Townships of Antioch, Boon, Colfax, and Selma*

   Population: **2,220**
   Total: $370,534,920

4. *Lake Cadillac, Silver Creek, Fletcher Creek Areas – Townships of Clam Lake, Greenwood, and Wexford; City of Cadillac*

   Population: **2,574**
   Total: $941,420,760

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

Objectives:

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

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

Objectives:

A. Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures
B. Create or update ordinances to reflect building codes, shoreline protection rules, etc.
C. Incorporate natural hazards mitigation into basic land use regulation mechanisms
D. Develop community education programs and public warning systems
E. Strengthen the role of the Local Emergency Planning Committee in the land development process
F. Integrate natural hazards mitigation into the capital improvement planning process so that public infrastructure does not lead to development in natural hazards areas
G. 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

Objectives:

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

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

Objectives:

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

IX. IDENTIFICATION AND SELECTION OF MITIGATION STRATEGIES

A. Climate Change Solutions

Regional residents, business leaders, and policymakers can help reduce the potential impacts from climate change by pursuing three necessary and complementary strategies:

- Reducing heat-trapping gas emissions will help curb the threat from a changing climate. This can be achieved by increasing energy efficiency, switching to renewable energy sources such as wind and biomass, increasing the fuel economy of vehicles, and investing in clean transportation choices.
- Minimize pressures on the environment by improving air quality, protecting the quality and supply of water resources, protecting habitat, and limiting sprawl.
- Prepare for impacts from global warming that cannot be avoided through better planning and emergency preparedness, adaptations in agriculture, strengthening public health response and warning systems, and adjusting flood control infrastructure based on projected precipitation trends.

B. 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.

1. The measure must be technically feasible.
2. The measure must be financially feasible.
3. The measure must be environmentally sound and not cause any permanent, significant environmental concerns.
4. 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.

At the Task Force meeting in **January 2005** the participants reviewed the suggested list of natural hazards mitigation strategies, matched them with each of the natural hazards priority areas, and also suggested other alternatives to create a list of the most desired strategies for each.

Priority Area 1. Potential of severe winter weather throughout the County
Snow Load Mitigation Strategies:
a. Re-analyze government and school buildings
b. Work with Utility Companies
c. 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:
a. Purchase fire suppression equipment for response
b. Planned burns

c. Public education and awareness activities such as programs and brochures regarding fuel management, proper vegetation, fire breaks
d. Continue enforcement of state fire codes regarding setback requirements
e. Public education utilizing the Michigan Department of Natural Resources FireWise Program

Priority Area 3. Potential high winds along M-115

Thunderstorm, High Winds, and Tornado Mitigation Strategies:

a. Establish additional sirens for early warning weather systems
b. Establish storm shelters, especially at campgrounds, trailer parks, modulars
c. Promote the anchoring of trailers and modulars
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

Priority Area 4. Potential of flooding in the areas of Lake Cadillac, Silver Creek, and Fletcher Creek

Flood Mitigation Strategies:

a. Drainage improvements such as larger culverts, clean up of river debris
b. Continue enforcement of building codes and soil erosion regulations

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. Quarterly reports were given to the Northwest Michigan Council of Governments' Board of Directors for neighboring counties' review.

B. Public Notices were published in the *Cadillac News* – no comments were received.

Public Notice
The Northwest Michigan Council of Governments is requesting public comment on the Natural Hazards Mitigation Plan draft for Wexford County. The Plan is available for review at the Wexford County Planning Department, County Building, Traverse City or at nwm.org, Community Resources, Community and Economic Development, Hazard Mitigation Planning Program, Wexford County Plan. Please send comments by November 22nd to: Hazard Mitigation Plans, NWMCOG, PO Box 506, Traverse City MI 49685-0506.

C. Postcards that gave notice of the draft plan was available for review at the County building and on the Northwest Michigan Council of Governments' website were sent to all the Township, Village, and City supervisors/managers – no comments were received.

D. During the development of the plan, all townships, cities, 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 provided comments, the others that did not provided 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 the development of this plan, including the risk assessment and community profile sections.

In addition, the townships, city 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.

The Townships, Cities, and Villages in the priority areas include:

1. Antioch
2. Boon
3. Cedar Creek - Zoning
4. Cherry Grove
5. Clam Lake
6. Colfax
7. Greenwood
8. Hanover
9. Haring - Zoning
10. Henderson
11. Liberty
12. Selma
13. Slagle
14. South Branch
15. Springville - Zoning
16. Village of Buckley - Zoning
17. City of Cadillac – Zoning
18. Village of Harrietta
19. Village of Mesick – Zoning

Participation Layout

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 paragraph D, above
Boon Township	No	Task Force meeting; review of draft plan
Cedar Creek Township	Yes	See paragraph D, above
Cherry Grove Township	No	See paragraph D, above
Clam Lake Township (2)	No	Task Force meeting; review of draft plan
Colfax Township	No	See paragraph D, above
Greenwood Township	No	See paragraph D, above
Hanover Township	No	See paragraph D, above
Haring Township	Yes	See paragraph D, above
Henderson Township	No	See paragraph D, above
Liberty Township	No	See paragraph D, above
Village of Manton	No	See paragraph D, above
Selma Township	No	See paragraph D, above
Slagle Township	No	See paragraph D, above
South Branch Township	No	See paragraph D, above
Springville Township	Yes	See paragraph D, above
Wexford Township	No	See paragraph D, above
Village of Buckley	Yes	See paragraph D, above
Village of Harrietta	No	See paragraph D, above
City of Cadillac	Yes	See paragraph D, above
Village of Mesick	Yes	See paragraph D, above
District Health Department #10	N/A	Task Force meeting; review of draft plan
MI Department of Transportation	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

1. 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 that is Michigan Public Act 226 of 2003, the Joint Municipal Planning Act. This Act provides for joint land use planning by cities, villages, and townships, and allows two or more municipalities' legislative bodies to create a single joint planning commission to address planning issues. This tool helps with planning for the "big picture" issues such as natural hazards that cross jurisdictional boundaries.

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

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

2. 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

3. Action Agenda

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

Action Agenda Layout:

Priority and Action Strategies	Responsible Parties	Timeframe
Priority Area 1 ***Snow Load Mitigation Strategies:***		
a. Re-analyze government and school buildings	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	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. Purchase 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. Planned burns	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 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, Villages	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 FireWise Program	County Planning County Building Inspector Emergency Management Coordinator Townships, City, Villages MI Department of Natural Resources	1-3 years from adoption of the plan
Priority Area 3 ***Thunderstorm, High Winds, Tornado Mitigation Strategies:***		
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,	Emergency Management Coordinator	1-5 years from adoption of the plan

especially at campgrounds, trailer parks, modular parks	County Planning County Building Inspector Townships, City, Villages	
c. Promote the anchoring of trailers and modulars	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 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

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

4. 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

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

1. **11” x 17” Full Map**
2. **11” x 17” Zoom in of Priority Areas**

Appendix C

Population Density Map

Appendix D

Risk Assessment Summary Table: WEXFORD COUNTY

HAZARD	How Frequently has the Hazard Occurred in the Past?	How Likely is the Hazard to Occur in the Future?	Potential Geographic Size of the Affected Area	Potential Population Impacted	Priority of Mitigation Activities for this Hazard	Detailed Damage and Estimated Costs
Drought	1 major event	2% chance	**County**	30,484	0	
Earthquakes	No recorded events	5% chance	County	30,484	0	
Flooding	6 major events	11% chance	**County, Lake Cadillac, West Side of County** Silver Creek Fletcher Creek	30,484	**4**	$20,000 property damage
Hail	16 major events	29% chance	**County**	30,484		
Snow and Ice	32 major events	57% chance	**County**	30,484	**1**	$5,100,000 property damage
Subsidence	No recorded events	5% chance	County	30,484	0	
High Winds/ Thunderstorms	37 major events	66% chance	**County** Cadillac Hoxeyville Mesick Sherman Buckley	30,484 10,000 300 447 200 550	**3**	$157,000 property damage
Tornadoes	7 events	13% chance	**County**	30,484	**3**	$553,000 property damage
Wildfires	319 events	130% chance	**County** Slagle/South Branch 800 acres – put out in Manistee County	30,484	**2**	

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

The Task Force meeting was held on **January 18th, 2005** to identify the hazard priority areas and to develop the mitigation strategies for the priority issues.

AGENDA
January 18, 2005

I. Welcome
   a. Introductions
II. Hazard Mitigation Planning Overview
III. Data Sources
IV. Hazard Mitigation Maps
V. Breakout into Small Groups by Region
   a. Analyze the maps for the top five potential hazard areas
   b. List out the top five potential hazard areas
VI. Report Out from Each Group and Develop the Top Five Potential Hazard Areas for the Entire County
VII. List out Recommended Mitigation Strategies
VIII. Next Steps

The following is the list of participants:

Wexford County Emergency Management Coordinator
Dan McPherson

Wexford County Geographic Information Services (GIS)
Chad Collins

Wexford County Planning and Zoning
Mike Haner

Wexford County Road Commission
Jerry Hawkins
Bob Lindbeck

Boon Township
John Okoren

Clam Lake Township
Robert Mackey
Darrell Kelley

District Health Department #10
Karen Schaper

Michigan Department of Transportation
David Widrig

Michigan State University Extension Service
Kurt Schindler

Appendix G

Resources

Benchmarks 2004, 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: EMD PUB-103, December 2001, Emergency Management 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 2000, 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.