Multi-Hazard Mitigation Plan

Porter County

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Northwestern Indiana
Regional Planning
Commission
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Porter County, Indiana

Adoption Date: -- _____ --

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Section 1 - Public Planning Process

1.1 Narrative Description

Hazard mitigation is defined as any sustained action to reduce or eliminate long-term risk to human life and property from hazards. The Federal Emergency Management Agency (FEMA) has made reducing hazards one of its primary goals; hazard mitigation planning and the subsequent implementation of resulting projects, measures, and policies is a primary mechanism in achieving FEMA's goal.

The Multi-Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The development of a local government plan is required in order to maintain eligibility for certain federal disaster assistance and hazard mitigation funding programs. In order for the National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt an MHMP.

The Porter County Emergency Management Agency, Northwestern Indiana Regional Planning Commission, and The Polis Center have joined efforts to develop this mitigation plan, realizing that the recognition of and the protection from hazards impacting the county and its residents contribute to future community and economic development. The team will continue to work together to develop and implement mitigation initiatives developed as part of this plan.

In recognition of the importance of planning in mitigation activities, FEMA created **Ha**zards **US**A **M**ulti-**H**azard (HAZUS-MH), a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to predict estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. The Indiana Department of Homeland Security has determined that HAZUS-MH should play a critical role in Indiana's risk assessments. The Polis Center (Polis) at Indiana University Purdue University Indianapolis (IUPUI) and the Indiana Geological Survey at Indiana University are assisting Porter County planning staff with performing the hazard risk assessment.

1.2 Planning Team Information

The Porter County multi-hazard mitigation planning team is headed by Phil Griffith, who is the primary point of contact. Members of the planning team include representatives from the public, private, and governmental sectors. Table 1-1 identifies the planning team individuals and the organizations they represent.

Table 1-1: Multi-Hazard Mitigation Planning Team Members

Name	Title	Organization	Jurisdiction
Phil Griffith	Director	Porter County EMA	Porter County
Tom Clements	Assistant Director	Porter County EMA	Porter County
David Lohse	Lieutenant	Chesterton Police Dept.	Chesterton
Mike Orlich	Fire Chief	Chesterton Fire Dept.	Chesterton
Bernard Doyle	Town Manager	Chesterton	Chesterton
Robert Edgecomb	Assistant Chief	Valparaiso Fire Dpt.	Valparaiso
Scott Arnold	EMS Assistant	Valparaiso Fire Dept.	Valparaiso
Mike DeHaven	Captain	Valparaiso Fire Dept.	Valparaiso
Russell Shirley	Director	Porter Co. Environmental Dept.	Porter County
Eric Kurtz	Fire Chief	Ogden Dunes Fire Dept.	Ogden Dunes
Donna Kuschel	Town Council member	Beverly Shores Town Council	Beverly Shores

The Disaster Mitigation Act (DMA) planning regulations stress that planning team members must be active participants. The Porter County MHMP committee members were actively involved on the following components:

- Attending the MHMP meetings
- Providing available GIS data and historical hazard information
- Reviewing and providing comments on the draft plans
- Coordinating and participating in the public input process
- Coordinating the formal adoption of the plan by the county

An MHMP kickoff meeting was held on September 15, 2009. Representatives from The Polis Center explained the rationale behind the MHMP program and answered questions from the participants. The Polis Center also provided an overview of HAZUS-MH, described the timeline and the process of the mitigation planning project, and presented Porter County with a Memorandum of Understanding (MOU) for sharing data and information.

The Porter County Multi-Hazard Mitigation Planning Committee met on September 15, 2009, October 22, 2009, February 16, 2010, June 2, 2010, and July 13, 2010. These meetings were held in Porter County. Each meeting was approximately two hours in length. The meeting minutes are included in Appendix A. During these meetings, the planning team successfully identified critical facilities, reviewed hazard data and maps, identified and assessed the effectiveness of existing mitigation measures, established mitigation projects, and assisted with preparation of the public participation information.

1.3 Public Involvement in Planning Process

An effort was made to solicit public input during the planning process, and a public meeting was held on July 13, 2010, to review the county's risk assessment. Appendix A contains the minutes from the public meeting. Appendix B contains articles published by the local newspaper throughout the public input process.

1.4 Neighboring Community Involvement

The Porter County planning team invited participation from various representatives of county government, local city and town governments, community groups, local businesses, and universities. The team also invited participation from adjacent counties to obtain their involvement in the planning process. Details of neighboring stakeholders' involvement are summarized in Table 1-2.

Table 1-2: Neighboring Community Participation

Person Participating	Neighboring Jurisdiction	Organization	Participation Description
Paul Young	LaPorte County	LaPorte County EMA	Reviewed draft; made comments and suggestions
Karen Wilson	Jasper County	Jasper County EMA	Reviewed draft; made comments and suggestions
Jodi Richmond	Lake County	Lake County EMA	Reviewed draft; made comments and suggestions

1.5 Review of Technical and Fiscal Resources

The MHMP planning team has identified representatives from key agencies to assist in the planning process. Technical data, reports, and studies were obtained from these agencies. The organizations and their contributions are summarized in Table 1-3.

Table 1-3: Key Agency Resources Provided

Agency Name	Resources Provided
Indiana Department of Homeland Security	Provided repetitive loss information
Indiana Department of Natural Resources, Division of Water	Digital Flood maps and levee information
Indiana Geological Survey	GIS data, digital elevation models

1.6 Review of Existing Plans

Porter County and its local communities utilized a variety of planning documents to direct community development. These documents include land use plans, comprehensive plans, emergency response plans, municipal ordinances, and building codes. The planning process also incorporated the existing natural hazard mitigation elements from previous planning efforts. Table 1-4 lists the plans, studies, reports, and ordinances used in the development of the plan.

Table 1-4: Planning Documents Used for MHMP Planning Process

Author(s)	Year	Title	Description	Where Used
Porter County	2007	Comprehensive Emergency Management Plan	Description and types of hazards; planning assumptions	Section 4
Porter County	2009	Comprehensive Hazard Analysis	Hazard descriptions	Sections 3 and 4

Section 2 - Jurisdiction Participation Information

The incorporated communities included in this multi-jurisdictional plan are listed in Table 2-1.

Table 2-1: Participating Jurisdictions

Jurisdiction Name
County of Porter
Town of Beverly Shores
Town of Burns Harbor
Town of Chesterton
Town of Dune Acres
Town of Hebron
Town of Kouts
Town of Ogden Dunes
City of Portage
Town of Porter
Town of Pines
City of Valparaiso

2.1 Adoption by Local Governing Body

The draft plan was made available on July 13, 2010, to the planning team for review. Comments were then accepted. The Porter County hazard mitigation planning team presented and recommended the plan to the county commissioners, who adopted it on <date adopted>. Resolution adoptions are included in Appendix C of this plan.

2.2 Jurisdiction Participation

It is required that each jurisdiction participates in the planning process. Table 2-2 lists each jurisdiction and describes its participation in the construction of this plan.

Table 2-2: Jurisdiction Participation

Jurisdiction Name	Participating Member	Participation Description
Porter County	Phil Griffith	Attended meetings, contributed to mitigation strategies
Beverly Shores	Donna Kuschel	Attended meetings, contributed to mitigation strategies
Burns Harbor	Toni Biancardi	Contributed to mitigation strategies
Chesterton	Mike Orlich	Attended meetings, contributed to mitigation strategies
Dune Acres	John Sullivan	Contributed to mitigation strategies
Hebron	Paul McKarney	Attended meetings, contributed to mitigation strategies
Kouts	Tim Jones	Attended meetings, contributed to mitigation strategies
Ogden Dunes	Eric Kurtz	Attended meetings, contributed to mitigation strategies
Portage	Bill Lundy	Attended meetings, contributed to mitigation strategies
Porter	Lew Craig	Attended meetings, contributed to mitigation strategies
Town of Pines	Cathi Murray	Attended meetings, contributed to mitigation strategies
Valparaiso	Mike DeHaven	Attended meetings, contributed to mitigation strategies

Section 3 - Jurisdiction Information

Porter County, named for naval war hero, Commodore David Porter, was organized on February 1, 1836. The county seat is Valparaiso. Valparaiso, originally named Portersville, was the first town to be platted on October 31, 1836. It was first incorporated as a town in 1850 and later as a city in 1866.

By the time the county was organized in 1836, Porter County already had a considerable population. Many families were from Ohio and southern Indiana, though some had migrated from the South and New England.

Porter County consists of 12 townships including Boone, Center, Jackson, Liberty, Morgan, Pine, Pleasant, Portage, Porter, Union, Washington, and Westchester.

Sources: http://www.countyhistory.com/porter/start.html; http://www.stats.indiana.edu/profiles/pr18127.html; http://www.goportercounty.org/index.php?option=com_content&task=view&id=12&Itemid=36

3.1 Topography

Porter County is located in northwestern Indiana between Chicago, Indianapolis, and Detroit. It is bounded by Jasper County to the south, Lake County to the west, and LaPorte and Starke Counties to the east. Lake Michigan borders the county to the north. The county's lowest point (585 feet above sea level) is on the shore of Lake Michigan, and the highest point (888 feet above sea level) is approximately 3.5 miles north of Valparaiso in the Valparaiso Moraine on a dissected ridge.

Porter County is located on the Valparaiso Moraine, formed from the Wisconsin Glaciation and characterized by high, hilly land consisting of glacial till and sand. Water on one side of the moraine flows into Lake Michigan and eventually the Atlantic Ocean; water on the other side flows into the Kankakee River.

Sources: Porter County Land Use Plan (2001)

3.2 Climate

In Porter County, mid-summer temperatures can be excessively hot and the winter snowfall can vary greatly from one year to the next. Humidity averages 60% for the mid-afternoon and rises during the evening with dawn humidity around 80%. The possibility for sunshine is 7% during the summer and 45% during the winter. Rainfall is moderately heavy and averages 39.8 inches annually, falling mostly during the spring and summer months. The average seasonal snowfall is 54.5 inches. The prevailing wind is from the south-southwest at an average speed of 10 miles per hour.

Source: http://www.city-data.com/city/Portage-Indiana.html; http://www.porterhealth.com/About/Pages/Fact%20Sheet.aspx

3.3 Demographics

Porter County has a population of 162,181. According to STATS Indiana, from 1990–2000, Porter County experienced a population increase of 13.9%. The population is spread through twelve townships including Boone, Center, Jackson, Liberty, Morgan, Pine, Pleasant, Portage, Porter, Union, Washington, and Westchester. The largest town in Porter County is Portage, which has a population of approximately 36,976. The breakdown of population by incorporated areas is included in Table 3-1.

Table 3-1: Population by Community

Community	2008 Population	% of County
Beverly Shores	729	0.4%
Burns Harbor	1,100	0.7%
Chesterton	12,705	7.8%
Dune Acres	231	0.1%
Hebron	3,698	2.3%
Kouts	1,849	1.1%
Ogden Dunes	1,278	0.8%
Portage	36,976	22.8%
Porter	5,379	3.3%
Town of Pines	793	0.5%
Valparaiso	30,429	18.8%

Source: STATS Indiana, 2008

3.4 Economy

STATS Indiana reported for 2007 that 88.6% of the workforce in Porter County was employed in the private sector. The breakdown is included in Table 3-2. Manufacturing represents the largest sector, employing approximately 12.3% of the workforce and generating approximately 27.9% of the earnings. The 2007 annual per capita income in Porter County is $39,479 compared to an Indiana average of $33,215.

Table 3-2: Industrial Employment by Sector

Industrial Sector	% of County Workforce (2007)
Agriculture, forestry, fishing, hunting, and mining	0.7%
Construction	8.6%
Manufacturing	12.3%
Wholesale trade	4.3%
Retail trade	11.8%
Information	0.8%
Professional and technical	4.6%
Educational, health, and social services	9.6%
Arts, entertainment, recreation, accommodation and food services	9.3%
Other services(except public administration)	23.4%
Public administration	10.7%

Source: STATS Indiana, 2007

3.5 Industry

Porter County's major employers and number of employees are listed in Table 3-3. The largest employer is Arcelor Mittal Steel, which has approximately 4,000 employees. Valparaiso University is the second largest, with 2,000 employees.

Table 3-3: Major Employers

Company Name	Location	Employees	Type of Business
Arcelor Mittal Steel	Burns Harbor	4,000	Steel
Valparaiso University	Valparaiso	2,000	Education
Porter Hospital	Valparaiso	1,700	Health Care
U.S. Steel	Portage	1,000	Steel
Wal-Mart	Portage	500	Retail
Levy Co.	Portage	300	Pharmaceutical
Urschel Laboratories, Inc.	Valparaiso	250	Pharmaceutical
Beta Steel Corp.	Portage	250	Steel
UGN Inc.	Burns Harbor	250	Manufacturing
Worthington Industries	Portage	230	Manufacturing
Porter-Starke Svc Inc.	Valparaiso	230	Health Care
Wiseway Food Center	Valparaiso	200	Retail
Opportunity Enterprises	Valparaiso	200	Education

Source: Porter County EDC

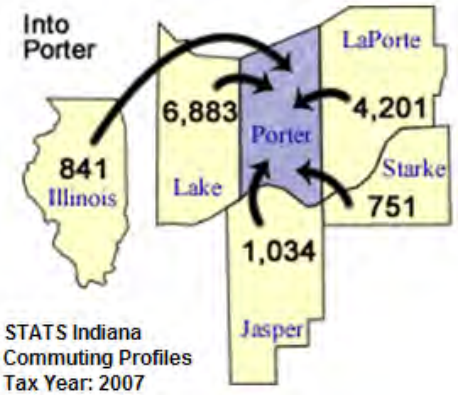
Commuter Patterns

According to STATS Indiana information from 2007, Porter County has approximately 107,546 residents who are in the work force. Of these, approximately 71,582 work in the county. Roughly 35,964 residents commute outside the county for work, and 14,985 non-residents commute into the county to work. Figure 3-1 depicts the commuting patterns into and out of the top five surrounding jurisdictions.

Figure 3-1: Commuter patterns into and out of Porter County

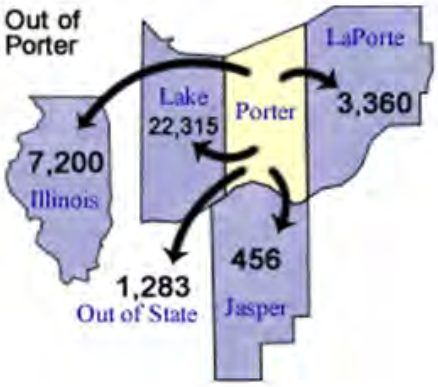
Top five counties sending workers INTO Porter County:

Lake County	6,883
LaPorte County	4,201
Jasper County	1,034
Illinois	841
Starke County	751
Total of above	13,710 workers
(15.8% of Porter County work force)	



Top five counties receiving workers FROM Porter County:

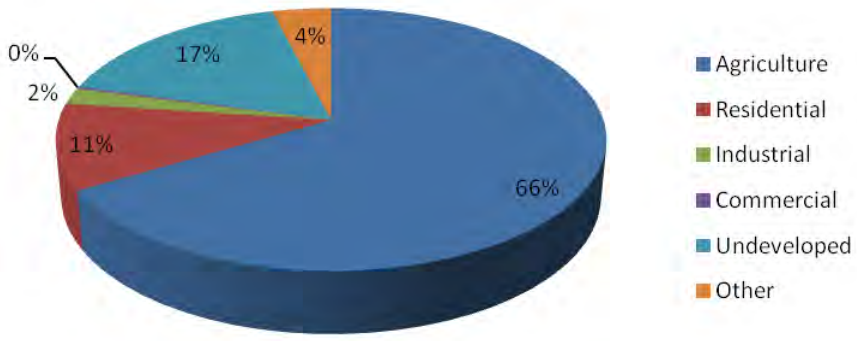
Lake County	22,315
Illinois	7,200
LaPorte County	3,360
Out of State	1,283
Jasper County	456
Total of above	34,614 workers
(32.2% of Porter County labor force)	



3.6 Land Use and Development Trends

Porter County has industrial development in the northern part of the county, particularly near Lake Michigan and the Port of Indiana at Burns Harbor. Much of the county is still primarily agricultural, although suburbanization quickly increasing near Portage, Valparaiso, and Chesterton. Figure 3-2 depicts the breakdown of existing land use by acreage.

Figure 3-2: Existing Land Use Breakdown by Acreage



The growth of the US 30/SR49 corridor in Valparaiso and the continuing development of the US 6 corridor in Portage have contributed to both commercial and residential growth in those areas. The development of the northern section of Portage along the Lake Michigan shoreline is fueling an additional area of commercial and residential growth. Figure 3-3 depicts Porter County's existing land use map. Figure 3-4 shows the future land use map.

Figure 3-3: Porter County Existing Land Use Map

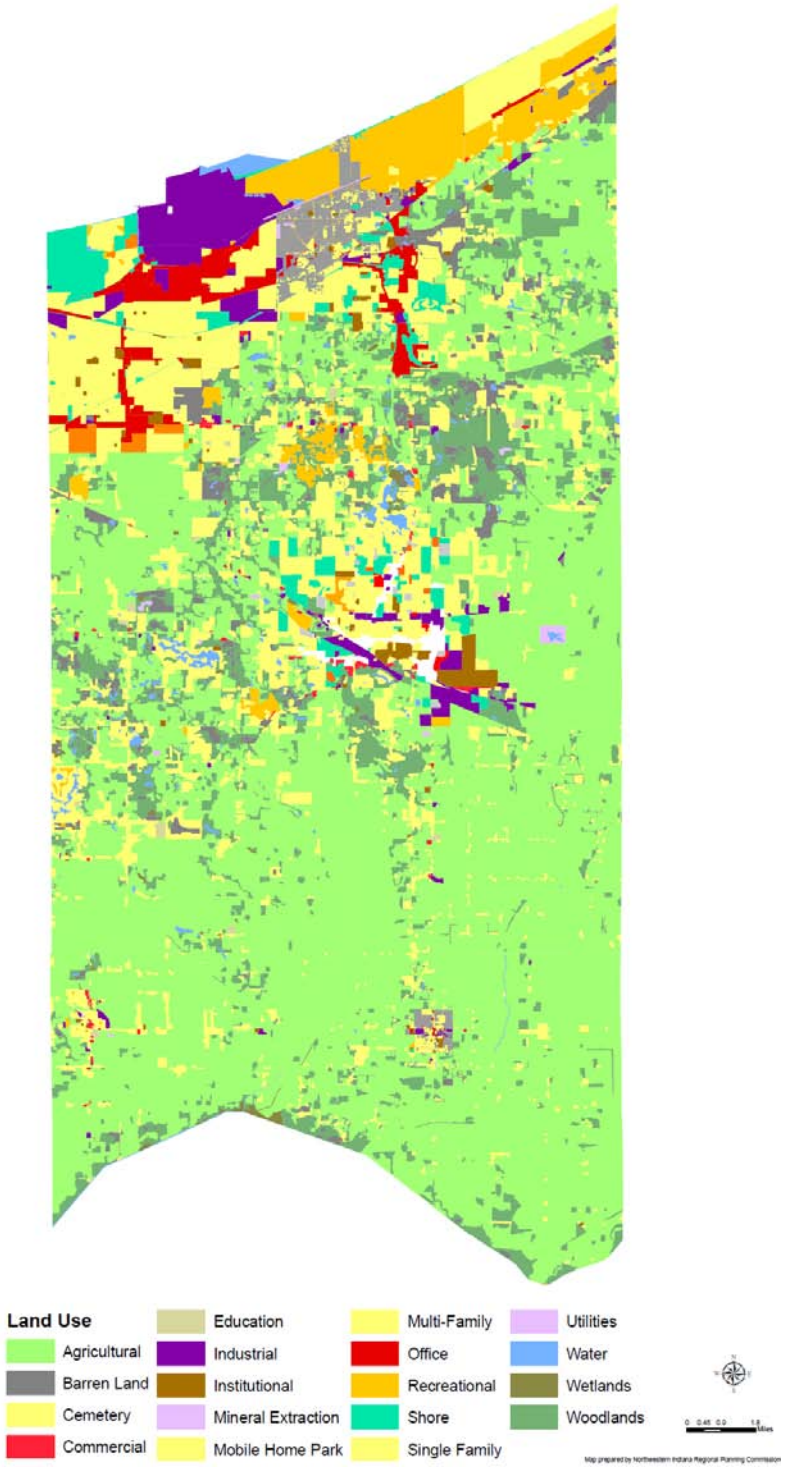
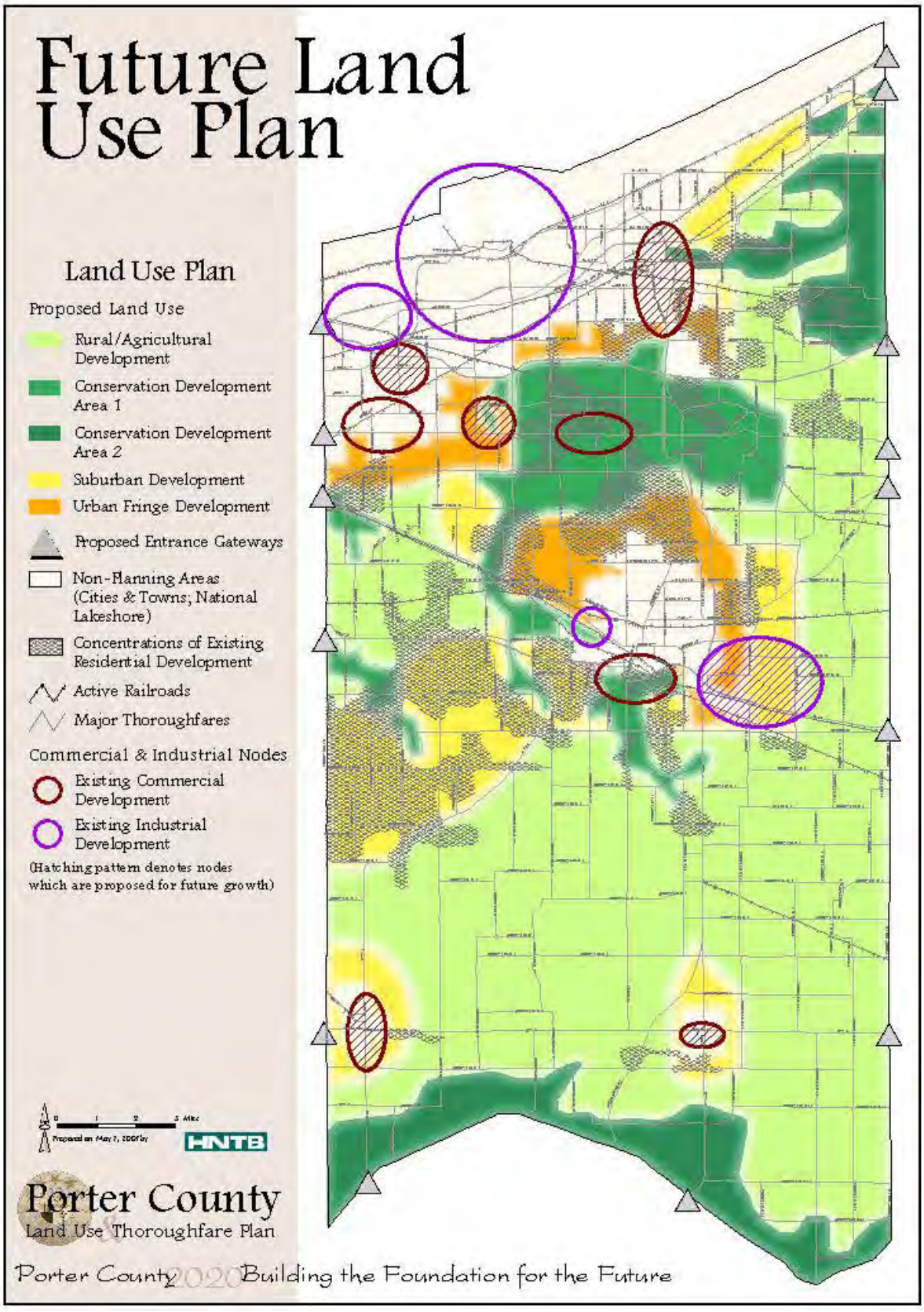


Figure 3-3: Porter County Future Land Use Map



3.7 Major Lakes, Rivers, and Watersheds

Porter County is bounded on the north by Lake Michigan. There are no other significant lakes or rivers in the county. A list of 14-digit Hydrologic Unit Code (HUC) watersheds is included in Table 3-4.

Table 3-4: Watersheds

Watershed Name	HUC Code
Lake Michigan Shoreline-Indiana Harbor Canal	04040001020010
Deep River-Deer Creek	04040001030050
Deep River-Lake George Dam	04040001030060
Duck Creek (Lake)	04040001040010
Deep River-Little Calumet River	04040001040020
Burns Ditch-Willow Creek	04040001040030
Salt Creek-Sagers Lake/Valparaiso	04040001050010
Salt Creek-Clark Ditch	04040001050020
Salt Creek-Pepper Creek	04040001050030
Damon Run	04040001050040
Salt Creek-Squirrel Creek	04040001050050
Little Calumet River-Reynolds Creek	04040001060010
Little Calumet River-Kemper Ditch	04040001060020
Little Calumet River-Sand/Coffee Creeks	04040001060030
Little Calumet River-Burns Ditch Outlet	04040001060040
Lake Michigan Shoreline-Dunes	04040001080010
Lake Michigan Shoreline-Dunes	04040001080010
Dunes Creek	04040001080020
Beverly Shores Tributary	04040001080030
Kintzele Ditch	04040001080040
Lake Michigan-Its Waters, Bays & Islands	04060200010010
Kankakee River-Payne/Rassmussen Ditches	07120001080070
Cook Ditch	07120001080080
Kankakee River-Lawton/Davis Ditches	07120001080090
Slocum Ditch	07120001090020
Greiger Ditch	07120001090030
Reeves Ditch	07120001090040
Crooked Creek-Headwaters (Porter)	07120001090050
West Branch Crooked Creek-Flint Lake	07120001090060
Crooked Creek-Snake Island School	07120001090070
Koselki Ditch	07120001090080
Crooked Creek-Hannon Ditch	07120001090090
Cobb Ditch-Sievers Creek	07120001090100
Cobb Ditch-Wolf Creek	07120001090110
Ahlgrim Ditch	07120001090120
Sandy Hook Ditch/Benkie Ditch-Kouts	07120001090130
Phillips Ditch-Cornell Ditch	07120001090140
Cobb Creek-Breyfogel Ditch	07120001090150

Watershed Name	HUC Code
Kankakee River-Brown Levee Ditch	07120001110020
East Branch Stony Run	07120001130010
Eagle Creek-Stony Run	07120001130020

Source: U.S. Geological Survey HUC14 Watersheds, 2006

Section 4 - Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation must be based on sound risk assessment. A risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people. This assessment identifies the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets. A risk assessment consists of three components—hazard identification, vulnerability analysis, and risk analysis.

4.1 Hazard Identification/Profile

4.1.1 Existing Plans

To facilitate the planning process, pre-existing plans were used for this hazard analysis section. These existing plans included Porter County Hazard Analysis (2009) and Indiana digital flood maps.

Previous planning efforts associated with the development of the Porter County Hazard Analysis identified the principal natural hazards to Porter County (not in order of priority): 1) tornadoes, 2) river flooding, which most often occurs because of severe storms and spring rains; 3) severe winds that accompany thunderstorms; and 4) severe winter weather, which includes snow storms as well as sleet and ice storms.

The plan also identified Porter County's principal technological hazards (not in order of priority): 1) hazardous material incidents (fixed-sites and transportation-related); 2) air transportation accidents; 3) structural fires, one of the nation's deadliest hazards; 4) pipeline fires which can burn for weeks and cause serious environmental damage; and 5) disaster-related infrastructure failures, which can result in millions of dollars of damage and severly impact public health and public safety in all areas of the county.

4.1.2 National Hazard Records

4.1.2.1 National Climatic Data Center (NCDC) Records

To assist the planning team, historical storm event data was compiled from the National Climatic Data Center (NCDC). NCDC records are estimates of damage reported to the National Weather Service from various local, state, and federal sources. However, these estimates are often

preliminary in nature and may not match the final assessment of economic and property losses related to given weather events.

The NCDC data included 245 reported events in Porter County between January 1, 1950, and October 31, 2009. A summary table of events related to each hazard type is included in the hazard profile sections that follow. A full table listing all events, including additional details, is included as Appendix D. In addition to NCDC data, Storm Prediction Center (SPC) data associated with tornadoes, strong winds, and hail were plotted using SPC recorded latitude and longitude. These events are plotted and included as Appendix E. The list of NCDC hazards is in Table 4-1.

Table 4-1: Climatic Data Center Historical Hazards

Hazard
Tornadoes
Severe Thunderstorms
Drought/Extreme Heat
Winter Storms
Flood/Flash flood

4.1.2.2 FEMA Disaster Information

In the past decade, FEMA has declared a number of emergencies and disasters for the state of Indiana. Emergency declarations allow states access to FEMA funds for Public Assistance (PA); disaster declarations allow for even more PA funding including Individual Assistance (IA) and the Hazard Mitigation Grant Program (HMGP). Porter County has received federal aid for both PA and IA funding for seven declared disasters since 1998. Figure 4-1 depicts the disasters and emergencies that have been declared for Porter County within the past decade. Table 4-2 lists more specific information for each declaration.

Figure 4-1: FEMA-Declared Emergencies and Disasters in Porter County (1998-2009)

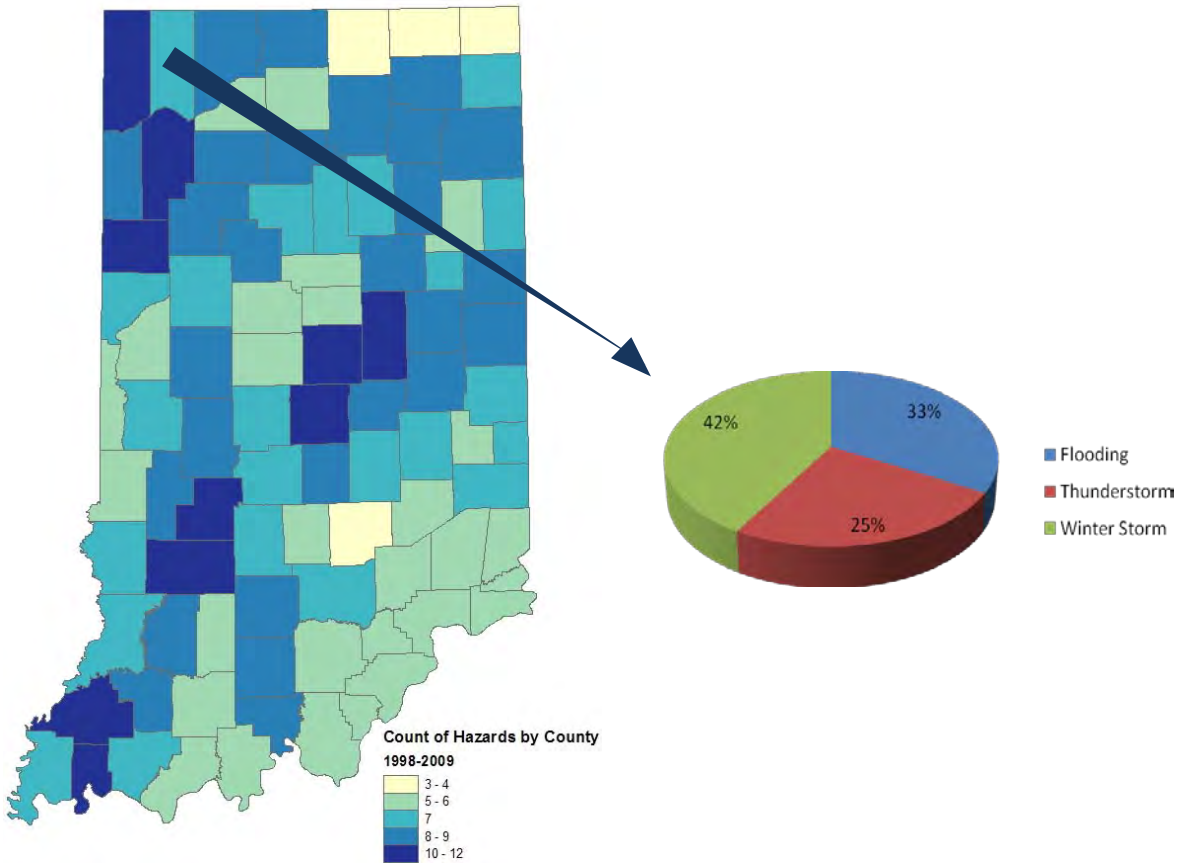


Table 4-2: FEMA-Declared Emergencies in Porter County (1998-2009)

Date of Incident	Date of Declaration	Disaster Description	Type of Assistance
3/09/98 - 3/12/98	5/8/1998	Severe Winter Storms	Public
1/01/99 - 1/31/99	1/15/1999	Severe Winter Storms	Public
12/11/00 - 12/31/00	1/24/2001	Severe Winter Storms	Public
7/04/03 - 8/06/03	7/11/2003	Severe Storms, Tornadoes, and Flooding	Individual
1/01/05 - 2/11/05	1/21/2005	Severe Winter Storms and Flooding	Individual
2/12/07 - 2/14/07	3/12/2007	Severe Winter Storms	Public
9/12/08 - 10/6/08	9/23/2008	Severe Storms and Flooding	Public and Individual

4.1.3 Hazard Ranking Methodology

During Meeting #2, held on October 22, 2009, the planning team reviewed historical hazards information and participated in a risk analysis using a projector and Excel spreadsheet. The spreadsheet listed the compiled NCDC data for each community.

The spreadsheet calculated the probability rating (Low, Medium, High) of each hazard based on the number of events that have occurred in the county within the past 50 years. Throughout the planning process, the MHMP team had the opportunity to update the NCDC data with more accurate local information. For example, the NCDC records often list the locations of hazards such as floods under the county, not accounting for how the individual communities were

affected. In such situations, the probability rating assigned to the county was applied to all jurisdictions within the county.

Team consensus was also important in determining the probability of hazards not recorded by NCDC, such as dam and levee failure and hazardous materials spills. The probabilities for these hazardous events were determined by the planning team's estimation, derived from local experience and records, of the number of historical events that have occurred within the past 50 years. The probability ratings are based on the following guidelines:

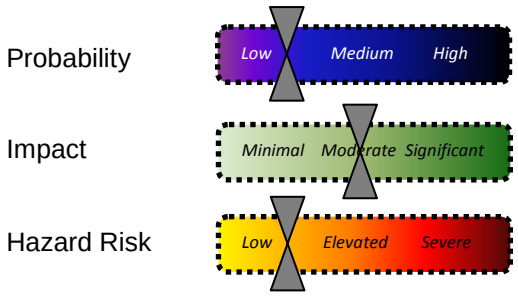
- Low = 0-5 events
- Medium = 6-15 events
- High = 16+ events

After improving the NCDC data with additional local data, the team determined each hazard's potential impact on the communities. The impact rating (Minimal, Moderate, Significant) was based on the following guidelines.

- Minimal = Few injuries
Critical facilities shut down for 24 hours
Less than 15% of property damaged
- Moderate = Multiple injuries
Critical facilities shut down for 1-2 weeks
At least 30% of property damaged
- Significant = Multiple deaths
Critical facilities shut down for more than 1 month
More than 50% of property damaged

Finally, the overall hazard risk was determined by multiplying probability and impact. It is important to consider both probability and impact when determining risk. For example, if an asteroid were to collide with Earth, the impact would be extreme; but the probability of an asteroid strike (has not happened in billions of years) is so negligibly small that the overall risk is extremely low. There has never been a situation in human history in which a person was killed by a meteor. In contrast, other potentially damaging events like thunderstorms and floods are relatively less severe, but have occurred regularly in many places.

Each hazard addressed within the plan will use sliding scales to represent the probability, impact, and overall risk ratings. The scales will be depicted as follows:



The planning team identified severe thunderstorms, severe winter weather, and hazardous materials releases as the three most significant hazards affecting Porter County. The hazard rankings are listed in Table 4-3.

Table 4-3: Porter County Hazards

HAZARD CATEGORIES	PROBABILITY RATING	HAZARD IMPACT	HAZARD RISK
	Low, Medium, High	Minimal, Moderate, Significant	Low, Elevated, Severe
PORTER COUNTY (ALL)			
Tornado	High	Minimal	Low
Flood	High	Minimal	Low
Dam/Levee Failure	High	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm/	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
BEVERLY SHORES			
Tornado	High	Significant	Severe
Flood	Low	Minimal	Low
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm/	High	Significant	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	Low	Minimal	Low
BURNS HARBOR			
Tornado	High	Moderate	Severe
Flood	Low	Minimal	Low
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
CHESTERTON			
Tornado	High	Moderate	Severe
Flood	High	Significant	Severe
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm/	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low

HAZARD CATEGORIES	PROBABILITY RATING	HAZARD IMPACT	HAZARD RISK
DUNE ACRES			
Tornado	High	Minimal	Low
Flood	Low	Minimal	Low
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm/	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
HEBRON			
Tornado	High	Significant	Severe
Flood	Medium	Moderate	Elevated
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm/	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
KOUTS			
Tornado	High	Significant	Severe
Flood	Medium	Moderate	Elevated
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm/	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
OGDEN DUNES			
Tornado	High	Moderate	Elevated
Flood	Low	Moderate	Elevated
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
PORTAGE			
Tornado	High	Moderate	Severe
Flood	High	Moderate	Severe
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe

HAZARD CATEGORIES	PROBABILITY RATING	HAZARD IMPACT	HAZARD RISK
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
PORTER (TOWN)			
Tornado	High	Moderate	Severe
Flood	High	Significant	Severe
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm/	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
TOWN OF PINES			
Tornado	High	Significant	Severe
Flood	High	Moderate	Severe
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low
VALPARAISO			
Tornado	High	Significant	Severe
Flood	High	Minimal	Low
Dam/Levee Failure	Low	Minimal	Low
Earthquake	Low	Significant	Elevated
Severe Thunderstorm/Hail/ Lightning/High Wind	High	Moderate	Severe
Winter Weather (snow & ice)	High	Moderate	Severe
Drought/Extreme Heat	Low	Minimal	Low
Hazardous Materials Release	High	Significant	Severe
Structural Failure & Fires	High	Minimal	Low

4.1.4 GIS and HAZUS-MH

The third step in this assessment is the risk analysis, which quantifies the risk to the population, infrastructure, and economy of the community. Where possible, the hazards were quantified using GIS analyses and HAZUS-MH. This process reflects a level two approach to analyzing hazards as defined for HAZUS-MH. The approach includes substitution of selected default data with local data. This process improved the accuracy of the model predictions.

HAZUS-MH generates a combination of site-specific and aggregated loss estimates depending upon the analysis options that are selected and the input that is provided by the user. Aggregate inventory loss estimates, which include building stock analysis, are based upon the assumption that building stock is evenly distributed across census blocks/tracts. Therefore, it is possible that

overestimates of damage will occur in some areas while underestimates will occur in other areas. With this in mind, total losses tend to be more reliable over larger geographic areas than for individual census blocks/tracts. It is important to note that HAZUS-MH is not intended to be a substitute for detailed engineering studies. Rather, it is intended to serve as a planning aid for communities interested in assessing their risk to flood-, earthquake-, and hurricane-related hazards. This documentation does not provide full details on the processes and procedures completed in the development of this project. It is only intended to highlight the major steps that were followed during the project.

Site-specific analysis is based upon loss estimations for individual structures. For flooding, analysis of site-specific structures takes into account the depth of water in relation to the structure. HAZUS-MH also takes into account the actual dollar exposure to the structure for the costs of building reconstruction, content, and inventory. However, damages are based upon the assumption that each structure will fall into a structural class, and structures in each class will respond in a similar fashion to a specific depth of flooding or ground shaking. Site-specific analysis is also based upon a point location rather than a polygon, therefore the model does not account for the percentage of a building that is inundated. These assumptions suggest that the loss estimates for site-specific structures as well as for aggregate structural losses need to be viewed as approximations of losses that are subject to considerable variability rather than as exact engineering estimates of losses to individual structures.

The following events were analyzed. The parameters for these scenarios were created though GIS, HAZUS-MH, and historical information to predict which communities would be at risk.

Using HAZUS-MH

1. 100-year overbank flooding
2. Earthquake scenarios

Using GIS

1. Tornado
2. Hazardous material release

4.2 Vulnerability Assessment

4.2.1 Asset Inventory

4.2.1.1 Processes and Sources for Identifying Assets

The HAZUS-MH data is based on best available national data sources. The initial step involved updating the default HAZUS-MH data using State of Indiana data sources. At Meeting #1, the planning team members were provided with a plot and report of all HAZUS-MH critical facilities. The planning team took GIS data provided by The Polis Center; verified the datasets using local knowledge, and allowed The Polis Center to use their local GIS data for additional verification. Polis GIS analysts made these updates and corrections to the HAZUS-MH data tables prior to performing the risk assessment. These changes to the HAZUS-MH inventory reflect a level two analysis. This update process improved the accuracy of the model predictions.

The default HAZUS-MH data has been updated as follows:

- The HAZUS-MH defaults, critical facilities, and essential facilities have been updated based on the most recent available data sources. Critical and essential point facilities have been reviewed, revised, and approved by local subject matter experts at each county.
- The essential facility updates (schools, medical care facilities, fire stations, police stations, and EOCs) have been applied to the HAZUS-MH model data. HAZUS-MH reports of essential facility losses reflect updated data.

The default aggregate building inventory tables have been replaced with the most recent Assessor records. Porter County provided the parcel boundaries to The Polis Center, and Indiana Department of Local Government and Finance provided the Porter County Assessor records. Records without improvements were deleted. The parcel boundaries were converted to parcel points located in the centroids of each parcel boundary. Each parcel point was linked to an Assessor record based upon matching parcel numbers. The generated building inventory points represent the approximate locations (within a parcel) of building exposure. The parcel points were aggregated by census block.

Parcel-matching results for Porter County are listed in Table 4-4.

Table 4-4: Parcel-Matching for Porter County

Data Source	Count
Assessor Records	64,954
County Provided Parcels	79,973
Assessor Records with Improvements	55,914
Matched Parcel Points	55,801

The following assumptions were made during the analysis:

- The building exposure is determined from the Assessor records. It is assumed that the population and the buildings are located at the centroid of the parcel.
- The algorithm used to match county-provided parcel point locations with the Assessor records is not perfect. The results in this analysis reflect matched parcel records only. The parcel-matching results for Porter County are included in Table 4-4.
- Population counts are based upon 2.5 persons per household. Only residential occupancy classes are used to determine the impact on the local population. If the event were to occur at night, it would be assumed that people are at home (not school, work, or church).
- The analysis is restricted to the county boundaries. Events that occur near the county boundaries do not contain damage assessments from adjacent counties.

4.2.1.2 Essential Facilities List

Table 4-5 identifies the essential facilities that were added or updated for the analysis. Essential facilities are a subset of critical facilities. A complete list of critical facilities is included as Appendix E. A map of all critical facilities is included as Appendix F.

Table 4-5: Essential Facilities List

Facility	Number of Facilities
Care Facilities	13
Emergency Operations Centers	1
Fire Stations	27
Police Stations	11
Schools	67

4.2.1.3 Facility Replacement Costs

Facility replacement costs and total building exposure are identified in Table 4-6. The replacement costs have been updated by local data. Table 4-6 also includes the estimated number of buildings within each occupancy class.

The Assessor records often do not distinguish parcels by occupancy class when the parcels are not taxable; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

Table 4-6: Building Exposure

General Occupancy	Estimated Total Buildings	Total Building Exposure (X 1000)
Agricultural	631	$85,598
Commercial	1,912	$970,404
Education	75	$222,882
Government	111	$36,392
Industrial	238	$919,998
Religious/Non-Profit	717	$246,859
Residential	52,117	$7,854,174
Total	**55,801**	**$10,336,307**

4.3 Future Development

As the county's population continues to grow, the residential and urban areas will extend further into the county, placing more pressure on existing transportation and utility infrastructure while increasing the rate of farmland conversion; Porter County will address specific mitigation strategies in Section 5 to alleviate such issues.

Because Porter County is vulnerable to a variety of natural and technological threats, the county government—in partnership with state government—must make a commitment to prepare for the management of these types of events. Porter County is committed to ensuring that county elected

and appointed officials become informed leaders regarding community hazards so that they are better prepared to set and direct policies for emergency management and county response.

4.4 Hazard Profiles

4.4.1 Tornado Hazard

Hazard Definition for Tornado Hazard

Tornadoes pose a great risk to the state of Indiana and its citizens. Tornadoes can occur at any time during the day or night. They can also happen during any month of the year. The unpredictability of tornadoes makes them one of Indiana's most dangerous hazards. Their extreme winds are violently destructive when they touch down in the region's developed and populated areas. Current estimates place the maximum velocity at about 300 miles per hour, but higher and lower values can occur. A wind velocity of 200 miles per hour will result in a wind pressure of 102.4 pounds per square foot of surface area—a load that exceeds the tolerance limits of most buildings. Considering these factors, it is easy to understand why tornadoes can be so devastating for the communities they hit.

Tornadoes are defined as violently-rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground; however, the violently-rotating column of air can reach the ground very quickly and become a tornado. If the funnel cloud picks up and blows debris, it has reached the ground and is a tornado.

Tornadoes are classified according to the Fujita tornado intensity scale. The tornado scale ranges from low intensity F0 with effective wind speeds of 40 to 70 miles per hour to F5 tornadoes with effective wind speeds of over 260 miles per hour. The Fujita intensity scale is included in Table 4-7.

Table 4-7: Fujita Tornado Rating

Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
0 *Gale*	40-72 mph	6-17 yards	0.3-0.9 miles	Light damage, some damage to chimneys, branches broken, sign boards damaged, shallow-rooted trees blown over.
1 *Moderate*	73-112 mph	18-55 yards	1.0-3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes pushed off foundations, attached garages damaged.
2 *Significant*	113-157 mph	56-175 yards	3.2-9.9 miles	Considerable damage, entire roofs torn from frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted.
3 *Severe*	158-206 mph	176-566 yards	10-31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.
4 *Devastating*	207-260 mph	0.3-0.9 miles	32-99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
5 *Incredible*	261-318 mph	1.0-3.1 miles	100-315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

Source: NOAA Storm Prediction Center

Previous Occurrences of Tornado Hazard

There have been several occurrences of tornadoes within Porter County during the past few decades. The NCDC database reported 19 tornadoes/funnel clouds in Porter County since 1950.

On August 19, 2009, a tornado touched down in southern Chesterton east of 11th Street and southwest of South Park Drive. The tornado quickly intensified as it moved to the northeast and caused the partial collapse of a gymnasium roof at the Chesterton Junior High School. A wind gust of 105 miles per hour was measured by an anemometer near the school. The tornado was rated F1 at this point with a path width of 40 yards. The tornado continued to track to the northeast reaching winds of 120 miles per hour. The tornado damage was rated F2 through this area with a path width of 60 yards. In Chesterton, 211 structures sustained damage; eight of these were completely destroyed and 54 suffered major damage, such as trees falling through roofs. County officials participated in a formal After Action Review (AAR) on August 28, 2009, to evaluate the response and management of the event. The full report is included in Appendix B.

Photo of August 19 tornado in Chesterton, *Source: NWS*

The Porter County NCDC recorded tornadoes are identified in Table 4-8. Additional details for NCDC events are included in Appendix D.

Table 4-8: Porter County Tornadoes*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Porter	04/05/58	Tornado	F	0	0	3K	0
Porter	06/08/58	Tornado	F1	0	0	25K	0
Porter	04/30/60	Tornado	F1	0	1	0K	0
Porter	04/30/62	Tornado	F3	0	0	3K	0
Porter	06/10/63	Tornado	F0	0	0	0K	0
Porter	04/11/65	Tornado	F3	0	0	25.0M	0
Porter	04/25/65	Tornado	F	0	0	0K	0
Porter	07/09/66	Tornado	F0	0	0	3K	0
Porter	07/09/66	Tornado	F1	0	0	0K	0
Porter	10/24/67	Tornado	F3	0	0	25K	0
Porter	06/20/74	Tornado	F1	0	0	25K	0
Porter	04/18/75	Tornado	F0	0	4	25K	0
Porter	03/12/76	Tornado	F3	0	0	250K	0
Porter	03/12/76	Tornado	F2	0	0	3K	0
Porter	05/30/80	Tornado	F1	1	0	0K	0
Porter	06/06/80	Tornado	F0	0	0	0K	0
Porter	08/03/88	Tornado	F1	0	0	0K	0
Hebron	05/18/00	Tornado	F0	0	0	0	0
Chesterton	08/19/09	Tornado	F2	0	0	1.5M	0K

** NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.*

Geographic Location for Tornado Hazard

The entire county has the same risk for occurrence of tornadoes. They can occur at any location within the county.

Hazard Extent for Tornado Hazard

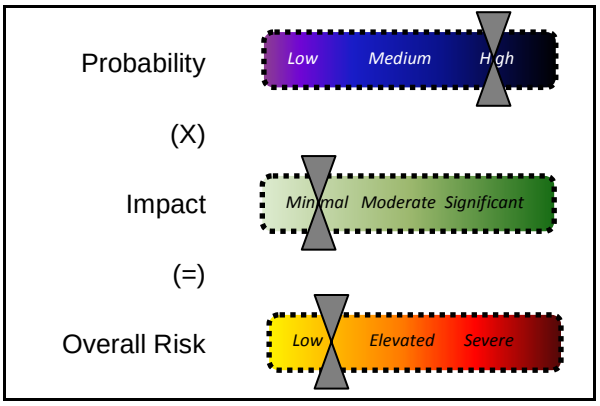
The historical tornadoes generally moved from southwest to northeast across the county. The extent of the hazard varies both in terms of the extent of the path and the wind speed.

Risk Identification for Tornado Hazard

Based on historical information, the probability of a tornado is high. Tornadoes with varying magnitudes are expected to occur. In Meeting #2, the planning team determined that the potential impact of a tornado is minimal; therefore, the overall risk of a tornado hazard for Porter County is low.

Vulnerability Analysis for Tornado Hazard

Tornadoes can occur within any area in the county; therefore, the entire county population and all buildings are vulnerable to tornadoes. To accommodate this risk, this plan will consider all buildings located within the county as vulnerable. The existing buildings and infrastructure in Porter County are summarized in Table 4-6.



Critical Facilities

All critical facilities are vulnerable to tornadoes. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts will vary based on the magnitude of the tornado but can include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, and loss of facility functionality (e.g. a damaged police station will no longer be able to serve the community). Table 4-5 lists the types and numbers of all of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Building Inventory

The building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-6. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, and loss of building function (e.g. damaged home will no longer be habitable, causing residents to seek shelter).

Infrastructure

During a tornado the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a tornado. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g. loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could fail or become impassable, causing risk to traffic.

An example scenario is described as follows to gauge the anticipated impacts of tornadoes in the county, in terms of numbers and types of buildings and infrastructure.

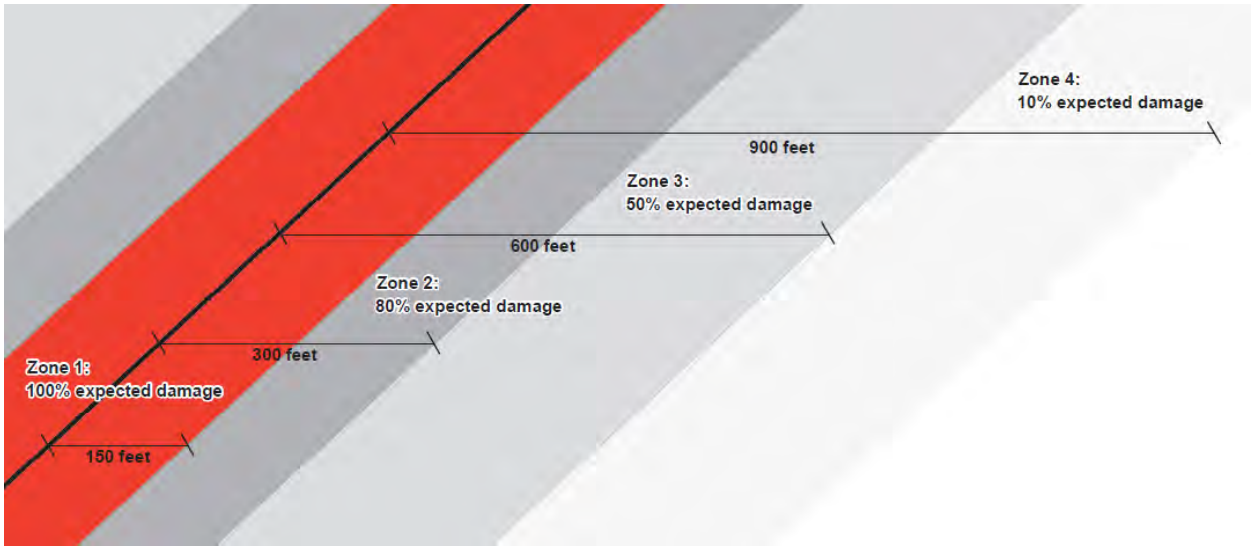
GIS overlay modeling was used to determine the potential impacts of an F4 tornado. The analysis used a hypothetical path based upon the F4 tornado event that would run for 13.5 miles through the towns of Portage, Burns Harbor, and Porter. The selected widths were modeled after a recreation of the Fujita-Scale guidelines based on conceptual wind speeds, path widths, and path lengths. There is no guarantee that every tornado will fit exactly into one of these six categories. Table 4-9 depicts tornado damage curves as well as path widths.

Table 4-9: Tornado Path Widths and Damage Curves

Fujita Scale	Path Width (feet)	Maximum Expected Damage
5	2,400	100%
4	1,800	100%
3	1,200	80%
2	600	50%
1	300	10%
0	150	0%

Within any given tornado path there are degrees of damage. The most intense damage occurs within the center of the damage path with decreasing amounts of damage away from the center. After the hypothetical path is digitized on a map, the process is modeled in GIS by adding buffers (damage zones) around the tornado path. Figure 4-2 and Table 4-10 describe the zone analysis. The selected hypothetical tornado path is depicted in Figure 4-3, and the damage curve buffers are shown in Figure 4-4.

Figure 4-2: F4 Tornado Analysis Using GIS Buffers



An F4 tornado has four damage zones, depicted in Table 4-10. Total devastation is estimated within 150 feet of the tornado path. The outer buffer is 900 feet from the tornado path, within which buildings will experience 10% damage.

Table 4-10: F4 Tornado Zones and Damage Curves

Zone	Buffer (feet)	Damage Curve
1	0-150	100%
2	150-300	80%
3	300-600	50%
4	600-900	10%

Figure 4-3: Hypothetical F4 Tornado Path in Porter County

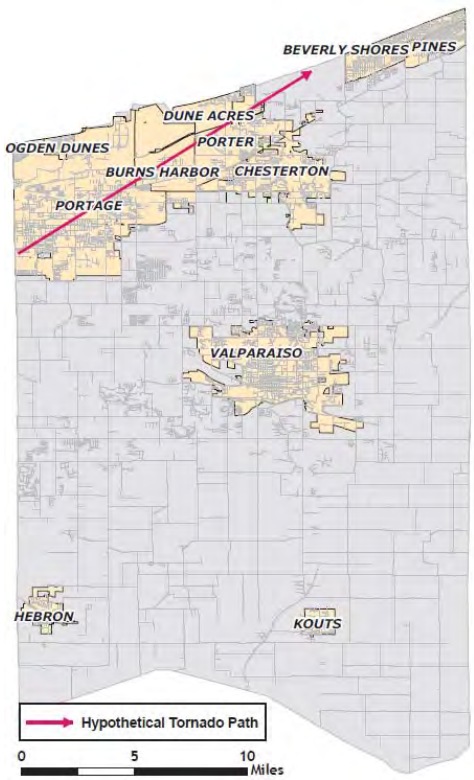
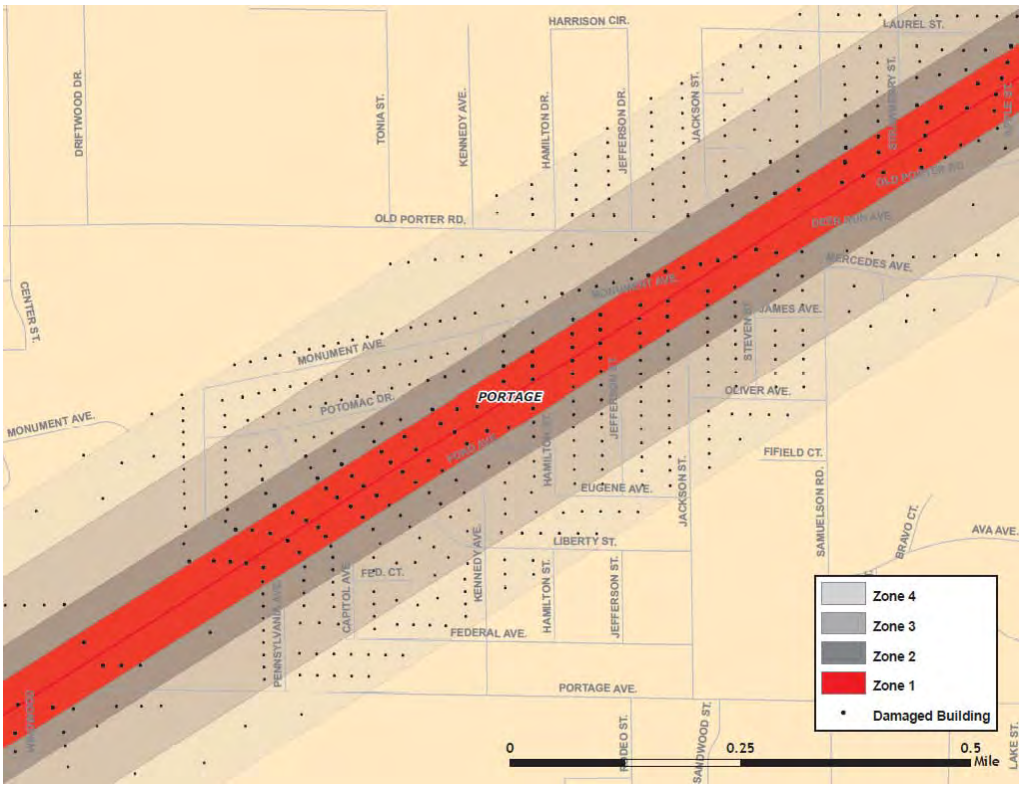


Figure 4-4: Modeled F4 Tornado Damage Buffers in Porter County



The results of the analysis are depicted in Tables 4-11 and 4-12. The GIS analysis estimates that 2,024 buildings will be damaged. The estimated building losses were $136.5 million. The building losses are an estimate of building replacement costs multiplied by the percentages of damage. The overlay was performed against parcels provided by Porter County that were joined with Assessor records showing property improvement.

The Assessor records often do not distinguish parcels by occupancy class when the parcels are not taxable; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

Table 4-11: Estimated Numbers of Buildings Damaged by Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	363	334	664	585
Commercial	5	9	18	19
Industrial	1	1	0	0
Agriculture	0	0	0	1
Religious	1	2	7	7
Government	0	0	3	4
Education	0	0	0	0
Total	**370**	**346**	**692**	**616**

Table 4-12: Estimated Building Losses by Occupancy Type (X 1000)

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	$41,098	$29,740	$37,534	$6,839
Commercial	$7,392	$2,403	$2,978	$544
Industrial	$1,369	$3,686	$0	$0
Agriculture	$0	$0	$0	$33
Religious	$55	$1,039	$921	$127
Government	$0	$0	$689	$73
Education	$0	$0	$0	$0
Total	**$49,913**	**$36,868**	**$42,123**	**$7,616**

Critical Facility Damage

There are seven critical facilities located within 900 feet of the hypothetical tornado path. The model predicts that one police department, two fire departments, and four schools would experience damage. The affected facilities are identified in Table 4-13, and Figure 4-5 shows the geographic location of some facilities.

Table 4-13: Estimated Critical Facilities Affected

Name
Burns Harbor Police Department
Burns Harbor Fire Department
Portage Fire Department #3
Wallace Aylesworth Elementary
Central Elementary
Willowcreek Middle School
George L. Myers Elementary

Figure 4-5: Critical Facilities within Tornado Path

Vulnerability to Future Assets/Infrastructure for Tornado Hazard

The entire population and buildings have been identified as at risk because tornadoes can occur anywhere within the state of Indiana, at any time of the day, and during any month of the year. Furthermore, any future development in terms of new construction within the county will be at risk. The building exposure for Porter County is included in Table 4-6.

All critical facilities in the county and communities within the county are at risk. Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warnings of approaching storms are also vital to preventing the loss of property and ensuring the safety of Porter County residents.

4.4.2 Flood Hazard

Hazard Definition for Flooding

Flooding is a significant natural hazard throughout the United States. The type, magnitude, and severity of flooding are functions of the amount and distribution of precipitation over a given area, the rate at which precipitation infiltrates the ground, the geometry and hydrology of the catchment, and flow dynamics and conditions in and along the river channel. Floods can be classified as one of two types: upstream floods or downstream floods. Both types of floods are common in Indiana.

January 2008 flooding in Porter County

Upstream floods, also called flash floods, occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage, and sometimes loss of life, due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person; another 18 inches might carry off a car. Generally, upstream floods cause damage over relatively localized areas, but they can be quite severe in the local areas in which they occur. Urban flooding is a type of upstream flood. Urban flooding involves the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Upstream or flash floods can occur at anytime of the year in Indiana, but they are most common in the spring and summer months.

Downstream floods, sometimes called riverine floods, refer to floods on large rivers at locations with large upstream catchments. Downstream floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for downstream floods than for upstream floods, generally providing ample warning for people to move to safe locations and, to some extent, secure some property against damage. Riverine flooding on the large rivers of Indiana generally occurs during either the spring or summer.

Hazard Definition for Dam and Levee Failure

Dams are structures that retain or detain water behind a large barrier. When full or partially full, the difference in elevation between the water above the dam and below creates large amounts of potential energy, creating the potential for failure. The same potential exists for levees when they serve their purpose, which is to confine flood waters within the channel area of a river and exclude that water from land or communities land-ward of the levee. Dams and levees can fail due to either 1) water heights or flows above the capacity for which the structure was designed; or 2) deficiencies in the structure such that it cannot hold back the potential energy of the water. If a dam or levee fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage.

Many communities view both dams and levees as permanent and infinitely safe structures. This sense of security may well be false, leading to significantly increased risks. Both downstream of dams and on floodplains protected by levees, security leads to new construction, added infrastructure, and increased population over time. Levees in particular are built to hold back flood waters only up to some maximum level, often the 100-year (1% annual probability) flood event. When that maximum is exceeded by more than the design safety margin, the levee will be overtopped or otherwise fail, inundating communities in the land previously protected by that levee. It has been suggested that climate change, land-use shifts, and some forms of river engineering may be increasing the magnitude of large floods and the frequency of levee failure situations.

In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. Many structures across the U.S. have been under-funded or otherwise neglected, leading to an eventual day of reckoning in the form either of realization that the structure is unsafe or, sometimes, an actual failure. The threat of dam or levee failure may require substantial commitment of time, personnel, and resources. Since dams and levees deteriorate with age, minor issues become larger compounding problems, and the risk of failure increases.

Previous Occurrences of Flooding

The NCDC database reported 22 flood events in Porter County since 1950. For example, on January 8, 2008, several roads were closed due to flooding. Numerous basements were flooded. The Chesterton wastewater plant measured 3.25 inches of rainfall. Heavy rain fell across northwest Indiana, which caused significant flooding.

January 2008 flooding in Porter County

Porter County NCDC recorded floods are identified in Table 4-14. Additional details for NCDC events are included in Appendix D.

Table 4-14: Porter County Previous Occurrences of Flooding*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Porter	01/01/93	Flood	N/A	0	0	5.0M	0
Porter	10/17/93	Flood	N/A	0	0	500K	500K
Porter	05/09/96	Flash Flood	N/A	0	0	0	0
Porter	07/17/96	Flash Flood	N/A	0	0	0	0
Porter	08/06/00	Flash Flood	N/A	0	0	0	0
Porter	07/17/03	Flash Flood	N/A	0	0	0	0
Hebron	07/21/03	Flash Flood	N/A	0	0	0	0
Porter	05/14/04	Flash Flood	N/A	0	0	0	0
Kouts	05/30/04	Flash Flood	N/A	0	0	0	0
Porter	02/16/05	Flood	N/A	0	0	0	0
Valparaiso	08/15/07	Flash Flood	N/A	0	0	0K	0K
Valparaiso	08/24/07	Flood	N/A	0	0	25K	0K

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Dune Acres	01/08/08	Flood	N/A	0	0	100K	0K
Hebron	08/05/08	Flood	N/A	0	0	0K	0K
Hebron	09/13/08	Flash Flood	N/A	0	0	1.0M	0K
Dune Acres	09/13/08	Flash Flood	N/A	0	0	0K	0K
Ogden Dunes	09/14/08	Flash Flood	N/A	2	0	2.0M	0K
Ogden Dunes	09/14/08	Flood	N/A	0	0	0K	0K
Clanricarde	03/14/09	Flash Flood	N/A	0	0	0K	0K
Burlington Beach	04/05/09	Flood	N/A	0	0	0K	0K
Ogden Dunes	06/11/09	Flash Flood	N/A	0	0	5K	0K
Ogden Dunes	07/28/09	Flood	N/A	0	0	0K	0K

** NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.*

Previous Occurrences of Dam and Levee Failure

In Meeting #2, the Porter County planning team related information regarding previous occurrences for dam failure. Although there have been no recorded dam failures, the potential for failure makes it necessary for periodic inspections of Sagers Lake dam and the dam between Long and Flint lakes in Valparaiso.

Repetitive Loss Properties

FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the NFIP, which has suffered flood loss damage on two occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is 25% of the market value of the structure at the time of each flood loss.

Indiana Department of Natural Resources (IDNR) and the Indiana Department of Homeland Security (IDHS) were contacted to determine the location of repetitive loss structures. Table 4-15 lists 2006 data including the total amount paid for building replacement and building contents for damages to these repetitive loss structures.

Table 4-15: Porter County Repetitive Loss Structures

Jurisdiction	Occupancy Type	Number of Structures	Number of Losses	Total Paid
Porter City	Single Family	1	2	$26,090.40
Chesterton	Non-Residential	1	2	$7,228.91
Chesterton	Single Family	1	2	$5,679.30
Rochester Park	Single Family	1	2	$17,694.24
Portage	Non-Residential	1	4	$19,802.82
Valparaiso	Non-Residential	3	7	$224,010.70
Valparaiso	Single Family	8	20	$154,852.90
Valparaiso	2-4 Family	1	3	$13,655.30
Wheeler	Single Family	1	2	$5,901.74
Totals		**18**	**76**	**$474,916.31**

Geographic Location for Flooding

Most river flooding occurs in early spring and is the result of excessive rainfall and/or the combination of rainfall and snowmelt. Severe thunderstorms may cause flooding during the summer or fall, but tend to be localized. According to the Porter County Hazard Analysis, the primary source of river flooding is the Kankakee River.

Flash floods, brief heavy flows in small streams or normally dry creek beds, also occur within the county. Flash flooding is typically characterized by high-velocity water, often carrying large amounts of debris. Urban flooding involves the overflow of storm drain systems and is typically the result of inadequate drainage following heavy rainfall or rapid snowmelt.

IDNR recently digitized the paper FEMA Flood Insurance Rate Maps (FIRM). These digital files, although not official FIRMs, provided the boundary which was the basis for this analysis. The overbank flooding areas are depicted on the map in Appendix E. Flash flooding may occur countywide.

The National Oceanic and Atmospheric Administration (NOAA) Advanced Hydrologic Prediction Service provides information from gauge locations at points along various rivers across the United States. For Porter County, data is provided for two points: Kankakee River 5 S Kouts and Kankakee River at Dunns Bridge. Appendix G lists information pulled from the NOAA website, which includes flood categories, historical crests, and details about anticipated impacts to agricultural lands, dams, levees, and other built structures at significant flood crest levels.

Geographic Location for Dam and Levee Failure

The National Inventory of Dams identified five dams in Porter County. The map in Appendix F illustrates the location of Porter County dams. Table 4-16 summarizes the National Inventory of Dams information.

Table 4-16: National Inventory of Dams

Dam Name	River	Hazard	EAP
Lake of Four Seasons (Dam A)	Unnamed East Branch Stony Run Creek #1	H	N
Timber Point Dam	Unnamed Tributary Deep River	S	N
Lake Louise Dam	Unnamed Tributary Salt Creek	H	N
Lake of the Woods Dam	Unnamed Tributary Salt Creek	H	N
Rice Lake Dam	Unnamed Tributary Little Calumet River	S	N
Lake of Four Seasons (Dam B)	Tributary- East Brook: Stoney Run Creek	H	N
Old Longs Mill Dam	Coffee Creek	S	N
Loomis Lake Dam	Unnamed Tributary Flint Lake	H	N

A review of the Indiana Department of Natural Resource's files identified no certified levees in Porter County; however, there are a number of agricultural levees.

** The dams and levees listed in this multi-hazard mitigation plan are recorded from historical IDNR data. Their physical presences were not confirmed; therefore, new or unrecorded structures may exist. A more complete list of locations is included in Appendix F.*

Hazard Extent for Flooding

The HAZUS-MH flood model is designed to generate a flood depth grid and flood boundary polygon by deriving hydrologic and hydraulic information based on user-provided elevation data or by incorporating selected output from other flood models. HAZUS-MH also has the ability to clip a Digital Elevation Model (DEM) with a user-provided flood boundary, thus creating a flood depth grid. For Porter County, HAZUS-MH was used to extract flood depth by clipping the DEM with the IDNR FIRMs Base Flood Elevation (BFE) boundary. The BFE is defined as the area that has a 1% chance of flooding in any given year.

Flood hazard scenarios were modeled using GIS analysis and HAZUS-MH. The flood hazard modeling was based on historical occurrences and current threats. Existing IDNR flood maps were used to identify the areas of study. These digital files, although not official FIRMs, provided the boundary which was the basis for this analysis. Planning team input and a review of historical information provided additional information on specific flood events.

Hazard Extent for Dam and Levee Failure

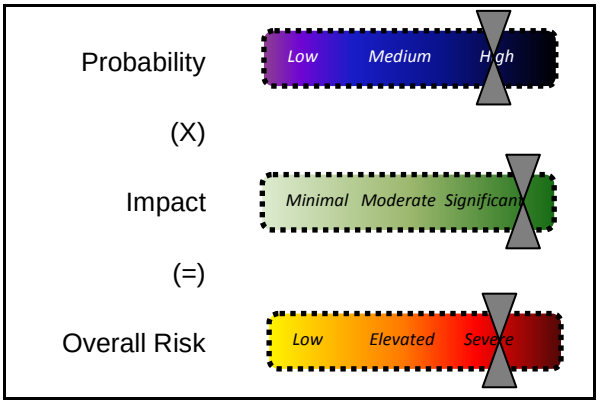
When dams are assigned the low (L) hazard potential classification, it means that failure or incorrect operation of the dam will result in no human life losses and no economic or environmental losses. Losses are principally limited to the owner's property. Dams assigned the significant (S) hazard classification are those dams in which failure or incorrect operation results in no probable loss of human life; however it can cause economic loss, environment damage, and disruption of lifeline facilities. Dams classified as significant hazard potential dams are often located in predominantly rural or agricultural areas, but could be located in populated areas with a significant amount of infrastructure. Dams assigned the high (H) hazard potential classification are those dams in which failure or incorrect operation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure.

According to IDNR and the National Inventory of Dams, five dams are classified as high hazard dams. No dams have an Emergency Action Plan (EAP). An EAP is not required by the State of Indiana but is strongly recommended in the 2003 Indiana Dam Safety & Inspection Manual.

Accurate mapping of the risks of flooding behind levees depends on knowing the condition and level of protection the levees actually provide. FEMA and the U.S. Army Corps of Engineers are working together to make sure that flood hazard maps clearly reflect the flood protection capabilities of levees, and that the maps accurately represent the flood risks posed to areas situated behind them. Levee owners—usually states, communities, or in some cases private individuals or organizations—are responsible for ensuring that the levees they own are maintained according to their design. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation, and maintenance standards for protection against the one-percent-annual chance flood.

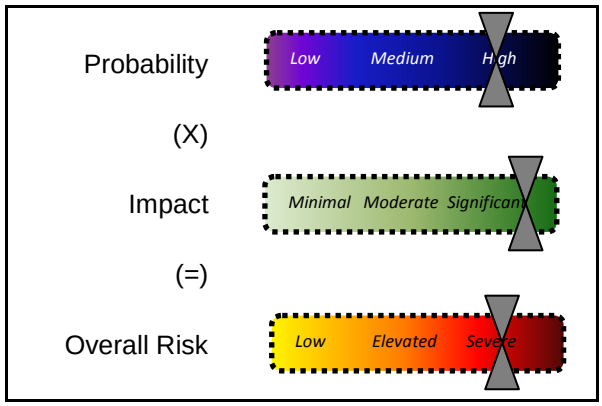
Risk Identification for Flood Hazard

Based on historical information, the probability of a flood is high. In Meeting #2, the planning team determined that the potential impact of a flood is minimal; therefore, the overall risk of a flood hazard for Porter County is low.



Risk Identification for Dam/Levee Failure

Based on historical information, the probability of dam/levee failure is high. In Meeting #2, the planning team determined that the potential impact of dam/levee failure is minimal; therefore, the overall risk of dam/levee failure for Porter County is low.



HAZUS-MH Analysis Using 100-Year Flood Boundary and County Parcels

HAZUS-MH generated the flood depth grid for a 100-year return period by clipping the IGS 1/3 ArcSecond (approximately 10 meters) Digital Elevation Model (DEM) to the Porter County flood boundary. Next, HAZUS-MH utilized a user-defined analysis of Porter County with site-specific parcel data provided by the county.

HAZUS-MH estimates the 100-year flood would damage 1,001 buildings at a replacement cost of $28.1 million. The total estimated numbers of damaged buildings are given in Table 4-17. Figure 4-6 depicts the Porter County parcel points that fall within the 100-year floodplain. Figures 4-7 and 4-8 highlight damaged buildings within the floodplain areas in Valparaiso and Chesterton.

Table 4-17: Porter County HAZUS-MH Building Damage

General Occupancy	Number of Buildings Damaged	Total Building Damage (x1000)
Residential	925	$26,184
Commercial	40	$1,566
Industrial	0	$0
Agricultural	18	$214
Religious	11	$14
Government	7	$100
Education	0	$0
Total	**1,001**	**$28,079**

Figure 4-6: Porter County Buildings in Floodplain (100-Year Flood)

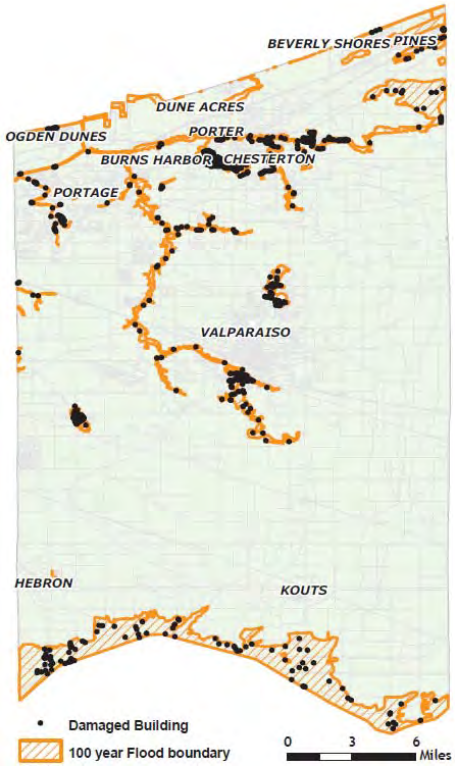


Figure 4-7: Porter County Urban Areas (Valparaiso) Flood-Prone Areas (100-Year Flood)

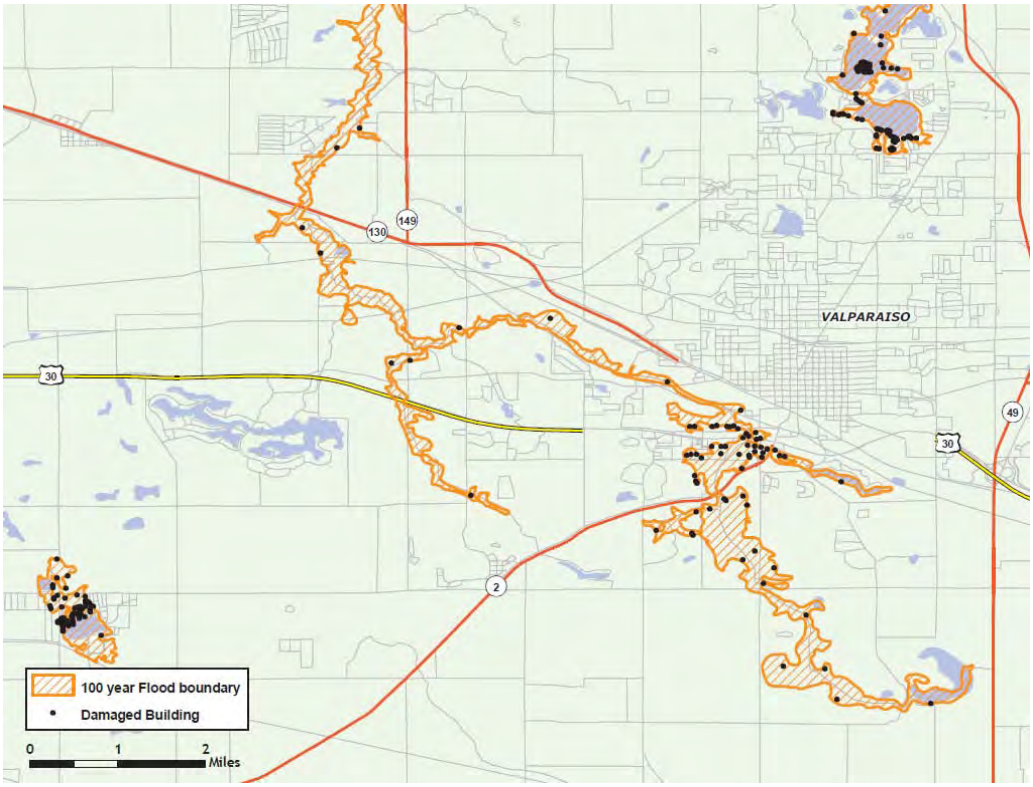
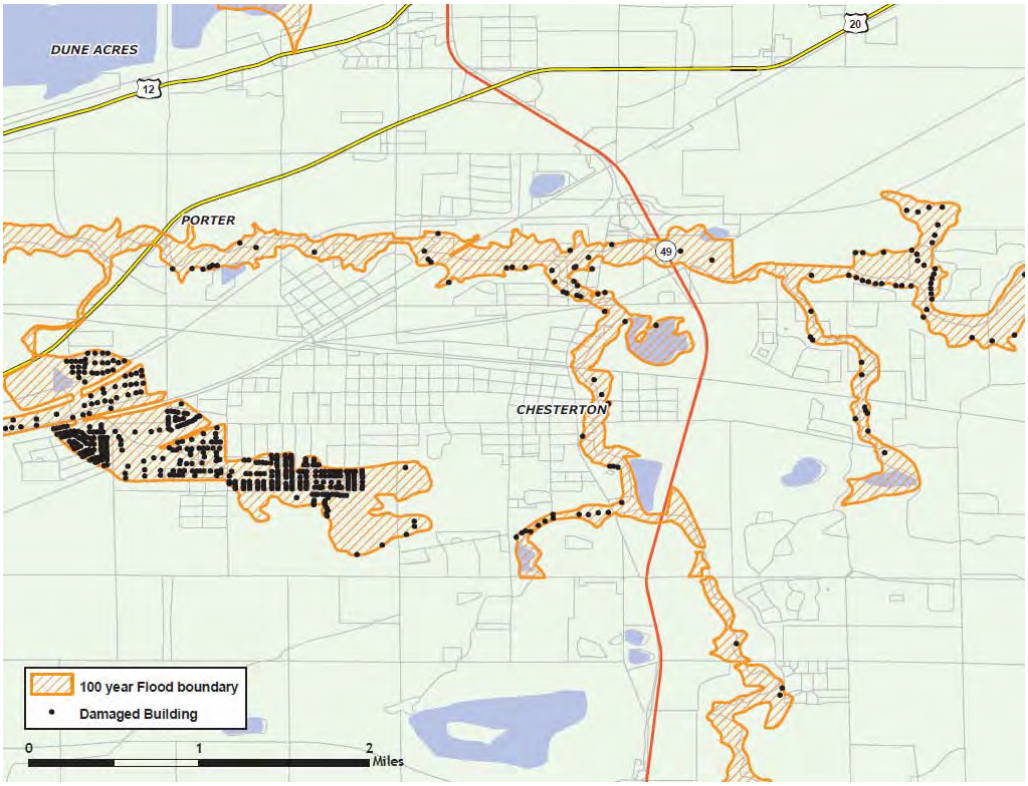


Figure 4-8: Porter County Urban Areas (Chesterton) Flood-Prone Areas (100-Year Flood)



Critical Facilities

A critical facility will encounter many of the same impacts as other buildings within the flood boundary. These impacts can include structural failure, extensive water damage to the facility and loss of facility functionality (e.g. a damaged police station will no longer be able to serve the community). A complete list of all the critical facilities, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

The analysis identified one port, one wastewater facility, and one dam that may be subject to flooding. A list of the critical facilities potentially at risk to flooding within Porter County is given in Table 4-18. A map of critical facilities potentially at risk to flooding is shown in Figures 4-9 and 4-10.

Table 4-18: Porter County Damaged Critical Facilities

Facility Name
US Steel Midwest Plant
Elden Kuehl Pollution Control Facility
Lake of the Woods Dam

Figure 4-9: Boundary of 100-Year Flood Overlaid with Critical Facilities

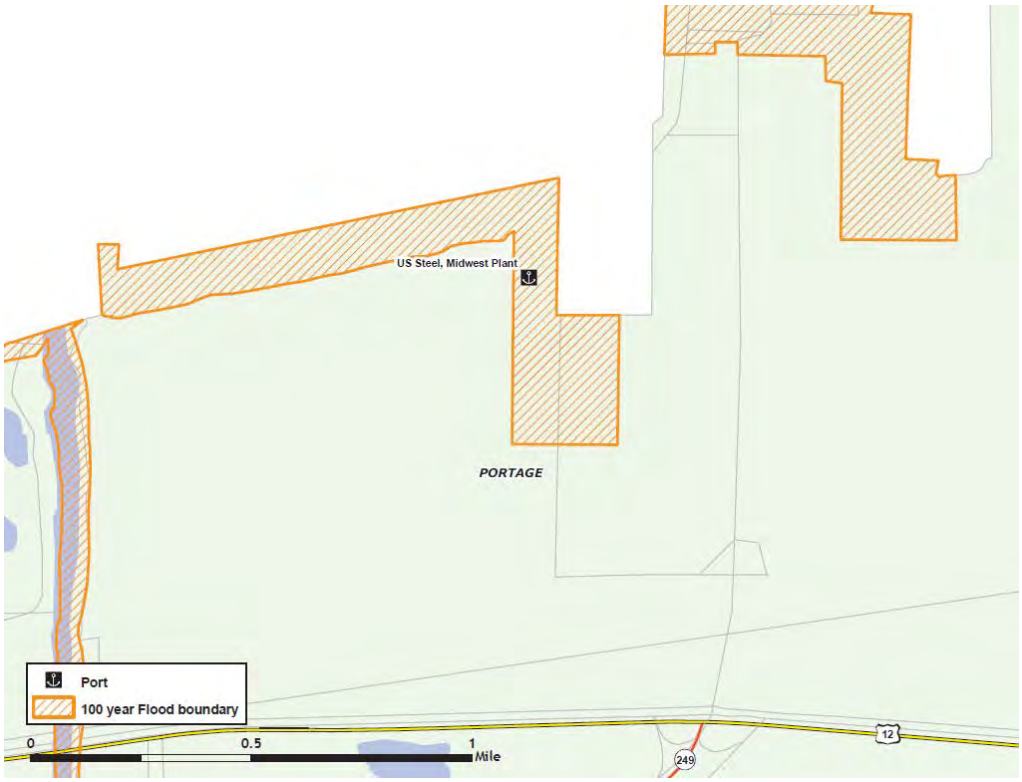
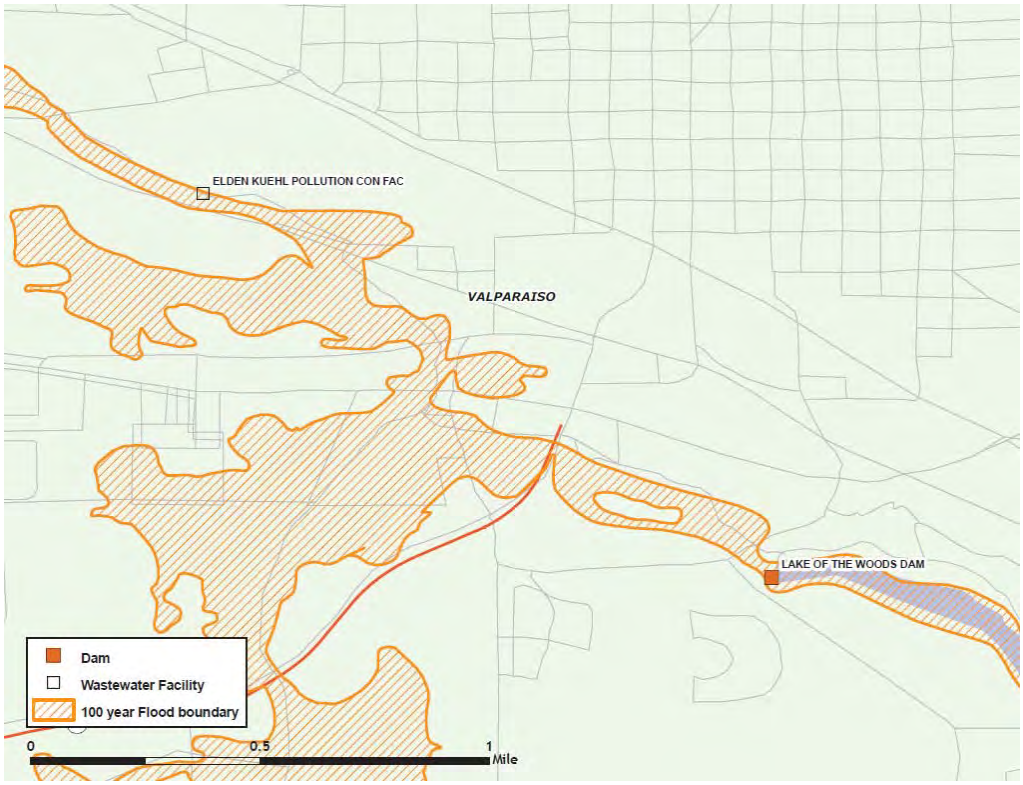


Figure 4-10: Boundary of 100-Year Flood Overlaid with Critical Facilities



Infrastructure

The types of infrastructure that could be impacted by a flood include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available for this plan, it is important to emphasize that any number of these items could become damaged in the event of a flood. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could also fail or become impassable, causing traffic risks.

Vulnerability Analysis for Flash Flooding

Flash flooding could affect any location within this jurisdiction; therefore, the entire county's population and buildings are vulnerable to a flash flood. These structures can expect the same impacts as discussed in a riverine flood.

Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Vulnerability Analysis for Dam and Levee Failure

An EAP is required to assess the effect of dam failure on these communities. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation, and maintenance standards for protection against the "one-percent-annual chance" flood.

Vulnerability to Future Assets/Infrastructure for Flooding

Flash flooding may affect nearly every location within the county; therefore all buildings and infrastructure are vulnerable to flash flooding. Currently, the Porter County planning commission reviews new development for compliance with the local zoning ordinance. At this time no construction is planned within the area of the 100-year floodplain. Therefore, there is no new construction which will be vulnerable to a 100-year flood.

Vulnerability to Future Assets/Infrastructure for Dam and Levee Failure

The Porter County planning commission reviews new development for compliance with the local zoning ordinance.

Analysis of Community Development Trends

Controlling floodplain development is the key to reducing flood-related damages. Areas with recent development within the county may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible. Damage to these can cause the back up of water, sewage, and debris into homes and basements, causing structural and mechanical damage as well as creating public health hazards and unsanitary conditions.

4.4.3 Earthquake Hazard

Hazard Definition for Earthquake Hazard

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped Earth as the huge plates that form the earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake.

Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates, as is the case for seismic zones in the Midwestern United States. The most seismically active area is referred to as the New Madrid Seismic Zone. Scientists have learned that the New Madrid fault system may not be the only fault system in the Central U.S. capable of producing damaging earthquakes. The Wabash Valley fault system in Illinois and Indiana shows evidence of large earthquakes in its geologic history, and there may be other, as yet unidentified, faults that could produce strong earthquakes.

Ground shaking from strong earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area it may cause deaths, injuries, and extensive property damage.

The possibility of the occurrence of a catastrophic earthquake in the central and eastern United States is real as evidenced by history and described throughout this section. The impacts of significant earthquakes affect large areas, terminating public services and systems needed to aid the suffering and displaced. These impaired systems are interrelated in the hardest struck zones. Power lines, water and sanitary lines, and public communication may be lost; and highways, railways, rivers, and ports may not allow transportation to the affected region. Furthermore, essential facilities, such as fire and police departments and hospitals, may be disrupted if not previously improved to resist earthquakes.

As with hurricanes, mass relocation may be necessary, but the residents who are suffering from the earthquake can neither leave the heavily impacted areas nor receive aid or even communication in the aftermath of a significant event.

Magnitude, which is determined from measurements on seismographs, measures the energy released at the source of the earthquake. Intensity measures the strength of shaking produced by the earthquake at a certain location and is determined from effects on people, human structures, and the natural environment. Tables 4-19 and 4-20 list earthquake magnitudes and their corresponding intensities.

Source: http://earthquake.usgs.gov/learning/topics/mag_vs_int.php

Table 4-19: Abbreviated Modified Mercalli Intensity Scale

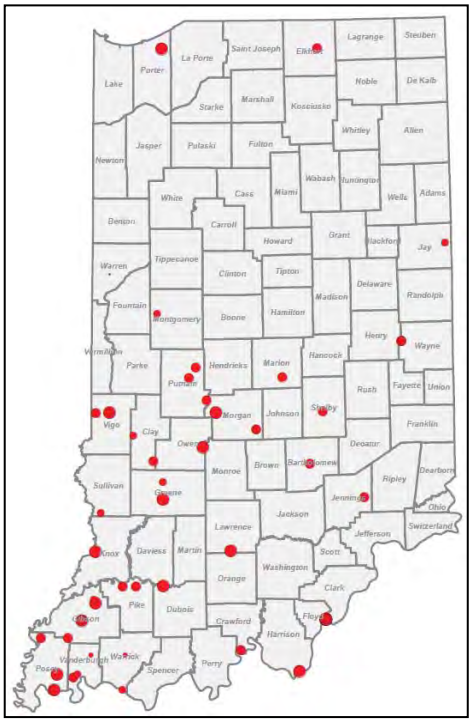
Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Table 4-20: Earthquake Magnitude vs. Modified Mercalli Intensity Scale

Earthquake Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 - 3.0	I
3.0 - 3.9	II - III
4.0 - 4.9	IV - V
5.0 - 5.9	VI - VII
6.0 - 6.9	VII - IX
7.0 and higher	VIII or higher

Previous Occurrences of Earthquake Hazard

Approximately 40 earthquakes have occurred in Indiana for which reasonably accurate records exist. They vary in moment magnitude from a low of approximately M=2.0 to a high of M=5.2. The consensus of opinion among seismologists working in the Midwest is that a magnitude 5.0- to 5.5-event could occur virtually anywhere at any time in the region. The last earthquake to occur in Indiana—as of the date of this report—occurred on September 12, 2004, just north of Shelbyville and measured 3.6 in magnitude. The largest prehistoric earthquake documented in the state occurred at Vincennes 6,100 years ago and is known by the size and physical character of sandblows formed during the quake to have had a moment magnitude of 7.4.



According to the Indiana Geological Survey (IGS), one earthquake has been recorded with epicenters in Porter County. Statewide historical epicenters outside of Porter County are included in the figure at right, although information related to the impacts to Porter County from these events is limited.

The most damaging Indiana earthquake originating within the state occurred on September 27, 1909, near the Indiana border between Vincennes and Terre Haute. Some chimneys fell, several building walls cracked, light connections severed, and pictures shook from the walls. It was felt throughout Indiana and parts of Iowa, Kentucky, Missouri, Arkansas, and probably in parts of Kansas, covering an area of 30,000 square miles.

Another damaging earthquake originating in Indiana occurred on April 29, 1899; it rated intensity VI to VII on the Modified Mercalli Scale. It was strongest in Jeffersonville and Shelbyville, and in Vincennes, chimneys crumbled and walls cracked. It was felt over an area of 40,000 square miles.

In 1876, twin shocks 15 minutes apart were felt over an area of 60,000 square miles. A shock in 1887 centered near Vincennes was felt over 75,000 square miles; an 1891 shock damaged property and frightened people in a church in Evansville.

Indiana has also suffered from damage caused by earthquakes originating in neighboring states. The worst occurred on November 9, 1968, and centered near Dale in southern Illinois. The shock, a magnitude of 5.3, was felt over 580,000 square miles and 23 states including all of Indiana. Intensity VII was reported from Cynthiana, where chimneys cracked, twisted, and toppled; at Fort Branch, where groceries fell from shelves and a loud roaring noise was heard; and in Mount Vernon, New Harmony, Petersburg, Princeton, and Stewartsville, all of which had similar effects. At Poseyville, “Fish jumped out of the rivers, ponds, and lakes.”

Most recently, on April 18, 2008, an earthquake originating in Illinois within the Wabash Valley Seismic Zone caused minor structural damage to buildings in East Alton, Mount Carmel, and

West Salem, Illinois, and a cornice fell from one building at Louisville, Kentucky. The earthquake, a magnitude 5.4, was felt widely throughout the central United States from Green Bay, Wisconsin south to Atlanta, Georgia and Tuscaloosa, Alabama and from Sioux City, Iowa and Omaha, Nebraska east to Akron, Ohio and Parkersburg, West Virginia, including all or parts of Alabama, Arkansas, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, Ohio, Tennessee, West Virginia, and Wisconsin. It was also felt in southern Ontario, Canada.

On November 7, 1958, an earthquake originating near Mt. Carmel, Illinois caused plaster to fall at Fort Branch. Roaring and whistling noises were heard at Central City, and the residents of Evansville thought there had been in an explosion or plane crash. It was felt over 33,000 square miles of Illinois, Indiana, Missouri, and Kentucky.

On March 2, 1937, a shock centering near Anna, Ohio threw objects from shelves at Fort Wayne and some plaster fell. Six days later, another shock originating at Anna brought pictures crashing down and cracked plaster in Fort Wayne and was strongly felt in Lafayette.

The great New Madrid earthquakes of 1811 and 1812 must have strongly affected the state, particularly the southwestern part, but there is little information available from these frontier times.

The above history was abridged from Earthquake Information Bulletin, Volume 4, Number 4, July-August 1972 and from http://earthquake.usgs.gov/eqcenter/eqinthenews/2008/us2008qza6/#summary.

1827 Jul 5 11:30 4.8M Intensity VI
Near New Harmony, Indiana (38.0N 87.5W)
The earthquake cracked a brick store at New Harmony, Indiana, and greatly alarmed some people. It was described as violent at New Madrid, Missouri, and severe in St. Louis. It also alarmed many in Cincinnati, Ohio, and Frankfort, Kentucky.

1827 Aug 7 04:30 4.8M Intensity V
Southern Illinois (38.0N 88.0W)

1827 Aug 7 07:00 4.7M Intensity V
Southern Illinois (38.0N 88.0W)

1887 Feb 6 22:15 4.6M Intensity VI
Near Vincennes, Indiana (38.7N 87.5W)
This shock was strongest in southwest Indiana and southeast Illinois. Plaster was shaken from walls in Vincennes, west of Terre Haute, and in Martinsville; a cornice reportedly fell from a building in Huntington, Indiana. It was felt distinctly in Evansville, Indiana, but only slightly in the outskirts of St. Louis, Missouri. The shockwave was also reported in Louisville, Kentucky.

1891 Jul 27 02:28 4.1M Intensity VI
Evansville, Indiana (37.9N 87.5W)
A strong local earthquake damaged a wall on a hotel, broke dishes, and overturned furniture in Evansville. The shock also was strong near Evansville in Mount Vernon, and Newburgh, Indiana; and at Hawesville, Henderson, and Owensboro, Kentucky.

1921 Mar 14 12:15 4.4M Intensity VI
Near Terre Haute, Indiana (39.5N 87.5W)
This earthquake broke windows in many buildings and sent residents rushing into the streets in Terre Haute. Small articles were overturned in Paris, Illinois, about 35 km northwest of Terre Haute.

1925 Apr 27 04:05 4.8M Intensity VI
Wabash River valley, near Princeton, Indiana (38.2N 87.8W)
Chimneys were downed in Princeton and in Carmi, Indiana; 100 km southwest chimneys were broken in Louisville, Kentucky. Crowds fled from the theaters in Evansville, Indiana. The affected area included parts of Indiana, Illinois, Kentucky, Missouri, and Ohio.

The above text was taken from http://earthquake.usgs.gov/regional/states/indiana/history.php

Geographic Location for Earthquake Hazard

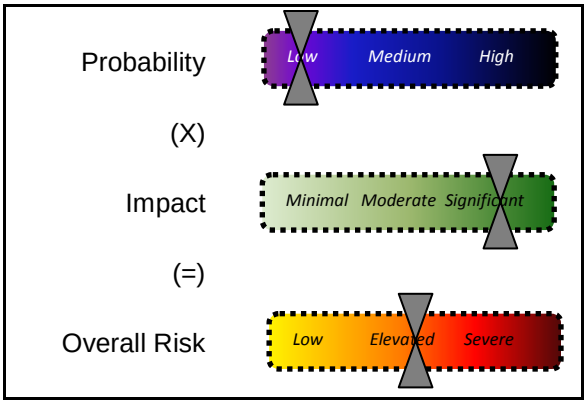
Porter County occupies a region susceptible to the threat of an earthquake along the Wabash Valley Fault System. Return periods for large earthquakes within the New Madrid System are estimated to be 500 years; moderate quakes between magnitude 5.5 and 6.0 can recur within approximately 150 years or less. The Wabash Valley Fault System is a sleeper that threatens the southwest quadrant of the state and may generate an earthquake large enough to cause damage as far north and east as Porter County.

Hazard Extent for Earthquake Hazard

The extent of the earthquake is countywide. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. A National Earthquake Hazards Reduction Program (NEHRP) compliant soils map was used for the analysis which was provided by IGS. The map identifies the soils most susceptible to failure.

Risk Identification for Earthquake Hazard

Based on historical information, the probability of an earthquake is low; however, USGS and IGS research and studies attest that future earthquakes in Porter County are possible. In Meeting #2, the planning team determined that the potential impact of an earthquake is significant; therefore, the overall risk of an earthquake hazard for Porter County is elevated.



Vulnerability Analysis for Earthquake Hazard

This hazard could impact the entire jurisdiction equally; therefore, the entire county's population and all buildings are vulnerable to an earthquake and can expect the same impacts within the affected area. To accommodate this risk, this plan will consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities are vulnerable to earthquakes. A critical facility would encounter many of the same impacts as any other building within the county. These impacts include structural failure and loss of facility functionality (e.g. a damaged police station will no longer be able to serve the community). A complete list of all of the critical facilities, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-6. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure and loss of building function which could result in indirect impacts (e.g. damaged homes will no longer be habitable causing residents to seek shelter).

Infrastructure

During an earthquake, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available to this plan, it is important to emphasize that any number of these items could become damaged in the event of an earthquake. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g. loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could also fail or become impassable causing traffic risks. Typical scenarios are described to gauge the anticipated impacts of earthquakes in the county in terms of numbers and types of buildings and infrastructure.

The Polis team contacted IGS to obtain existing geological information. Four earthquake scenarios—two based on deterministic scenarios and two based on probabilistic scenarios—were developed to provide a reasonable basis for earthquake planning in Porter County. Note that a deterministic scenario, in this context, refers to hazard or risk models based on specific scenarios without explicit consideration of the probability of their occurrences.

The first deterministic scenario was a 7.1 magnitude epicenter along the Wabash Valley fault zone. Shake maps provided by FEMA were used in HAZUS-MH to estimate losses for Porter County based on this event.

The second deterministic scenario was a moment magnitude of 5.5 with the epicenter located in Porter County. This scenario was selected based upon the opinion of the IGS stating it could occur in the selected location and that it would therefore represent a realistic scenario for planning purposes.

Additionally, the analysis included two different types of probabilistic scenarios. These types of scenarios are based on ground shaking parameters derived from U.S. Geological Survey probabilistic seismic hazard curves. The first probabilistic scenario was a 500-year return period scenario. This scenario evaluates the average impacts of a multitude of possible earthquake epicenters with a magnitude that would be typical of that expected for a 500-year return period. The second probabilistic scenario allowed calculation of annualized loss. The annualized loss

analysis in HAZUS-MH provides a means for averaging potential losses from future scenarios while considering their probabilities of occurrence. The HAZUS-MH earthquake model evaluates eight different return period scenarios for the 100-, 250-, 500-, 750-, 1000-, 1500-, 2000-, and 2500-year return period earthquake events. HAZUS-MH then calculates the probabilities of these events as well as the interim events, calculates their associated losses, and sums these losses to calculate an annualized loss. These analysis options were chosen because they are useful for prioritization of seismic reduction measures and for simulating mitigation strategies.

The following earthquake hazard modeling scenarios were performed:

- 7.1 magnitude earthquake on the Wabash Valley Fault System
- 5.5 magnitude earthquake local epicenter
- 500-year return period event
- Annualized earthquake loss

Modeling a deterministic scenario requires user input for a variety of parameters. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. Fortunately, a National Earthquake Hazards Reduction Program (NEHRP) soil classification map exists for Indiana. NEHRP soil classifications portray the degree of shear-wave amplification that can occur during ground shaking. The IGS supplied the soils map was used for the analysis. FEMA provided a map for liquefaction potential that was used by HAZUS-MH.

An earthquake depth of 10.0 kilometers was selected based on input from IGS. HAZUS-MH also requires the user to define an attenuation function unless ground motion maps are supplied. Because Porter County has experienced smaller earthquakes, the decision was made to use the Central Eastern United States (CEUS) attenuation function. The probabilistic return period analysis and the annualized loss analysis do not require user input.

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

Results for 7.1 Magnitude Earthquake Wabash Valley Scenario

The results of the 7.1 Wabash Valley earthquake are depicted in Table 4-21, Table 4-22, and Figure 4-11. HAZUS-MH estimates that approximately 18 buildings will be at least moderately damaged. This is approximately 0% of the total number of buildings in the region. It is estimated that no buildings will be damaged beyond repair.

The total building related losses totaled $4.39 million; 10% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up more than 46% of the total loss.

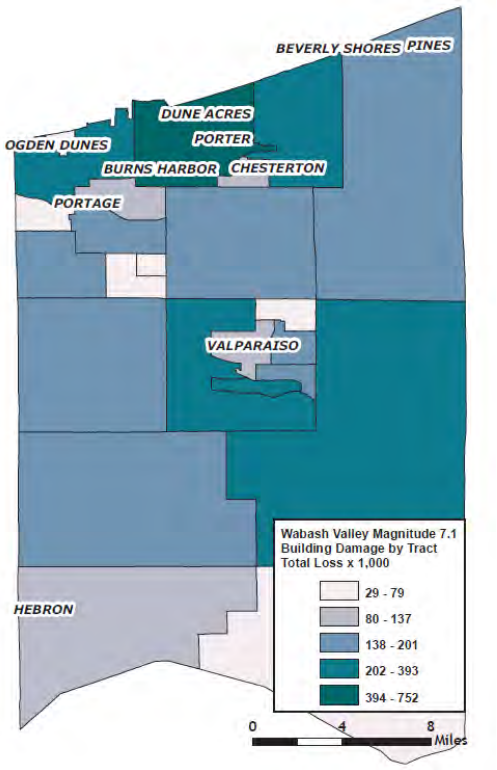
Table 4-21: Wabash Valley Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	623	1.12	7	2.60	1	3.61	0	0.00	0	0.00
Commercial	1,892	3.41	19	6.98	2	9.29	0	0.00	0	0.00
Education	74	0.13	1	0.25	0	0.25	0	0.00	0	0.00
Government	110	0.20	1	0.33	0	0.35	0	0.00	0	0.00
Industrial	235	0.42	3	0.95	0	1.36	0	0.00	0	0.00
Other Residential	3,896	7.02	40	14.92	3	14.52	0	0.00	0	0.00
Religion	709	1.28	7	2.79	1	3.28	0	0.00	0	0.00
Single Family	47,974	86.42	191	71.18	12	67.35	0	0.00	0	0.00
Total	**55,514**		**269**		**18**		**0**		**0**	

Table 4-22: Wabash Valley Scenario-Building Economic losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	0.00	0.05	0.02	0.02	0.09
	Capital-Related	0.00	0.00	0.05	0.01	0.01	0.07
	Rental	0.02	0.01	0.07	0.01	0.00	0.12
	Relocation	0.06	0.01	0.05	0.02	0.02	0.16
	Subtotal	**0.08**	**0.02**	**0.23**	**0.06**	**0.05**	**0.44**
Capital Stock Loses							
	Structural	0.18	0.02	0.07	0.05	0.03	0.35
	Non_Structural	0.96	0.15	0.33	0.52	0.18	2.14
	Content	0.54	0.06	0.25	0.27	0.15	1.25
	Inventory	0.00	0.00	0.02	0.17	0.00	0.20
	Subtotal	**1.68**	**0.22**	**0.67**	**1.01**	**0.37**	**3.95**
	Total	**1.76**	**0.24**	**0.90**	**1.07**	**0.42**	**4.39**

Figure 4-11: Wabash Valley Scenario-Building Economic Losses in Thousands of Dollars



Wabash Valley Scenario—Essential Facility Losses

Before the earthquake, the region had 1,714 care beds available for use. On the day of the earthquake, the model estimates that only 906 care beds (53%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 97% of the beds will be back in service. By day 30, 100% will be operational.

Results for 5.5 Magnitude Earthquake in Porter County

The results of the initial analysis, the 5.5 magnitude earthquake with an epicenter in the center of Porter County, are depicted in Tables 4-23 and 4-24 and Figure 4-12. HAZUS-MH estimates that approximately 8,438 buildings will be at least moderately damaged. This is more than 15% of the total number of buildings in the region. It is estimated that 347 buildings will be damaged beyond repair.

The total building related losses totaled $900 million; 19% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which comprised more than 64% of the total loss.

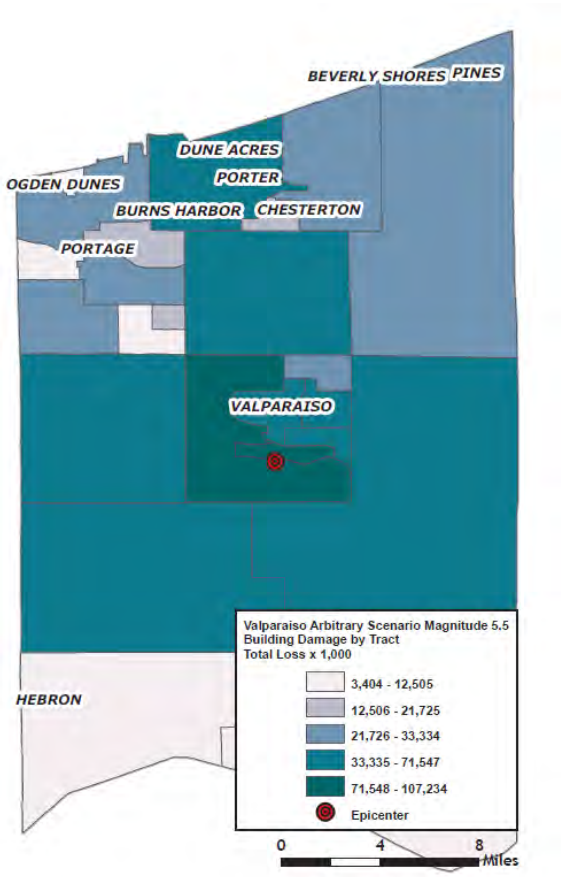
Table 4-23: Porter County 5.5M Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	344	1.01	123	0.93	115	1.76	43	2.69	7	1.94
Commercial	1,059	3.11	386	2.90	325	5.00	119	7.45	23	6.64
Education	32	0.09	17	0.12	18	0.27	7	0.43	2	0.56
Government	77	0.23	18	0.13	13	0.19	3	0.20	1	0.20
Industrial	130	0.38	45	0.34	43	0.67	17	1.06	3	0.78
Other Residential	2,343	6.88	859	6.45	572	8.81	141	8.88	22	6.45
Religion	411	1.21	148	1.11	110	1.69	39	2.46	9	2.52
Single Family	29,649	87.09	11,720	88.01	5,305	81.61	1,223	76.83	281	80.92
Total	**34,045**		**13,317**		**6,500**		**1,591**		**347**	

Table 4-24: Porter County 5.5M Scenario-Building Economic Losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	1.29	17.00	2.72	3.38	24.40
	Capital-Related	0.00	0.53	15.85	1.66	1.38	19.42
	Rental	12.37	5.44	14.27	1.35	2.05	35.48
	Relocation	45.83	3.96	21.00	5.52	18.59	94.89
	Subtotal	**58.20**	**11.23**	**68.12**	**11.25**	**25.39**	**174.19**
Capital Stock Loses							
	Structural	59.34	4.35	15.69	6.45	8.49	94.34
	Non_Structural	273.07	34.00	43.32	31.48	31.94	413.81
	Content	122.80	12.06	30.03	17.83	21.35	204.07
	Inventory	0.00	0.00	2.51	10.31	0.35	13.17
	Subtotal	**455.21**	**50.41**	**91.55**	**66.09**	**62.13**	**725.39**
	Total	**513.41**	**61.64**	**159.67**	**77.34**	**87.53**	**899.59**

Figure 4-12: Porter County 5.5M Scenario-Building Economic Losses in Thousands of Dollars



Porter County 5.5M Scenario—Essential Facility Losses

Before the earthquake, the region had 1,714 care beds available for use. On the day of the earthquake, the model estimates that only 33 care beds (2%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 42% of the beds will be back in service. By day 30, 73% will be operational.

Results 5.0 Magnitude 500-Year Probabilistic Scenario

The results of the 500-year probabilistic analysis are depicted in Tables 4-25 and 4-26. HAZUS-MH estimates that approximately 359 buildings will be at least moderately damaged. This is more than 1% of the total number of buildings in the region. It is estimated that three buildings will be damaged beyond repair. The total building-related losses totaled $17.6 million; 39% of the estimated losses were related to business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up more than 52% of the total loss.

Table 4-25: 500-Year Probabilistic Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	596	1.10	24	2.16	9	2.96	1	3.35	0	1.78
Commercial	1,817	3.35	68	6.05	23	7.41	3	8.19	0	4.70
Education	72	0.13	3	0.22	1	0.27	0	0.28	0	0.26
Government	106	0.20	3	0.29	1	0.34	0	0.34	0	0.31
Industrial	225	0.41	9	0.80	3	1.09	0	1.22	0	0.55
Other Residential	3,764	6.93	127	11.33	44	13.96	4	10.30	0	7.14
Religion	682	1.26	24	2.19	9	2.89	1	3.29	0	2.80
Single Family	47,060	86.63	861	76.96	225	71.07	29	73.02	3	82.45
Total	54,323		1,119		317		39		3	

Table 4-26: 500-Year Probabilistic Scenario-Building Economic Losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	0.02	0.79	0.21	0.14	1.16
	Capital-Related	0.00	0.01	0.75	0.13	0.05	0.94
	Rental	0.40	0.16	0.70	0.10	0.07	1.43
	Relocation	1.46	0.12	0.90	0.35	0.59	3.42
	Subtotal	**1.86**	**0.32**	**3.14**	**0.79**	**0.85**	**6.95**
Capital Stock Loses							
	Structural	2.00	0.17	0.67	0.46	0.35	3.65
	Non_Structural	3.80	0.43	0.64	0.48	0.47	5.82
	Content	0.55	0.05	0.19	0.18	0.13	1.10
	Inventory	0.00	0.00	0.02	0.11	0.00	0.13
	Subtotal	**6.35**	**0.66**	**1.52**	**1.23**	**0.95**	**10.70**
	Total	**8.21**	**0.98**	**4.66**	**2.01**	**1.80**	**17.66**

500-Year Probabilistic Scenario—Essential Facility Losses

Before the earthquake, the region had 1,714 care beds available for use. On the day of the earthquake, the model estimates that only 1,114 care beds (65%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 98% of the beds will be back in service. By day 30, 100% will be operational.

Results Annualized Risk Scenario

HAZUS-MH estimates that approximately 220 buildings will be at least moderately damaged. This is approximately 0% of the total number of buildings in the region. It is estimated that no buildings will be damaged beyond repair.

Vulnerability to Future Assets/Infrastructure for Earthquake Hazard

New construction, especially critical facilities, will accommodate earthquake mitigation design standards.

Analysis of Community Development Trends

Community development will occur outside of the low-lying areas in floodplains with a water table within five feet of grade that is susceptible to liquefaction.

In Meeting #4, the MHMP team discussed specific mitigation strategies for potential earthquake hazards. The discussion included strategies to harden and protect future, as well as existing, structures against the possible termination of public services and systems including power lines, water and sanitary lines, and public communication.

4.4.4 Thunderstorm Hazard

Hazard Definition for Thunderstorm Hazard

Severe thunderstorms are defined as thunderstorms with one or more of the following characteristics: strong winds, large damaging hail, or frequent lightning. Severe thunderstorms most frequently occur in Indiana during the spring and summer months, but can occur any month of the year at any time of day. A severe thunderstorm's impacts can be localized or can be widespread in nature. A thunderstorm is classified as severe when it meets one or more of the following criteria.

- Hail of diameter 0.75 inches or higher
- Frequent and dangerous lightning
- Wind speeds equal to or greater than 58 miles per hour

Hail

Hail is a product of a strong thunderstorm. Hail usually falls near the center of a storm; however, strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, resulting in damage in other areas near the storm. Hailstones range from pea-sized to baseball-sized, but hailstones larger than softballs have been reported on rare occasions.

Lightning

Lightning is a discharge of electricity from a thunderstorm. Lightning is often perceived as a minor hazard, but in reality lightning causes damage to many structures and kills or severely injures numerous people in the United States each year.

Severe Winds (Straight-Line Winds)

Straight-line winds from thunderstorms are a fairly common occurrence across Indiana. Straight-line winds can cause damage to homes, businesses, power lines, and agricultural areas, and may require temporary sheltering of individuals who are without power for extended periods of time.

Previous Occurrences of Thunderstorm Hazard

A storm approaches Porter County in August 2007
Source: Weather Underground

The NCDC database reported 46 hailstorms in Porter County since 1950. Hailstorms occur nearly every year in the late spring and early summer months. For example, in 2007, quarter-sized hail was reported at Route 2 and Route 30. Severe storms moved across northwest Indiana during the evening hours of October 18.

Porter County hailstorms are identified in Table 4-27. Additional details for NCDC events are included in Appendix D.

Table 4-27: Porter County Hailstorms*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Porter	06/16/60	Hail	1.25 in.	0	0	0	0
Porter	04/30/62	Hail	1.75 in.	0	0	0	0
Porter	08/26/65	Hail	0.75 in.	0	0	0	0
Porter	03/12/76	Hail	1.75 in.	0	0	0	0
Porter	06/29/79	Hail	1.75 in.	0	0	0	0
Porter	04/07/80	Hail	0.75 in.	0	0	0	0
Porter	08/13/80	Hail	1.75 in.	0	0	0	0
Porter	03/28/85	Hail	1.00 in.	0	0	0	0
Porter	05/26/85	Hail	0.75 in.	0	0	0	0
Porter	03/17/89	Hail	1.25 in.	0	0	0	0
Porter	03/27/91	Hail	1.00 in.	0	0	0	0
Chesterton	04/24/93	Hail	0.75 in.	0	0	0	0
Portage	06/13/94	Hail	1.00 in.	0	0	0	0
Chesterton	06/13/94	Hail	1.75 in.	0	0	0	0
Portage	04/12/96	Hail	0.75 in.	0	0	0	0
Malden	04/19/96	Hail	1.75 in.	0	0	0	0
Hebron/Kouts	05/09/96	Hail	1.75 in.	0	0	0	0
Hebron	05/05/97	Hail	2.00 in.	0	0	0	0
Chesterton	04/10/99	Hail	1.50 in.	0	0	0	0
Porter	09/11/00	Hail	0.75 in.	0	0	0	0
Valparaiso	06/28/03	Hail	0.75 in.	0	0	0	0
Wheeler	07/17/03	Hail	0.88 in.	0	0	0	0
Hebron	07/17/03	Hail	1.00 in.	0	0	0	0
Lake Eliza	07/17/03	Hail	1.00 in.	0	0	0	0
Hebron	07/17/03	Hail	1.00 in.	0	0	0	0
Hebron	05/20/04	Hail	0.88 in.	0	0	0	0
Chesterton	05/23/04	Hail	1.00 in.	0	0	0	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Porter	06/07/05	Hail	0.88 in.	0	0	0	0
Valparaiso	06/07/05	Hail	0.75 in.	0	0	0	0
Valparaiso	07/21/05	Hail	0.88 in.	0	0	0	0
Hebron	02/16/06	Hail	1.00 in.	0	0	0	0
Crocker	05/17/06	Hail	0.88 in.	0	0	0	0
Hebron	06/21/06	Hail	0.75 in.	0	0	0	0
Chesterton	08/23/06	Hail	1.75 in.	0	0	500K	0
Valparaiso	08/23/06	Hail	0.75 in.	0	0	0	0
Edgewater Beach	10/02/06	Hail	0.75 in.	0	0	0K	0K
Chesterton	06/27/07	Hail	0.75 in.	0	0	0K	0K
Hebron	08/15/07	Hail	1.00 in.	0	0	0K	0K
Valparaiso	08/15/07	Hail	1.00 in.	0	0	0K	0K
Valparaiso	08/15/07	Hail	0.88 in.	0	0	0K	0K
Boone Grove	08/15/07	Hail	1.25 in.	0	0	0K	0K
Malden	10/18/07	Hail	0.88 in.	0	0	0K	0K
Valparaiso	10/18/07	Hail	1.00 in.	0	0	0K	0K
Valparaiso	06/22/08	Hail	1.00 in.	0	0	0K	0K
Valparaiso	06/22/08	Hail	0.88 in.	0	0	0K	0K
Valparaiso	06/22/08	Hail	1.00 in.	0	0	0K	0K

** NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.*

The NCDC database reported 10 occurrences of significant lightning strikes in Porter County since 1950. For example, in 2007, a house was struck by lightning, which ignited a fire in the attic. The house suffered extensive damage, mainly from water.

Porter County lightning strikes are identified in Table 4-28. Additional details for NCDC events are included in Appendix D. Lightning occurs in Porter County every year. The following list represents only those events which were recorded by the NCDC.

Table 4-28: Porter County Lightning Strikes*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Valparaiso	04/15/94	Lightning	N/A	0	0	5K	0
Chesterton	08/07/96	Lightning	N/A	0	0	10K	0
Porter	08/06/00	Lightning	N/A	0	0	0	0
Chesterton	06/11/01	Lightning	N/A	0	0	0	0
Burdick	07/07/01	Lightning	N/A	0	0	12K	0
Chesterton	07/23/01	Lightning	N/A	0	0	10K	0
Chesterton	08/02/01	Lightning	N/A	0	0	25K	0
Valparaiso	07/21/05	Lightning	N/A	0	1	0	0
Chesterton	08/20/05	Lightning	N/A	0	0	40K	0
Chesterton	08/15/07	Lightning	N/A	0	0	50K	0K

** NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.*

21 metal truss towers for power lines were toppled by 100-120 mph winds, Kouts, August 2007
Source: Weather Underground

The NCDC database identified 101 wind storms reported since 1950. For example, in 2003, powerful severe thunderstorms developed over Lake Michigan during the afternoon of August 23. These thunderstorms moved south into northwest Indiana and produced wind speeds as high as 106 mph, which was measured at a coastal observation site in Michigan City. Trees, tree limbs and power lines were blown down across much of northeast and eastern Porter County. In Town of Pines, a tree fell onto a trailer, which was destroyed. Numerous houses suffered damage to roofs and siding from falling trees. Several cars were damaged by falling trees and tree limbs. In Valparaiso, trees were blown down and windows were blown out of buildings on Washington Street, Randall Street, and Fairlane Drive.

As shown in Table 4-29, wind storms have historically occurred year-round with the greatest frequency and damage between May and July. The following table includes available top wind speeds for Porter County. It also includes rip current events that were caused by high winds.

Table 4-29: Porter County Wind Storms*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Porter	06/13/60	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	06/08/63	Thunderstorm Winds	58 kts.	0	0	0	0
Porter	07/19/63	Thunderstorm Winds	75 kts.	0	0	0	0
Porter	06/19/64	Thunderstorm Winds	75 kts.	0	0	0	0
Porter	04/20/66	Thunderstorm Winds	50 kts.	0	0	0	0
Porter	09/19/68	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	04/21/69	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	07/02/70	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	06/20/74	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	07/15/76	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	07/21/78	Thunderstorm Winds	61 kts.	0	0	0	0
Porter	04/07/80	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	05/30/80	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	08/10/80	Thunderstorm Winds	70 kts.	0	0	0	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Porter	04/03/82	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	05/22/82	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	07/01/83	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	07/01/83	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	07/16/88	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	10/04/91	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	06/17/92	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	06/17/92	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	07/02/92	Thunderstorm Winds	0 kts.	0	0	0	0
Portage	04/25/94	Thunderstorm Winds	0 kts.	0	0	5K	0
Porter	11/21/94	High Wind	0 kts.	0	0	50K	0
Porter	11/27/94	High Wind	0 kts.	0	0	120K	0
Chesterton	06/07/95	Thunderstorm Winds	0 kts.	0	0	5K	0
Valparaiso	06/07/95	Thunderstorm Winds	0 kts.	0	0	3K	0
Chesterton and Porter	08/15/95	Thunderstorm Winds	0 kts.	0	0	0	0
Kouts	01/18/96	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	03/20/96	High Wind	55 kts.	0	0	0	0
Porter	03/25/96	High Wind	46 kts.	0	0	0	0
Porter	10/29/96	Thunderstorm Winds	0 kts.	0	0	0	0
Valparaiso	05/18/97	Thunderstorm Winds	0 kts.	0	0	0	0
Porter	07/18/97	Thunderstorm Winds	50 kts.	0	0	0	0
Porter	08/24/98	Thunderstorm Winds	50 kts.	0	0	0	0
Porter	11/10/98	High Winds	50 kts.	0	0	0	0
Beverly Shores	08/29/99	Rip Currents	N/A	1	0	0	0
Valparaiso Municipal Airport	05/08/00	Thunderstorm Winds	66 kts.	0	0	0	0
Valparaiso	05/08/00	Thunderstorm Winds	60 kts.	0	0	0	0
Porter	08/06/00	Thunderstorm Winds	61 kts.	0	1	0	0
Porter	09/11/00	Thunderstorm Winds	60 kts.	0	0	0	0
Porter	02/25/01	Strong Wind	0 kts.	0	0	0	0
Porter	06/11/01	Thunderstorm Winds	60 kts.	0	0	55K	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Chesterton	07/07/01	Thunderstorm Winds	50 kts.	0	0	2K	0
Wheeler	08/25/01	Tornado	F0	0	0	0	0
Chesterton	10/24/01	Thunderstorm Winds	50 kts.	0	0	0	0
Porter	03/09/02	High Wind	51 kts.	0	0	0	0
Valparaiso	06/25/02	Thunderstorm Winds	50 kts.	0	0	0	0
Wheeler	07/22/02	Thunderstorm Winds	50 kts.	0	0	0	0
Valparaiso	06/28/03	Thunderstorm Winds	50 kts.	0	0	0	0
Chesterton	07/05/03	Thunderstorm Winds	52 kts.	0	0	0	0
Porter	07/07/03	Thunderstorm Winds	57 kts.	0	0	0	0
Valparaiso	08/26/03	Thunderstorm Winds	57 kts.	0	0	0	0
Porter	11/13/03	High Wind	52 kts.	0	0	0	0
Porter	03/05/04	High Wind	59 kts.	0	0	0	0
Valparaiso	05/09/04	Thunderstorm Winds	60 kts.	0	0	0	0
Hebron	05/20/04	Thunderstorm Winds	50 kts.	0	0	0	0
Hebron	05/30/04	Thunderstorm Winds	50 kts.	0	0	0	0
Beverly Shores	07/21/04	Thunderstorm Winds	60 kts.	0	0	0	0
Porter	07/21/04	Thunderstorm Winds	50 kts.	0	0	0	0
Kouts	06/05/05	Thunderstorm Winds	50 kts.	0	0	0	0
Chesterton	07/21/05	Thunderstorm Winds	55 kts.	0	0	0	0
Beverly Shores	07/26/05	Rip Current	N/A	2	0	0	0
Kouts	06/21/06	Thunderstorm Winds	50 kts.	0	0	1K	0
Valparaiso	07/20/06	Thunderstorm Winds	50 kts.	0	0	0	0
Valparaiso	07/27/06	Thunderstorm Winds	50 kts.	0	0	0	0
Portage	07/30/06	Thunderstorm Winds	50 kts.	0	0	5K	0
Malden	07/30/06	Thunderstorm Winds	55 kts.	0	0	25K	0
Chesterton	08/02/06	Thunderstorm Winds	50 kts.	0	0	0	0
Chesterton	08/03/06	Thunderstorm Winds	50 kts.	0	0	0	0
Porter	08/03/06	Thunderstorm Winds	50 kts.	0	0	0	0
Town of Pines	08/23/06	Thunderstorm Winds	65 kts.	0	0	1.0M	0
Beverly Shores	08/23/06	Thunderstorm	65 kts.	0	0	1.0M	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
		Winds					
Valparaiso	08/23/06	Thunderstorm Winds	65 kts.	0	0	100K	0
Kouts	08/23/06	Thunderstorm Winds	65 kts.	0	0	0	0
Portage	05/15/07	Thunderstorm Winds	60 kts.	0	0	35K	0K
Chesterton	05/15/07	Thunderstorm Winds	61 kts.	0	0	0K	0K
South Haven	05/15/07	Thunderstorm Winds	55 kts.	1	0	15K	0K
Valparaiso	05/15/07	Thunderstorm Winds	55 kts.	0	0	0K	0K
Valparaiso	07/18/07	Thunderstorm Winds	55 kts.	0	0	5K	0K
Burns Harbor	07/26/07	Thunderstorm Winds	51 kts.	0	0	0K	0K
Hurlburt	08/15/07	Thunderstorm Winds	85 kts.	0	0	2.5M	0K
Valparaiso	08/23/07	Thunderstorm Winds	70 kts.	0	0	0K	0K
Valparaiso	08/23/07	Thunderstorm Winds	70 kts.	0	0	0K	0K
Valparaiso Municipal Airport	08/23/07	Thunderstorm Winds	52 kts.	0	0	0K	0K
Chesterton	12/23/07	Thunderstorm Winds	55 kts.	0	0	5K	0K
Chesterton	06/08/08	Thunderstorm Winds	50 kts.	0	0	0K	0K
INZ002	07/13/08	Rip Currents	N/A	1	0	0K	0K
Sedley	07/31/08	Thunderstorm Winds	52 kts.	0	0	0K	0K
Valparaiso	07/31/08	Thunderstorm Winds	52 kts.	0	0	0K	0K
INZ002	08/02/08	Rip Current	N/A	1	0	0K	0K
Tremont	08/04/08	Thunderstorm Winds	56 kts.	0	0	0K	0K
Chesterton	08/04/08	Thunderstorm Winds	61 kts.	0	0	2K	0K
Valparaiso	08/04/08	Thunderstorm Winds	61 kts.	0	0	25K	0K
Portage	05/13/09	Thunderstorm Winds	56 kts.	0	0	5K	0K
Portage	06/19/09	Thunderstorm Winds	52 kts.	0	0	0K	0K
Chesterton	08/27/09	Heavy Rain	N/A	0	0	0K	0K
Valparaiso	08/27/09	Heavy Rain	N/A	0	0	0K	0K
Valparaiso	09/27/09	Thunderstorm Winds	56 kts.	0	0	0K	0K
Willow Creek	09/27/09	Thunderstorm Winds	52 kts.	0	0	0K	0K

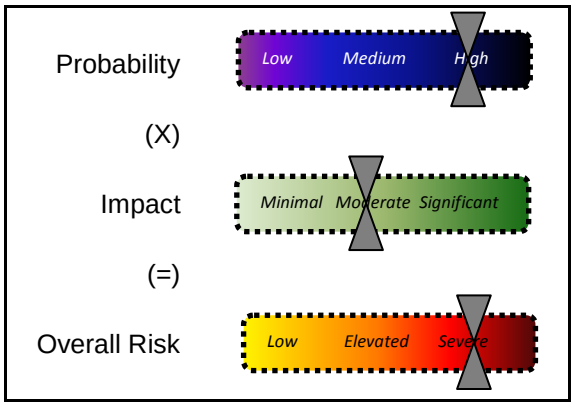
** NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.*

Geographic Location for Thunderstorm Hazard

The entire county has the same risk for occurrence of thunderstorms. They can occur at any location within the county.

Hazard Extent for Thunderstorm Hazard

The extent of the historical thunderstorms varies in terms of the extent of the storm, the wind speed, and the size of hail stones. Thunderstorms can occur at any location within the county.



Risk Identification for Thunderstorm Hazard

Based on historical information, the probability of a thunderstorm is high. In Meeting #2, the planning team determined that the potential impact of a thunderstorm is moderate; therefore, the overall risk of a thunderstorm hazard for Porter County is severe.

Vulnerability Analysis for Thunderstorm Hazard

Severe thunderstorms are an equally distributed threat across the entire jurisdiction; therefore, the entire county's population and all buildings are vulnerable to a severe thunderstorm and can expect the same impacts within the affected area. This plan will therefore consider all buildings located within the county as vulnerable. The existing buildings and infrastructure in Porter County are discussed in Table 4-6.

Severe winds in May 2007 snapped utility poles and dropped power lines into the streets, *Source: CBS*

Critical Facilities

All critical facilities are vulnerable to severe thunderstorms. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g. a damaged police station will no longer be able to serve the community). Table 4-5 lists the types and numbers of all of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is provided in Table 4-6. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure,

damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g. a damaged home will no longer be habitable causing residents to seek shelter).

Infrastructure

During a severe thunderstorm, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable it is important to emphasize that any number of these items could become damaged during a severe thunderstorm. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

Potential Dollar Losses for Thunderstorm Hazard

A HAZUS-MH analysis was not completed for thunderstorms because the widespread extent of such a hazard makes it difficult to accurately model outcomes. To determine dollar losses for a thunderstorm hazard, the available NCDC hazard information was condensed to include only thunderstorm hazards that occurred within the past ten years. Porter County's MHMP team then reviewed the property damages reported to NCDC and made any applicable updates.

It was determined that since 1998, Porter County has incurred $5,417,000 in damages relating to thunderstorms, including hail, lightning, and high winds. The resulting information is listed in Table 4-30.

Table 4-30: Porter County Property Damage (1998–2008)

Location or County	Date	Type	Property Damage
Porter	08/24/98	Thunderstorm Winds	$0
Porter	11/10/98	High Wind	$0
		1998 Subtotal	**$0**
Chesterton	04/10/99	Hail	$0
Beverly Shores	08/29/99	Rip Currents	$0
		1999 Subtotal	**$0**
Valparaiso Municipal Airport	05/08/00	Thunderstorm Winds	$0
Valparaiso	05/08/00	Thunderstorm Winds	$0
Porter	08/06/00	Lightning	$0
Porter	08/06/00	Thunderstorm Winds	$0
Porter	09/11/00	Hail	$0
Porter	09/11/00	Thunderstorm Winds	$0
		2000 Subtotal	$0
Porter	02/25/01	Strong Wind	$0
Chesterton	06/11/01	Lightning	$0
Porter	06/11/01	Thunderstorm Winds	$55,000
Burdick	07/07/01	Lightning	$12,000
Chesterton	07/07/01	Thunderstorm Winds	$2,000
Chesterton	07/23/01	Lightning	$10,000

Location or County	Date	Type	Property Damage
Chesterton	08/02/01	Lightning	$25,000
Wheeler	08/25/01	Tornado	$0
Chesterton	10/24/01	Thunderstorm Winds	$0
		2001 Subtotal	**$104,000**
Porter	03/09/02	High Wind	$0
Valparaiso	06/25/02	Thunderstorm Winds	$0
Wheeler	07/22/02	Thunderstorm Winds	$0
		2002 Subtotal	**$0**
Valparaiso	06/28/03	Hail	$0
Valparaiso	06/28/03	Thunderstorm Winds	$0
Chesterton	07/05/03	Thunderstorm Winds	$0
Porter	07/07/03	Thunderstorm Winds	$0
Wheeler	07/17/03	Hail	$0
Hebron	07/17/03	Hail	$0
Lake Eliza	07/17/03	Hail	$0
Hebron	07/17/03	Hail	$0
Valparaiso	08/26/03	Thunderstorm Winds	$0
Porter	11/13/03	High Wind	$0
		2003 Subtotal	**$0**
Porter	03/05/04	High Wind	$0
Valparaiso	05/09/04	Thunderstorm Winds	$0
Hebron	05/20/04	Hail	$0
Hebron	05/20/04	Thunderstorm Winds	$0
Chesterton	05/23/04	Hail	$0
Hebron	05/30/04	Thunderstorm Winds	$0
Beverly Shores	07/21/04	Thunderstorm Winds	$0
Porter	07/21/04	Thunderstorm Winds	$0
		2004 Subtotal	**$0**
Kouts	06/05/05	Thunderstorm Winds	$0
Porter	06/07/05	Hail	$0
Valparaiso	06/07/05	Hail	$0
Valparaiso	07/21/05	Hail	$0
Valparaiso	07/21/05	Lightning	$0
Chesterton	07/21/05	Thunderstorm Winds	$0
Beverly Shores	07/26/05	Rip Current	$0
Chesterton	08/20/05	Lightning	$40,000
		2005 Subtotal	**$40,000**
Hebron	02/16/06	Hail	$0
Crocker	05/17/06	Hail	$0
Hebron	06/21/06	Hail	$0
Kouts	06/21/06	Thunderstorm Winds	$1,000
Valparaiso	07/20/06	Thunderstorm Winds	$0
Valparaiso	07/27/06	Thunderstorm Winds	$0
Portage	07/30/06	Thunderstorm Winds	$5,000
Malden	07/30/06	Thunderstorm Winds	$25,000
Chesterton	08/02/06	Thunderstorm Winds	$0
Chesterton	08/03/06	Thunderstorm Winds	$0

Location or County	Date	Type	Property Damage
Porter	08/03/06	Thunderstorm Winds	$0
Chesterton	08/23/06	Hail	$500,000
Valparaiso	08/23/06	Hail	$0
Town of Pines	08/23/06	Thunderstorm Winds	$1,000,000
Beverly Shores	08/23/06	Thunderstorm Winds	$1,000,000
Valparaiso	08/23/06	Thunderstorm Winds	$100,000
Kouts	08/23/06	Thunderstorm Winds	$0
Edgewater Beach	10/02/06	Hail	$0
		2006 Subtotal	**$2,631,000**
Portage	05/15/07	Thunderstorm Winds	$35,000
Chesterton	05/15/07	Thunderstorm Winds	$0
South Haven	05/15/07	Thunderstorm Winds	$15,000
Valparaiso	05/15/07	Thunderstorm Winds	$0
Chesterton	06/27/07	Hail	$0
Valparaiso	07/18/07	Thunderstorm Winds	$5,000
Burns Harbor	07/26/07	Thunderstorm Winds	$0
Hebron	08/15/07	Hail	$0
Valparaiso	08/15/07	Hail	$0
Valparaiso	08/15/07	Hail	$0
Boone Grove	08/15/07	Hail	$0
Chesterton	08/15/07	Lightning	$50,000
Hurlburt	08/15/07	Thunderstorm Winds	$2,500,000
Valparaiso	08/23/07	Thunderstorm Winds	$0
Valparaiso	08/23/07	Thunderstorm Winds	$0
Valparaiso Municipal Airport	08/23/07	Thunderstorm Winds	$0
Malden	10/18/07	Hail	$0
Valparaiso	10/18/07	Hail	$0
Chesterton	12/23/07	Thunderstorm Winds	$5,000
		2007 Subtotal	**$2,610,000**
Chesterton	06/08/08	Thunderstorm Winds	$0
Valparaiso	06/22/08	Hail	$0
Valparaiso	06/22/08	Hail	$0
Valparaiso	06/22/08	Hail	$0
INZ002	07/13/08	Rip Current	$0
Sedley	07/31/08	Thunderstorm Winds	$0
Valparaiso	07/31/08	Thunderstorm Winds	$0
INZ002	08/02/08	Thunderstorm Winds	$0
Tremont	08/04/08	Thunderstorm Winds	$0
Chesterton	08/04/08	Thunderstorm Winds	$2,000
Valparaiso	08/04/08	Thunderstorm Winds	$25,000
		2008 Subtotal	**$27,000**
Portage	05/13/09	Thunderstorm Winds	$5,000
Portage	06/19/09	Thunderstorm Winds	$0
Chesterton	08/27/09	Heavy Rain	$0
Valparaiso	08/27/09	Heavy Rain	$0
Valparaiso	09/27/09	Thunderstorm Winds	$0
Willow Creek	09/27/09	Thunderstorm Winds	$0

Location or County	Date	Type	Property Damage
		2009 Subtotal	$5,000
		Total Property Damage	$5,417,000

The historical data is erratic and not wholly documented or confirmed. As a result, potential dollar losses for a future event cannot be precisely calculated; however, based on averages in the last decade, it can be determined that Porter County incurs an annual risk of approximately $541,700 per year.

Vulnerability to Future Assets/Infrastructure for Thunderstorm Hazard

All future development within the county and all communities will remain vulnerable to these events.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warning of approaching storms are also vital to preventing the loss of property and ensuring the safety of Porter County residents.

4.4.5 Drought and Extreme Heat Hazard

Hazard Definition for Drought Hazard

Drought is a climatic phenomenon that occurs in Porter County. The meteorological condition that creates a drought is below normal rainfall. However, excessive heat can lead to increased evaporation, which will enhance drought conditions. Droughts can occur in any month. Drought differs from normal arid conditions found in low rainfall areas. Drought is the consequence of a reduction in the amount of precipitation over an undetermined length of time (usually a growing season or more).

The severity of a drought depends on location, duration, and geographical extent. Additionally, drought severity depends on the water supply, usage demands made by human activities, vegetation, and agricultural operations. Drought brings several different problems that must be addressed. The quality and quantity of crops, livestock, and other agricultural assets will be affected during a drought. Drought can adversely impact forested areas leading to an increased potential for extremely destructive forest and woodland fires that could threaten residential, commercial, and recreational structures.

Hazard Definition for Extreme Heat Hazard

Drought conditions are often accompanied by extreme heat, which is defined as temperatures that hover 10°F or more above the average high for the area and last for several weeks. Extreme

heat can occur in humid conditions when high atmospheric pressure traps the damp air near the ground or in dry conditions, which often provoke dust storms.

Common Terms Associated with Extreme Heat

Heat Wave: Prolonged period of excessive heat, often combined with excessive humidity

Heat Index: A number in degrees Fahrenheit that tells how hot it feels when relative humidity is added to air temperature. Exposure to full sunshine can increase the heat index by 15°F.

Heat Cramps: Muscular pains and spasms due to heavy exertion. Although heat cramps are the least severe, they are often the first signal that the body is having trouble with heat.

Heat Exhaustion: Typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to decrease to the vital organs, resulting in a form of mild shock. If left untreated, the victim's condition will worsen. Body temperature will continue to rise and the victim may suffer heat stroke.

Heat and Sun Stroke: A life-threatening condition. The victim's temperature control system, which produces sweat to cool the body, stops working. The body's temperature can rise so high that brain damage and death may result if the body is not cooled quickly.

Source: FEMA

Previous Occurrences of Drought and Extreme Heat Hazard

The NCDC database reported two drought/heat wave events in Porter County since 1950. For example, in August 2007, heat wave conditions initially developed over southwest Indiana on the 12th then overspread all but northwest Indiana for the remainder of the week. Heat wave conditions ended across the north and central sections on the 19th and over the south by the 21st. High temperatures were in the 90s throughout the period and near 100 across the south. High humidity also yielded Heat Index values between 100°F and 115°F most of the week. These extreme conditions resulted in a heat stroke and death of an elderly male. The Indiana State Fair lost over $400,000 due to low turnouts and most of Indiana crops suffered some due to the heat.

NCDC records of droughts/heat waves are identified in Table 4-31. Additional details for NCDC events are included in Appendix D.

Table 4-31: Porter County Drought/Heat Wave Events*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Statewide	7/13/1995	Heat Wave	N/A	14	0	1.0M	0
Statewide	8/21/1995	Heat Wave	N/A	1	0	0	0

** NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.*

Geographic Location for Drought and Extreme Heat Hazard

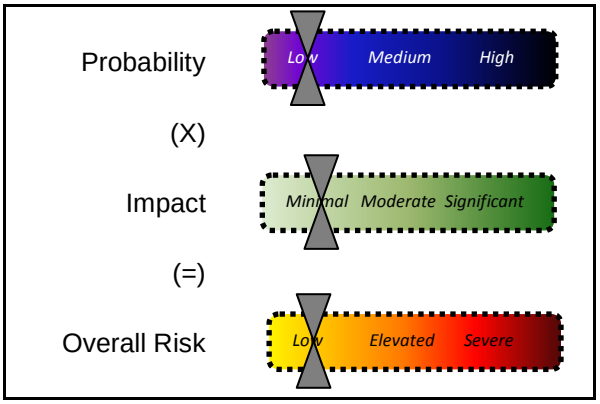
Droughts are regional in nature. All areas of the United States are vulnerable to the risk of drought and extreme heat.

Hazard Extent for Drought and Extreme Heat Hazard

Droughts and extreme heat can be widespread or localized events. The extent of the droughts varies both in terms of the extent of the heat and the range of precipitation.

Risk Identification for Drought/Extreme Heat Hazard

Based on historical information, the probability of a drought is low. In Meeting #2, the planning team determined that the potential impact of a drought or an extended period of extreme heat is minimal; therefore, the overall risk of a drought/extreme heat hazard for Porter County is low.



Vulnerability Analysis for Drought and Extreme Heat Hazard

Drought and extreme heat impacts are an equally distributed threat across the entire jurisdiction; therefore, the county is vulnerable to this hazard and can expect the same impacts within the affected area. According to FEMA, approximately 175 Americans die each year from extreme heat. Young children, elderly, and infirmed populations have the greatest risk.

The entire population and all buildings have been identified as at risk. The building exposure for Porter County, as determined from the building inventory is included in Table 4-6.

Critical Facilities

All critical facilities are vulnerable to drought. A critical facility will encounter many of the same impacts as any other building within the jurisdiction, which should involve only minor damage. These impacts include water shortages, fires as a result of drought conditions, and residents in need of medical care from the heat and dry weather. Table 4-5 lists the types and numbers of all of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-6. The buildings within the county can all expect the same impacts similar to those discussed for critical facilities. These impacts include water shortages, fires as a result of drought conditions, and residents in need of medical care from the heat and dry weather.

Infrastructure

During a drought the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. The risk to these structures is primarily associated with a fire that could result from the hot, dry conditions. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a heat wave. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

Vulnerability to Future Assets/Infrastructure for Drought/Extreme Heat Hazard

Future development will remain vulnerable to these events. Typically, some urban and rural areas are more susceptible than others. For example, urban areas are subject to water shortages during periods of drought. Excessive demands of the populated area place a limit on water resources. In rural areas, crops and livestock may suffer from extended periods of heat and drought. Dry conditions can lead to the ignition of wildfires that could threaten residential, commercial, and recreational areas.

Analysis of Community Development Trends

Because droughts and extreme heat are regional in nature, future development will be impacted across the county. Although urban and rural areas are equally vulnerable to this hazard, those living in urban areas may have a greater risk from the effects of a prolonged heat wave. The atmospheric conditions that create extreme heat tend to trap pollutants in urban areas, adding contaminated air to the excessively hot temperatures and creating increased health problems. Furthermore, asphalt and concrete store heat longer, gradually releasing it at night and producing high nighttime temperatures. This phenomenon is known as the "urban heat island effect."

Source: FEMA

Local officials should address drought and extreme heat hazards by educating the public on steps to take before and during the event—for example, temporary window reflectors to direct heat back outside, staying indoors as much as possible, and avoiding strenuous work during the warmest part of the day.

4.4.6 Winter Storm Hazard

Hazard Definition for Winter Storm Hazard

Severe winter weather consists of various forms of precipitation and strong weather conditions. This may include one or more of the following: freezing rain, sleet, heavy snow, blizzards, icy roadways, extreme low temperatures, and strong winds. These conditions can cause human health risks such as frostbite, hypothermia, and death.

Ice (glazing) and Sleet Storms

Ice or sleet, even in the smallest quantities, can result in hazardous driving conditions and can be a significant cause of property damage. Sleet can be easily identified as frozen raindrops. Sleet does not stick to trees and wires. The most damaging winter storms in Indiana have been ice storms. Ice storms are the result of cold rain that freezes on contact with objects having a temperature below freezing. Ice storms occur when moisture-laden gulf air converges with the northern jet stream causing strong winds and heavy precipitation. This precipitation takes the form of freezing rain coating power lines, communication lines, and trees with heavy ice. The winds will then cause the overburdened limbs and cables to snap; leaving large sectors of the population without power, heat, or communication. Falling trees and limbs can also cause building damage during an ice storm. In the past few decades numerous ice storm events have occurred in Indiana.

Snowstorms

Significant snowstorms are characterized by the rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility. A blizzard is categorized as a snowstorm with winds of 35 miles per hour or greater and/or visibility of less than one-quarter mile for three or more hours. The strong winds during a blizzard blow about falling and already existing snow, creating poor visibility and impassable roadways. Blizzards have the potential to result in property damage.

Indiana has repeatedly been struck by blizzards. Blizzard conditions cannot only cause power outages and loss of communication, but also make transportation difficult. The blowing of snow can reduce visibility to less than one-quarter mile, and the resulting disorientation makes even travel by foot dangerous if not deadly.

Severe Cold

Severe cold is characterized by the ambient air temperature dropping to around 0°F or below. These extreme temperatures can increase the likelihood of frostbite and hypothermia. High winds during severe cold events can enhance the air temperature's effects. Fast winds during cold weather events can lower the wind chill factor (how cold the air feels on your skin). As a result, the time it takes for frostbite and hypothermia to affect a person's body will decrease.

Previous Occurrences of Winter Storm Hazard

The NCDC database identified 45 winter storm and extreme cold events for Porter County since 1950. For example, in 2008, heavy snow developed during the evening hours of February 25th and continued into the early afternoon hours of February 26th. Storm total snowfall amounts included 7.8 inches Valparaiso, 6.8 inches in Merrillville, 6.2 inches in Goodland, 6.1 inches in Portage, 6.0 Remington, 6.0 inches in Earl Park and 5.8 inches in Rensselaer.

February 2009, two feet of snow in Valparaiso, Indiana
Source: Weather Underground

The NCDC winter storms are listed in Table 4-32. Additional details for NCDC events are included in Appendix D.

Table 4-32: Winter Storm Events*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Porter	03/04/93	Heavy Snow	N/A	0	0	0	0
Northwest In	03/13/93	Heavy Snow	N/A	0	0	0	0
Porter	01/14/94	Extreme Cold	N/A	3	0	5.0M	0
Northern Indiana	02/25/94	Heavy Snow	N/A	0	0	0	0
Porter	04/10/95	Ice Storm	N/A	0	0	0	0
Porter	12/08/95	Winter Storm	N/A	0	0	0	0
Porter	12/18/95	Winter Storm	N/A	0	0	0	0
Porter	12/27/95	Heavy Snow	N/A	0	0	0	0
Porter	02/02/96	Extreme Cold	N/A	0	0	0	0
Porter	01/09/97	Winter Storm	N/A	0	0	0	0
Porter	01/15/97	Winter Storm	N/A	0	0	0	0
Porter	12/09/97	Heavy Snow	N/A	0	0	0	0
Porter	12/30/97	Heavy Snow	N/A	0	0	0	0
Porter	03/09/98	Heavy Snow	N/A	0	0	0	0
Porter	01/01/99	Heavy Snow	N/A	0	0	0	0
Porter	03/08/99	Heavy Snow	N/A	0	0	0	0
Porter	01/19/00	Heavy Snow	N/A	0	0	0	0
Porter	01/25/00	Heavy Snow	N/A	0	0	0	0
Porter	02/18/00	Heavy Snow	N/A	0	0	0	0
Porter	12/11/00	Blizzard	N/A	0	0	0	0
Porter	01/31/02	Winter Storm	N/A	0	0	0	0
Porter	02/26/02	Winter Storm	N/A	0	0	0	0
Porter	03/02/02	Winter Storm	N/A	0	0	0	0
Porter	12/24/02	Winter Storm	N/A	0	0	0	0
Porter	01/17/03	Heavy Snow	N/A	0	0	0	0
Porter	01/23/03	Extreme Cold	N/A	0	0	0	0
Porter	03/04/03	Winter Storm	N/A	0	0	0	0
Porter	01/29/04	Extreme Cold	N/A	0	0	0	0
Porter	05/03/04	Frost/freeze	N/A	0	0	0	0
Porter	01/04/05	Heavy Snow	N/A	0	0	0	0
Porter	01/21/05	Heavy Snow	N/A	0	0	0	0
Porter	12/08/05	Winter Storm	N/A	0	0	0	0
Porter	02/25/07	Winter Storm	N/A	0	0	0K	0K
Porter	12/01/07	Ice Storm	N/A	0	0	0K	0K
Porter	12/15/07	Heavy Snow	N/A	0	0	0K	0K
Porter	01/31/08	Winter Storm	N/A	0	0	0K	0K
Porter	02/20/08	Lake-effect Snow	N/A	0	0	0K	0K
Porter	02/25/08	Winter Storm	N/A	0	0	0K	0K
Porter	11/18/08	Lake-effect Snow	N/A	0	0	0K	0K
Porter	12/18/08	Winter Storm	N/A	0	0	0K	0K

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Porter	12/21/08	Extreme Cold	N/A	0	0	0K	0K
Porter	01/14/09	Winter Storm	N/A	0	0	0K	0K
Porter	01/15/09	Extreme Cold	N/A	0	0	0K	0K
Porter	01/18/09	Lake-effect Snow	N/A	0	0	0K	0K
Porter	02/03/09	Lake-effect Snow	N/A	0	0	0K	0K

** NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.*

Geographic Location for Winter Storm Hazard

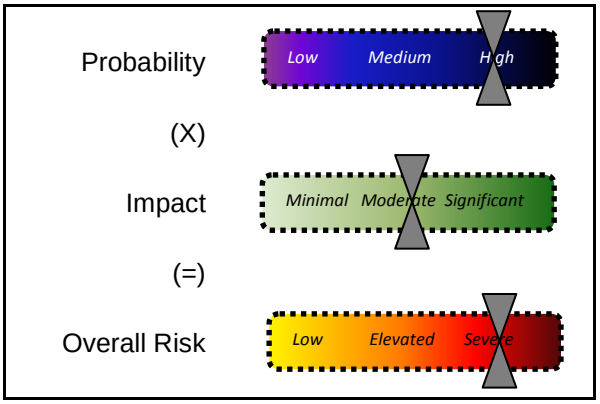
Severe winter storms are regional in nature. Most of the NCDC data is calculated regionally or in some cases statewide.

Hazard Extent for Winter Storm Hazard

The extent of the historical winter storms varies in terms of storm location, temperature, and ice or snowfall. A severe winter storm can occur anywhere in the jurisdiction.

Risk Identification for Winter Storm Hazard

Based on historical information, the probability of a winter storm is high. In Meeting #2, the planning team determined that the potential impact of a winter storm is moderate; therefore, the overall risk of a winter storm hazard for Porter County is severe.



Vulnerability Analysis for Winter Storm Hazard

Winter storm impacts are equally distributed across the entire jurisdiction; therefore, the entire county is vulnerable to a winter storm and can expect the same impacts within the affected area. The building exposure for Porter County, as determined from the building inventory, is included in Table 4-6.

Critical Facilities

All critical facilities are vulnerable to a winter storm. A critical facility will encounter many of the same impacts as other buildings within the jurisdiction. These impacts include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow. Table 4-5 lists the types and numbers of

the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-6. The impacts to the general buildings within the county are similar to the damages expected to the critical facilities. These include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow.

Infrastructure

During a winter storm, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable it is important to emphasize that any number of these items could become damaged during a winter storm. Potential impacts include broken gas and/or electricity lines or damaged utility lines, damaged or impassable roads and railways, and broken water pipes.

IBEW helps restore power after an Indiana ice storm, *Source: ibew.org*

Potential Dollar Losses for Winter Storm Hazard

A HAZUS-MH analysis was not completed for winter storms because the widespread extent of such a hazard makes it difficult to accurately model outcomes. To determine dollar losses for a winter storm hazard, the available NCDC hazard information was condensed to include only winter storm hazards that occurred within the past ten years. Porter County's MHMP team then reviewed the property damages reported to NCDC and made any applicable updates. It was determined that since 1998, Porter County has incurred no significant property damages relating to winter storms.

Vulnerability to Future Assets/Infrastructure for Winter Storm Hazard

Any new development within the county will remain vulnerable to these events.

Analysis of Community Development Trends

Because the winter storm events are regional in nature future development will be equally impacted across the county.

4.4.7 Hazardous Materials Storage and Transport Hazard

Hazard Definition for Hazardous Materials Storage and Transport Hazard

The state of Indiana has numerous active transportation lines that run through many of its counties. Active railways transport harmful and volatile substances between our borders every day. The transportation of chemicals and substances along interstate routes is commonplace in Indiana. The rural areas of Indiana have considerable agricultural commerce creating a demand for fertilizers, herbicides, and pesticides to be transported along rural roads. Finally, Indiana is bordered by two major rivers and Lake Michigan. Barges transport chemicals and substances along these waterways daily. These factors increase the chance of hazardous material releases and spills throughout the state of Indiana.

The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials/chemicals, dust, and bombs. An explosion can potentially cause death, injury, and property damage. In addition, a fire routinely follows an explosion which may cause further damage and inhibit emergency response. Emergency response may require fire, safety/law enforcement, search and rescue, and hazardous materials units.

Previous Occurrences of Hazardous Materials Storage and Transport Hazard

Porter County has not experienced a significantly large-scale hazardous material incident at a fixed site or during transport resulting in multiple deaths or serious injuries, although there have been many minor releases that have put local firefighters, hazardous materials teams, emergency management, and local law enforcement into action to try to stabilize these incidents and prevent or lessen harm to Porter County residents.

Geographic Location for Hazardous Materials Storage and Transport Hazard

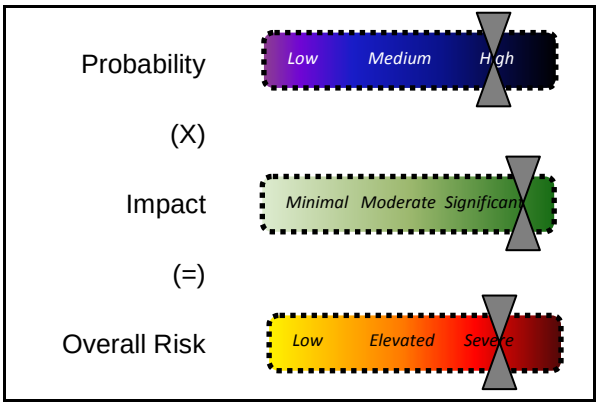
The hazardous material hazards are countywide and are primarily associated with the transport of materials via highway, railroad, and/or river barge.

Hazard Extent for Hazardous Materials Storage and Transport Hazard

The extent of the hazardous material hazard varies both in terms of the quantity of material being transported as well as the specific content of the container.

Risk Identification for Hazardous Materials Release

Based on historical information, the probability of a hazmat hazard is high. In Meeting #2, the planning team determined that the potential impact of a hazmat release is significant; therefore, the overall risk of a hazmat hazard for Porter County is severe.



Vulnerability Analysis for Hazardous Materials Storage and Transport Hazard

Hazardous material impacts are an equally distributed threat across the entire jurisdiction; therefore, the entire county is vulnerable to a hazardous material release and can expect the same impacts within the affected area. The main concern during a release or spill is the population affected. The building exposure for Porter County, as determined from building inventory, is included in Table 4-6. This plan will therefore consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities and communities within the county are at risk. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure due to fire or explosion and loss of function of the facility (e.g. a damaged police station will no longer be able to serve the community). Table 4-5 lists the types and numbers of all essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-6. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure due to fire or explosion or debris and loss of function of the building (e.g. a damaged home will no longer be habitable causing residents to seek shelter).

Infrastructure

During a hazardous material release the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available to this plan it is important to emphasize that any number of these items could become damaged in the event of a hazardous material release. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

In terms of numbers and types of buildings and infrastructure, typical scenarios are described to gauge the anticipated impacts of hazardous material release events in the county.

The U.S. EPA's ALOHA (Areal Locations of Hazardous Atmospheres) model was utilized to assess the area of impact for an anhydrous ammonia release at the interchange of I-94 and State Road 149 in Burns Harbor.

Anhydrous ammonia is a clear colorless gas with a strong odor. Contact with the unconfined liquid can cause frostbite. Though the gas is generally regarded as nonflammable, it can burn within certain vapor concentration limits with strong ignition. The fire hazard increases in the presence of oil or other combustible materials. Vapors from an anhydrous ammonia leak initially

hug the ground, and prolonged exposure of containers to fire or heat may cause violent rupturing and rocketing. Long-term inhalation of low concentrations of the vapors or short-term inhalation of high concentrations has adverse health effects. Anhydrous ammonia is generally used as a fertilizer, a refrigerant, and in the manufacture of other chemicals.

Source: CAMEO

ALOHA is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. Anhydrous ammonia is a common chemical used in industrial operations and can be found in either liquid or gas form. Rail and truck tankers commonly haul anhydrous ammonia to and from facilities.

For this scenario, moderate atmospheric and climatic conditions with a slight breeze from the west were assumed. The target area was chosen due to its centralized location for transport in the region. The geographic area covered in this analysis is depicted in Figure 4-13.

Figure 4-13: Location of Chemical Release

Analysis

The ALOHA atmospheric modeling parameters, depicted in Figure 4-14, were based upon a westerly wind speed of five miles per hour. The temperature was 68°F with 75% humidity and partly-cloudy skies.

The source of the chemical spill is a horizontal tank. The diameter of the tank was set to eight feet and the length set to 33 feet (12,408 gallons). At the time of its release, it was estimated that the tank was 85% full. The Anhydrous ammonia in this tank is in its liquid state.

This release was based on a leak from a 2.5-inch-diameter hole, 12 inches above the bottom of the tank. According to the ALOHA parameters, approximately 7,730 pounds of material would be released per minute. The image in Figure 4-15 depicts the plume footprint generated by ALOHA.

Figure 4-14: ALOHA Plume Modeling Parameters

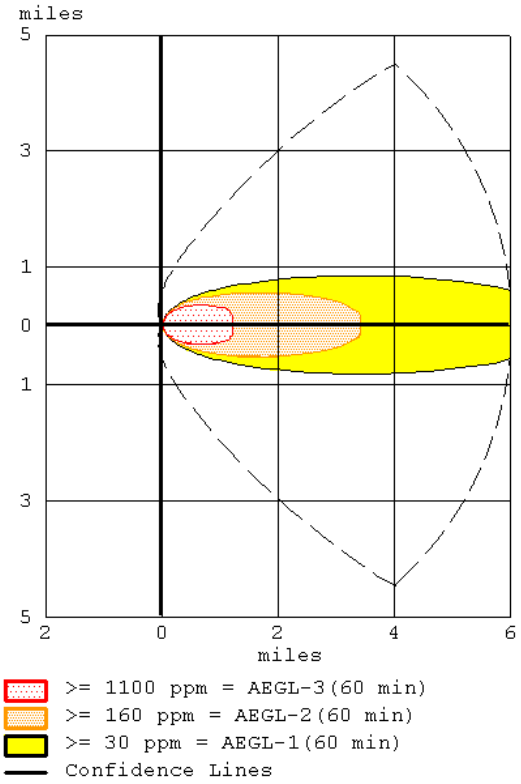
```
SITE DATA:
  Location: BURNS HARBOR, INDIANA
  Building Air Exchanges Per Hour: 0.29 (sheltered single storied)
  Time: December 7, 2009  1452 hours CST (user specified)

CHEMICAL DATA:
  Chemical Name: AMMONIA                  Molecular Weight: 17.03 g/mol
  AEGL-1(60 min): 30 ppm   AEGL-2(60 min): 160 ppm   AEGL-3(60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 160000 ppm      UEL: 250000 ppm
  Ambient Boiling Point: -29.0° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 5 miles/hour from W at 10 meters
  Ground Roughness: open country          Cloud Cover: 5 tenths
  Air Temperature: 68° F                  Stability Class: C
  No Inversion Height                     Relative Humidity: 75%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 8 feet                   Tank Length: 33 feet
  Tank Volume: 12,408 gallons
  Tank contains liquid                    Internal Temperature: 68° F
  Chemical Mass in Tank: 26.9 tons        Tank is 85% full
  Circular Opening Diameter: 2.5 inches
  Opening is 12 inches from tank bottom
  Release Duration: 11 minutes
  Max Average Sustained Release Rate: 7,730 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 50,572 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```

Figure 4-15: Plume Footprint Generated by ALOHA



Acute Exposure Guideline Levels (AEGLs) are intended to describe the health effects on humans due to once-in-a-lifetime or rare exposure to airborne chemicals. The National Advisory Committee for AEGLs is developing these guidelines to help both national and local authorities, as well as private companies, deal with emergencies involving spills or other catastrophic exposures. As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million (ppm). The image in Figure 4-16 depicts the plume footprint generated by ALOHA in ArcGIS.

- **AEGL 3:** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death. The red buffer (>=1,100 ppm) extends no more than 1.7 miles from the point of release after one hour.

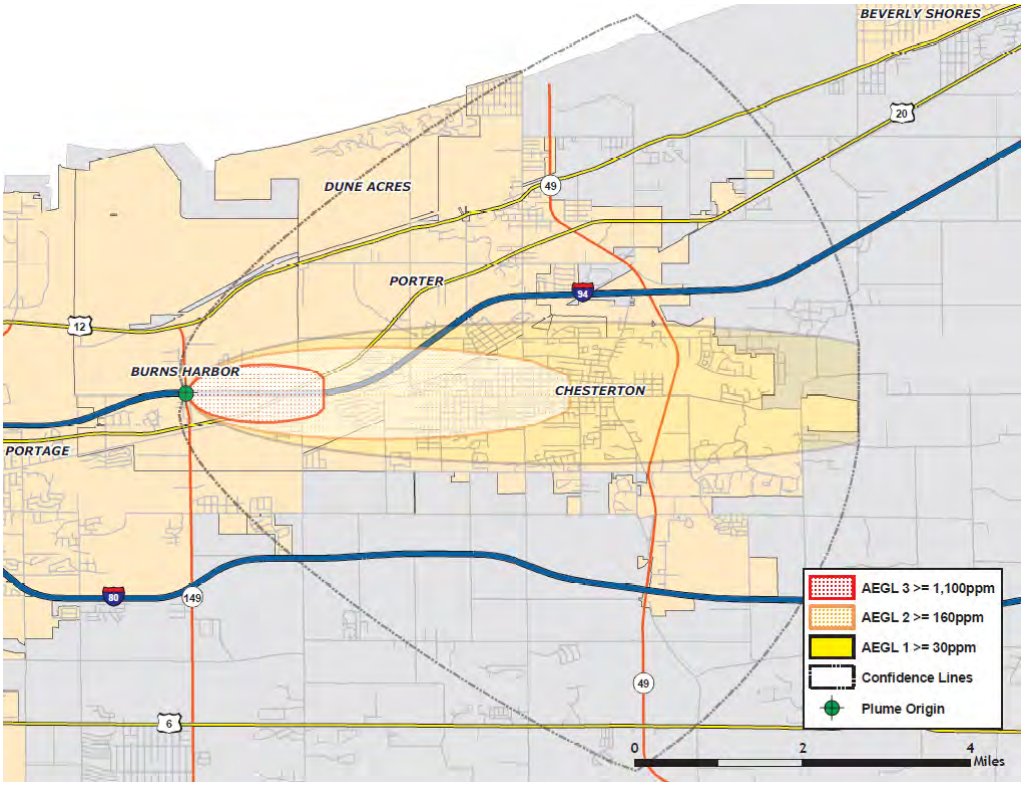
- **AEGL 2:** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape. The orange buffer (>=160 ppm) extends no more than 3.5 miles from the point of release after one hour.

- **AEGL 1:** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects

are not disabling and are transient and reversible upon cessation of exposure. The yellow buffer (>=30 ppm) extends more than 6 miles from the point of release after one hour.

- **Confidence Lines:** The dashed lines depict the level of confidence in which the exposure levels will be contained. The ALOHA model is 95% confident that the release will stay within this boundary.

Figure 4-16: ALOHA Plume Footprint Overlaid in ArcGIS

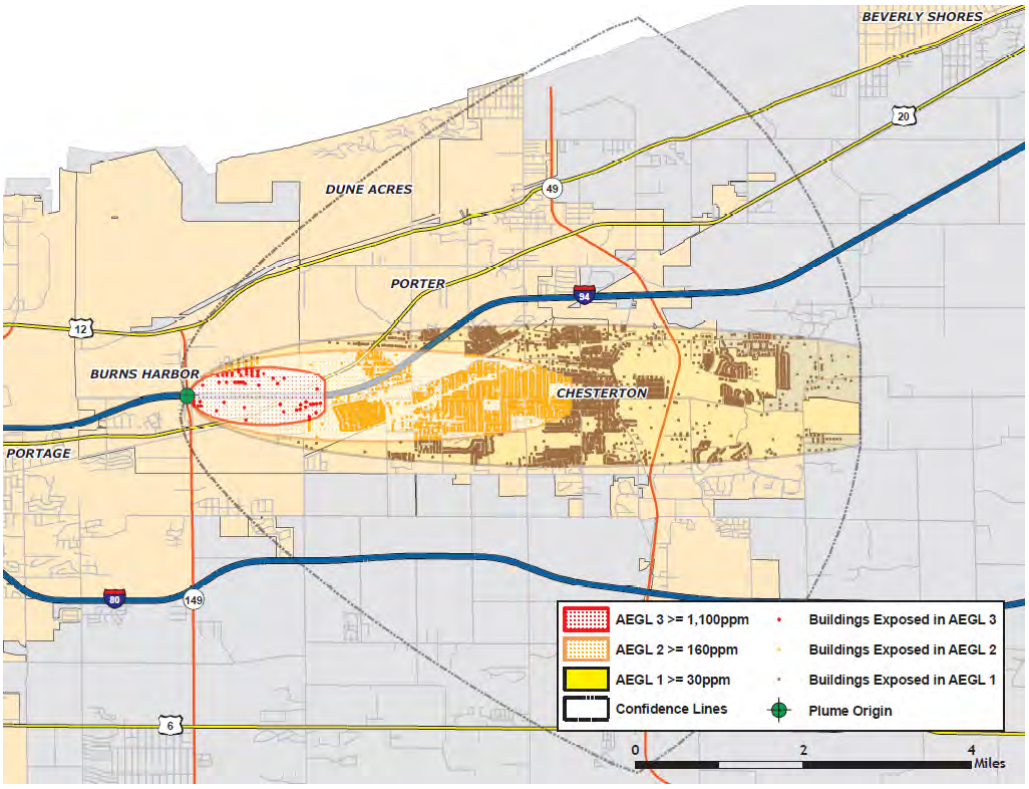


Results

By summing the building inventory within all AEGL exposure levels (Level 3: 1,100 ppm, Level 2: 160 ppm and Level 1: 30 ppm.), the GIS overlay analysis predicts that as many as 4,700 buildings could be exposed at a replacement cost of $823 million. The overlay was performed against parcels provided by Porter County that were joined with Assessor records showing property improvement. If this event were to occur, approximately 6,223 people would be affected. Figure 4-17 depicts the vulnerable areas.

The Assessor records often do not distinguish parcels by occupancy class when the parcels are not taxable; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

Figure 4-17: Porter County Building Inventory Classified By Plume Footprint



Building Inventory Damage

The results of the analysis against the Building Inventory points are depicted in Tables 4-33 through 4-36. Table 4-33 summarizes the results of the chemical spill by combining all AEGL levels. Tables 4-34 through 4-36 summarize the results of the chemical spill for each level separately.

Table 4-33: Estimated Exposure for all AEGL Levels (all ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	6,223	4,295	$562,776
Commercial	0	307	$130,840
Industrial	0	14	$27,518
Agriculture	0	11	$1,348
Religious	0	36	$18,531
Government	0	28	$14,522
Education	0	9	$67,440
Total	**6,223**	**4,700**	**$822,974**

Table 4-34: Estimated Exposure for AEGL Level 3 (1,100ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	123	49	$5,246
Commercial	0	7	$7,834
Industrial	0	0	$0
Agriculture	0	1	$93
Religious	0	0	$0
Government	0	1	$353
Education	0	0	$0
Total	**123**	**58**	**$13,526**

Table 4-35: Estimated Exposure for AEGL Level 2 (160 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	4,270	1,757	$209,556
Commercial	0	50	$14,513
Industrial	0	5	$24,196
Agriculture	0	1	$278
Religious	0	10	$3,537
Government	0	3	$1,367
Education	0	4	$28,682
Total	**4,270**	**1,830**	**$282,128**

Table 4-36: Estimated Exposure for AEGL Level 1 (30 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	1,830	2,489	$347,974
Commercial	0	250	$108,493
Industrial	0	9	$3,322
Agriculture	0	9	$977
Religious	0	26	$14,994
Government	0	24	$12,802
Education	0	5	$38,758
Total	**1,830**	**2,812**	**$527,319**

Critical Facilities Damage

There are 21 critical facilities within the limits of the chemical spill plume. Included in the list of affected critical facilities are seven schools, which could potentially expose 3,003 students. The affected facilities are identified in Table 4-37. Their geographic locations are depicted in Figures 4-18 and 4-19.

Table 4-37: Critical Facilities within Plume Footprint

Name	
The Waters of Duneland (Care Facility)	
W04CQ (Communication Tower)	
WDSO (Communication Tower)	
Siren #016 (Weather Siren)	
Siren #049/019 (Weather Siren)	
Siren #020 (Weather Siren	
Siren #021 (Weather Siren)	
Siren #033 (Weather Siren)	
Porter Fire Department	
Chesterton Fire Department	
Worthington Steel (Hazmat Facility)	
Paulson/POCO (Oil Facility)	
Porter Police Department	
Chesterton Police Department	
Schools	**Number of Students**
Brummitt Elementary School	348
Westchester Intermediate School	525
Bailly Elementary School	487
Chesterton Middle School	940
Newton Yost Elementary School	450
Chesterton Montessori School	180
Wee Care Child Development Center	73
Total Students	**3,003**

Figure 4-18: Critical Facilities within Plume Footprint

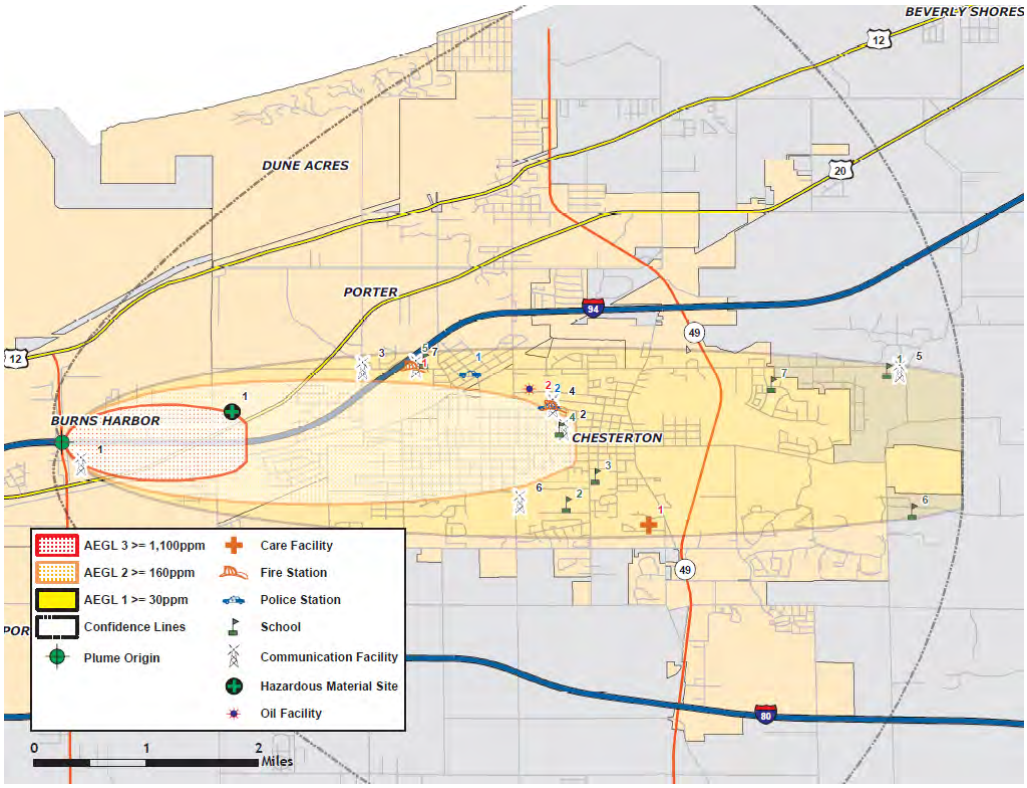
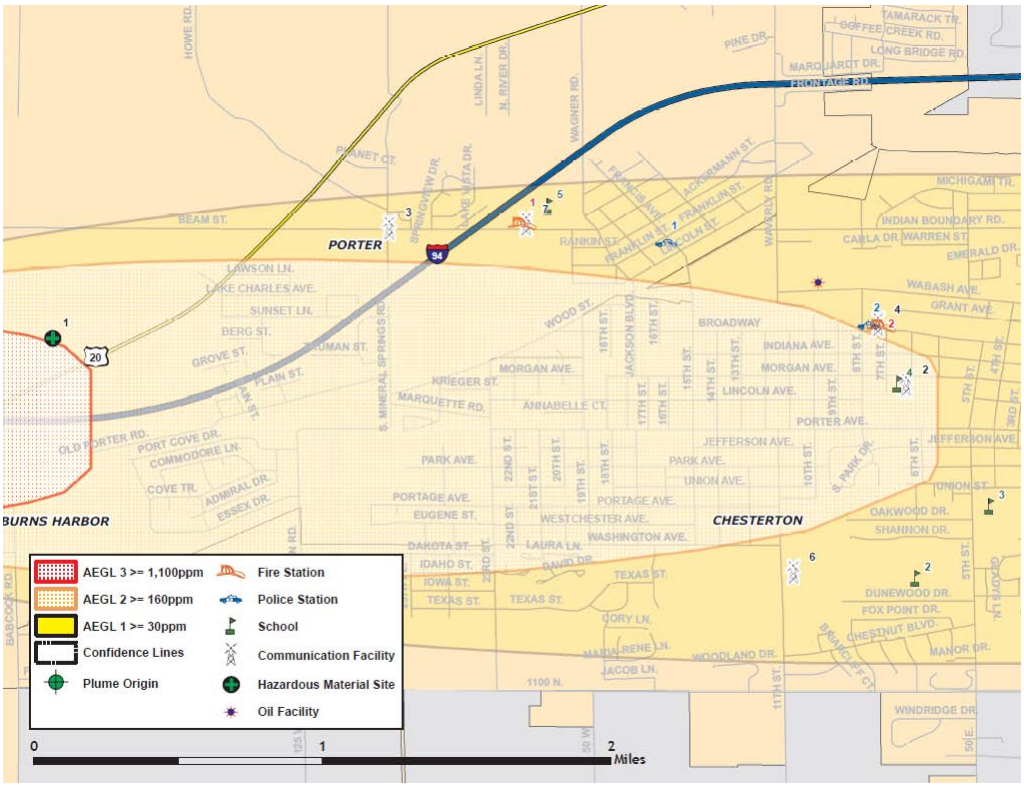


Figure 4-19: Critical Facilities at Greatest Risk



Vulnerability to Future Assets/Infrastructure for Hazardous Materials Storage and Transport Hazard

Any new development within the county will be vulnerable to these events, especially development along major roadways.

Analysis of Community Development Trends

Because the hazardous material hazard events may occur anywhere within the county, future development will be impacted. The major transportation routes and the industries located in Porter County pose a threat of dangerous chemicals and hazardous materials release.

4.4.8 Fire Hazard

Hazard Definition for Fire Hazard

This plan will identify four major categories of fires within the county: tire/scrap fires, structural fires, wildfires, and arson.

Tire Fires

The state of Indiana generates thousands of scrap tires annually. Many of those scrap tires end up in approved storage sites that are carefully regulated and controlled by federal and state officials. However, scrap tires are sometimes intentionally dumped in unapproved locations throughout the

state. Porter County has no approved locations for tire disposal and storage, and the number of unapproved locations cannot be readily determined. These illegal sites are owned by private residents who have been continually dumping waste and refuse, including scrap tires, at those locations for many years.

Tire disposal sites can be fire hazards, in large part, because of the enormous number of scrap tires typically present at one site. This large amount of fuel renders standard firefighting practices nearly useless. Flowing and burning oil released by the scrap tires can spread the fire to adjacent areas. Tire fires differ from conventional fires in the following ways:

- Relatively small tire fires can require significant fire resources to control and extinguish.
- Those resources often cost much more than Porter County government can absorb compared to standard fire responses.
- There may be significant environmental consequences of a major tire fire. Extreme heat can convert a standard vehicle tire into approximately two gallons of oily residue that may leak into the soil or migrate to streams and waterways.

Structural Fires

Lightning strikes, poor building construction, and building condition are the main causes for most structural fires in Indiana. Porter County has a few structural fires each year countywide.

Wildfires

Approximately 35% to 55% of Indiana's land base is heavily wooded or forested. When hot and dry conditions develop, forests may become vulnerable to devastating wildfires. In the past few decades an increased commercial and residential development near forested areas has dramatically changed the nature and scope of the wildfire hazard. In addition, the increase in structures resulting from new development strains the effectiveness of the fire service personnel in the county.

Wildland-urban interface (WUI) is defined as the area where human development and undeveloped wildland meet, creating an environment in which wildfires would threaten a community's population and infrastructure. The towns of Ogden Dunes, Porter, Dunes Acres, and Beverly Shores all have high risks for WUI events.

Arson

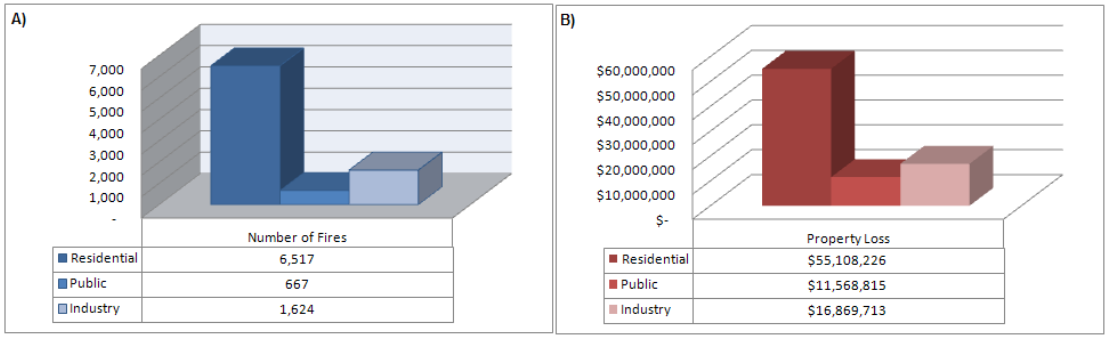
It is important to note that arson is a contributing factor to fire-related incidents within the county. According to the United States Fire Administration, approximately 22% of the total fires reported in the nation from 2001 to 2002 were of incendiary or suspicious nature.

Previous Occurrences of Fire Hazard

In Porter County, there have not been many structural fires with significant numbers of deaths or injuries. Records of structural fires in the state of Indiana between January 1, 2007, and

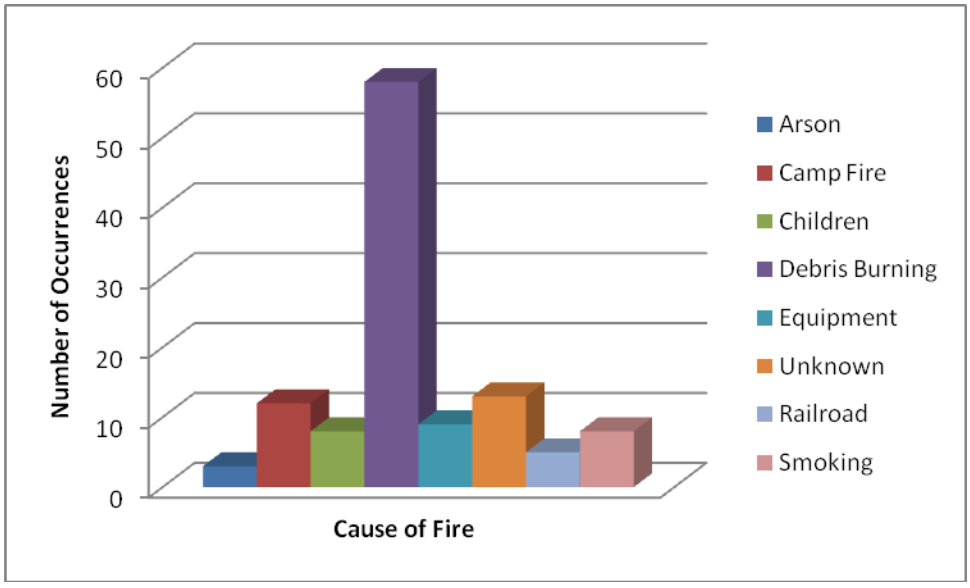
December 31, 2007, were obtained from the Fire Service Safety and Risk Management department of the Indiana Department of Homeland Security. Figure 4-20 A and B illustrates the numbers of annual structural fires and the associated property loss respectively, categorized by property type.

Figure 4-20: 2007 Indiana Structural Fires



According to the Indiana Department of Natural Resources, there have been 116 wildfires in Porter County in the past decade. Figure 4-21 displays the data by cause of the fire.

Figure 4-21: Porter County Wildfires (1999-2009)



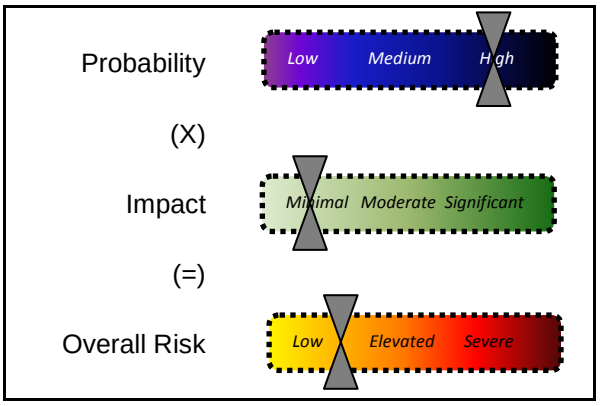
Geographic Location for Fire Hazard

Fire hazards occur countywide and therefore affect the entire county. The heavily forested areas in the county have a higher chance of widespread fire hazard.

Hazard Extent for Fire Hazard

The extent of the fire hazard varies both in terms of the severity of the fire and the type of material being ignited. All communities in Porter County are affected by fire equally.

Risk Identification for Fire Hazard



Based on historical information, the probability of a fire is high. In Meeting #2, the planning team determined that the potential impact of a fire is minimal; therefore, the overall risk of a fire hazard for Porter County is low.

Vulnerability Analysis for Fire Hazard

This hazard impacts the entire jurisdiction equally; therefore, the entire population and all buildings within the county are vulnerable to fires and can expect the same impacts within the affected area.

Table 4-5 lists the types and numbers of all essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

The building exposure for Porter County, as determined from the building inventory, is included in Table 4-6. Because of the difficulty predicting which communities are at risk, the entire population and all buildings have been identified at risk.

Critical Facilities

All critical facilities are vulnerable to fire hazards. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural damage from fire and water damage from efforts extinguishing fire. Table 4-5 lists the types and numbers of essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix E. A map of the critical facilities is included in Appendix F.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is provided in Table 4-6. Impacts to the general buildings within the county are similar to the damages expected to the critical facilities. These impacts include structural damage from fire and water damage from efforts to extinguish the fire.

Infrastructure

During a fire the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a fire. Potential impacts include structural damage resulting in impassable roadways and power outages.

Vulnerability to Future Assets/Infrastructure for Fire Hazard

Any future development will be vulnerable to these events.

Analysis of Community Development Trends

Fire hazard events may occur anywhere within the county, because of this future development will be impacted.

4.4.9 Coastal Hazards

Hazard Definition for Coastal Hazards

This multi-hazard mitigation plan will address coastal erosion and seiches as they pertain to Lake Michigan and Porter County.

Coastal Erosion

Coastal erosion in Porter County affects those communities along Lake Michigan: Ogden Dunes, Burns Harbor, Dune Acres, and Beverly Shores. According to the USGS, the erosion and flooding of Lake Michigan's coastline have resulted in extensive damage to residential, commercial, and industrial facilities.

Shoreline erosion damages home in Ogden Dunes, *Source: Michigan Sea Grant Extension, Carole Y. Swinehart*

Each time the lake level rises significantly, bluff erosion increases, submerging beaches and damaging beachfront property and infrastructure. When the lake level subsequently lowers, navigation channels and harbors must be extensively dredged of the sediments that are commonly polluted. These fluctuating water levels in the Great Lakes have caused hundreds of millions of dollars in loss by the 40 million people and the many economically vital industries located in the Great Lakes Basin.

Source: http://marine.usgs.gov/fact-sheets/michigan/michigan.html

Sand dunes, which can range in height from several feet to hundreds of feet, protect beaches by preventing storm waves from washing inland and dragging sand from the beaches back into the lake or ocean. However, dunes are fragile and can be easily destroyed by pedestrian and vehicular traffic, construction, and mining. Almost half of the Indiana Dunes shoreline, for example, has been altered to protect residential, industrial, and commercial properties. In 1981, the U.S. Army Corps of Engineers piled 120,000 tons of sand in front of Indiana Dunes' Mount Baldy to prevent erosion; by 1984, all the sand had been swept away and Mount Baldy was again vulnerable to erosion from breaking waves.

Source: http://www.nps.gov/history/history/online_books/indu/1085/sec5.htm

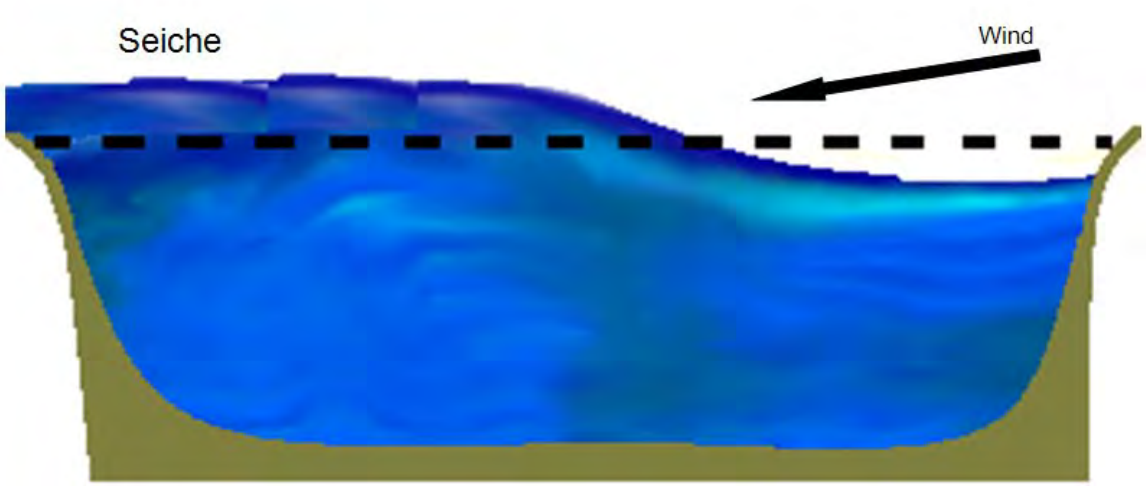
Seiches

Seiches are periodic fluctuations of water level within enclosed or partially enclosed bodies of water—such as lakes, reservoirs, bays, and seas—caused by atmospheric or seismic disturbances. These oscillations, often initiated by prolonged strong winds and rapidly moving weather fronts, create tide-like rises and falls in the water levels. The waves in a seiche differ from waves at sea because they are stationary, moving up and down; not progressing forward. A seiche's wave height depends on the strength of wind or air pressure that forms it.

Sources: University of Wisconsin Sea Grant Institute; University of California San Diego Earthguide; Illinois State Geological Survey

Figure 4-22 illustrates the formation of a seiche. As the wind consistently pushes from one direction, the water swells into a wave that builds momentum until it reaches shore, where it is then reflected and pushed back toward the other shore. While the water level rises at one shore; it falls at the opposite shore.

Figure 4-22: Seiche Formation



Previous Occurrences of Coastal Hazards

Shoreline erosion occurs most frequently in the early spring, late fall, or during mild winters when ice on Lake Michigan does not freeze to the shore. On March 9, 1998, following one of the warmest winters on record, the above-normal water temperatures contributed to heavy lake-effect snowfall and gusting winds over 40 miles per hour. The high winds generated waves with heights estimated anywhere between 10 and 20 feet. Beach erosion during this storm caused a home in Beverly Shores to fall into Lake Michigan (see photo at left).

Photo by Joy Raymond; South Bend Tribune, March 12, 1998

Source: "Indiana Shorelines for Coastal Coordination," Summer 1998

During the spring and summer months, it is normal for small seiches to occur on the shores of Lake Michigan. These seiches

typically have wave heights of a few inches to one foot. The most significant Lake Michigan seiche occurred in June 1954 on the coast of Chicago, Illinois. The seiche was created from a severe squall line with wind speeds of up to 60 miles per hour. The seiche—wave height of six feet—struck Michigan City, Indiana. It was reflected back along the coast of southern Lake Michigan. By the time the seiche reached the Chicago lakeshore, 80 minutes after it hit Michigan City, the wave had swelled to nearly 10 feet high. It crashed over North Avenue beach, sweeping people and infrastructure into the lake; eight people drowned.

Source: Illinois State Geological Survey

Geographic Location for Coastal Hazards

The northern border of Porter County is located along Lake Michigan; therefore, all areas along this border are vulnerable to coastal hazards.

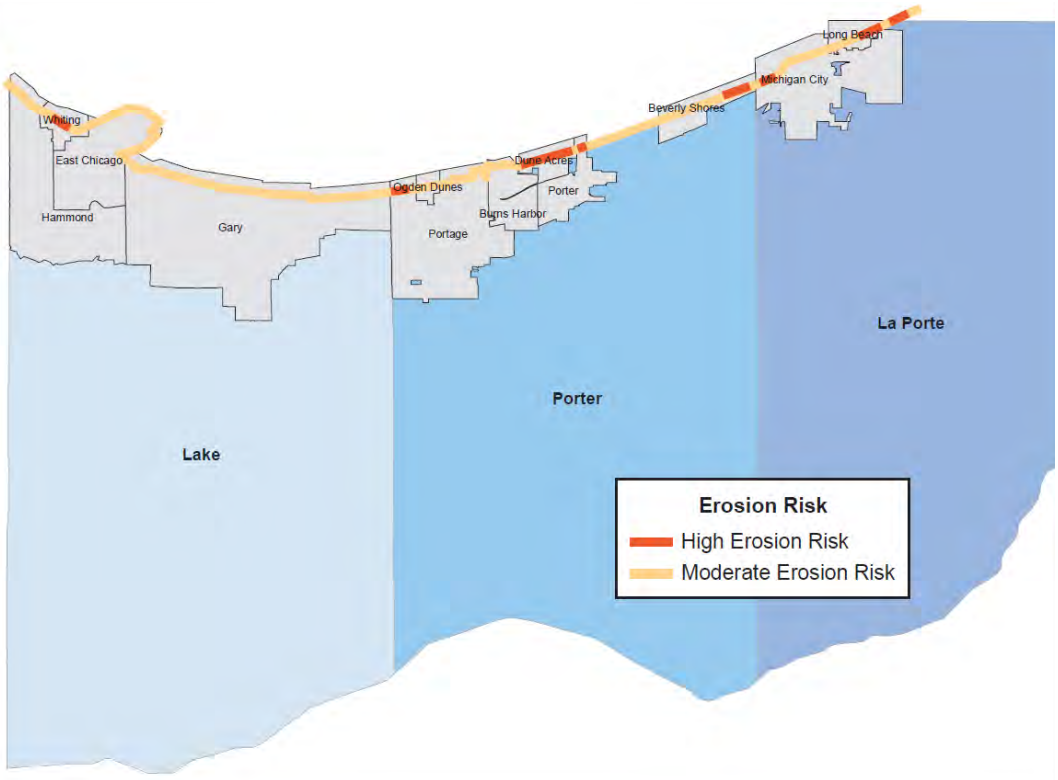
Hazard Extent for Coastal Hazards

The extent of coastal hazards is closely related to development near the regions that are at risk. The extent of coastal erosion will vary within these areas depending on the fluctuations of lake water levels; the extent of seiches and storm surges will vary according to changes in atmospheric pressure and strong storm winds. The hazard extent of coastal hazards is spread throughout the northern border of the county in various concentrated areas.

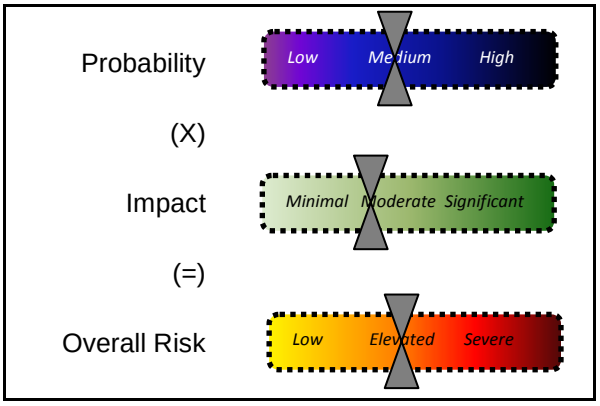
The Indiana coast of Lake Michigan includes several areas that are considered High Erosion Hazard Areas (HEHAs). A HEHA is a portion of shoreline with a long-term erosion rate that is greater than one foot per year. In Porter County, HEHAs are identified in a few areas, such as the shoreline of the Indiana Dunes State Park and a stretch of property north of Porter. The entire coast of Dune Acres is a HEHA, but only a small portion is left unprotected by hardened, man-made structures. Similarly, while a portion of the Burns Small Boat Harbor is designated a HEHA, most of the area is sheltered by the Harbor breakwater or by private erosion protection structures built by Ogden Dunes. While the exact boundaries of Indiana's HEHAs could not be determined, Figure 4-23 illustrates the general locations of each.

Source: http://www.in.gov/nrc_dnr/lakemichigan/coadyn/coadyna.html#4p

Figure 4-23: Designated HEHA Areas in Northern Indiana



Risk Identification for Coastal Hazards



Based on historical information, the probability of a coastal hazard is medium. The planning team determined that the potential impact of a coastal hazard is moderate; therefore, the overall risk of coastal hazards in Porter County is elevated.

Vulnerability Analysis for Coastal Hazards

Coastal hazards impact the areas of Porter County located along the Lake Michigan coast; therefore, the entire population and all buildings within this area are vulnerable to coastal hazards and can expect similar impacts.

A HAZUS-MH analysis was not completed for coastal hazards. To determine dollar losses for a coastal hazard, The Polis Center used building points from Porter County's most recent Assessor records. Because of the difficulty determining how far inland damage could occur, the buildings considered vulnerable were those located on the coast with no visible protection, e.g. sea walls, roads, et cetera.

It is estimated that a coastal hazard could damage 127 buildings at a replacement cost of $37,879. The total estimated numbers of damaged buildings are given in Table 4-38. Figure 4-24

depicts the Porter County parcel points located directly on the coast. Figure 4-25 shows a magnified view of an orthophoto of Ogden Dunes' vulnerable buildings.

Table 4-38: Porter County Coastal Building Damage

General Occupancy	Number of Buildings Damaged	Total Building Damage (x1000)
Residential	120	$36,861
Commercial	2	$326
Government	4	$692
Total	**1,001**	**$37,879**

Figure 4-24: Porter County Vulnerable Buildings

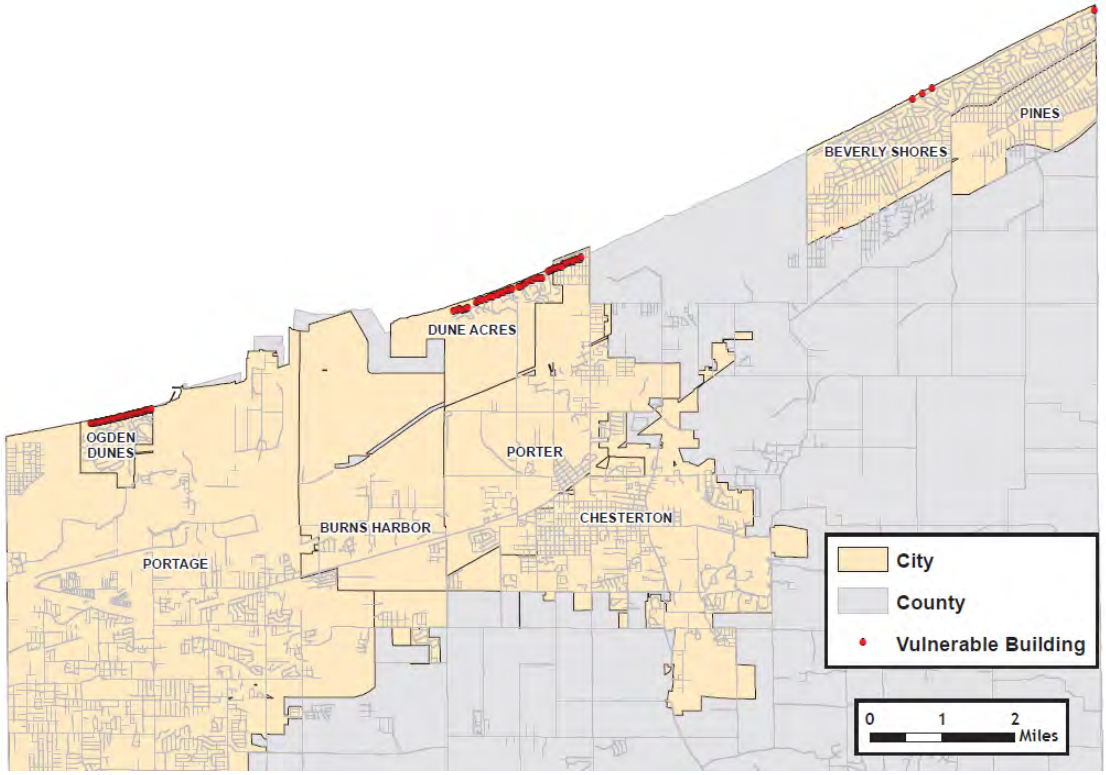


Figure 4-25: Ogden Dunes Orthophoto

Critical Facilities

There were no critical facilities directly located along the coast.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings along the Porter County coast is listed in Table 4-38. The buildings within this area can anticipate damages ranging from cosmetic to structural. Buildings may sustain minor cracks in walls due to a small amount of settling, while in more severe cases the failure of building foundations causes cracking of critical structural elements.

Infrastructure

In the area of Porter County affected by coastal hazards, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. The risk to these structures is primarily associated with land collapsing directly beneath them in a way that undermines their structural integrity. Since all infrastructure along the shoreline is equally vulnerable, it is important to emphasize that any number of these items could become damaged as a result of significant erosion. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); and railway failure from broken or impassable railways. In addition bridges could fail or become impassable causing risk to traffic.

Vulnerability to Future Assets/Infrastructure for Coastal Hazards

All future communities, buildings, and infrastructure along the Lake Michigan shoreline of Porter County will remain vulnerable to coastal hazards. In areas with higher levels of population, the vulnerability is greater than in open areas with no infrastructure demands.

Analysis of Community Development Trends

Coastal hazards can occur anywhere along the Lake Michigan shoreline in Porter County. In 2002, the National Oceanic and Atmospheric Administration approved the Indiana Lake Michigan Coastal Program (LMCP) under the Coastal Zone Management Act. The LMCP receives annual federal funding to coordinate partnerships among local, state, and federal agencies to protect and sustain the natural and cultural resources in the Lake Michigan region. Projects that the LMCP may use funds for include programs to prevent loss of life and property in coastal hazard areas, revitalized urban waterfronts and ports, and pollution prevention initiatives. For the 2010 grant cycle, approximately $650,000 of Indiana LMCP funding is available to local entities for projects that meet the program criteria.

Section 5 - Mitigation Strategy

The goal of mitigation is to reduce the future impacts of a hazard including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. The goal of mitigation is to build disaster-resistant communities. Mitigation actions and projects should be based on a well-constructed risk assessment, provided in Section 4 of this plan. Mitigation should be an ongoing process adapting over time to accommodate a community's needs.

5.1 Community Capability Assessment

The capability assessment identifies current activities used to mitigate hazards. The capability assessment identifies the policies, regulations, procedures, programs, and projects that contribute to the lessening of disaster damages. The assessment also provides an evaluation of these capabilities to determine whether the activities can be improved in order to more effectively reduce the impact of future hazards. The following sections identify existing plans and mitigation capabilities within all of the communities listed in Section 2 of this plan.

5.1.1 National Flood Insurance Program (NFIP)

The county and all of the communities within the county, except Kouts and Town of Pines, are members of the NFIP. Kouts and Town of Pines are not located within flood hazard boundaries and choose not to participate in the program. HAZUS-MH identified approximately 925 households located within the Porter County Special Flood Hazard Area; 131 households paid flood insurance, insuring $19,078,500 in property value. The total premiums collected amounted to $75,301, which on average was $574.82 annually. As of November 30, 2006, 123 claims were filed totaling $973,644.67. The average claim was $7,915.81.

The county and incorporated areas do not participate in the NFIP'S Community Rating System (CRS). The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating; and 3) promote the awareness of flood insurance.

Table 5-1 identifies each community and the date each participant joined the NFIP.

Table 5-1: Additional Information on Communities Participating in the NFIP

Community	Participation Date	FIRM Date	CRS Date	CRS Rating	Floodplain Ordinance
Porter County	04/14/78	04/01/82	N/A	N/A	2008
Beverly Shores	03/23/73	03/23/73	N/A	N/A	1993
Burns Harbor	06/07/74	06/07/74	N/A	N/A	N/A
Chesterton	10/24/75	02/01/80	N/A	N/A	2007
Dune Acres	12/28/73	04/24/81	N/A	N/A	1990
Hebron	03/21/75	10/09/81	N/A	N/A	1998
Kouts	N/A	N/A	N/A	N/A	N/A
Ogden Dunes	05/31/74	08/05/86	N/A	N/A	N/A
Portage	07/26/74	06/01/82	N/A	N/A	2007
Porter	12/28/73	06/04/80	N/A	N/A	2004
Town of Pines	N/A	N/A	N/A	N/A	N/A
Valparaiso	12/28/73	03/02/79	N/A	N/A	2008

5.1.2 Plans and Ordinances

Porter County and its incorporated communities have a number of plans and ordinances in place to ensure the safety of residents and the effective operation of communities. Table 5-2 lists some of the plans.

Table 5-2: Description of Zoning Plans/Ordinances

Community	Comp Plan	Zoning Ord	Subd Control	Erosion Control	Stormwater Mgmt	Burning Ord	Seismic Ord	Bldg. Stndrds
Porter County	2003	2008	2008	2007	2007	N/A	N/A	State
Hebron	N/A	1994	2004	1994	2004	N/A	N/A	State

Fire Insurance Rating Programs/ Policy

Table 5-3 lists Porter County's fire departments and respective information.

Table 5-3: Porter County Fire Departments, Ratings, and Number of Firefighters

Fire Department	Fire Insurance Rating	Number of Firefighters
Beverly Shores Fire Dept	9	25
Boone Grove/Porter Twp. Fire Dept	9	25
Burns Harbor Fire Dept	6	20
Chesterton Fire Dept	5	33
Nat'l Lakeshore Fire Dept	N/A	12
Hebron Fire Dept	8	25
Kouts Fire Dept	8	24
Lake of Four Seasons Fire Dept	8	25
Liberty Twp. Fire Dept	5/9	30
Morgan Twp. Fire Dept	9	25
Ogden Dunes Fire Dept	5	25
Pine Twp. Fire Dept	9	20
Portage Fire Dept	5	68
Porter Fire Dept	5/8	25
Portage Twp/South Haven Fire Dept	7	30
Union Twp. Fire Dept	6/8	25
Valparaiso Fire Dept	4	64
Washington Twp. Fire Dept	8	20
Westville Fire Dept	8	20

Land Use Plan

Porter County's land use plan was adopted in May 2001. It outlines the county's vision for smart, planned growth through the year 2020. The plan addresses land use, transportation, infrastructure and utilities, drainage, environmental conservation, economic development, recreation and open space, and housing.

5.2 Mitigation goals

In Section 4 of this plan, the risk assessment identified Porter County as prone to eight hazards. The MHMP planning team members understand that although hazards cannot be eliminated altogether, Porter County can work toward building disaster-resistant communities. Following are a list of goals, objectives, and actions. The goals represent long-term, broad visions of the overall vision the county would like to achieve for mitigation. The objectives are strategies and steps that will assist the communities in attaining the listed goals.

Goal 1: Lessen the impacts of hazards to new and existing infrastructure

(a) Objective: Retrofit critical facilities and structures with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.

(b) Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.

(c) Objective: Minimize the amount of infrastructure exposed to hazards.

(d) Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the community.

(e) Objective: Improve emergency sheltering in the community.

Goal 2: Create new or revise existing plans/maps for the community

(a) Objective: Support compliance with the NFIP.

(b) Objective: Review and update existing, or create new, community plans and ordinances to support hazard mitigation.

(c) Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.

Goal 3: Develop long-term strategies to educate community residents on the hazards affecting their county

(a) Objective: Raise public awareness on hazard mitigation.

(b) Objective: Improve education and training of emergency personnel and public officials.

5.3 Mitigation Actions/Projects

Upon completion of the risk assessment and development of the goals and objectives, the planning committee was provided a list of the six mitigation measure categories from the *FEMA State and Local Mitigation Planning How to Guides*. The measures are listed as follows:

- **Prevention:** Government, administrative, or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.

- **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, structural retrofits, storm shutters, and shatter-resistant glass.

- **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

- **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

After Meeting #3, held February 16, 2010, MHMP members were presented with the task of individually listing potential mitigation activities using the FEMA evaluation criteria. The MHMP members brought their mitigation ideas to Meeting #4 which was held June 2, 2010. The evaluation criteria (STAPLE+E) involved the following categories and questions.

Social:
- Will the proposed action adversely affect one segment of the population?
- Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Technical:
- How effective is the action in avoiding or reducing future losses?
- Will it create more problems than it solves?
- Does it solve the problem or only a symptom?
- Does the mitigation strategy address continued compliance with the NFIP?

Administrative:
- Does the jurisdiction have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained?
- Can the community provide the necessary maintenance?
- Can it be accomplished in a timely manner?

Political:
- Is there political support to implement and maintain this action?
- Is there a local champion willing to help see the action to completion?
- Is there enough public support to ensure the success of the action?
- How can the mitigation objectives be accomplished at the lowest cost to the public?

Legal:

- Does the community have the authority to implement the proposed action?
- Are the proper laws, ordinances, and resolution in place to implement the action?
- Are there any potential legal consequences?
- Is there any potential community liability?
- Is the action likely to be challenged by those who may be negatively affected?
- Does the mitigation strategy address continued compliance with the NFIP?

Economic:

- Are there currently sources of funds that can be used to implement the action?
- What benefits will the action provide?
- Does the cost seem reasonable for the size of the problem and likely benefits?
- What burden will be placed on the tax base or local economy to implement this action?
- Does the action contribute to other community economic goals such as capital improvements or economic development?
- What proposed actions should be considered but be "tabled" for implementation until outside sources of funding are available?

Environmental:

- How will this action affect the environment (land, water, endangered species)?
- Will this action comply with local, state, and federal environmental laws and regulations?
- Is the action consistent with community environmental goals?

5.4 Implementation Strategy and Mitigation Projects

Implementation of the mitigation plan is critical to the overall success of the mitigation planning process. In order to pursue the top priority first, an analysis and prioritization of the actions is important. Some actions may occur before the top priority due to financial, engineering, environmental, permitting, and site control issues. Public awareness and input of these mitigation actions can increase knowledge to capitalize on funding opportunities and monitoring the progress of an action.

In Meeting #4, the planning team prioritized mitigation actions based on a number of factors. A rating of high, medium, or low was assessed for each mitigation item and is listed next to each item in Table 5-5. The factors were the STAPLE+E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria listed in Table 5-4.

Table 5-4: STAPLE+E planning factors

S – Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T – Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – Economic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
E – Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

For each mitigation action related to infrastructure, new and existing infrastructure was considered. Additionally, the mitigation strategies address continued compliance with the NFIP. While an official cost benefit review was not conducted for any of the mitigation actions, the estimated costs were discussed. The overall benefits were considered when prioritizing mitigation items from high to low. An official cost benefit review will be conducted prior to the implementations of any mitigation actions. Table 5-5 presents mitigation projects developed by the planning committee, as well as actions that are ongoing or already completed. Since this is the first mitigation plan developed for Porter County, there are no deleted or deferred mitigation items.

Table 5-5: Mitigation Strategies

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Ensure that all communities participate in the NFIP	Goal: Create new or revise existing plans/maps for the community Objective: Support compliance with the NFIP for each jurisdiction.	Flood	Porter County, Beverly Shores, Burns Harbor, Chesterton, Dune Acres, Hebron, Kouts, Ogden Dunes, Portage, Porter, Town of Pines, Valparaiso	Complete	All communities participate in the NFIP. The County will continue to educate the public on the benefits of the NFIP.
Establish an active LEPC	Goal: Develop long-term strategies to educate the community residents on the hazards affecting their county Objective: Improve education and training of emergency personnel and public officials.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire, Drought	Porter County	Complete	Porter County has an active LEPC.
Distribute weather radios to critical facilities	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Tornado, Thunderstorm, Flood, Earthquake, Drought, Winter Storm	Porter County, Beverly Shores, Burns Harbor, Chesterton, Dune Acres, Hebron, Kouts, Ogden Dunes, Portage, Porter, Town of Pines, Valparaiso	Ongoing	All critical facilities, including schools, are equipped with weather radios.
Trim trees to minimize the amount/duration of power outages	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Winter Storm	Porter County, Beverly Shores, Burns Harbor, Chesterton, Dune Acres, Hebron, Kouts, Ogden Dunes, Portage, Porter, Town of Pines, Valparaiso	Ongoing	NIPSCO trims trees throughout the county as necessary.
Conduct a sewer upgrade to separate stormwater and sanitary sewer lines	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Flood	Chesterton, Porter, Portage, Valparaiso	In Progress	Some communities in the county have CSO or plans in place but many require additional funding to complete the projects. Funding will be sought from IDEM, IDHS, and FEMA. Implementation will begin within one year if funding is available.
Conduct stream and ditch maintenance, particularly Peterson ditch, Little Cal, and Coffee Creek	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.	Flood	Porter County	High	The County EMA will oversee this project. IDHS and IDNR are potential funding sources. If funding is available, implementation will begin within one year.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Conduct a study to determine shelter capacity; establish new shelters, safe rooms, and warming centers as necessary; equip with generators and necessary response materials	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Improve emergency sheltering in the community.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire	Porter County, Portage	High	The County EMA will oversee the implementation of this project. Local resources and IDHS grants will be sought to procure the materials. Implementation, if funding is available, is forecasted to begin within one year.
Institute a mass notification system, e.g. Reverse 911 or Blackboard Connect, to cover all communities within the county	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Drought, Hazmat, Fire	Porter County, Beverly Shores, Burns Harbor, Chesterton, Dune Acres, Hebron, Kouts, Ogden Dunes, Portage, Porter, Town of Pines	High	The County EMA oversees the implementation of the project. Valparaiso is the only community with a mass notification system. Local resources will be used to maintain the system. Funding for implementation will be sought from state and federal agencies. Implementation, if funding is available, is forecasted to begin within one year.
Procure generators or transfer switches for all essential facilities	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Improve emergency sheltering in the community.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire	Porter County, Beverly Shores, Burns Harbor, Chesterton, Dune Acres, Hebron, Kouts, Ogden Dunes, Portage, Porter, Town of Pines, Valparaiso	High	The County EMA will oversee the implementation of this project. Local resources will be used to determine which facilities should receive generators. Funding has not been secured as of 2010, but local resources, community grants, or the PDM program are possible funding sources. If funding is available, this project is forecasted to begin within one year.
Develop a debris management program for vegetation removal	Goal: Create new or revise existing plans/maps for the community Objective: Review and update existing community plans and ordinances to support hazard mitigation.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Porter County	High	The County EMA will work with other community leaders and first response agencies to develop this program. Fund may be sought from INDOT, IDHS, and FEMA. If funding is available, the project is forecasted to begin within one year.
Implement NOAA's radio system for hazmat spill alerts	Goal: Create new or revise existing plans/maps for the community Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.	Hazmat	Porter County, Beverly Shores, Burns Harbor, Chesterton, Dune Acres, Hebron, Kouts, Ogden Dunes, Portage, Porter, Town of Pines, Valparaiso	Medium	The County EMA will oversee this project. Local resources will be used to research the radio's capabilities and implement it in the county. Funding for implementation has not been secured as of 2010, but local, state, and federal resources will be sought. Implementation will begin within three years.
Purchase de-icing agents	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Winter Storm	Porter County	Medium	The County needs additional funding for salt. The County EMA will work with other local government leaders and first responders to determine what is needed. Funding may be sought from INDOT or IDHS. If funding is available, implementation will begin within three years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Purchase new equipment for managing debris, e.g. chippers and tub grinders	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Fire	Porter County	Medium	The County needs additional funding for debris management. The County EMA will work with other local government leaders and first responders to determine what is needed. Funding may be sought from INDOT or IDHS. If funding is available, implementation will begin within three years.
Repair drainage tiles and culverts and redirect surface runoff	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Flood	Porter County, Dune Acres, Portage, Porter, Town of Pines	Medium	The County EMA will coordinate this project. Funding will be sought from IDNR and IDHS. If funding is available, implementation will begin within three years.
Purchase equipment for containing spills, e.g. foam equipment	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Hazmat, Fire	Porter County	Medium	The County EMA will oversee the implementation of this project. Funding will be sought from the PDM program and community grants. If funding is available, implementation will begin within three years.
Update the LEPC's commodity flow study	Goal: Create new or revise existing plans/maps for the community Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.	Hazmat	Porter County, Valparaiso	Medium	The completed a commodity flow study, but it needs to be updated. Community planners and local government leaders will coordinate this study. Funding will be requested from community grants or IDHS. Implementation will begin within three years.
Upgrade existing and install new warning sirens	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Porter County	Low	78% of the population is covered by sirens; however, unincorporated areas could use more coverage. Funding may be sought from the PDM program or community grants. Implementation, if funding is available, is forecasted to begin within five years.
Improve and enforce floodplain ordinances regarding new construction	Goal: Create new or revise existing plans/maps for the community Objective: Review and update existing, or create new, community plans and ordinances to support hazard mitigation.	Flood	Porter County, Beverly Shores, Burns Harbor, Chesterton, Dune Acres, Hebron, Kouts, Ogden Dunes, Portage, Porter, Town of Pines, Valparaiso	Low	The County EMA will work with the local planning commission to review floodplain ordinances. The MHMP planning committee will develop public education options to re-affirm the ordinances in the communities. If local, state, and federal resources are available, implementation of this project will begin within five years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Work with a corps of engineers to redesign levees in order to minimize damages to future development, especially agricultural areas	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Retrofit critical facilities with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.	Flood	Porter County	Low	The County EMA will oversee the implementation of this project. Funding has not been secured as of 2010, but the pre-disaster mitigation program and state and federal grants are possible funding sources. Implementation, if funding is available, will begin within five years.
Institute a buy-out plan for repetitive loss properties	Goal: Create new or revise existing plans/maps for the community Objective: Support compliance with the NFIP for each jurisdiction.	Flood	Porter County (South Haven, Liberty Township), Chesterton, Hebron	Low	The County EMA oversees the implementation of the project. Funding has not been secured as of 2010 but will be sought from funding sources such as IDHS. Implementation, if funding is available, is forecasted to begin within five years.
Elevate roads that frequently flood including Meridian and 950N, Meridian and 1100N, SR 149 and 700N or repave older roads	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.	Flood	Porter County, Dune Acres	Low	The County EMA will oversee the implementation of this project. Local resources will be used to research options for signage. Funding has not been secured as of 2010, but the pre-disaster mitigation program, local resources, and INDOT are possible funding sources. If funding is available, this project is forecasted to begin within five years.
Install inertial valves at critical facilities	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Retrofit critical facilities with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.	Earthquake	Porter County, Beverly Shores, Burns Harbor, Chesterton, Dune Acres, Hebron, Kouts, Ogden Dunes, Portage, Porter, Town of Pines, Valparaiso	Low	The County EMA will oversee implementation of this project and determine which facilities do not currently have inertial valves. Funding has not been secured as of 2010, but the PDM program and community grants are an option. If funding is available, implementation will begin within five years.
Create a natural snow fence to mitigate issues from drifting snow	Goal: Lessen the impacts of hazards to new and existing infrastructure Objective: Minimize the amount of infrastructure exposed to hazards.	Winter Storm	Porter County, Dune Acres	Low	The EMA working with the county highway department and INDOT will oversee the implementation of this project. Funding has not been secured, but additional funding will be sought from the Pre-Disaster Mitigation program and local resources. Implementation is forecasted to begin within approximately five years.
Develop a database of special needs populations to be housed at a facility that can serve as a shelter	Goal: Create new or revise existing plans/maps for the community Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Drought, Hazmat, Fire	Porter County	Low	The health department will be approached to oversee implementation of this project. Local resources will be used to update the database. Once the database is in place, County Planners and first response agencies can develop specialized evacuation plans. Implementation will begin within five years.

The Porter County Emergency Management will be the local champions for the mitigation actions. The County Commissioners and the city and town councils will be an integral part of the implementation process. Federal and state assistance will be necessary for a number of the identified actions. NIRPC is qualified to provide technical grant writing services to assist the county in seeking resources to achieve the recommended mitigation action.

5.5 Multi-Jurisdictional Mitigation Strategy

As a part of the multi-hazard mitigation planning requirements, at least two identifiable mitigation action items have been addressed for each hazard listed in the risk assessment and for each jurisdiction covered under this plan.

Each of the 12 incorporated communities within and including Porter County was invited to participate in brainstorming sessions in which goals, objectives, and strategies were discussed and prioritized. Each participant in these sessions was armed with possible mitigation goals and strategies provided by FEMA, as well as information about mitigation projects discussed in neighboring communities and counties. All potential strategies and goals that arose through this process are included in this plan. The county planning team used FEMA's evaluation criteria to gauge the priority of all items. A final draft of the disaster mitigation plan was presented to all members to allow for final edits and approval of the priorities.

Section 6 - Plan Maintenance

6.1 Monitoring, Evaluating, and Updating the Plan

Throughout the five-year planning cycle, the Porter County Emergency Management Agency will reconvene the MHMP planning committee to monitor, evaluate, and update the plan on an annual basis. Additionally, a meeting will be held during September 2015 to address the five-year update of this plan. Members of the planning committee are readily available to engage in email correspondence between annual meetings. If the need for a special meeting, due to new developments or a declared disaster occurs in the county, the team will meet to update mitigation strategies. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented independently by individual communities or through local partnerships.

The committee will review the county goals and objectives to determine their relevance to changing situations in the county. In addition, state and federal policies will be reviewed to ensure they are addressing current and expected conditions. The committee will also review the risk assessment portion of the plan to determine if this information should be updated or modified. The parties responsible for the various implementation actions will report on the status of their projects, and will include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

Updates or modifications to the MHMP during the five-year planning process will require a public notice and a meeting prior to submitting revisions to the individual jurisdictions for

approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by the county commissioners.

The GIS data used to prepare the plan was obtained from existing county GIS data as well as data collected as part of the planning process. This updated HAZUS-MH GIS data has been returned to the county for use and maintenance in the county's system. As newer data becomes available, this updated data will be used for future risk assessments and vulnerability analyses.

6.2 Implementation through Existing Programs

The results of this plan will be incorporated into ongoing planning efforts since many of the mitigation projects identified as part of this planning process are ongoing. Porter County and its incorporated jurisdictions will update the zoning plans and ordinances listed in Table 5-2 as necessary and as part of regularly scheduled updates. The mitigation plan will be used to help guide building code changes and land use planning. Each community will be responsible for updating its own plans and ordinances.

6.3 Continued Public Involvement

Continued public involvement is critical to the successful implementation of the MHMP. Comments from the public on the MHMP will be received by the EMA director and forwarded to the MHMP planning committee for discussion. Education efforts for hazard mitigation will be ongoing through the EMA. The public will be notified of periodic planning meetings through notices in the local newspaper. Once adopted, a copy of this plan will be maintained in each jurisdiction and in the County EMA Office.

Glossary of Terms

A

AEGL – Acute Exposure Guideline Levels
ALOHA – Areal Locations of Hazardous Atmospheres

B

BFE – Base Flood Elevation

C

CAMEO – Computer-Aided Management of Emergency Operations
CEMA – County Emergency Management Agency
CEMP – Comprehensive Emergency Management Plan
CPRI – Calculated Priority Risk Index
CRS – Community Rating System

D

DEM – Digital Elevation Model
DFIRM – Digital Flood Insurance Rate Map
DMA – Disaster Mitigation Act

E

EAP – Emergency Action Plan
ERPG – Emergency Response Planning Guidelines
EMA – Emergency Management Agency
EPA – Environmental Protection Agency

F

FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Maps
FIS – Flood Information Study

G

GIS – Geographic Information System

H

HAZUS-MH – **Ha**zards **US**A **M**ulti-**H**azard
HUC – Hydrologic Unit Code

I

IDHS – Indiana Department of Homeland Security
IDNR – Indiana Department of Natural Resources
IGS – Indiana Geological Survey

M

MHMP – Multi-Hazard Mitigation Plan

N

NCDC – National Climatic Data Center
NEHRP – National Earthquake Hazards Reduction Program
NFIP – National Flood Insurance Program
NOAA – National Oceanic and Atmospheric Administration

P

PPM – Parts Per Million

S

SPC – Storm Prediction Center

U

USGS – United States Geological Survey

Appendix A – Minutes of the Multi-Hazard Mitigation Planning Team Meetings

Porter County Pre-Disaster Mitigation Meeting

September 15, 2009 at 2:00 p.m. Central

Meeting Minutes

Meeting #1 of the Porter County Pre-Disaster Mitigation (PDM) Committee was held September 15, 2009 at 2:00 p.m. at the Greg Phillips Emergency Management Agency Building conference room located at 1995 State Road 2, Valparaiso, IN. Those present are listed in the following table.

Jody Melton	NIRPC
Phil Griffith	Porter Co. Co. HS/EMA
Tom Clements	Porter Co. Co. HS/EMA
David Lohse	Chesterton Police Dept.
Robert Edgecomb	Valparaiso Fire Dept.
Scott Arnold	Valparaiso Fire Dept.
Mike Orlich	Chesterton Fire Dept.
Bernard Doyle	Town of Chesterton
Russell Shirley	Porter Co. Environment Dept.
Mike DeHaven	Valparaiso Fire Dept.
Eric Kurtz	Porter Co. Health/ Ogden Dunes
Gary Atherton	Porter Co. EMS
Dave Coats	The Polis Center
Melissa Gona	The Polis Center

Phil Griffith, Director of the Porter County Homeland Security/Emergency Management Agency who will chair the Committee thanked all for coming and explained that this is an initial meeting to assemble the necessary parties and distribute information. He then introduced Dave Coats of The Polis Center. Dave Coats described the plan and what it is to accomplish and how it will be formed. He provided an overview of the Disaster Mitigation Act of 2000, explained the process of at least 6 meetings and the work that will be necessary.

He introduced the website http://pdmplanning.com and the user name "Indiana_PDM" and password "hoosiers". Much information can be gained from this site as the process continues. Participants in the plan will need to keep track of their time at meetings as well as time preparing information for the meetings. That time will contribute to the matching funds requirement. He introduced Jody Melton from Northwestern Indiana Regional Planning Commission who will assist in the planning process.

Melissa Gona also from The Polis Center asked for documentation of memorable historical hazards that might be archived within the communities. She also distributed critical structure inventory lists and the group divided the items for verification. The lists include airports, buses, medicine, communication, water, electricity, emergency centers, fire stations, hazmat, military, propane, oil, and police stations

Meeting adjourned 3:00 p.m.

Jody Melton/Coordinator/NIRPC

Porter County Pre-Disaster Mitigation Meeting

October 22, 2009 at 1:00 p.m. Central

Meeting Minutes

Meeting #2 of the Porter County Pre-Disaster Mitigation (PDM) Committee was held October 22, 2009 at 1:00 p.m. at the Greg Phillips Emergency Management Agency Building conference room located at 1995 State Road 2, Valparaiso, IN. Those present are listed in the following table.

Jody Melton	NIRPC
Phil Griffith	Porter Co. Co. HS/EMA
Tom Clements	Porter Co. Co. HS/EMA
David Lohse	Chesterton Police Dept.
Robert Edgecomb	Valparaiso Fire Dept.
Donna Kuschel	Beverly Shores Town Council
Mike Orlich	Chesterton Fire Dept.
Bernard Doyle	Town of Chesterton
Russell Shirley	Porter Co. Environment Dept.
Mike DeHaven	Valparaiso Fire Dept.
Gary Atherton	Porter Co. EMS
John Buechler	The Polis Center
Melissa Gona	The Polis Center

John Buechler outlined the process and the reason for creating a hazard mitigation model and plan for Indiana Department of Homeland Security. The planning team then reviewed the possible hazards and rated them as to probability, impact, and risks. The group reviewed tornadoes, flooding, dam/levee failure, earthquakes, severe thunderstorms, severe winter storms, drought, hazmat incidents, and structural fires. There were determinations for the county as a whole and for each individual community.

Melissa Gona from The Polis Center collected critical structure inventory lists and asked for documentation of memorable historical hazards that might be archived within the communities.

Next step will be Meeting #3 where the model will be presented and a public meeting held.

Meeting adjourned 2:15 p.m.

Jody Melton/Coordinator/NIRPC

Porter County Pre Disaster Mitigation Committee Public Meeting

February 16, 2010 at 6:00 p.m. Central

Meeting Minutes

Meeting #3 of the Porter County Pre-Disaster Mitigation (PDM) Committee was held February 16, 2010 at 6:00 p.m. in the auditorium of the Northwestern Indiana Regional Planning Commission , 6100 Southport Road, Portage, Indiana.. Those present are listed in the following table.

Jody Melton	NIRPC
Phil Griffith	Porter Co. Co. HS/EMA
Tom Clements	Porter Co. Co. HS/EMA
Don Hess	Dist. 1, Hospital Planning
Dan Morford	IN Dunes Nat. Lakeshore
Tim Jones	Town of Kouts
Mike Orlich	Chesterton Fire Dept.
Eric Kurtz	Town of Ogden Dunes
Jennifer Payne	IDHS
Brent Chayhitz	Valparaiso Police Dept.
Bill Lundy	Portage Fire Dept.
Gary Atherton	Porter Co. EMS
Paul McKamey	Hebron Police Dept.
Frank Harper	Beck Disaster Recovery
Ken Croft	USS
Dave Coats	The Polis Center
Melissa Gona	The Polis Center

Dave Coats from the Polis Center introduced Frank Harper who is a representative of Beck Disaster Recovery working in the Chicago, Northwest Indiana, and Southeast Wisconsin area.

Dave Coats then gave a power point presentation of the draft plan as created by POLIS with the help of the steering committee addressing the hazards which were discussed in meeting #2. He also showed the modeling which was done for tornadoes and a model of a hazardous material spill. He also discussed earthquakes, winter storms, and building codes. Questions were asked about the adopting ordinances and who should adopt, what are consequences of not adopting, and how soon will the project be ready for consideration? A Hazard Mitigation strategy packet was distributed to all attendees. The attendees were asked to study the draft plan and prepare to discuss strategies and objectives for meeting #4.

Meeting adjourned 7:30 p.m.

Jody Melton/Coordinator/NIRPC

Porter County Pre-Disaster Mitigation Meeting

June 2, 2010 at 2:00 p.m. Central

Meeting Minutes

Meeting #4 of the Porter County Pre-Disaster Mitigation (PDM) Committee was held June 2, 2010 at 2:00 p.m. at the Greg Phillips Emergency Management Agency Building conference room located at 1995 State Road 2, Valparaiso, IN. Those present are listed in the following table.

Jody Melton	NIRPC
Phil Griffith	Porter Co. Co. HS/EMA
Deb Townsend	Porter Co. Red Cross
Eric Kurtz	Ogden Dunes Council
Mike Orlich	Chesterton Fire Dept.
Bernard Doyle	Town of Chesterton
Laura Danielson	The Polis Center
Melissa Gona	The Polis Center

Laura Danielson began a discussion on mitigation strategies for the major hazards that were identified in meeting #3. There was much discussion about flood mitigation and Eric Kurtz suggested contacting Dave Burrus and Kevin Breitzke from the County Drainage Board as to the status of the county drainage study. Separating storm water and sanitary sewers was identified as a priority and several roads will be listed for elevation. A resource for further highway information is the Porter Co. Highway Superintendent Al Hoagland. Multi Hazards were discussed and it was felt that 78% of Porter Co. is covered by warning sirens, most schools and county shelters are equipped with weather radios. Hardening of police, fire, and critical shelters should be addressed and a reverse 911 system or something equivalent should be developed. Winter storms can be covered with existing equipment in normal events but new replacement equipment is always needed. Dead vegetation removal should be more of a priority. Pre treatment (salt, etc.) should be emphasized. An inventory of special needs population needs to be done so evacuations can be planned around those special needs. And evacuation plans need to be developed for various incidents. More temporary shelters should be identified. Haz mat training and new equipment is always a priority. Lastly, public education concerning all hazards, including earthquakes, should become routine.

The 5th meeting of the MHPH will be held on July 13th at 2;00 pm central at the Greg Phillips Center in Valparaiso. This will be a public meeting and will be advertised as such.

Meeting adjourned 3:35 p.m.

Jody Melton/Coordinator/NIRPC

Town of Pines, IN Multi-Disaster Mitigation Meeting

October 5, 2010 at 6:30 p.m. Central

Meeting Minutes

Those present are listed in the following table.

Jody Melton	NIRPC
George Adey	Town of Pines Town Councilman
Vicki Kuzio	Town of Pines Town Councilman
Cathi Murray	Town of Pines Town Councilman, Pres.
Sandi Hall	Town of Pines Clerk-Treasurer
Alan Murray	Building Commissioner
James Papp	citizen
Helen Molinaro	citizen
John Molinaro	citizen
Ronald Vicker	citizen

Jody Melton described the plan and what it is to accomplish and how it has been formed. He provided an overview of the Disaster Mitigation Act of 2000, explained the process of at least 6 meetings and the work that has been completed.

Jody Melton presented a prepared list of disasters and mitigation activities for those disasters. He asked for prioritization of disasters and hazards facing Town of Pines.

FLOOD

- Flooding is a problem around town due to the high water table.
- The groundwater in Town of Pines is contaminated from a Superfund site and residents have municipal water or bottled water. Drainage ditches need to be maintained to keep the water from accumulating around residences or seeping into basements.
- Town of Pines has no storm sewers to help with runoff. They need a stormwater system.
- Town of Pines has no sanitary sewers. They need sanitary sewers to help with groundwater and sanitary issues.
- There are many drywells in Town of Pines. They need to be eliminated to help with the high water table

DAM/LEVEE FAILURE

- There are no dams or levees in Town of Pines.

TORNADO/THUNDERSTORMS

- Town of Pines needs more warning sirens particularly on the east side. Trees need to be trimmed.

EARTHQUAKES

- Public education is necessary.

WINTER STORM

- Town of Pines needs a mass notification system (Reverse 911, Nixel, or other)

- No shelter has been identified. Equipment and space are needed to provide for shelters and generators.
- Small street department could use additional snow removal equipment.

HAZARD MATERIALS SPILLS

- Town of Pines has two major routes: US 12 and US 20. Both have heavy truck traffic. The town needs to develop an evacuation and escape plan and conduct a transportation survey to find out what types of material is moving through the town.

FIRE

- Town of Pines is served by the Pine Township Fire Department. The Pine Township Fire Dept. needs more and newer equipment. They need a new fire station to house the equipment they have and the additional they need.

DROUGHT

- Drought is not a problem in Town of Pines.

The attendees at the meeting identified flooding and ground water issues as the most immediate threat to the community. The situation will only get better when a sanitary sewer system can be installed which is cost prohibitive currently. They are joining the National Flood Insurance Program but are somewhat restricted in maintaining ditches because of the proximity to the Indiana National Lakeshore. The other major issue that is a threat in the community is the lack of a Police Department. Currently Town of Pines is covered by the Porter County Sheriff's Office.

Meeting adjourned at 8:00 pm.
Jody Melton/Coordinator/NIRPC

Community Name: Town of Dune Acres

The purpose of this planning grant is to identify the hazards that most affect your community and then identify projects and strategies that could reduce the damage and loss of life for future disasters (Mitigation Strategies). This worksheet will help us prepare materials for the plan document and meetings.

Flood:

- Is flooding a major problem in your community (yes or no) Yes
- What is the major reason or source of flooding? Heavy Precipitation

- What could be done to reduce future flooding (Mitigation strategy)? LIST AT LEAST ONE STRATEGY (use the back side of the sheet for additional space if needed).
  Installation of dry wells, Repaving/crowning older roads, Redirecton of surface runoff

Dam/Levee Failure:

- Will your community be impacted by any dam failure? (yes or no) No

Tornado:

- What could be done to reduce damage and loss of life (Mitigation strategy)?

  Bury all power/utility lines

  Remove unhealthy trees

Earthquake:

- What could be done to reduce damage and loss of life (Mitigation strategy)?

  Bury all power/utility power lines

Thunderstorm:

- What could be done to reduce damage and loss of life (Mitigation strategy)?

  Bury all power/utility lines

  Remove unhealthy trees

Winter Storm:

- What could be done to reduce damage and loss of life (Mitigation strategy)?

  Bury all power/utility lines

  Remove unhealthy trees

  Crown older roads

Hazardous Materials Spills:

- What could be done to reduce damage and loss of life (Mitigation strategy)?

  Disallow hazardous materials

Fire:

- What could be done to reduce damage and loss of life (Mitigation strategy)?

  Bury all power lines

  Remove unhealthy trees

  Remove deadfall and clear excessive brush from Town parks

Drought:

- What could be done to reduce damage and loss of life (Mitigation strategy)?

  Remove unhealthy trees and deadfall to reduce fire risk

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

Fire , storm, and flood damage are the biggest threats to our community. In the past a fires have swept through town and rapidly spread – excessive fuel enabled the fires to spread. Storms, all seasons, have repeatedly caused downed power lines and blown transformers. Potential for loss of life, and property, are significant due to storm and fire.

Submitted by ***John D. Sullivan, Town of Dune Acres Councilman***

Community Name: Burns Harbor

The purpose of this planning grant is to identify the hazards that most affect your community and then identify projects and strategies that could reduce the damage and loss of life for future disasters (Mitigation Strategies). This worksheet will help us prepare materials for the plan document and meetings.

Flood:

- Is flooding a major problem in your community (yes or no) No, The only flooding is during a major rain storm event and this is mainly near the river.
- What is the major reason or source of flooding? Heavy rain that is out of the normal rain fall.
- What could be done to reduce future flooding (Mitigation strategy)? LIST AT LEAST ONE STRATEGY (use the back side of the sheet for additional space if needed). Placement of storm drains and culverts in these area's to control the rain runoff.

Dam/Levee Failure:

- Will your community be impacted by any dam failure? (yes or no)
- If so what could be done to reduce the risk of failure? LIST AT LEAST ONE STRATEGY. No don't have any in the Town.

Tornado:

- What could be done to reduce damage and loss of life (Mitigation strategy)? LIST AT LEAST ONE STRATEGY. The town and county already had in place weather sirens and weather alert systems.

Earthquake:

- What could be done to reduce damage and loss of life (Mitigation strategy)? LIST AT LEAST ONE STRATEGY. Use of fire and police to help notify and move residents to safe area or shelter in place to help with life safety.

Thunderstorm:

- What could be done to reduce damage and loss of life (Mitigation strategy)? LIST AT LEAST ONE STRATEGY. Help educate schools and family's about the danger of severe weather and what to do to make your homes safe during severe weather event.

Winter Storm:

- What could be done to reduce damage and loss of life (Mitigation strategy)? LIST AT LEAST ONE STRATEGY. The Town already had back-up generators for the town hall and fire station that can and would be used as shelter and warming centers.

Hazardous Materials Spills:

- What could be done to reduce damage and loss of life (Mitigation strategy)? LIST AT LEAST ONE STRATEGY. We have three major interstates in town and in the event of a spell or release it is the fire or police department duty to alert the siren and to control evacuation of residents if needed and control the hazardous area.

Fire:

- What could be done to reduce damage and loss of life (Mitigation strategy)? LIST AT LEAST ONE STRATEGY. Fire department had events were we hand out fire safety brochures and other fire safety information.

Drought:

- What could be done to reduce damage and loss of life (Mitigation strategy)? LIST AT LEAST ONE STRATEGY: The town could have brochures to hand out during a drought to educate on how to conserve water in those times.

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

I would say Tornado and Thunderstorms are the biggest threat that the Town of Burns Harbor faces do to the area we are in has a well put together fire and disaster plan between the County EMA and the Towns fire and police departments.

Submitted by *Toni Biancardi*

Porter County Pre-Disaster Mitigation Meeting

July 13, 2010 at 2:00 p.m. Central

Meeting Minutes

Meeting #5 of the Porter County Pre-Disaster Mitigation (PDM) Committee was held July 13, 2010 at 2:00 p.m. at the Greg Phillips Emergency Management Agency Building conference room located at 1995 State Road 2, Valparaiso, IN. Those present are listed in the following table.

Jody Melton	NIRPC
Phil Griffith	Porter Co. Co. HS/EMA
Russell Shirley	Porter Co. Env. Dept.
Mike Orlich	Chesterton Fire Dept.
Bernard Doyle	Town of Chesterton
Lew Craig	Town of Porter

Jody Melton began a discussion on the draft plan which he provided in hard copy and which has been available on line. There was general agreement that the plan reflected the work of the committee and most of the concerns had been addressed. Noted on pg. 5 & 6 that David Lohse is a Lieutenant with the Chesterton Police Department, that Robert Edgecomb is Assistant Chief with the Valparaiso Fired Department, that Scott Arnold is EMS Assistant with Valpo Fire, Mike DeHaven is a Captain with Valparaiso Police Department, and Russell Shirley is Director of the Porter Co. Environmental Dept.

On pg. 8 there is a lack of listing for participants from several communities. Phil Griffith will forward those names to Jody Melton.

On pg. 95, the floodplain ordinances for Porter Co. is 2008Beverly Shores is 1993, Burns Harbor is n/a, Chesterton is 2007, Dunes Acres is 1990, Hebron is 1998, Portage is 2007, Porter is 2004, Valparaiso is 2008.

We do not have statistics for zoning plans other than Porter Co. who has erosion control in 2007, Stormwtrmgt. in 2007 and no burning ordinance.

Fire Insurance ratings

Community	rating	firefighters
Beverly Shores	9	25
Boone Grove/Porter Twp.	9	25
Burns Harbor	6	20
Chesterton	5	33
Nat. lakeshore	n/a	12
Hebron	8	25
Kouts	8	24
Lake of Four Seasons	8	25
Liberty Twp.	5/9	30
Morgan Twp.	9	25
Ogden Dunes	5	25
Pine Twp.	9	20
Portage	5	68
Porter	5/8	25
Portage Twp./South Haven	7	30

Union Twp.	6/8	25
Valparaiso	4	64
Washingnton Twp.	8	20
Westville FireDept.	8	20
USS Midwest	private	
Mittal Steel	private	

On pg. 37 it was noted that there have been no dam failures in Porter County but it is necessary to inspect periodically the dam at Sagers Lake and the dam between Long and Flint Lake in Valparaiso.

With these corrections and additions the material and minutes will be forwarded to the POLIS Center for final revision.

Meeting adjourned 3:35 p.m.

Jody Melton/Coordinator/NIRPC

Appendix B – Articles published by Local Newspaper

Chesterton Tribune.
VOLUME 127 CHESTERTON, INDIANA 46304 (USPS 105—100) WEDNESDAY, JUNE 30, 2010 50 Cents NUMBER 64

Committee wants public input on 'multi-hazard mitigation' plan for FEMA

The Porter County Hazard Mitigation Steering Committee will hold a public information and strategy planning session at 2 p.m. Tuesday, July 13, at the Greg Phillips Emergency Management Agency at 1995 Ind. 2 in Valparaiso.

Over the last several months, a planning committee consisting of community members from various municipalities in Porter County has worked with The Polis Center at Indiana University-Purdue University Indianapolis to develop a multi-hazard mitigation plan. When the plan is completed, the committee will submit it to FEMA for approval. The committee will also work to develop funding for any mitigation activities identified by the plan.

The committee is interested in receiving public input on the plan. Anyone with questions or who would like to provide input should contact Phil Griffith, emergency management director for Porter County, at (219) 462-8654.

The public will receive a draft copy of the plan at the meeting.

Bill Mlsich uses a backhoe Friday to fix a break in the Kankakee River levee where the Braylogle Ditch empties into the river between Hebron and DeMotte. Ben Hamstra, left, Bob Godfrey, of the Indiana Department of Natural Resources, and Russell Perry watch Mlsich fill in the break.

Kankakee River spills onto farmland

Flood water could hit Sumava Resorts on Monday

BY MELANIE CSEPREGI
Times Correspondent

Jody Melton, left, director of the Kankakee River Basin Commission, checks a break in the river's levee just west of County Road 625 West in Porter County with John Law of the St. Joseph County drainage board Friday while crews work to fix the break.

A break where the Braylogle Ditch empties into the river between Hebron and DeMotte had county and state officials scrambling to contain the river that threatened to overrun U.S. 231 on Friday.

That break was just one more in a series of man-against-the-river scenarios played out across the state as officials battle rising rivers in Indiana.

"If we don't get this fixed, (U.S.)231 will be in jeopardy. There's so much pressure, we could lose them both," Bob Caulfman, a conservation officer with the Indiana Department of Natural Resources said of U.S. 231 and Porter County Road 625 West.

At the point of the break, the river spilled into a farmer's field and rose as much as 16 inches in two hours, Caulfman said.

By afternoon, however, the break was filled with riprap, clay and sand.

Caulfman said the Porter County Commissioners immediately authorized the repair. "Even in their financial situation, they could see the danger," Caulfman said.

Jasper County Rural Electric Membership Corp. shut off power to nine homes that was isolated by water and inaccessible. No one was in the house. Mlsich Excavating of Wheatfield handled the repair work.

"In this situation, everybody works together" Caulfman said as he walked the saturated levee.

By late afternoon Friday, Jody Melton, director of the Kankakee River Basin Commission, said, "The hole at Braylogle is closed up for now. The river water is up against 231, but I don't think it'll crest," he predicted, adding that he had spent Friday coming problem areas.

"It's flooded by English Lake (Starke County). A farmer's ditch broke, but it's not the back in there to be able to do anything about it. We'll just have to let it run," Melton said. "We've lost a levee (near Braylogle), and that's a problem, but if that's the worst that happens, it's OK."

Melton said that, temporarily, the break could have slowed the river and kept it lower than it might have been at points west of Hebron, including Shelby.

The National Weather Service predicted Friday that the Kankakee River will rise to 11.3 feet by Monday at Shelby where a wide levee protects residence along the river. The Advanced Hydrologic Prediction Services of the National Weather Service says that at 11.5 feet, flood water surrounds a number of homes east of Seneca Resorts and some homes in Illinois along the river are endangered as well.

On Aug. 23, 1998, the

See RIVER, A2

Duneland Schools scramble to get kids home safely in blizzard

Tuesdays wintry blast hit the Duneland community at about the same time that schools were nearing their normal dismissal times, prompting school officials to kick in alternative plans for transporting students home.

Duneland Superintendent Dirk Baer said he and other Porter County superintendents were in a meeting together when the snow began to hit. At least one school had already been dismissed due to a teacher training day, while another decided to dismiss early at 2 p.m.

Duneland has a normal dismissal time of 2:20 p.m., so in order to close schools early, the decision has to be made at around noon to prepare all the buses. But on Tuesday, the severe white-out and windy conditions hit so fast and not early enough to call an early dismissal.

"It hit at such an inopportune time," Baer said.

Several elementary schools did manage to dismiss about five to 10 minutes early in anticipation of a slow bus ride home. All Duneland students gathered in their gyms and waited until their bus was ready to be loaded, or until their parents arrived to pick them up.

Baer said that Burns Harbor experienced white-out conditions well before other areas, making the transport home slower for Yost Elementary students. One bus in Jackson Township got stuck and arrangements were made for a student transfer to another bus. Some buses were changed for middle and high schoolers, but about 10 of those students didn't hear their new bus number, resulting in confusion over which bus they should board.

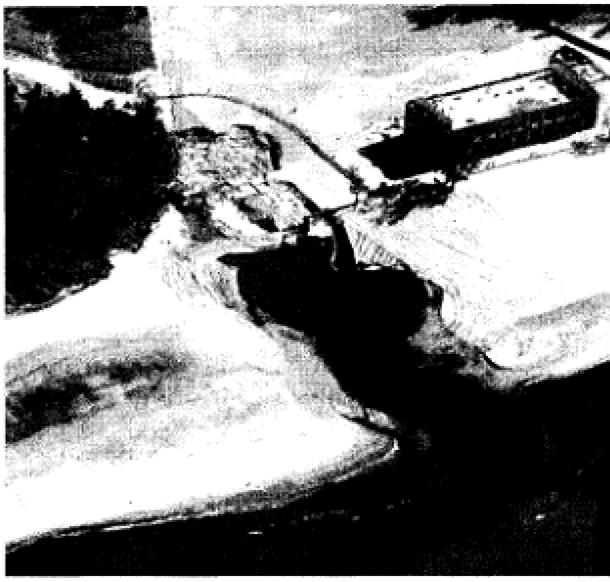
The last student to arrive home in Jackson Township -- got home at 5:20 p.m., about an hour later than usual, Baer said.

Overall, Baer said the bus drivers did an outstanding job, and that he appreciates the cooperation and patience shown by bus drivers, parents, and teachers. "Yesterday was just exceptional," he said.

Most importantly, though, Baer noted: "We got everybody home safely."

Feb 2009

Divide and conquer: Christine Gerlach and her husband William Saunis each took a section of their driveway at 740 S. Second St. to clear away the snow dumped on the area overnight. Duneland got socked by lake effect snow, accompanied by wind, leaving school cancelled and many people stuck home digging out.
(Tribune photo by Margaret L. Willis)



Dunes Creek / Dunes River? Aerial photo shows the collapsed Indiana Dunes State Park main parking lot. The Pavilion is at lower right. The parking lot collapsed during the heavy rains September 13 and 14. Photo was taken by John W. Cripliver, pilot of a Piper Warrior single-engine airplane on Sept. 17. The darker water of Dunes Creek is shown flowing into Lake Michigan at bottom. (Photo povided by John W. Cripliver)

Dunes State Park's collapsed parking lot to be restored 7/28/02

A design consultant has been selected to prepare options for restoring the parking lot at the Indiana Dunes State Park that collapsed due to the recent flooding from Dunes Creek.

State Park Property Manager Brandt Baughman said the design firm of Troyer is scheduled to present its conceptual plans on Monday. Troyer is the same firm that designed the state park's upgraded campground as well as the Dunes Creek "day lighting" project, in which the parking lot over part of the creek was removed.

After the torrential rainfall that began on Sept. 13, Dunes Creek overflowed with floodwaters, result- ing in a col ing lot eas eroding av beach surro pipe.

Baughma mary respor stabilize th further er "Obviously, repairs mac he said.

Exactly repaired, wl er collapse to be outlin to be preser

Baughman said the parking lot

'Microburst' likely cause of Sunday's storm damage 8/8/00

By KEVIN NEVERS

The devastation wreaked by Sunday's tree killing storm was probably the result of a microburst.

Paul Merzlock, a meteorologist with the National Weather Service, told the *Chesterton Tribune* today that microbursts, powerful gusts of wind which fall vertically from the center of a storm to hit the ground like a bomb, are not infrequently produced by the sort of intense thunderstorm which razed Duneland early Sunday evening.

Microbursts are formed, he said, when large drops of rain in the middle atmosphere, about 10,000 feet, evaporate. That evaporation in turn cools the air, which begins to grow heavy and fall. The drop from 10,000 feet, though, is a long one, and as it descends the gust accelerates and gains momentum until it crashes into the ground at speeds of 100 miles per hour or more. The collision, of course, deflects the vertical gust into a horizontal blast.

Chesterton Street Commissioner John Schnadenberg is himself convinced that a microburst is responsible for the destruction of as many as 300 of the 4,000 trees maintained by the town. Oddly enough, though, for the most part only the healthy trees were victimized, he said, while the dead or sick ones survived the microburst.

That selectivity Schnadenberg attributes to the branch spread and leaf cover of the healthy trees, which acted almost like sails to catch the gusts. Once caught, the wind twisted and torqued the trees until they snapped or were simply uprooted.

By Wednesday Schnadenberg hopes his first crew will have completed removing the hazardous overhang of limbs left by the wind. In the meantime, he said, a second crew has begun chipping.

Given the urgency of the situation, Schnadenberg added, town has bought, on a lease-p chase agreement and at a cost $32,000, a second chipper replace the one whose motor d last week. That acquisition a Schnadenberg learned the price renting a chipper: $165 per hou

As of deadline today proximately 150 custom remained without power, NIPS spokesperson Bob Schaefer t the *Tribune*. "Hopefully by e evening everybody will be b on."

The delays in restoration chiefly the result of tree dama he noted. "You can't do any w (on the lines) until the trees removed. . . . It involves cooperation of our tree trimm crews with our line crews."

"We've more than doubled contingent of linemen," Scha added. "Actually tripled our c tingent of linemen."

Some Duneland homes remain cold and dark

By KEVIN NEVERS

Frigid temperatures have made the lives of those whose homes remain dark even more miserable.

About 1000 customers still lack power in Porter County, Bob Schaefer, manager of community development for the Northern Indiana Public Service Company, said this morning, and a full return to service "is probably, realistically, going to get into the weekend."

"It's literally down to pockets of folks," he added. "It's a time-consuming, tedious kind of restoration. Spending a lineman's time just to get one customer up."

Among the areas affected, Schaefer said, are a strip from 11th St. to 13th St. in the vicinity of Jefferson Ave. in Chesterton; portions of Porter, Porter Beach, Ogden Dunes, and Beverly Shores; and numerous enclaves in Portage.

"We may just not have gotten to these places yet," he noted. "We still have poles down. There are still a number of areas that require a replacement of poles and wires."

In other cases, however, customers may need to hire contractors to perform repairs on private property before NIPSCO crews can energize them.

As hard hit as Porter County was, though, Schaefer said as many as 9,400 customers in Lake and La-Porte counties remain powerless. "Probably the heaviest hit are Portage, Merrillville, Gary, and south Lake County."

For all of its melodrama last August's storm caused much less damage, he also said. "This was much larger in terms of the number of customers. And the working conditions were more difficult. Our crews were hampered in just getting around. Some roads still need to be cleared of drifting snow."

Those crews Schaefer warmly praised. "They've worked non-stop. They got their passenger cars right back out."

Representatives at the customer call center in Merrillville have also "literally been manning the night there," he said, to handle the roughly 16,000 calls which have received daily since Monday. On an average day, Schaefer observed, the center receives between 7,000 and 8,000.

Those in need of power can report their outage at 1-800-464-7726.

The South Shore

The effects of the snow storm have been nothing short of catastrophic on the South Shore.

Biggs, R-North, chair of the board of the Northern Indiana Commuter Transportation District, told the *Chesterton Tribune* this morning it would be "weeks" before service is fully restored.

"In a couple of weeks," he said, service may be restored as far east as Ogden Dunes.

Biggs also said inquiries into the possibility of contracting buses to shuttle commuters have not proved fruitful. "The number needed is not even available, and of those some buses won't cross state lines," he observed.

Biggs did say crews will work around the clock and seven days a week until service is restored.

At the moment the eastbound station still in operation in East Chicago and then only during rush hour. According to John Parson, director of marketing and planning for NICTD, said trains depart from East Chicago from 4:07 a.m. until 8:10 a.m. and the Randolph St. station from 3:58 p.m. until 5:58 p.m.

Parson said NICTD has secured additional parking across the street from the station—located at Indianapolis Blvd. and U.S. Highway 20—in the old Roosevelt Elementary School lot. Police will soon be on hand to direct parking, he noted.

The problem, Parson said, is damage to sign

Illinois quake rudely wakes Dunelanders

By KEVIN NEVERS

Scores—or possibly hundreds—of Dunelanders were rudely awakened shortly before dawn today by an earthquake epicentered in Illinois but as of deadline the *Chesterton Tribune* had received no reports of injuries or damage.

The quake did appear to give a number of people the Magic Fingers experience of their lives. As a *Tribune* reporter said on arriving at work this morning, "My bed was like a rocking boat.

"The windows were rattling and the whole house was shaking," another staffer said.

"My husband and I get up early in the morning," a *Tribune* reader noted in an e-mail. "My bird went crazy in her cage right before it happened. I felt a rolling rumble and churning coming under the floor of my bedroom. Very strange feeling. It woke my son up from a sound sleep. That's how strong the vibration was."

Meanwhile, an employee of the Chesterton Police Department described her introduction to seismology this way: "It felt like someone was underneath by bed."

Apparently Dunelanders felt the quake more or less depending on where they live. Residents on the north side of town, along 21st and Furness, for instance, reported [illegible] at all or feeling only a slight tremor.

The CPD dispatcher did receive around 20 calls from residents about the quake; the Porter County 911 Dispatch Center, not quite that many.

But the quake appears to have left Duneland and the rest of Porter County unscathed. Phil Griffith, director of the Porter County Emergency Management Agency, told the *Tribune* that he's received no reports of injuries or damage.

Chesterton Street Commissioner John Schmadenberg said the same thing. "We've received no reports of side effects from the earthquake." And Chesterton Town Engineer Mark O'Dell said that the wastewater treatment plant was functioning just fine this morning.

On the other hand, NIPSCO spokesman Jim Fitzer did hear of a leak at a natural gas regulator station near Fort Wayne but he was unable to confirm whether the leak was related to the quake. Nor was he able to identify the cause of a brief flickering of current in the Downtown around 9 a.m., except to say that a 34,000-volt transmission circuit feeding the Chesterton substation had apparently locked out. But Fitzer did not immediately know why it had locked out.

The last time an earthquake was felt in Chesterton was early in the morning of June 28, 2004.

Street crews have wild night as ice attacks Duneland

1/26/07

By KEVIN NEVERS

Dunelanders who cringed in their beds early Sunday morning every time they heard the rifle shot of a tree limb's cracking can perhaps imagine what it was like for the Chesterton Street Department crews who were actually working the ice storm, keeping the roadways clear of debris.

With most of the town swallowed in darkness and live wires snaking unseen on the ground, the crews had the added threat of being brained by tree limbs which they could hear but not see falling all around them from 40 or 50 feet above.

"In the 24 years I've worked for the town it was the scariest night I've ever had," Street Commissioner John Schnadenberg told the *Chesterton Tribune*.

In the end Schnadenberg ordered his men to abandon the standard operating procedure of chaining the limbs to their vehicles and dragging them from the right-of-way. Instead, he instructed them to stay in the relative safety of their trucks and let the snow plows simply push the limbs off the road.

It was a bit of inspired improvisation which worked so well, Schnadenberg said, that he may use the same technique during the storms of summer.

"It was the worst night I've had and the fact that nobody got hurt was a miracle," he said. "It's just amazing that no one from the Street Department, the Fire Department, the Police Department got injured. I thought someone was going to be hurt for sure."

In fact, as of deadline today, the *Tribune* had received no reports of injuries, though one of a utility cut involving a Chesterton motorist whose pickup was struck across the bed by a huge limb as she approached the corner of Third Street and Lincoln Ave. The Chesterton Police Department took reports from two other residents, one in the 1500 block of Portage Ave. where a limb crushed a parked car, causing $3,500 in damage; the other in the 100 block of Park Ave. where a limb fell across a fence, causing $100 in damage.

Meanwhile, the Chesterton Fire Department responded to nine weather-related calls during the ice storm. Lt. John Jarka said, mostly "baby-sitting" downed power lines until NIPSCO crews arrived at the scene. The Porter Fire Department responded to nine calls as well, Fire Chief Lewis Craig said. The Liberty Township Volunteer Fire Department, on the other hand, responded to 13 calls over Saturday night and Sunday morning, including eight downed power lines, a couple of tree fires, and one from a resident trapped in a power-assisted recliner rendered inoperable by the blackout. Most of Liberty Township was without power from 11:30 p.m. Saturday until 9:30 a.m. Sunday, the LTVFD said.

At 10:43 a.m. today, approximately 2,500 customers of the Northern Indiana Public Service Company were still without power. NIPSCO said, down from the nearly 82,000 customers at the height of the ice storm. While the company's entire service territory experienced outages, the "hardest hit areas" were Porter and LaPorte counties.

"Additional line crews have been brought in to assist NIPSCO," the company said. "Crews will work around the clock until power is restored to all customers, which could be by late Monday evening. At this point crews will be focusing their efforts on restoring power to individual homes. Customers are advised to visually check the 'weather-head'—a pipe coming out of the electric meter box—for damage. If a customer suspects damage, a licensed electrician should be contacted to check the outside power lines and make repairs before NIPSCO crews arrive."

NIPSCO reminded customers not to go near downed power lines and to report them immediately by calling (800) 4-NIPSCO.

Troopers with the Indiana State Police were also kept busy by the ice storm. Sgt. Ann Wojas reported a total of 31 property-damage accidents in Porter, Lake, LaPorte, and Jasper counties, six personal injury accidents, and 21 slide-offs, with four property-damage accidents and one slide-off in Porter County.

The Ice Storm

According to *The Old Farmer's Almanac Book of Weather & Natural Disasters*, ice storms occur when rain falls from a layer of air above 32 degrees to temperatures through a layer of air below 32 degrees and then, "supercooled," freezes on contact when it hits the ground. Or power lines and tree limbs.

In fact, Schnadenberg said, very few if any trees toppled during the ice storm but a vast number of large limbs did, in the six- to seven-inch diameter class, splintering from the trees beneath the added weight of the ice encrusting them.

As Jarka noted, "all hell broke

(Continued on Back Page)

Ice storm

(Continued from Front Page)

loose around 10 or 10:30 p.m." but the Street Department crews had already been on the road for four hours, spreading salt to melt the sleet which had begun pelting around 6 p.m. Schnadenberg said that crews used the same amount of salt—as much as $3,000 worth—as they would have for a four-inch snowfall.

Then, around 10 p.m., Schnadenberg said, while he was standing outside the town hall talking with firefighters, he began hearing the explosion of transformers, as limbs fell across wires and shorted them out. "We knew bad things were going to happen. We called in additional people and were at it until 3 a.m."

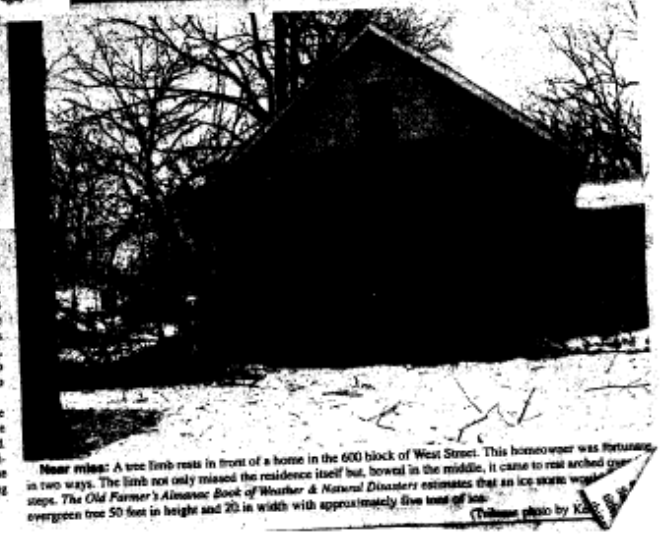
Nearly the whole of the town lost power, although a section at the west end never did. "It was dark, man. It was scary," Street Department employee Bill Diahman said. "It was wicked."

Eventually, around 2 or 2:30 a.m., Schnadenberg said, the ice began melting. "It was a big reprieve. If the temperature had stayed cold, the damage would have been twice as bad."

As it is, the damage was bad enough. Schnadenberg said that around half a dozen vehicles got clobbered by tree limbs, and five trees split and rendered unstable by the fall of a limb will have to come down. Schnadenberg advised residents whose property was damaged by limbs cracked from trees in the public right-of-way to contact their insurance companies.

Schnadenberg estimated that it will take crews two to three weeks to clean up the debris. To expedite matters a couple of brush chippers were to be put on duty this morning, and residents are encouraged to move their brush piles from alleys to curbside for faster service.

"It's been several years, more than eight, since we've had a bad ice storm like this," Schnadenberg said. "And it's because we've got a dedicated staff that we could keep the roadways clear and safe even during the worst part of the storm."



Near miss: A tree limb rests in front of a home in the 600 block of West Street. This homeowner was fortunate in two ways. The limb not only missed the residence itself but, bowed in the middle, it came to rest arched over steps. *The Old Farmer's Almanac Book of Weather & Natural Disasters* estimates that an ice storm would evergreen tree 50 feet in height and 20 in width with approximately five tons of ice.

(Tribune photo by K

Flooding closes area roads

1/8/08

By KEVIN NEVERS

In a quarter of a century Chesterton Street Commissioner John Schnadenberg has not seen flooding in town like that which yesterday and last night caused closures, swamping basements, and overwhelming the wastewater treatment plant.

"It's bad," Schnadenberg told the Chesterton Tribune. "I haven't seen anything like it in 25 years."

Rising waters in the Pope O'Connor Ditch in the area of C.R. 1100N and Fifth Street and in the Coffee Creek beneath the bridge east of WiseWay Foods could prompt the Street Department to close C.R. 1100N. Meanwhile, rear yards in the Tanglewood subdivision—whose rear-yard drains are probably blocked by leaves—were flooding and filling some basements, Schnadenberg said. A crew was dispatched there with three pumps to alleviate that problem.

Elsewhere, Schnadenberg added, high water had forced the closure of one entrance to the Westchester South subdivision off Fifth Street, while high-water signs were posted on 11th Street in the vicinity of the Chesterton High School.

Throughout town huge pools of standing water were filling yards, streets, and intersections. For its part the Porter County Highway Department closed C.R. 1300N in the area of C.R. 450E in Pine Township when motorists woke up this morning to find a lake where the road used to be.

"The forecast is rain all day," Schnadenberg said. "There's too many problems to tell you about. I've seen areas flooded I haven't seen flooded for years."

How much rain has fallen?

Dick Condon, chief operator at the wastewater utility plant, says 3.25 inches, beginning around 8 p.m. and lasting all night long. But it's not simply the amount of rain, he said. It's also the rapidity with which it's fallen. "It's come down in a short duration. That's part of the problem. I've got a bucket. It'll hold a gallon of water. But I'm using a fire hose to fill it."

Another part of the problem, Condon noted: frigid temperatures which last week turned the ground into something like concrete. This past weekend's thaw may have melted the snow and saturated the top soil, but it's done nothing to soften the ground deeper down. "The ground is still frozen. It's like putting in a parking lot. There's no pervious surface to absorb it."

Brass tacks: the wastewater treatment plant has been bypassing sewage into the Little Calumet River since around 8:30 or 9 p.m. Monday. Condon was unable to say how much had been bypassed, since a flow meter's sensor was currently blocked by debris from the Little Cal, which itself had risen ominously. "Hopefully the river won't come up high enough to damage any equipment," he said.

Condon noted that at one point last night the rain eased considerably, then returned "with a vengeance" and by that time the system was full. "It's like trying to put

(Continued on Back Page)

Flooding closes roads

(Continued from Front Page)

a gallon of milk in a teacup," he said.

"I would be willing to bet that most treatment plants in the area right now are close to flood stage," Condon ventured. "Right now we're praying for snow."

So are a lot of residents whose basements are backing up with wastewater. Town Engineer Mark O'Dell said that the sanitary sewer system, even the separated portions of it, is strained to capacity right now, in some cases because residents are illegally draining their sump pumps into it, but also because water from the saturated ground is infiltrating old clay-tile pipes.

The Villages of Sand Creek in particular is having a problem with basement backups, O'Dell observed, as the Dickinson Road lift station is "maxed out." But the Utility is receiving reports of isolated backups throughout the town.

"There's water everywhere," O'Dell said. "In the street. In yards. The Little Cal is overflowing. So's Coffee Creek. It's like an act of God."

Meanwhile, the Indiana Department of Transportation announced the closure of a number of highways in Northwest Indiana. As of 11 a.m. lanes of I-94 near Chesterton were closed, as were Indianapolis Blvd. (U.S. Highway 41) south of the Little Calumet River in Lake County and the cloverleaf ramps at U.S. Highway 35 and Ind. 212 in LaPorte County.

"INDOT reminds drivers to use caution in severe weather conditions and avoid driving if possible. According to the National Weather Service, most flooding deaths occur in automobiles. Turn around, don't drown," INDOT said.

12 inches of rain closes schools, roads

7/15/08

By KEVIN NEVERS

Water always finds a way. And water will have its way.

It had its way with us over the weekend, as more than 12 inches of rain—recorded at the Chesterton wastewater treatment plant between midnight Thursday and midnight Sunday—deluged Duneland and created havoc on an unprecedented scale.

The rising waters caused two deaths and forced the closing of Duneland Schools and state and local roads throughout Northwest Indiana. (See related stories.)

"I've never seen it so bad," Chesterton Street Commissioner John Schnadenberg told the Chesterton Tribune today. "I had to charge my cell phone four times yesterday, I was getting so many calls from the police. There were so many problems, it was overwhelming."

Begin with neighborhood flooding. "The infrastructure quickly filled up," Schnadenberg said. "A lot of people thought the ditches and pipes were clogged by leaves. But once the detention ponds and storm sewers filled up, there was absolutely no place for the water to go."

Except into yards and basements. And roadways.

Essentially, Schnadenberg said, "roadways became detention ponds." A number of them remained closed this morning: 1100N between Dickinson Road and Pioneer Point; 1100N between 100E and Fifth Street; 11th Street between Chesterton Blvd. and Park Ave.; and Pearson Road north of the Brassie Golf Course.

In addition, Schnadenberg said roadways in subdivisions like Old Towne, Tanglewood, and Golfview Estates remain impassable.

Even so, at least half a dozen motorists got the idea that barricades and "Road Closed" signs didn't apply to them, Schnadenberg noted, would drive around the barricades, and promptly find themselves stranded in three feet of water.

(Continued on Back Page)

Floods

(Continued from Front Page)

Schnadenberg himself happened to be traveling behind one such motorist who got it into her head to negotiate the raging Pope O'Conner Ditch as it overflowed 1100N west of 100E. She got stuck in rushing water as high as her door handles, Schnadenberg said, but he was fortunately able to push her vehicle through the flood with his own pick-up before she was washed away.

"That's the kind of dangerous thing people were doing," Schnadenberg said.

It could take as long as 24 hours for the water to recede from some of the roadways, including those in the subdivisions, Schnadenberg estimated, where detention ponds will likely remain at high levels into the middle of the week.

The Utility

Meanwhile, at around 3:30 a.m. on Saturday, the Chesterton Utility began bypassing partially treated sewage into the Little Calumet River. It did so until sometime that evening. Town Engineer Mark O'Dell said, when the rising Little Cal began back-flowing into the plant itself. "You could say we were still bypassing but really it's hard to tell where our gallonage ended and the river began."

The flooding Little Cal was not the only threat to the plant, however. Overflowing wetlands began to encroach on the influent building late on Sunday, O'Dell said, forcing the construction of an emergency berm outside the building and the sandbagging of the vital pumps inside.

In only 72 hours, from early Friday through late Sunday, a total of 12.19 inches of rain was recorded at the plant, O'Dell noted: 0.37 inches on Friday, 6.35 inches on Saturday, and 5.43 inches on Sunday.

"At locations across town, from the Villages of Sand Creek to Crocker, we had multiple reports from residents of backups from the sewage and stormwater," O'Dell added, and when the Utility ran short of manpower was forced to tap the Street Department for two employees and R.V. Sutton Inc. for eight to 10 more, just to man pumps, tend lift stations, and work the vacuum truck. "We had guys going around the clock," he said.

Sandbagging

In Chesterton and Porter firefighters accustomed to thinking of water as their friend found it to be an implacable foe. CFD Engineer Nate Williams said that he and his crew spent most of their shift on sandbagging operations, as frantic residents watched the water rise from roadways and backyards and turn their homes into islands. Among other places, the CFD sandbagged in the Westchester South and Tanglewood subdivisions as well as at the wastewater treatment plant, while the PFD sandbagged on Lake Vista Drive and Woodlawn Ave.

"We were able to keep one house on Lake Vista pretty dry," Porter Fire Chief Lewis Craig said. "By the time we got there two other houses were already under water."

"We've never had such a large amount of rain that we've had to sandbag before," Williams remarked. "But now we're the go-to sandbag guys."

Elsewhere in Porter County

Porter County Highway Superintendent Al Hoagland, speaking to the *Tribune* on the fly, was unable to give a really clear picture of the damage done by floodwaters—and of the damage they still might do—because his crews were still unable this morning to get close enough to affected areas to do any meaningful assessment. But Hoagland did express his concern about the integrity of some of the county's bridges, where debris is beginning to pile up. "Bridges aren't designed to take a lot of pressure from the side," he said. "They're designed to flex up and down. But it's hard to inspect the bridges because the decks are under water."

One of those bridges, Hoagland added, is located on Brummitt Road south of Indian Boundary Road.

Of course a lot of county roads remain flooded, and it may take 10 to 12 hours before conditions improve. "Take a look at the C.R. 1100N near C.R. 416E. There's a big washout there. Just don't stand too close to the hole. It's hard to believe that water can move that amount of earth in such a short period of time."

On the Home Front

Here's one indication of the impact of the flooding on Dunelanders. Over the weekend Hopkins Ace Hardware sold out of pumps, shop vacs, dehumidifiers, fans, carpet shampooers, any number of plumbing fixtures, and a variety of cleaning supplies like mops, brooms, and squeegees, Manager Emerson DeLaney said. On Saturday, with a pretty good idea of what was coming down the pike, those items were re-ordered for delivery today.

The truck came in this morning, and many of those items were already sold out again by noon.

"Unfortunately we're doing well at everybody's expense," DeLaney said. "Which we're not happy about. We're here to help. If we don't have it, we're trying to find it, calling other stores for people. That's what we're here to do."

THE TIMES Home Newspaper of the Calumet Region
C-1 Wednesday, December 26, 1979

South Lake County

'River Folks' Hope Repairs Hold

George Stumpf watches as dirt is unloaded for protective barrier to guard Shady Shores subdivision; levee work at bridge is nearly finished.

SHELBY — Gus Augustine prays flood protection improvements being constructed along the Kankakee River will keep its often-rampaging waters away from his house next spring.

Last March, floodwaters gashed huge holes in the Shady Shores subdivision road.

As a result, Augustine and 30 other families living in the riverside subdivision were cut off from the rest of the world except by boat for three months.

William Henderson, of the Lake County Surveyor's office, won't guarantee the $150,000 construction project will eliminate the annual flooding which drives dozens of families from their homes and inundates thousands of acres of farmland.

He does say, though, the work will lessen the risk of flooding in and around Shelby.

Henderson hopes the state-financed project will accomplish this through building and repairing critical levees and installing a floodgate.

Four trouble spots where floodwaters poured through for weeks last spring are targeted for improvements.

A new levee more than 600 feet long is close to completion across the Reid levee between the Conrail tracks and the river bank. The levee, to be more than 10 feet high, is intended to divert water, which curves around the Triple-I railroad bridge, from pressuring the weak field.

Four breaks in the river spoilbank between the Triple I and Ind. 55 have been filled with sand. Material from excessively high mounds along the levee have been pushed by bulldozer into low points. A fifth break will either be left open to equalize pressure between the river bank and the Reid or filled if funds hold out.

At the downstream opening of the Shady Shores bayou, a retirement neighborhood at the L & N Railroad tracks, a floodgate will be set inside a levee which has been constructed across the bayou mouth.

The gate will be closed during flood stages to keep the water from swirling inside the bayou and rushing across Augustine's yard and breaking the Williams Levee.

The levee across the mouth has been constructed, but the 7 by 11-foot gate hasn't been installed.

At the fourth weak spot in the levee system, the Williams Levee, slag will be removed from four hastily patched holes and sand will be packed there instead.

The work is about half completed, which is ahead of schedule, Henderson said. All work except seeding should be completed before flood season, he said.

Rip rap, 18-inch diameter concrete-like stones, will be stacked against the new levee and possibly at other critical areas, Henderson said.

Duneland spared worst of violent Lake Michigan storm

8/27/02

By KEVIN NEVERS

Duneland once again got lucky, as it escaped the brunt of a storm which freight-trained its way off Lake Michigan early Wednesday evening and ripped a wide swath of damage in northeast Porter County and northwest LaPorte County.

Hardest hit here were Beverly Shores and The Pines, while Michigan City and Westville across the county line were both slammed. The *Chesterton Tribune* has received unconfirmed reports of funnel clouds from both counties, and Porter Fire Chief Lewis Craig—whose firefighters spent five hours on the ground last night in Pine Township, cutting trees and seeking possible victims—said that the place looks "like a war zone."

Laura Jones, a student at Purdue North Central in Westville, told the *Tribune* today that she was in her sign language class when all hell broke loose, beginning at 6 p.m. with a tornado siren which her teacher, who is totally deaf, was unable to hear. Students didn't have enough sign language in the introductory class to make themselves understood at first, but when they did they all took shelter in the building's basement. Jones said that she suspects a tornado was at work topside, because the force of the wind caused two sets of double steel doors in the basement to flap open and closed like saloon doors.

On emerging from the basement, Jones said, students found the parking lot flooded to the depth of vehicle bumpers and several vehicles crushed beneath fallen trees. The famous "eye candy" sculpture in front of the campus was completely destroyed, nothing left of it but its framework with what looked like toilet paper festooned from it.

Hail falls here: Hail stones described as quarter-sized by the Porter County Sheriff's Police are gathered for measurement. The icy "stones" were reported at 7:15 p.m. Wednesday evening in the Chesterton area. (Photo provided)

It took students until 8 p.m. actually to get off campus, Jones added, because the trees in the parking lot made ingress and egress impossible.

Jim Allsopp of the National Weather Service (NWS) was unable to confirm any reports of funnel clouds, although spotters did report a wall cloud with rotation while a pilot overflying Lake Michigan reported a waterspout. A high gust of 106 miles per hour was reported in Michigan City. NWS officials were in the field this morning surveying damage, he said.

In Pine Township both the Porter and Chesterton fire departments worked until the early hours of this morning on tree-removal and search-and-rescue operations. No injuries were immediately reported by either the PFD or the CFD. Craig did say that one initial report had a woman trapped in her flooded basement but that she proved to be okay.

Officials with the Porter County Emergency Management Agency were in the field and at meetings this morning and no one was available to comment on an unconfirmed report that the county has been declared a disaster area.

David James, assistant superintendent of the Porter County Highway Department said that it will be some time before all county roads have been cleared of trees,

(Continued on Back Page)

Tornado timeline: 13 minutes to damage 211 buildings

By KEVIN NEVERS

It was a tornado, it was born at 7:32 p.m. Wednesday and died 13 minutes later, and over its brief life span it damaged 211 structures, eight of them utterly.

The tornado's path extended further to the northeast than was originally believed, to Hadenfelt Road in unincorporated Westchester Township and into the Ly-co-ki-we area of Indiana Dunes National Lakeshore in Furnessville.

Meanwhile, cleanup in the Town of Chesterton is expected to take several weeks.

And emergency responders have a better—though not a total—understanding of why sirens were never activated.

Begin with the storm survey conducted on Thursday by meteorologists with the National Weather Service (NWS). Their conclusion: an EF2 tornado—at its height—was responsible for the damage inflicted on Chesterton and points northeast.

The NWS timeline:

•The tornado formed as an EF1 at 7:32 p.m. in the area east of 11th Street and southwest of South Park Ave.

•It quickly intensified as it moved northeast—it would continue to move northeast in almost a straight line for the duration of its life—to collapse the roof of the Goldsborough Gymnasium at Chesterton Middle School. At this point the tornado was generating winds of 110 miles per hour and had a path width of 40 yards.

•The tornado then jumped the Norfolk Southern railroad tracks in the direction of Grant Ave., peeling off the roof of a warehouse and tossing it behind the building 15 yards to the north.

•Increasing in intensity, at this point rated an EF2 with winds of 120 mph and a path width of 60 yards, the tornado crashed into the apartment complex at Brown Ave. and Third Street. Continuing in a northeasterly direction, it damaged nearly every house in the Pinney's Park neighborhood and razed an entire field of healthy old hard wood trees.

•The tornado began to weaken slightly—now an EF1 again—as it approached the eastbound I-94 exit/westbound entrance ramps at Ind. 49, but its 100 mph winds remained substantial enough to blow off a garage roof south of the Interstate.

•Packing winds of around 95 miles per hour, with a path width of 30 yards, it crossed Ind. 49 in the direction of U.S. Highway 20, near Hadenfelt Road, where it peeled off the aluminum sheeting of a storage facility.

•Finally, the tornado moved through the heavily forested area of the Ly-co-ki-we Trail in Indiana Dunes National Lakeshore and crossed U.S. Highway 12.

•"Radar imagery and an aerial survey suggest that the tornado dissipated between U.S. 12 and Lake Michigan at about 7:45 p.m.," NWS said. When it died, the tornado had traveled a distance of four miles and cut a damage swath of approximately one quarter of a mile in width.

Damage Assessment

At a press conference late Thursday afternoon, Chesterton Fire Chief Mike Orlich gave this rundown on damage in town:

•A total of 211 structures—residences, businesses, and accessory structures like garages and sheds—sustained damage.

•Eight of those structures were simply destroyed.

•54 of them sustained "major damage": trees through roofs, windows blown out.

•The remaining 149 structures sustained "some sort of damage": missing shingles, gutters mangled.

"A lot of properties are listed as having storm-effect damage but are still livable," Orlich said. The residents of homes which are not currently livable, he added, "have been put in contact with the Red Cross or the Salvation Army. But most have turned to family, friends, or neighbors for assistance."

For his part Street Commissioner John Schnadenberg reported that all roadways were now open, thanks to the assistance of the City of Valparaiso and the Porter County Highway Department, who loaned heavy equipment to the town and human muscle. "They were instrumental," he said.

Some alleys, however, remain closed, Schnadenberg noted, and it may take several weeks to open

(Continued on the Back Page)

Cutting out from under storm damage: A small tree over the front of her house on Wabash Ave. seemed small potatoes once the huge oak in back was spotted in Karla Kronke's yard. The tree was completely uprooted and the garage collapsed atop her car. Luckily she was not at home at the time and has a second vehicle undamaged. Dane Jackson and his son Justin, both of Chesterton, were hard at work Thursday afternoon cutting the huge tree in pieces to be trucked away--a daunting task, but Dane and Justin were in good spirits and just taking the tree apart a bit at a time. (Tribune photo by Margaret L. Willis)

September 9, 2009

To: Chesterton Town Council

From: Mike Orlich, Chesterton Fire Chief & Bernie Doyle, Chesterton Town Manager

Subject: Briefing Paper on **After Action Review** of Tornado Event 8/19/09

The formal AAR (after action review) of the August 19th Tornado took place at 1pm August 28, 2009. The AAR is a part of NIMS (national incident management system) and ICS (incident command system). All parties that were involved or assisted were invited to participate. The purpose of the AAR is to evaluate the response and management of the event. Not all mutual aid departments and resources were represented, however all town department heads and the town manager attended.

The AAR was held at the Chesterton fire station training room and facilitated by Chief Orlich. The beginning of the AAR was a timeline overview of the event. We then followed an outline determining the who, what, when, where and how to determine lessons learned.

The first part of the discussion reviewed goals/objectives set by the incident commander during the first hours of the event. Establishment of a command structure with prioritization such as opening of main roads and door to door surveying for injured was discussed. We then canvassed each responder group (fire, police, emergency medical service, utility, park and street) to list and discuss the rolls played and the goals/objectives either achieved or not achieved.

We discussed the operational periods for the event and if they were adequate for the objectives that the unified command set and if completed in the given time of the incident. Problems attaining the objective were discussed as to future application, such as a more unified command. Following tornado touchdown and the realization that the town needed to organize rapid emergency assistance to a wide area of Chesterton, it was apparent that not all of the department heads knew where to go and what to do. Chief Orlich and Street Commissioner John Schnadenberg were both attending conferences in Indianapolis at the time of the incident. The assistant fire chief assumed command of emergency services but there was some confusion initially with the street and utility departments in rounding up personnel, bringing them to a central staging area, assessing needs, assigning tasks and dispersing them out to the field. This is not meant to be critical of any one department or person, only to highlight the need for clearly assigned tasks and staging areas in the future. Part of the solution will come down to training in NIMS and practice “tabletop” exercises.

Key operational command objectives discussed that needed further enhancement for future events include:

- Lack of a planning section chief/officer; this person being critical in the fundamental ICS (Incident Command System) plan especially if this event had been of a catastrophic nature with substantial property damage, injuries and/or loss of life. However, with this being a relatively minor incident we made due without the position. This position that will be developed into our ICS. These ties in with the need for a more unified command structure which comes from experience and annual NIMS disaster management training.
- Crowd control was a problem. It is human nature to want to be a part of an event that could be catastrophic. People are naturally curious. However, many people do not realize the hindrance to emergency operations they present by their simply being on the roads. It was recommended that we establish a parameter around the command area in the future restricting non-essential personnel and/or citizenry from entering. It should be noted that the worse the event, especially if there are injuries or fatalities, the more “gawkers” will be out. Public education is essential here to assist in keeping people in their homes or at a shelter.
- Communications overall could have been better especially between the command vehicle and emergency crews in the field. This segment will require further discussion that will include representatives from the town departments with Verizon on cell phone applications that worked and those that failed after their

system went down. Two way radio use will be looked into to determine the best course of utilization of the relatively new 800 MHz radios. There was no central dispatch monitoring and coordinating radio traffic, and there was no unified set of frequencies being utilized by all responding departments from surrounding communities. One channel needs to be selected in the event of a repeater malfunction. It has been recommended to have an 800 mobile unit in our command vehicle as a result. The repeater (which takes a local radio transmission signal and boosts it for higher reception) locked up within the first hour rendering the radios useless for all but very local traffic during the first phase of the storm emergency. We were informed that this fault is being looked into.

- The alert siren failed reportedly due to a mechanical function. As of this writing the system hardware has been replaced and tested along with additional redundancy being built into the system. The county emergency director will now have a manual control from his office as well as the capability to activate from his vehicle. It is recommended that the town have the capability of manually activating the alert sirens.
- Not all town department heads knew where to go. The park superintendent wasn't sure nor was the building commissioner. Training in NIMS and this past incident will alleviate that confusion.
- NIPSCO took too long to respond to the central command vehicle. Initial calls to NIPSCO were made to NIPSCO between 8:30-9:00pm. Part of that problem stemmed from the primary Public Information Officer (Jim Fitzer) being away on vacation. Eventually his supervisor arrived by 11:00pm, some 3 and a half hours into the incident. We were provided with better numbers to contact in the event of a similar incident. This is another reason to have a disaster management plan in place that contains essentially a game book" with current points of contact and numbers to be used by emergency managers.
- Use of the town manager's administrative assistant or someone from the Clerk/Treasurer's could have been utilized to gather information to produce press releases to the media thus providing consistency and accuracy in reporting to the media. This individual would have worked closely with the town manager who was being drawn in too many directions. The town managers role should be one of inclusion into the ICS and not one of just acting as the town spokesperson. Much depends on the nature of the incident and level of experience of the town manager now and in the future.
- Chesterton High School did not have sufficient power to supply energy to the gymnasium. What would have happened in a catastrophic event where we would have needed several hundred cots and room for the Red Cross and Salvation Army to set up for several days? We had the Town Hall with a capacity for 80. That was it. Yost School in Porter could have been used for shelter but would not have had shower facilities or space for a large number of displaced citizens.
- House to house searches although very well coordinated and thorough when it began, took too long to organize. The first search phase with its 4 divisions delegated to numerous agencies began at 11:12pm some 3 and a half hours after the tornado hit.

Key operational command objectives that succeeded include:

- The seamless transition of control between assistant fire chief Tom Fieffer and Chief Orlich.
- Excellent cooperation between acting police chief Lt. Dave Lohse and supporting law enforcement agencies from the region.
- The rapid response and level of support by Red Cross and Salvation Army personnel, the Boy Scouts and Civil Air Patrol, outside community assistance from numerous cities and towns and local volunteers many of whom will never be known.
- Inter-department cooperation between all of our departments was evident throughout although building and utility staff could have been initially called in and dismissed later. It is recommended that this be incorporated into a future disaster management plan. Essential town staff needed in a crisis has to know who they, where they will report and what they are expected to do. There were town staff that could have been utilized but weren't.
- Tasks from the command center assigned were carried out in a timely and professional manner.
- There was no question about who was in charge as we operated under a unified command structure.
- Once NIPSCO was on the scene, they performed admirably taking the prioritization list from the acting utility superintendent and relaying that to the field, i.e. the lift stations and nursing home.

- At one point, 12,784 customers were without power immediately following the tornado. By 8:10am the next morning, there were only 459 without (several of those intentionally left without due to severe structural damage).
- Streets opened within 2 hours of the tornado included Broadway, Porter Ave., Woodlawn, 11th, 15th and 8th. All major streets and roads were open by the following morning (20th).
- The positive spirit and cooperation of the Clerk/Treasurer's office although not widely publicized was essential in assisting the management team in facilitating communications from a wide variety of people for extensive phone calls into the town hall the following day from the citizenry. They are to be commended for stepping up without question.

Following two Indiana Department of Homeland Security inspections by the state director the day after the storm on 8/20 and his field team on Tuesday 8/25, the following structural assessments were determined:

- 16 Commercial properties damaged
- 159 Single Family Homes damaged
- 11 Multi-Family Homes damaged

Of those:

- 10 were destroyed (100%)
- 33 sustained major damage (50-75%)
- 52 sustained minor damage (25-50%)
- 91 were affected ((25% or less damage)

It was determined early on that the town would not qualify for the Federal threshold of assistance from FEMA but that we might (and of this writing it looks probable) receive low rate loans for businesses and underinsured home owners from the Small Business Administration. As of Monday, August 31st, the SBA had received a request for assistance from Indiana Governor Mitch Daniel's. The town should receive a determination one way or another by the week of September 7th.

All town staff involved performed to the fullest and should be commended for their actions. There is no question that we were lucky in that the event caused no serious injuries, fatalities and/or extensive property damage. This event will be and should be used as a positive learning experience to reinforce the need for the town to continue in the training and use of NIMS and ICS. A full power point of the timeline is being constructed by the town manager, his administrative assistant and key participants in the storm management to be presented at a later date and for use in training exercises. It's not a question of if a catastrophic manmade or natural event will happen, but when.

This briefing paper only captures a "thumbnail sketch" of events that occurred following the tornado touchdown the night of August 19th, 2009. It is meant to be a summary only for your quick review as the incident has not concluded. Cleanup of portions of Coffee Creek are ongoing as is the determination of aid from the Small Business Administration.

cc: Department Heads
Chuck Lukmann

Appendix C – Adopting Resolutions

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, Porter County recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, Porter County participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Porter County Commissioners hereby adopt the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

_____
County Commissioner Chairman

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County Commissioner

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County Commissioner

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Attested by: County Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Beverly Shores recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Beverly Shores participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Beverly Shores hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

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Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

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Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Burns Harbor recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Burns Harbor participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Burns Harbor hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

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Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

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Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Chesterton recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Chesterton participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Chesterton hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

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Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

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Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Dune Acres recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Dune Acres participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Dune Acres hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

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Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

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Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Hebron recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Hebron participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Hebron hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

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Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

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Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Kouts recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Kouts participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Kouts hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

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Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

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Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Ogden Dunes recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Ogden Dunes participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Ogden Dunes hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

_____
Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

_____
Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the City of Portage recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the City of Portage participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the City of Portage hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

_____
City Mayor

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City Council Member

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City Council Member

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City Council Member

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City Council Member

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Attested by: City Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Porter recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Porter participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Porter hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

_____
Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

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Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the Town of Pines recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the Town of Pines participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the Town of Pines hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

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Town President

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Town Council Member

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Town Council Member

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Town Council Member

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Town Council Member

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Attested by: Town Clerk

Resolution #_____

ADOPTING THE PORTER COUNTY MULTI-HAZARD MITIGATION PLAN

WHEREAS, the City of Valparaiso recognizes the threat that natural hazards pose to people and property; and

WHEREAS, undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars; and

WHEREAS, an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects; and

WHEREAS, the City of Valparaiso participated jointly in the planning process with the other local units of government within the County to prepare a Multi-Hazard Mitigation Plan;

NOW, THEREFORE, BE IT RESOLVED, that the City of Valparaiso hereby adopts the Porter County Multi-Hazard Mitigation Plan as an official plan; and

BE IT FURTHER RESOLVED, that the Porter County Emergency Management Agency will submit on behalf of the participating municipalities the adopted Multi-Hazard Mitigation Plan to the Indiana Department of Homeland Security and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS _____ Day of _____, 2010.

_____
City Mayor

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City Council Member

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City Council Member

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City Council Member

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City Council Member

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Attested by: City Clerk

Appendix D – Historical Hazards from NCDC

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Porter	04/05/58	Tornado	F	0	0	3K	0	None Reported
Porter	06/08/58	Tornado	F1	0	0	25K	0	None Reported
Porter	04/30/60	Tornado	F1	0	1	0K	0	None Reported
Porter	06/13/60	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	06/16/60	Hail	1.25 in.	0	0	0	0	None Reported
Porter	04/30/62	Hail	1.75 in.	0	0	0	0	None Reported
Porter	04/30/62	Tornado	F3	0	0	3K	0	None Reported
Porter	06/08/63	Tstm Wind	58 kts.	0	0	0	0	None Reported
Porter	06/10/63	Tornado	F0	0	0	0K	0	None Reported
Porter	07/19/63	Tstm Wind	75 kts.	0	0	0	0	None Reported
Porter	06/19/64	Tstm Wind	75 kts.	0	0	0	0	None Reported
Porter	04/11/65	Tornado	F3	0	0	25.0M	0	None Reported
Porter	04/25/65	Tornado	F	0	0	0K	0	None Reported
Porter	08/26/65	Hail	0.75 in.	0	0	0	0	None Reported
Porter	04/20/66	Tstm Wind	50 kts.	0	0	0	0	None Reported
Porter	07/09/66	Tornado	F0	0	0	3K	0	None Reported
Porter	07/09/66	Tornado	F1	0	0	0K	0	None Reported
Porter	10/24/67	Tornado	F3	0	0	25K	0	None Reported
Porter	09/19/68	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	04/21/69	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	07/02/70	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	06/20/74	Tornado	F1	0	0	25K	0	None Reported
Porter	06/20/74	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	04/18/75	Tornado	F0	0	4	25K	0	None Reported
Porter	03/12/76	Hail	1.75 in.	0	0	0	0	None Reported
Porter	03/12/76	Tornado	F3	0	0	250K	0	None Reported
Porter	03/12/76	Tornado	F2	0	0	3K	0	None Reported
Porter	07/15/76	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	07/21/78	Tstm Wind	61 kts.	0	0	0	0	None Reported
Porter	06/29/79	Hail	1.75 in.	0	0	0	0	None Reported
Porter	04/07/80	Hail	0.75 in.	0	0	0	0	None Reported
Porter	04/07/80	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	05/30/80	Tornado	F1	1	0	0K	0	None Reported

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Porter	05/30/80	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	06/06/80	Tornado	F0	0	0	0K	0	None Reported
Porter	08/10/80	Tstm Wind	70 kts.	0	0	0	0	None Reported
Porter	08/13/80	Hail	1.75 in.	0	0	0	0	None Reported
Porter	04/03/82	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	05/22/82	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	07/01/83	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	07/01/83	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	03/28/85	Hail	1.00 in.	0	0	0	0	None Reported
Porter	05/26/85	Hail	0.75 in.	0	0	0	0	None Reported
Porter	07/16/88	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	08/03/88	Tornado	F1	0	0	0K	0	None Reported
Porter	03/17/89	Hail	1.25 in.	0	0	0	0	None Reported
Porter	03/27/91	Hail	1.00 in.	0	0	0	0	None Reported
Porter	10/04/91	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	06/17/92	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	06/17/92	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	07/02/92	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	01/01/93	Flood	N/A	0	0	5.0M	0	Near major flooding developed during early January in northern Indiana. Extensive flooding occurred along the Kankakee, Elkhart, Tippecanoe, Yellow, both St. Joseph Rivers, and numerous lakes in northeast Indiana. At least 1000 residential units were affected by the flooding and over 20 evacuations resulted. The antecedent conditions for this flood were reminiscent of the late December 1990 and early January 1991 major flood. Cold weather arrived Christmas Eve and froze the ground. Snow cover of three to seven inches in northern Indiana melted quickly at the end of December, with rain of two to three inches occurring on the 30th and 31st. Significant flooding developed along northern Indiana rivers by January 1. Just as the rivers were beginning to fall, an additional 1.5 to 2.5 inches of rain fell across the entire state on the 3rd and 4th. This produced near major flooding in northern Indiana, and significant widespread flooding across central and western Indiana. The flooding affected numerous local and several state roads. Flooding along portions of the Kankakee and both St. Joseph Rivers was the highest since 1985. Flooding along other streams in northern Indiana and the Wabash River in western Indiana was the highest since the flood of December 1990-January 1991.
Porter	03/04/93	Heavy Snow	N/A	0	0	0	0	Six inches of snow fell over far northern Indiana from Valparaiso to Angola.
Northwest In	03/13/93	Heavy Snow	N/A	0	0	0	0	Heavy lake effect snow fell in a narrow band from Michigan City to Medaryville. Snow amounts ranged from 6 to 14 inches in parts of LaPorte County, and in the western parts of Starke and Pulaski Counties.
Chesterton	04/24/93	Hail	0.75 in.	0	0	0	0	None Reported
Porter	10/17/93	Flood	N/A	0	0	500K	500K	Significant agricultural flooding occurred along the Kankakee River in northwest Indiana. The Iroquois River flooded several homes and city streets in Rensselaer and State Road 55 near Foresman.

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Porter	01/14/94	Extreme Cold	N/A	3	0	5.0M	0	Bitter cold weather settled over Indiana during the third week of January. Many locations recorded daily minimum temperatures below zero each day from January 14 to January 21. The coldest temperatures were recorded on the morning of January 19, when a new record minimum for the state of Indiana was established with a reading of -36 at the National Weather Service cooperative weather station at New Whiteland in Johnson County.
Northern Indiana	02/25/94	Heavy Snow/blowing Snow	N/A	0	0	0	0	Snow moved into northwest Indiana late on the morning of the 25th and spread east across the northern part of the state during the afternoon. At times snow fell at the rate of one to two inches per hour. Most of northern Indiana received between three and five inches of snow, although there were some spots that reported six inches or more. After the snow tapered off strong winds developed and caused severe blowing and drifting snow. At times whiteout conditions were reported in northern Indiana, with wind gusts of 40 to 60 mph. Numerous roads had to be closed, and many motorists were stranded. State Emergency Management reported that approximately 1,400 stranded motorists were housed at shelters.
Valparaiso	04/15/94	Lightning	N/A	0	0	5K	0	None Reported
Portage	04/25/94	Tstm Windss	0 kts.	0	0	5K	0	Thunderstorm winds blew down large tree limbs and power lines.
Portage	06/13/94	Hail	1.00 in.	0	0	0	0	None Reported
Chesterton	06/13/94	Hail	1.75 in.	0	0	0	0	None Reported
Porter	11/21/94	High Wind	0 kts.	0	0	50K	0	An intense low pressure system over the Great Lakes and its associated cold front produced high winds across all of Indiana. Winds in excess of 50 mph were common across the state beginning near midnight in western Indiana. High winds spread to eastern Indiana by noon EST. Scattered power outages and downed trees were reported across many parts of Indiana including South Bend, Lafayette, and Indianapolis.
Porter	11/27/94	High Wind	0 kts.	0	0	120K	0	An intense low pressure area and its associated cold front swept across the region with high winds both before and after the cold front. The cold front itself triggered a squall line that produced damage. The high winds resulted in a roof collapse at the ATF automotive business in Indianapolis around 2 PM EST.
Porter	04/10/95	Ice Storm	N/A	0	0	0	0	Freezing rain occurring during the night and early morning caused power outages due to the weight of ice on power lines and due to tree limbs falling on lines.
Chesterton	06/07/95	Tstm Winds	0 kts.	0	0	5K	0	Large tree limbs fell on cars at Chesterton and Valparaiso. A tree also fell across Route 12 in Porter County.
Valparaiso	06/07/95	Tstm Winds	0 kts.	0	0	3K	0	Large tree limbs fell on cars at Chesterton and Valparaiso. A tree also fell across Route 12 in Porter County.
Porter	07/13/95	Heat Wave	N/A	14	0	1.0M	0	Heat wave conditions developed across all of Indiana. High temperatures reached between 95 and 105 degrees with heat indices between 100 and 120 degrees. Nearly all heat related deaths occurred in the sick or elderly populations and most occurred in northwest Indiana.
Chesterton And Porter	08/15/95	Tstm Winds	0 kts.	0	0	0	0	Thunderstorms knocked down tree limbs and power lines in Porter and Chesterton.
Porter	08/21/95	Heat Wave	N/A	1	0	0	0	Heat wave conditions initially developed over southwest Indiana on the 12th then overspread all but northwest Indiana for the remainder of the week. Heat wave conditions ended across the north and central sections on the 19th and over the south by the 21st. High temperatures were in the 90s throughout the period and near 100 across the south. High humidity also yielded Heat Index values between 100 and 115 degrees most of the week. These extreme conditions resulted in a heat stroke and death of an elderly male. The Indiana State Fair lost over $400 thousand due to low turnouts and most of Indiana crops suffered some due to the heat.

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Porter	12/08/95	Winter Storm	N/A	0	0	0	0	A low pressure system and cold front swept across Indiana bringing the first significant snowfall and cold temperatures of the winter season. Though snowfall amounts only averaged from two to four inches across the state, numerous vehicle accidents occurred, several resulting in fatalities. The cold front brought the first subzero temperatures to the state and prompted wind chill advisories for all of Indiana.
Porter	12/18/95	Winter Storm	N/A	0	0	0	0	A low pressure system moving east through the Ohio and Tennessee River Valleys brought significant ice and snow to the northern two thirds of Indiana. Freezing rain began during the evening on the 18th across central and northeast Indiana while snow fell in northwest and north central sections. The freezing rain changed to snow between 0600 and 1100 on the 19th across central and northeast sections. Total snowfall amounts of four to eight inches were common across central and northeast Indiana. Ice accumulations of a quarter to a half inch were common in east-central Indiana. The ice accumulation caused widespread power outages in central and east central Indiana leaving up to 65,000 homes without power at one point. Locations near Muncie did not have power restored until the 21st.
Porter	12/27/95	Heavy Snow	N/A	0	0	0	0	A narrow band of lake effect snow developed over eastern Lake County and western Porter County during the morning of the 27th. The band drifted west toward Illinois in the morning then back east into LaPorte County during the afternoon. Snowfall amounts were generally three to five inches across north and central parts of Lake, Porter, and LaPorte Counties but localized eight to 14 inch amounts fell in northwest Porter County between Portage and Valparaiso.
Kouts	01/18/96	Tstm Wind	0 kts.	0	0	0	0	Tree limbs were blown down south and east of Kouts.
Porter	02/02/96	Extreme Cold	N/A	0	0	0	0	Bitter cold weather occurred in northwest and north central Indiana February 2 through February 4. At South Bend records set included; record low of -13 on February 3rd, record low maximum of -7 on February 3rd (this was the lowest maximum for the month of February) and record low of -13 on February 4th. There were no known fatalities from the cold.
Porter	03/20/96	High Wind	55 kts.	0	0	0	0	Strong north winds blowing down the entire fetch of Lake Michigan caused beach erosion and damaging winds along the south shore of the lake. Winds brought down tree limbs and power lines.
Porter	03/25/96	High Wind	46 kts.	0	0	0	0	A powerful storm brought strong winds to northwest Indiana on March 25th. The strongest winds occurred in the early morning hours. The winds also blew down tree limbs and caused scattered power outages from downed power lines.
Portage	04/12/96	Hail	0.75 in.	0	0	0	0	None Reported
Malden	04/19/96	Hail	1.75 in.	0	0	0	0	None Reported
Porter	05/09/96	Flash Flood	N/A	0	0	0	0	Flash flooding occurred during the afternoon and evening of May 9th over parts of Northwest and North Central Indiana. Traffic was temporarily halted on Interstate 94 from flooding. Total rainfall from the storm averaged between 3 and 6 inches over the 24 hour period ending 7am May 10th. The cooperative observing site at Indiana Dunes reported a 24 hour rainfall total of 5.71 inches.
Hebron/kouts	05/09/96	Hail	1.75 in.	0	0	0	0	None Reported
Porter	07/17/96	Flash Flood	N/A	0	0	0	0	None Reported
Chesterton	08/07/96	Lightning	N/A	0	0	10K	0	Lightning struck a home in Chesterton, and blew apart a chimney. Damage estimates of $10,000.00.
Porter	10/29/96	Tstm Wind	0 kts.	0	0	0	0	None Reported
Porter	01/09/97	Winter Storm	N/A	0	0	0	0	On January 9th 5 to 10 inches of snow fell across northwest and north central Indiana.
Porter	01/15/97	Winter Storm	N/A	0	0	0	0	A winter storm brought 4 to 6 inches of snow to northern Indiana on January 15. The snow was followed by strong winds and cold temperatures creating wind chills of 20 to 40 below zero. Lake effect snow developed in north central Indiana on the 16th. The NWS office at South Bend recorded 8.6 inches of snow. The coldest

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
								low temperatures recorded at the NWS office at South Bend during that time are as follows: -9 on the 17th and -4 on the 18th.
Hebron	05/05/97	Hail	2.00 in.	0	0	0	0	None Reported
Valparaiso	05/18/97	Tstm Wind	0 kts.	0	0	0	0	Trees and limbs downed throughout the county, especially southwest of Valparaiso.
Porter	07/18/97	Tstm Wind	50 kts.	0	0	0	0	None Reported
Porter	12/09/97	Heavy Snow	N/A	0	0	0	0	A band of heavy snow fell across extreme northwest Indiana during the evening of the 9th and ended the morning of the 10th. Eight to 10 inches of snow fell over portions of Lake, Porter and LaPorte counties. Some snowfall amounts include: Indiana Dunes - 6.1 inches in Porter county.
Porter	12/30/97	Heavy Snow	N/A	0	0	0	0	A lake effect snow event began during the evening of the 30th and ended during the afternoon of the 30th. The heavy snow band fell across portions of LaPorte, Porter and St. Joseph counties, with the heaviest amounts reported from LaPorte county.
Porter	03/09/98	Heavy Snow	N/A	0	0	0	0	A strong low pressure system brought a late winter storm to northwest Indiana the morning of March 9th. The low, which originated in the southwestern U.S., took an east-northeast track, reaching central Illinois by the evening of the 8th. Precipitation in the form of rain began out ahead of this system, and changed over to a heavy, wet snow between 7am and 8am (est). The snow continued into the middle of the afternoon on the 9th, dropping around a foot of snow in some places. Lake induced snow showers followed this main storm event and causing additional snowfall accumulations of 2 to 6 inches. The combination of strong winds and heavy snowfall brought traffic to a standstill on stretches of I-65 and Interstate 80/94 in Indiana. Some drivers were stranded for as long as 18 hours. Many homes were without electricity, as numerous power lines were downed due to the weight of the heavy, wet snow. Also, tree limbs and branches were downed. Total snowfall storm totals reported: Porter: Valparaiso-15 inches.
Porter	08/24/98	Tstm Wind	50 kts.	0	0	0	0	A small intense squall line moved east southeast at 55 mph from the south suburbs of Chicago into northern Lake and Porter Counties. NIPSCO utility company and emergency management reported numerous tree limbs and power lines down, with most of the damage in the northern parts of Lake and Porter Counties. In Portage, part of the ceiling of a bank collapsed, injuring 2 people. Trees were down on roads and intersections in Gary, Portage and Hobart.
Porter	11/10/98	High Wind	50 kts.	0	0	0	0	Strong low pressure moved from Iowa to eastern Minnesota to northwest Wisconsin producing strong winds across northwest Indiana. Sustained winds of 35 to 45 mph were common throughout the afternoon and evening with a few gusts of 55 to 65 mph. Winds subsided after midnight. There were tree limbs and power lines knocked down throughout northwest Indiana.
Porter	01/01/99	Heavy Snow	N/A	0	0	0	0	A powerful winter storm developed over the Texas Panhandle and moved northeast through the Missouri Boot heal, and then north northeast through eastern Illinois, southern Lake Michigan and into Michigan. Snow began accumulating in northwest Indiana during the evening hours of New Year's Day and continued through the night and through the next day. Snow was heaviest during the day Saturday January 2. Snow tapered off to flurries by later that evening. Snowfall totals included 12.0 inches at Valparaiso.
Porter	03/08/99	Heavy Snow	N/A	0	0	0	0	Heavy snow fell over northwest Indiana. Snow began in the late afternoon/early evening of the 8th and diminished to flurries during the morning of the 9th. Strong east wind caused some blowing and drifting of snow. Snowfall amounts were generally 5 to 8 inches.
Chesterton	04/10/99	Hail	1.50 in.	0	0	0	0	Thunderstorms moved through northwest Indiana dumping hail from marble to golf ball size. In some places hail was 2 inches deep.
Beverly Shrs	08/29/99	Rip Currents	N/A	1	0	0	0	None Reported

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Porter	01/19/00	Heavy Snow	N/A	0	0	0	0	On the afternoon and evening of January 19th and early morning of January 20th, 5 to 8 inches of snow fell across much of northwest Indiana. The snow event was at the eastern most end of a general broad band of heavy snow from central and eastern Iowa, across north and north central Illinois, and into northwest Indiana. The heaviest snow amounts for northwest Indiana fell across extreme northern Porter county and northeastward along Lake Michigan. Official snowfall reports: 7.5 inches in Porter, 5.0 inches in Merrillville, 5.0 inches in Valparaiso, 7.0 inches in Morocco, 5.0 inches in Rensselaer and 7.1 inches in Remington.
Porter	01/25/00	Heavy Snow	N/A	0	0	0	0	Lake effect snow began the evening of January 25th and continued for much of the day on January 26th. Arctic air flowing down the length of Lake Michigan resulted in heavy lake effect snow with white out conditions. Snowfall reports from Porter County included 17 inches in Valparaiso and 12 to 14 inches around the Chesterton area.
Porter	02/18/00	Heavy Snow	N/A	0	0	0	0	Snow, sleet, and freezing rain turned to all snow by the afternoon of February 18th and continued through evening, leaving 6 to 9 inches of snow across northern portions of Lake and Porter Counties.
Valparaiso Muni Arpt	05/08/00	Tstm Wind	66 kts.	0	0	0	0	A line of thunderstorms moved through the south suburbs of Chicago and into northwest Indiana. Tree limbs and downed power lines knocked out power along I-80. The ASOS at VPZ recorded a 76 mph wind gust. Large limbs were blown down, a tree was uprooted and a large heavy swing set was toppled east of Valparaiso.
Valparaiso	05/08/00	Tstm Wind	60 kts.	0	0	0	0	A line of thunderstorms moved through the south suburbs of Chicago and into northwest Indiana. Tree limbs and downed power lines knocked out power along I-80. The ASOS at VPZ recorded a 76 mph wind gust. Large limbs were blown down, a tree was uprooted and a large heavy swing set was toppled east of Valparaiso.
Hebron	05/18/00	Tornado	F0	0	0	0	0	A series of supercell storms moved across northwest Indiana. An amateur radio operator and trained spotter reported a brief tornado touchdown in a rural area near Roselawn. The tornado crossed I-65. No damage was reported. Later a trained spotter reported a tornado near Hebron. There was no report of any damage.
Porter	08/06/00	Flash Flood	N/A	0	0	0	0	Severe Thunderstorms, which originally developed in central Illinois during early afternoon, continued moving eastward through far northwest Indiana. Porter county received widespread tree damage, downed power lines, and property damage to several homes. During the storm an individual at the Indiana Dunes State Park had to be rushed to a nearby hospital after being injured when a tree fell. Throughout the county two homes were damaged by falling trees and three homes caught fire when struck by lightning.
Porter	08/06/00	Lightning	N/A	0	0	0	0	Severe Thunderstorms, which originally developed in central Illinois during early afternoon, continued moving eastward through far northwest Indiana. Porter county received widespread tree damage, downed power lines, and property damage to several homes. During the storm an individual at the Indiana Dunes State Park had to be rushed to a nearby hospital after being injured when a tree fell. Flash flooding occurred in the community of South Haven, and at one point over half of the county was without electrical power. Throughout the county two homes were damaged by falling trees and three homes caught fire when struck by lightning.
Porter	08/06/00	Tstm Wind	61 kts.	0	1	0	0	Severe Thunderstorms, which originally developed in central Illinois during early afternoon, continued moving eastward through far northwest Indiana. Porter county received widespread tree damage, downed power lines, and property damage to several homes. During the storm an individual at the Indiana Dunes State Park had to be rushed to a nearby hospital after being injured when a tree fell. Flash flooding occurred in the community of South Haven, and at one point over half of the county was without electrical power. Throughout the county two homes were damaged by falling trees and three homes caught fire when struck by lightning.
Porter	09/11/00	Hail	0.75 in.	0	0	0	0	A line of severe thunderstorms that developed in north central Illinois moved into far northwest Indiana during the afternoon hours. In Portage, the strong winds downed trees and with hail small sheds were damaged.
Porter	09/11/00	Tstm Wind	60 kts.	0	0	0	0	A line of severe thunderstorms that developed in north central Illinois moved into far northwest Indiana during the afternoon hoursIn Portage, the strong winds downed trees and with hail small sheds were damaged.

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Porter	12/11/00	Blizzard	N/A	0	0	0	0	An intense winter storm, which developed in the Texas Panhandle, moved northeast through southern Illinois and northeast Indiana December 11 and 12. Heavy snow fell at the rate of nearly an inch per hour during the morning and early afternoon. During the height of the blizzard from around 200 pm through 800 pm CST, a combination of heavy snow and wind gusts of 35 to 40 mph created near white-out conditions. Law enforcement officials reported visibilities reduced to near zero along Interstate 80 and Interstate 65, stranding many motorists. Wind chill indices dropped to 30 to 40 degrees below zero during the evening of the 11th. By early morning on the 12th, nearly one foot of snow had fallen over Lake and Porter Counties. Some snowfall totals included 10.5 inches at Lowell, 9.0 inches at Crown Point, and 8.0 inches at Hebron.
Porter	02/25/01	Strong Wind	0 kts.	0	0	0	0	An intense low pressure system brought strong winds to northwest Indiana. Peak wind gusts were around 50 mph. The wind knocked down tree limbs and power lines, causing scattered power outages. Altogether, 9000 NIPSCO customers lost power.
Chesterton	06/11/01	Lightning	N/A	0	0	0	0	A large bow echo moved southeast from Wisconsin, across northeast Illinois and then into far northwest Indiana late on Monday June 11th and early on June 12th. Wind speeds were estimated as high as 70 mph in the city of Valparaiso. Trees and power lines were blown down across all of Porter, Lake and Newton counties. A first story bedroom was demolished by a four foot diameter tree that was blown down onto the house in Valparaiso in Porter county at 2340 CST. Two parked cars were hit by falling limbs in Valparaiso at 2345 CST, but only received minor damage. A tree was struck by lightning in Chesterton in Porter county at 2350 CST, but caused no damage. Over 10,000 customers were reported to have lost their power across northwest Indiana.
Porter	06/11/01	Tstm Wind	60 kts.	0	0	55K	0	A large bow echo moved southeast from Wisconsin, across northeast Illinois and then into far northwest Indiana late on Monday June 11th and early on June 12th. Wind speeds were estimated as high as 70 mph in the city of Valparaiso. Trees and power lines were blown down across all of Porter, Lake and Newton counties. A first story bedroom was demolished by a four foot diameter tree that was blown down onto the house in Valparaiso in Porter county at 2340 CST. Two parked cars were hit by falling limbs in Valparaiso at 2345 CST, but only received minor damage. A tree was struck by lightning in Chesterton in Porter county at 2350 CST, but caused no damage. Over 10,000 customers were reported to have lost their power across northwest Indiana.
Burdick	07/07/01	Lightning	N/A	0	0	12K	0	Lightning struck a garage at 452E and 1000N in Jackson Township at 0454 CST. The 24 foot by 24 foot garage was a total loss.
Chesterton	07/07/01	Tstm Wind	50 kts.	0	0	2K	0	A garage door was blown into the garage, windows of the garage were blown out and tree limbs were blown down north of the garage.
Chesterton	07/23/01	Lightning	N/A	0	0	10K	0	Lightning struck the northeast corner of a garage and started a small fire. Most of the damage to the garage was caused by smoke and water used to put out the fire.
Chesterton	08/02/01	Lightning	N/A	0	0	25K	0	Lightning struck a tree, went down a security wire which was nailed to the tree, blew out wall sockets in a garage, traveled underground, blew out a light and a pump in a pool and finally struck a gas meter , but did not cause a fire.
Wheeler	08/25/01	Tornado	F0	0	0	0	0	A small weak tornado touched down briefly on the north side of Wheeler. A few tree limbs were blown down and corn was flattened.
Chesterton	10/24/01	Tstm Wind	50 kts.	0	0	0	0	A squall line moved east into northwest Indiana during the afternoon of October 24th. Winds gusting as high as 65 mph blew trees and power lines down across many areas.
Porter	01/31/02	Winter Storm	N/A	0	0	0	0	A strong winter storm moved into the Ohio Valley on January 30th. Snow began falling across Lake and Porter counties in the evening. The snow changed to freezing rain over most areas and produced ice accumulations of one quarter inch.

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Porter	02/26/02	Winter Storm	N/A	0	0	0	0	A winter storm moved northeast across southern Indiana on February 25th and into Ohio on February 26th. Snow began falling across northwest Indiana during the evening hours of the 25th and by the early morning hours, snow had accumulated 4 to 6 inches across most areas.
Porter	03/02/02	Winter Storm	N/A	0	0	0	0	Snow began falling late on Friday March 1st and continued into the morning hours of Saturday March 2nd. The second part of this storm began Saturday afternoon and continued into the early morning hours of Sunday March 3rd. Storm total snowfall amounts ranged from 5 to 9 inches. Lowell in Lake county reported 8.5 inches and the Indiana Dunes in Porter county reported 6.6 inches.
Porter	03/09/02	High Wind	51 kts.	0	0	0	0	Strong low pressure moved across the upper Midwest on Saturday, March 9th. Winds were sustained between 40 and 50 mph during most of the afternoon and evening hours, with wind gusts to 60 mph. Trees, branches, utility poles, and wires were blown down across all of northwest Indiana. Several semi trucks and tractor trailers were blown over on interstates in northwest Indiana, though no injuries were reported.
Valparaiso	06/25/02	Tstm Wind	50 kts.	0	0	0	0	Thunderstorms moved across northwest Indiana during the afternoon and evening hours of June 25th. Two men, who were working on a piece of drilling equipment in Crown Point, were struck by lightning. Both were thrown to the ground but suffered only minor injuries. Three trees were blown down in Valparaiso in Porter county and damaged a few parked cars.
Wheeler	07/22/02	Tstm Wind	50 kts.	0	0	0	0	Trees and power lines were blown down in Portage in Porter county, 4 miles north of Wheeler.
Porter	12/24/02	Winter Storm	N/A	0	0	0	0	Low pressure tracked across Kentucky, southern Indiana and Ohio during the evening of December 24th and the morning of December 25th 2002. The storm left a band of snowfall between 5 and 7 inches across far northwest Indiana. Many locations reported 6 inches of snow.
Porter	01/17/03	Heavy Snow	N/A	0	0	0	0	Very cold air moved south over Lake Michigan late on January 16th and during the morning hours of January 17th. Winds in the lower levels of the atmosphere were due north which allowed a narrow, persistent band of lake effect snow to form. This band of snow dumped over a foot of snow over much of central Porter County. Chesterton reported a storm total of 20 inches. The snow quickly tapered off to only a few inches east and west of Porter County. The snowfall caused several accidents on the Indiana Toll Road, which had to be closed between mile markers 35 and 39.
Porter	01/23/03	Extreme Cold/wind Chill	N/A	0	0	0	0	Strong high pressure moved across the northern plains on January 22 and 23rd. Low temperatures on the morning of January 23rd ranged from zero to five below across most of northwest Indiana. These cold temperatures along with northwest winds of 10 to 20 mph produced wind chills between 20 and 25 degrees below zero.
Porter	03/04/03	Winter Storm	N/A	0	0	0	0	A winter storm moved out of the southern plains Monday night March 4th and across the Ohio Valley Tuesday morning, March 5th. This storm spread snow across far Northwest Indiana where snowfall amounts ranged from 5 to 7 inches across Lake and Porter counties.
Valparaiso	06/28/03	Hail	0.75 in.	0	0	0	0	None Reported
Valparaiso	06/28/03	Tstm Wind	50 kts.	0	0	0	0	Large tree limbs were blown down across parts of eastern Valparaiso.
Chesterton	07/05/03	Tstm Wind	52 kts.	0	0	0	0	Severe thunderstorms moved across northern Lake and northern Porter counties during the early morning hours of Saturday July 5th. Numerous trees and power lines were blown down. Minor flooding was also reported across some locations in northwest Indiana.
Porter	07/07/03	Tstm Wind	57 kts.	0	0	0	0	A line of thunderstorms moved from northern Illinois into northwest Indiana during the morning of July 7th. Several trees, tree limbs and power lines were blown down across Porter county.
Porter	07/17/03	Flash Flood	N/A	0	0	0	0	Thunderstorms formed over far northeast Illinois during the afternoon hours of July 17th and moved southeast into northwest Indiana during the evening hours. Very heavy rain fell across Lake and Porter counties which caused flooding of some streets and low lying areas. A few roads were impassable because of high water. Rainfall amounts ranged between 1 and 2 inches but the rain fell in a very short period of time.

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
								2.1 inches of rain was reported in just 15 minutes in Munster.
Wheeler	07/17/03	Hail	0.88 in.	0	0	0	0	Thunderstorms formed over far northeast Illinois during the afternoon hours of July 17th and moved southeast into northwest Indiana during the evening hours. Very heavy rain fell across Lake and Porter counties which caused flooding of some streets and low lying areas. A few roads were impassable because of high water. Rainfall amounts ranged between 1 and 2 inches but the rain fell in a very short period of time. 2.1 inches of rain was reported in just 15 minutes in Munster.
Hebron	07/17/03	Hail	1.00 in.	0	0	0	0	Thunderstorms formed over far northeast Illinois during the afternoon hours of July 17th and moved southeast into northwest Indiana during the evening hours. Very heavy rain fell across Lake and Porter counties which caused flooding of some streets and low lying areas. A few roads were impassable because of high water. Rainfall amounts ranged between 1 and 2 inches but the rain fell in a very short period of time. 2.1 inches of rain was reported in just 15 minutes in Munster.
Lake Eliza	07/17/03	Hail	1.00 in.	0	0	0	0	Thunderstorms formed over far northeast Illinois during the afternoon hours of July 17th and moved southeast into northwest Indiana during the evening hours. Very heavy rain fell across Lake and Porter counties which caused flooding of some streets and low lying areas. A few roads were impassable because of high water. Rainfall amounts ranged between 1 and 2 inches but the rain fell in a very short period of time. 2.1 inches of rain was reported in just 15 minutes in Munster.
Hebron	07/17/03	Hail	1.00 in.	0	0	0	0	Thunderstorms formed over far northeast Illinois during the afternoon hours of July 17th and moved southeast into northwest Indiana during the evening hours. Very heavy rain fell across Lake and Porter counties which caused flooding of some streets and low lying areas. A few roads were impassable because of high water. Rainfall amounts ranged between 1 and 2 inches but the rain fell in a very short period of time. 2.1 inches of rain was reported in just 15 minutes in Munster.
Hebron	07/21/03	Flash Flood	N/A	0	0	0	0	Thunderstorms moved across northwest Indiana producing hail and very heavy rain during the early morning hours of July 21st. Flooding was reported in Hebron in Porter county and in Wheatfield in Jasper county. Many roads were closed due to flooding. The ground across parts of northwest Indiana was already saturated from heavy rains on July 17th.
Valparaiso	08/26/03	Tstm Wind	57 kts.	0	0	0	0	A severe thunderstorm moved across Porter county during the early afternoon hours of August 26th. A tree fell onto a pickup truck on Michigan Avenue in Valparaiso. Several trees were also blown down near Morgan and Beech streets. Power lines and tree limbs were blown down across other parts of the county.
Porter	11/13/03	High Wind	52 kts.	0	0	0	0	Strong low pressure moved across the upper Midwest and the upper great lakes during the afternoon and evening hours of November 13th. A strong cold front from this low moved across northwest Indiana during the early afternoon hours. Winds increased to 40 to 50 mph across northwest Indiana with gusts as high as 60 mph. Trees, tree limbs, and power lines were blown down across many parts of northwest Indiana. A tree fell onto a house in Chesterton in Porter county causing significant damage.
Porter	01/29/04	Extreme Cold/wind Chill	N/A	0	0	0	0	A cold arctic airmass with temperatures as low as -5F to -10F and winds of 10 to 15mph produced widespread wind chill readings from -20F to -34F.
Porter	03/05/04	High Wind	59 kts.	0	0	0	0	Strong wind associated with a deep low pressure system moving across the Great Lakes region produced wind gusts as high as 69 mph at the Gary Indiana airport. There were widespread power outages in the Gary and Hammond areas.
Porter	05/03/04	Frost/freeze	N/A	0	0	0	0	Temperatures fell to or below freezing across much of northwest Indiana. The coldest reading was at Wanatah where the low was 26.
Valparaiso	05/09/04	Tstm Wind	60 kts.	0	0	0	0	In Morgan Township several old trees were blown down.
Porter	05/14/04	Flash Flood	N/A	0	0	0	0	Street flooding occurred.

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Hebron	05/20/04	Hail	0.88 in.	0	0	0	0	None Reported
Hebron	05/20/04	Tstm Wind	50 kts.	0	0	0	0	Large tree limbs were blown down.
Chesterton	05/23/04	Hail	1.00 in.	0	0	0	0	None Reported
Kouts	05/30/04	Flash Flood	N/A	0	0	0	0	Street flooding occurred.
Hebron	05/30/04	Tstm Wind	50 kts.	0	0	0	0	Power lines and tree limbs were blown down.
Beverly Shrs	07/21/04	Tstm Wind	60 kts.	0	0	0	0	A 20 foot tree was knocked down and blocked a road at the Indiana Dunes National Seashore. During the morning hours of July 21, a cold front extended from north central Wisconsin southwestward through northwestern Iowa. Ahead of the cold front, over the upper Midwest, a very humid, unstable airmass had set up. By late morning, a small cluster of thunderstorms had developed over northwestern Illinois. The line of storms rapidly moved eastward into northwestern Indiana. Strong wind gusts were also measured by coastal observing stations of Lake Michigan. Numerous incidents of wind damage were observed, with a considerable number of trees knocked down or large limbs torn from trees. Power poles were knocked down over many locations. While the primary threat was strong winds, there were also isolated reports of up to 1 inch diameter hail as well.
Porter	07/21/04	Tstm Wind	50 kts.	0	0	0	0	Tree limbs and power lines were knocked down. During the morning hours of July 21, a cold front extended from north central Wisconsin southwestward through northwestern Iowa. Ahead of the cold front, over the upper Midwest, a very humid, unstable airmass had set up. By late morning, a small cluster of thunderstorms had developed over northwestern Illinois. The line of storms rapidly moved eastward into northwestern Indiana. Numerous incidents of wind damage were observed, with a considerable number of trees knocked down or large limbs torn from trees. Power poles were knocked down over many locations. While the primary threat was strong winds, there were also isolated reports of up to 1 inch diameter hail as well.
Porter	01/04/05	Heavy Snow	N/A	0	0	0	0	On Monday January 3, a deep low pressure system tracked out of the Southern Plains. As the low moved northeast, it brought a band of heavy snow to far northwest Indiana and a wintery mix of freezing rain and sleet to central Indiana. Snowfall of 6 to 12 inches fell north of Portage, Indiana to Mendota, Illinois. Locations south of the Kankakee River received up to 3/4 inch of ice and one to two inches of snow. Snow and Ice Accumulation Reports Porter: 7.1 inches at Indiana Dunes
Porter	01/21/05	Heavy Snow	N/A	0	0	0	0	During the evening of January 21, a low pressure system developed over the northern plains and tracked southeast over western Illinois. By the afternoon of January 22, a lake effect snow event set up as strong north winds developed over the region in response to this low pressure system and a strengthening low pressure system in the Mid Atlantic region. The lake effect snow fell from the afternoon of January 22 to the morning of January 23. Snow Accumulation Reports: Porter: 10.1 inches in Chesterton 6.8 inches in 3 miles southeast of Valparaiso
Porter	02/16/05	Flood	N/A	0	0	0	0	Kankakee River Flooding Precipitation over Northern Illinois and Northwest Indiana was above normal during the month of February. Many stages on rivers were high at the beginning of February from flooding in January. A combination of rain and snowmelt resulted in rises above flood stage at several locations. Rainfall combined with snowmelt resulted in flooding. The flooding was limited primarily to forest preserve lands, park areas, and agricultural lands immediately adjacent to the river.
Kouts	06/05/05	Tstm Wind	50 kts.	0	0	0	0	Tree limbs and power lines were blown down across parts of southern Porter County. A line of thunderstorms developed in extreme eastern Illinois during the early afternoon of June 5th and move east into northwest Indiana. This line of thunderstorms produced winds in excess of 60 mph which blew down trees, tree limbs and power lines in several locations.
Porter	06/07/05	Hail	0.88 in.	0	0	0	0	Nickel size hail was reported at the Indiana Dunes National Park.
Valparaiso	06/07/05	Hail	0.75 in.	0	0	0	0	Penny size hail fell for about 10 minutes.

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Valparaiso	07/21/05	Hail	0.88 in.	0	0	0	0	None Reported
Valparaiso	07/21/05	Lightning	N/A	0	1	0	0	A worker at the Porter County Fairgrounds was struck by lightning.
Chesterton	07/21/05	Tstm Wind	55 kts.	0	0	0	0	Trees and power lines were blown down between Chesterton and Valparaiso. The front porch on a house in Valparaiso was destroyed when a tree fell on it. Several tents at the Porter County Fairgrounds also received wind damage.
Beverly Shrs	07/26/05	Rip Current	N/A	2	0	0	0	A 16 year old female and a man in his mid-20s were swimming in Lake Michigan, 80 to 100 yards offshore of Beverly Shores. At 4 pm CST, Michigan City had a north-northeast wind with gusts to 30 mph. These strong winds likely produced waves of 4 feet or higher as well as rip currents. Both people were found about an hour and half later, but had drowned.
Chesterton	08/20/05	Lightning	N/A	0	0	40K	0	A bolt of lightning struck an apartment building during a thunderstorm early Saturday morning. It is suspected of starting a smoldering fire in the insulation in the attic which was finally noticed at 315 pm in the afternoon. Damage was estimated at $30,000 for the structure, mainly the roof, and $10,000 to contents in the building.
Porter	12/08/05	Winter Storm	N/A	0	0	0	0	A winter storm moved across the southern Great Lakes region during the afternoon and evening of December 8th. Heavy snow developed across northwest Indiana during the evening causing significant travel delays on area roads and at local airports. Snowfall amounts ranged between 5 and 8 inches, including 6.5 inches in Chesterton, 6.2 inches in Valparaiso.
Hebron	02/16/06	Hail	1.00 in.	0	0	0	0	Quarter size hail was reported near 700S and County Line Road near Hebron. The storm continued east northeast and quarter size hail was reported several minutes later near Route 30 and 100W, southwest of Valparaiso.
Crocker	05/17/06	Hail	0.88 in.	0	0	0	0	Nickel size hail was reported in Portage.
Hebron	06/21/06	Hail	0.75 in.	0	0	0	0	None Reported
Kouts	06/21/06	Tstm Wind	50 kts.	0	0	1K	0	Trees and power lines were blown down.
Valparaiso	07/20/06	Tstm Wind	50 kts.	0	0	0	0	Small trees were uprooted and large limbs were blown down near County Road 325 and County Road 400.
Valparaiso	07/27/06	Tstm Wind	50 kts.	0	0	0	0	A 30 foot tall tree was blown down along the county line, 2 miles west of Westville in Porter County.
Portage	07/30/06	Tstm Wind	50 kts.	0	0	5K	0	Trees, tree limbs and power lines were blown down across parts of northwest Porter County.
Malden	07/30/06	Tstm Wind	55 kts.	0	0	25K	0	A strong thunderstorm moved south across eastern Porter County and damaged or blew down 12 trees along County Road 150S in Morgan Township. One of these trees fell onto a truck which appeared to be totaled. A window was blown in and a shed was blown down. Another tree was blown down along County Road 75E.
Chesterton	08/02/06	Tstm Wind	50 kts.	0	0	0	0	A tree was blown down, partially blocking a road.
Chesterton	08/03/06	Tstm Wind	50 kts.	0	0	0	0	Several tree limbs were blown down.
Porter	08/03/06	Tstm Wind	50 kts.	0	0	0	0	A tree was blown down in an alley.
Chesterton	08/23/06	Hail	1.75 in.	0	0	500K	0	Golf ball size hail was reported at Route 20 and Bean Road. These thunderstorms moved south into northwest Indiana and produced wind speeds as high as 106 mph, which was measured at a coastal observation site in Michigan City. Trees, tree limbs and power lines were blown down across much of northeast and eastern Porter County. In Town of Pines, a tree fell onto a trailer, which was destroyed. Numerous houses suffered damage to roofs and siding from falling trees. Several cars were damaged by falling trees and tree limbs. In Valparaiso, trees were blown down and windows were blown out of buildings on Washington Street, Randall Street, and Fairlane Drive.
Valparaiso	08/23/06	Hail	0.75 in.	0	0	0	0	These thunderstorms moved south into northwest Indiana and produced wind speeds as high as 106 mph, which was measured at a coastal observation site in Michigan City. Trees, tree limbs and power lines were

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
								blown down across much of northeast and eastern Porter County. In Town of Pines, a tree fell onto a trailer, which was destroyed. Numerous houses suffered damage to roofs and siding from falling trees. Several cars were damaged by falling trees and tree limbs. In Valparaiso, trees were blown down and windows were blown out of buildings on Washington Street, Randall Street, and Fairlane Drive.
Town of Pines	08/23/06	Tstm Wind	65 kts.	0	0	1.0M	0	These thunderstorms moved south into northwest Indiana and produced wind speeds as high as 106 mph, which was measured at a coastal observation site in Michigan City. Trees, tree limbs and power lines were blown down across much of northeast and eastern Porter County. In Town of Pines, a tree fell onto a trailer, which was destroyed. Numerous houses suffered damage to roofs and siding from falling trees. Several cars were damaged by falling trees and tree limbs. In Valparaiso, trees were blown down and windows were blown out of buildings on Washington Street, Randall Street, and Fairlane Drive.
Beverly Shrs	08/23/06	Tstm Wind	65 kts.	0	0	1.0M	0	The thunderstorms moved south into northwest Indiana and produced wind speeds as high as 106 mph, which was measured at a coastal observation site in Michigan City. Trees, tree limbs and power lines were blown down across much of northeast and eastern Porter County. In Town of Pines, a tree fell onto a trailer, which was destroyed. Numerous houses suffered damage to roofs and siding from falling trees. Several cars were damaged by falling trees and tree limbs. In Valparaiso, trees were blown down and windows were blown out of buildings on Washington Street, Randall Street, and Fairlane Drive.
Valparaiso	08/23/06	Tstm Wind	65 kts.	0	0	100K	0	These thunderstorms moved south into northwest Indiana and produced wind speeds as high as 106 mph, which was measured at a coastal observation site in Michigan City. Trees, tree limbs and power lines were blown down across much of northeast and eastern Porter County. In Town of Pines, a tree fell onto a trailer, which was destroyed. Numerous houses suffered damage to roofs and siding from falling trees. Several cars were damaged by falling trees and tree limbs. In Valparaiso, trees were blown down and windows were blown out of buildings on Washington Street, Randall Street, and Fairlane Drive.
Kouts	08/23/06	Tstm Wind	65 kts.	0	0	0	0	These thunderstorms moved south into northwest Indiana and produced wind speeds as high as 106 mph, which was measured at a coastal observation site in Michigan City. Trees, tree limbs and power lines were blown down across much of northeast and eastern Porter County. In Town of Pines, a tree fell onto a trailer, which was destroyed. Numerous houses suffered damage to roofs and siding from falling trees. Several cars were damaged by falling trees and tree limbs. In Valparaiso, trees were blown down and windows were blown out of buildings on Washington Street, Randall Street, and Fairlane Drive.
Edgewater Beach	10/02/06	Hail	0.75 in.	0	0	0K	0K	A round of thunderstorms moved across far northwest Indiana during the afternoon hours of October 2nd, and then a second round of thunderstorms moved across the same areas during the late evening hours of October 2nd.
Porter	02/25/07	Winter Storm	N/A	0	0	0K	0K	Mixed precipitation occurred with accumulations of snow, sleet and ice between 1 and 3 inches. A mixed precipitation event developed over northwest Indiana on February 25th. Most areas saw a mix of snow, sleet and rain, though some areas received a quarter inch of ice accumulation. Wind gusts were frequently above 35 mph over much of the area. Numerous accidents were reported as well as downed power lines from ice accumulations and high winds.
Portage	05/15/07	Tstm Wind	60 kts.	0	0	35K	0K	A large tree fell onto a pickup truck and a van, crushing both. A large tree was uprooted on Charlotte Street, falling onto a house. Tree limbs and power lines were also blown down. Severe storms moved across northwest Indiana May 15th, producing significant wind damage.
Chesterton	05/15/07	Tstm Wind	61 kts.	0	0	0K	0K	Wind gusts estimated to 70 mph near 1100 N and IN-49 Bypass just north of the toll Road. Severe storms moved across northwest Indiana May 15th, producing significant wind damage.
South Haven	05/15/07	Tstm Wind	55 kts.	1	0	15K	0K	A tree was blown down onto a pickup truck on State Road 149, north of US Route 6, killing the driver. Severe storms moved across northwest Indiana May 15th, producing significant wind damage.
Valparaiso	05/15/07	Tstm Wind	55 kts.	0	0	0K	0K	A two and half foot diameter tree was snapped at its base. Severe storms moved across northwest Indiana

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
								May 15th, producing significant wind damage.
Chesterton	06/27/07	Hail	0.75 in.	0	0	0K	0K	Strong storms moved across northwest Indiana during the afternoon hours of June 27th.
Valparaiso	07/18/07	Tstm Wind	55 kts.	0	0	5K	0K	Trees and power lines blown down. Strong to severe storms moved across northwest Indiana during the evening hours of July 18th.
Burns Harbor	07/26/07	Tstm Wind	51 kts.	0	0	0K	0K	Wind equipment at Burns Harbor measured a wind gust to 59 mph. Heavy rain caused flooding along Interstate 80/94. Two passing lanes were closed with several vehicles stalled in high water. Over 500 basements were flooded in Hammond. The Indiana Dunes measured 2.79 inches of rain.
Valparaiso	08/15/07	Flash Flood	N/A	0	0	0K	0K	Roadways covered by water. Powerful storms developed over southern Lake Michigan and moved south across northwest Indiana during the evening hours of August 15th.
Hebron	08/15/07	Hail	1.00 in.	0	0	0K	0K	Powerful storms developed over southern Lake Michigan and moved south across northwest Indiana during the evening hours of August 15th.
Valparaiso	08/15/07	Hail	1.00 in.	0	0	0K	0K	Quarter size hail reported on the west side of Valparaiso. Powerful storms developed over southern Lake Michigan and moved south across northwest Indiana during the evening hours of August 15th.
Valparaiso	08/15/07	Hail	0.88 in.	0	0	0K	0K	Nickel size hail reported at Sweetbriar Road. Powerful storms developed over southern Lake Michigan and moved south across northwest Indiana during the evening hours of August 15th.
Boone Grove	08/15/07	Hail	1.25 in.	0	0	0K	0K	Half dollar size hail in Lake of The Four Seasons. Powerful storms developed over southern Lake Michigan and moved south across northwest Indiana during the evening hours of August 15th.
Chesterton	08/15/07	Lightning	N/A	0	0	50K	0K	A house was struck by lightning, which ignited a fire in the attic. The house suffered extensive damage, mainly from water. Powerful storms developed over southern Lake Michigan and moved south across northwest Indiana during the evening hours of August 15th.
Hurlburt	08/15/07	Tstm Wind	85 kts.	0	0	2.5M	0K	Widespread wind damage from near Lakes of The Four Seasons along the Lake/Porter County line, through central Porter County, ending southeast of Kouts, near the Porter LaPorte County line. Numerous trees were uprooted and blown over. At least 50 houses across the county were damaged. The most intense damage was near Kouts where large hardwood trees were uprooted or snapped. Twenty three large metal truss towers for high tension power lines were blown down along a four mile path east of Kouts. Winds with the most intense damage were estimated at 100 to 120 mph. Powerful storms developed over southern Lake Michigan and moved south across northwest Indiana during the evening hours of August 15th.
Valparaiso	08/23/07	Tstm Wind	70 kts.	0	0	0K	0K	Estimated gust to 80 mph in rural Washington Township. Powerful, severe storms moved across northwest Indiana during the afternoon and evening hours of August 23rd.
Valparaiso	08/23/07	Tstm Wind	70 kts.	0	0	0K	0K	Trees blown down near Route 30 and Horseprairie Road, winds estimated to 80 mph. Powerful, severe storms moved across northwest Indiana during the afternoon and evening hours of August 23rd.
Valparaiso Muni Arpt	08/23/07	Tstm Wind	52 kts.	0	0	0K	0K	Measured gust to 60 mph. Powerful, severe storms moved across northwest Indiana during the afternoon and evening hours of August 23rd.
Valparaiso	08/24/07	Flood	N/A	0	0	25K	0K	A van drove into eight inches of flood water, lost control, crossed the median into westbound lanes and was hit by a semi-trailer. Two passengers were killed and the driver was critically injured. Powerful, severe storms moved across northwest Indiana during the afternoon and evening hours of August 23rd.
Malden	10/18/07	Hail	0.88 in.	0	0	0K	0K	Severe storms moved across northwest Indiana during the evening hours of October 18th.
Valparaiso	10/18/07	Hail	1.00 in.	0	0	0K	0K	Quarter size hail was reported at Route 2 and Route 30.Severe storms moved across northwest Indiana during the evening hours of October 18th.
Porter	12/01/07	Ice Storm	N/A	0	0	0K	0K	A mix of snow and sleet began during the early afternoon hours of December 1st, then quickly changed to freezing rain by late afternoon. The freezing rain continued for several hours into Saturday night.

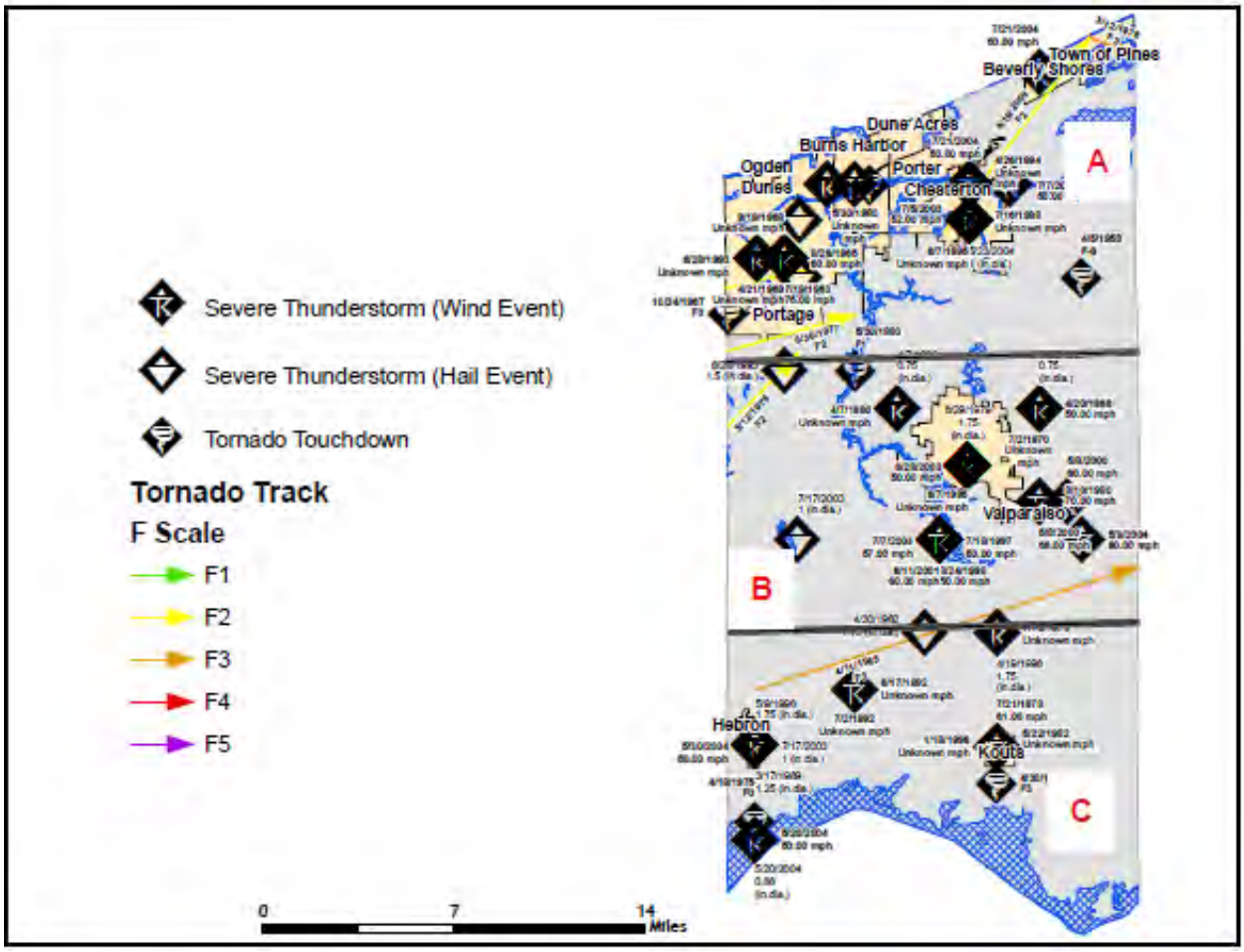
Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Porter	12/15/07	Heavy Snow	N/A	0	0	0K	0K	Storm total snowfall amounts ranged between 6 and 10 inches across much of the county. Highland reported the most snowfall with 11.0 inches. Heavy snow began to fall during the afternoon of December 15th and continued into the morning hours of December 16th.
Chesterton	12/23/07	Tstm Wind	55 kts.	0	0	5K	0K	Numerous trees and utility poles were blown down. A thin but powerful line of convection moved across northwest Indiana during the early morning hours of December 23rd. Only a few bolts of lightning were reported but winds gusted as high as 70 mph.
Dune Acres	01/08/08	Flood	N/A	0	0	100K	0K	Several roads were closed due to flooding. Numerous basements were flooded. The Chesterton wastewater plant measured 3.25 inches of rainfall. Heavy rain fell across northwest Indiana which caused significant flooding.
Porter	01/31/08	Winter Storm	N/A	0	0	0K	0K	Heavy snow developed across northwest Indiana during the afternoon of January 31st and continued into the morning of February 1st. Most areas received between 5 and 7 inches of snowfall. Storm total snowfall amounts included 6.0 inches in Kouts, 6.0 inches in Valparaiso.
Porter	02/20/08	Lake-effect Snow	N/A	0	0	0K	0K	Lake effect snow developed across northwest Indiana during the morning of February 20th and continued into the evening hours. Snowfall amounts ranged from a few inches to as much as one foot of snow. The largest snowfall totals included 10.0 inches in Chesterton and 11.0 inches in Porter.
Porter	02/25/08	Winter Storm	N/A	0	0	0K	0K	Heavy snow developed during the evening hours of February 25th and continued into the early afternoon hours of February 26th. Storm total snowfall amounts included 7.8 inches Valparaiso, 6.1 inches in Portage.
Chesterton	06/08/08	Tstm Wind	50 kts.	0	0	0K	0K	Eight inch diameter tree limbs were blown down. Strong to severe thunderstorms moved across northwest Indiana during the early afternoon hours of June 8th.
Valparaiso	06/22/08	Hail	1.00 in.	0	0	0K	0K	Strong to severe storms moved across northwest Indiana during the afternoon hours of June 22nd.
Valparaiso	06/22/08	Hail	0.88 in.	0	0	0K	0K	Strong to severe storms moved across northwest Indiana during the afternoon hours of June 22nd.
Valparaiso	06/22/08	Hail	1.00 in.	0	0	0K	0K	Penny to quarter size hail was reported. Strong to severe storms moved across northwest Indiana during the afternoon hours of June 22nd.
INZ002	07/13/08	Rip Current	N/A	1	0	0K	0K	West winds to 25 knots along with waves to 3 feet caused rip currents to develop near Kemil Beach in Northwest Indiana. A 14 year old boy drowned. His body was recovered three days later.
Sedley	07/31/08	Tstm Wind	52 kts.	0	0	0K	0K	Wind gusts were estimated to 60 mph. Strong to severe thunderstorms moved across northwest Indiana during the afternoon hours of July 31st.
Valparaiso	07/31/08	Tstm Wind	52 kts.	0	0	0K	0K	Wind gusts were estimated to 60 mph one mile east of Valparaiso. Strong to severe thunderstorms moved across northwest Indiana during the afternoon hours of July 31st.
INZ002	08/02/08	Rip Current	N/A	1	0	0K	0K	A 13 year old boy drowned due to rip currents at Porter Beach, Indiana. His 10 year old brother was also caught in the rip current, but he was pulled out of the water alive.
Tremont	08/04/08	Tstm Wind	56 kts.	0	0	0K	0K	Several 8 inch diameter tree limbs were blown down at Indiana Dunes State Park. A line of powerful thunderstorms moved across northwest Indiana during the evening hours of August 4th. These storms produced widespread and significant wind damage.
Chesterton	08/04/08	Tstm Wind	61 kts.	0	0	2K	0K	Numerous tree limbs were blown down. Part of a utility pole was blown down along with some power lines. A line of powerful thunderstorms moved across northwest Indiana during the evening hours of August 4th. These storms produced widespread and significant wind damage.
Valparaiso	08/04/08	Tstm Wind	61 kts.	0	0	25K	0K	Several trees and tree limbs were blown down. One tree was blown onto a house. A large tree was blown down in Tower Park. The roof of a restaurant was blown off a sandwich shop. A line of powerful thunderstorms moved across northwest Indiana during the evening hours of August 4th. These storms produced widespread and significant wind damage.

Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
Hebron	08/05/08	Flood	N/A	0	0	0K	0K	One to two feet of standing water was reported on State Road 8 with some flooding of homes and businesses. Severe thunderstorms moved across parts of northwest Indiana during the early morning hours of August 5th.
Hebron	09/13/08	Flash Flood	N/A	0	0	1.0M	0K	Basement and street flooding was reported in Valparaiso. Water was waist high in some locations with some roads impassable. Street flooding was also reported in South Haven. These two features combined to produce heavy rain and flash flooding across many areas of northwest Indiana.
Dune Acres	09/13/08	Flash Flood	N/A	0	0	0K	0K	Interstate 94 was closed from Chesterton to the Porter-Laporte county line due to flooding. A warm front moved across northwest Indiana during the morning hours of September 13th as the remnants of tropical storm Lowell moved across the region. These two features combined to produce heavy rain and flash flooding across many areas of northwest Indiana.
Ogden Dunes	09/14/08	Flash Flood	N/A	2	0	2.0M	0K	Flash flooding or significant flooding was reported across most of Porter County, including street closures due to flooding, basement flooding and creek, stream and river flooding. Two men were sucked into a culvert while trying to rescue a boy in flood waters in Chesterton. The boy survived but both men drowned. A sinkhole developed and swallowed the back of a fire truck in Valparaiso. The remnants of hurricane Ike moved across northwest Indiana during the morning hours of September 14th. This system produced a second round of very heavy rain after a period of heavy rain just 24 hours earlier across many of the same areas. Flash flooding was common as many creeks, streams and rivers swelled over their banks, some reaching all-time high record crests. Flooding was extensive and widespread with some of the worst flooding located near streams and rivers. Storm total rainfall amounts for September 13th and September 14th (combined) included, 11.02 inches near Valparaiso, 10.69 inches in Porter, 10.59 inches in Chesterton, 10.41 inches in Lakes of the Four Seasons.
Ogden Dunes	09/14/08	Flood	N/A	0	0	0K	0K	Widespread flooding across parts of Porter County slowly receded through September 17th.The remnants of hurricane Ike moved across northwest Indiana during the morning hours of September 14th. This system produced a second round of very heavy rain after a period of heavy rain just 24 hours earlier across many of the same areas. Flash flooding was common as many creeks, streams and rivers swelled over their banks, some reaching all-time high record crests. Flooding was extensive and widespread with some of the worst flooding located near streams and rivers. Storm total rainfall amounts for September 13th and September 14th (combined) included, 11.02 inches near Valparaiso, 10.69 inches in Porter, 10.59 inches in Chesterton, 10.41 inches in Lakes of the Four Seasons.
Porter	11/18/08	Lake-effect Snow	N/A	0	0	0K	0K	Lake effect snow developed during the early morning hours of November 18th across northwest Indiana. The snow shifted east from Lake County into Porter County. Snowfall totals ranged from only a few inches across western Lake County to 6 to 8 inches along the Lake Porter County Line. Numerous locations in central Porter County received 8 to 10 inches of snow. The highest total reported was 10.0 inches 5 miles west southwest of Valparaiso. The snow was so heavy at times that visibility was reported to be near zero.
Porter	12/18/08	Winter Storm	N/A	0	0	0K	0K	A strong winter storm moved across northwest Indiana during the late evening hours of December 18th into the morning of December 19th. Power outages were widespread and power wasn't restored for over one week in some locations. A combination of snow, sleet and freezing rain fell across Lake and Porter Counties where ice accumulations were around one quarter of an inch and sleet/snow accumulations ranged between one half and one inch. The snow, ice and sleet caused numerous vehicle accidents and spinouts.
Porter	12/21/08	Extreme Cold/wind Chill	N/A	0	0	0K	0K	A combination of temperatures falling to 5 below zero and winds of 20 to 30 mph caused wind chill readings to drop to 35 below zero across parts of northwest Indiana during the morning hours of December 21st.
Porter	01/14/09	Winter Storm	N/A	0	0	0K	0K	A small but potent winter storm moved from the plains across northwest Indiana on January 14th. Air temperatures were only 5 to 15 degrees above zero and snow/water ratios were very high, in some cases 40 to 1. Snow began falling during the morning of January 14th and continued into the evening of January 14th.

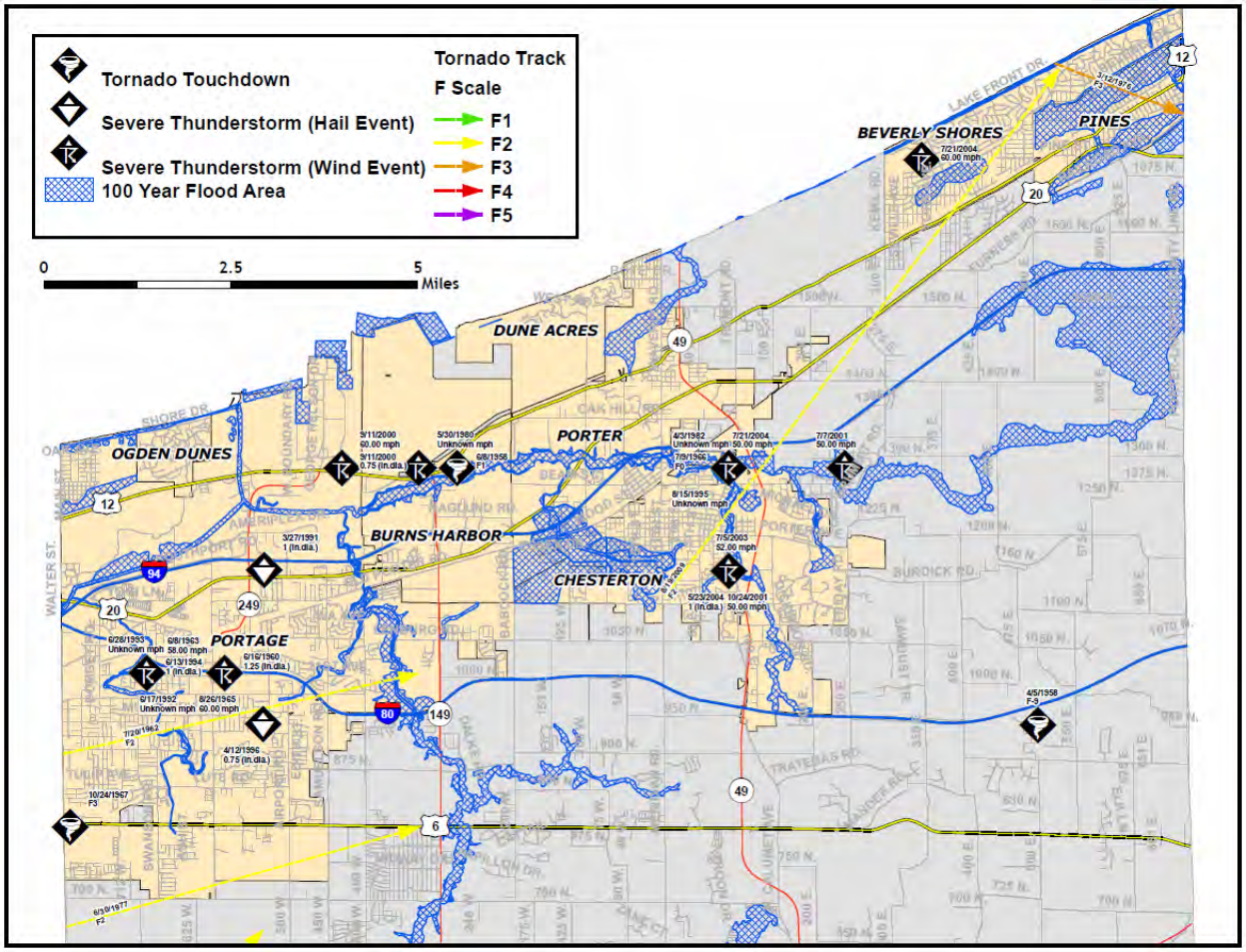
Location or County	Date	Type	Mag	Dth	Inj	PrD	CrD	Description
								Lake effect snow then continued into the night across Porter County. Total snowfall amounts included 7.0 inches in Valparaiso and 6.1 inches in Lake of the Four Seasons.
Porter	01/15/09	Extreme Cold/wind Chill	N/A	0	0	0K	0K	Very cold temperatures combined with strong winds to create dangerously low wind chill values on January 15th which continued into the morning hours of January 16th. Low temperatures on the morning of January 15th dropped to 10 below to 15 below zero. Wind chill readings for most of January 15th ranged from 30 below to 40 below zero.
Porter	01/18/09	Lake-effect Snow	N/A	0	0	0K	0K	Lake effect snow developed late in the evening on January 18th over Porter County and then shifted west across Lake County during the early morning hours of January 20th. The lake effect snow ended during the evening hours of January 20th. Storm total snowfall amounts included 14.0 inches 2 miles east of Chesterton, 10.8 inches near Valparaiso.
Porter	02/03/09	Lake-effect Snow	N/A	0	0	0K	0K	Cold air flowing over the relatively warmer waters of Lake Michigan allowed lake effect snow to develop over northwest Indiana. North winds generated a single band which continued across parts of Porter County for several hours. Snowfall totals ranged between 10 and 20 inches with 29 inches measured in Burdick, five miles east of Chesterton. Visibility during the heaviest snow was reported to be near zero.
Clanricarde	03/14/09	Flash Flood	N/A	0	0	0K	0K	A 40 foot section of a levee failed along the north side of the Kankakee River near county road S 200 E, where a house and barn were surrounded by water. Flood waters affected an area bounded by the Kankakee River to the south, Route 49 to the west, county road E 1200 S to the north and county road S 350 E to the east.
Burlington Beach	04/05/09	Flood	N/A	0	0	0K	0K	Standing water was reported on some roads in Valparaiso.
Portage	05/13/09	Tstm Wind	56 kts.	0	0	5K	0K	Several large trees were blown down. A roof was blown off a picnic shelter in Woodland Park. Tree limbs and power lines were also blown down. Three horses escaped after a tree fell onto a fence. One of the horses was struck and killed by a tractor-trailer on US 20.

Appendix E – Hazard Map

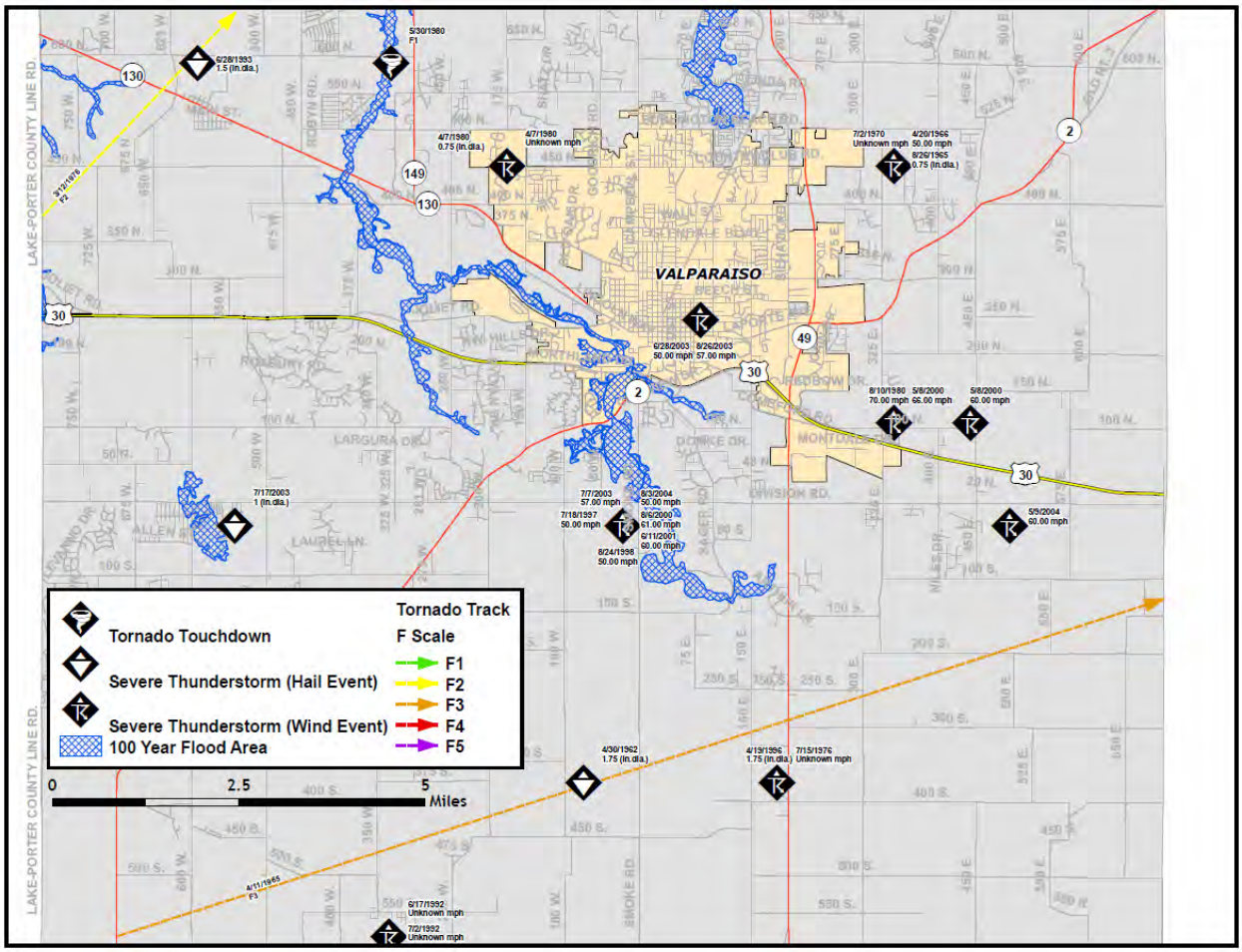
The following map shows historical natural hazard events for Porter County. Figures A through C on the following pages depict magnified views of the demarcated regions shown below.



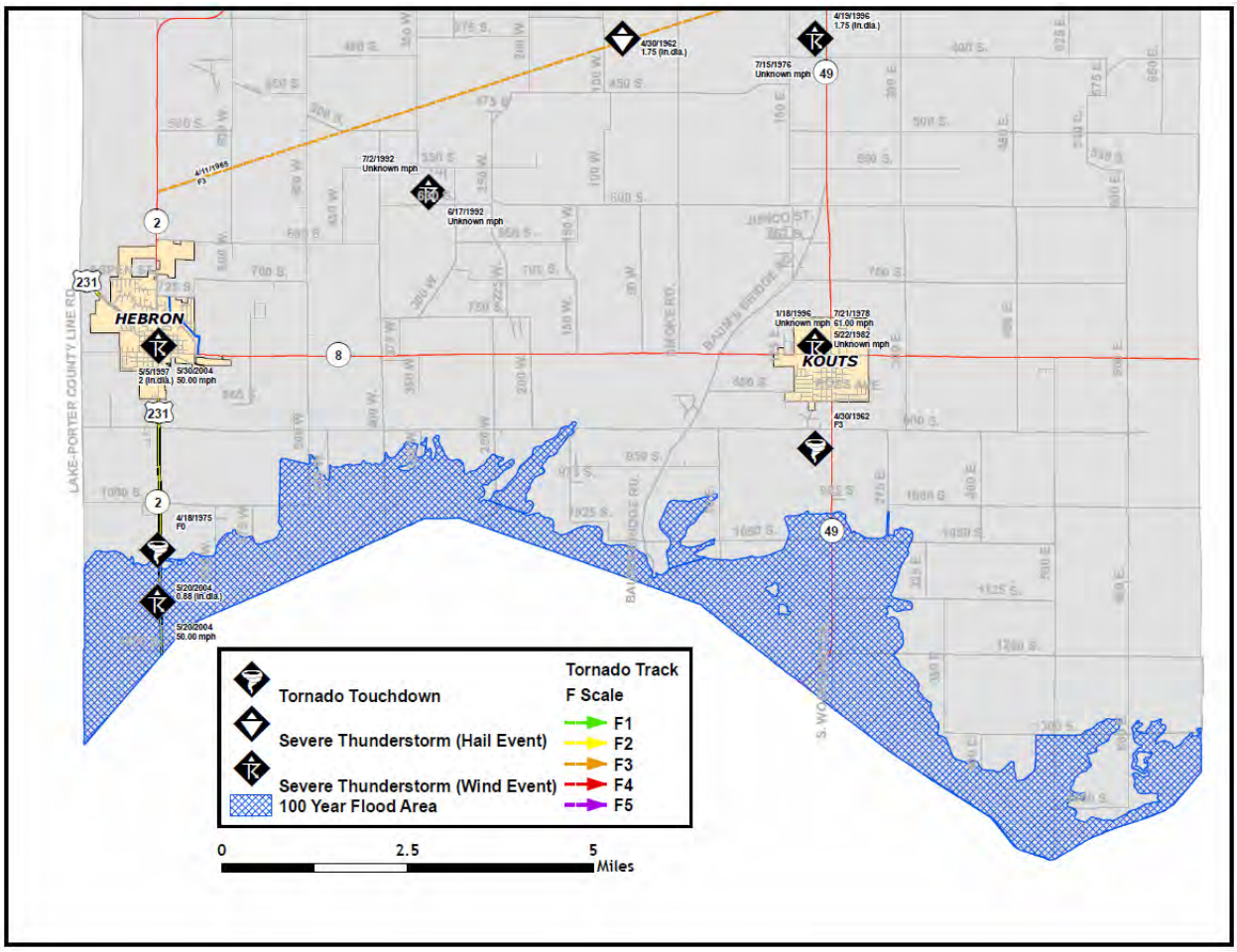
Region A


Tornado Touchdown
Severe Thunderstorm (Hail Event)
Severe Thunderstorm (Wind Event)
100 Year Flood Area
Tornado Track
F Scale
F1
F2
F3
F4
F5
0
2.5
5
Miles
BEVERLY SHORES
PINES
DUNE ACRES
PORTER
OGDEN DUNES
BURNS HARBOR
CHESTERTON
PORTAGE
LAKE FRONT DR
SHORE DR
WALTER ST
BURDICK RD
TRAVERSAS RD
12
20
49
94
249
80
149
6

Region B

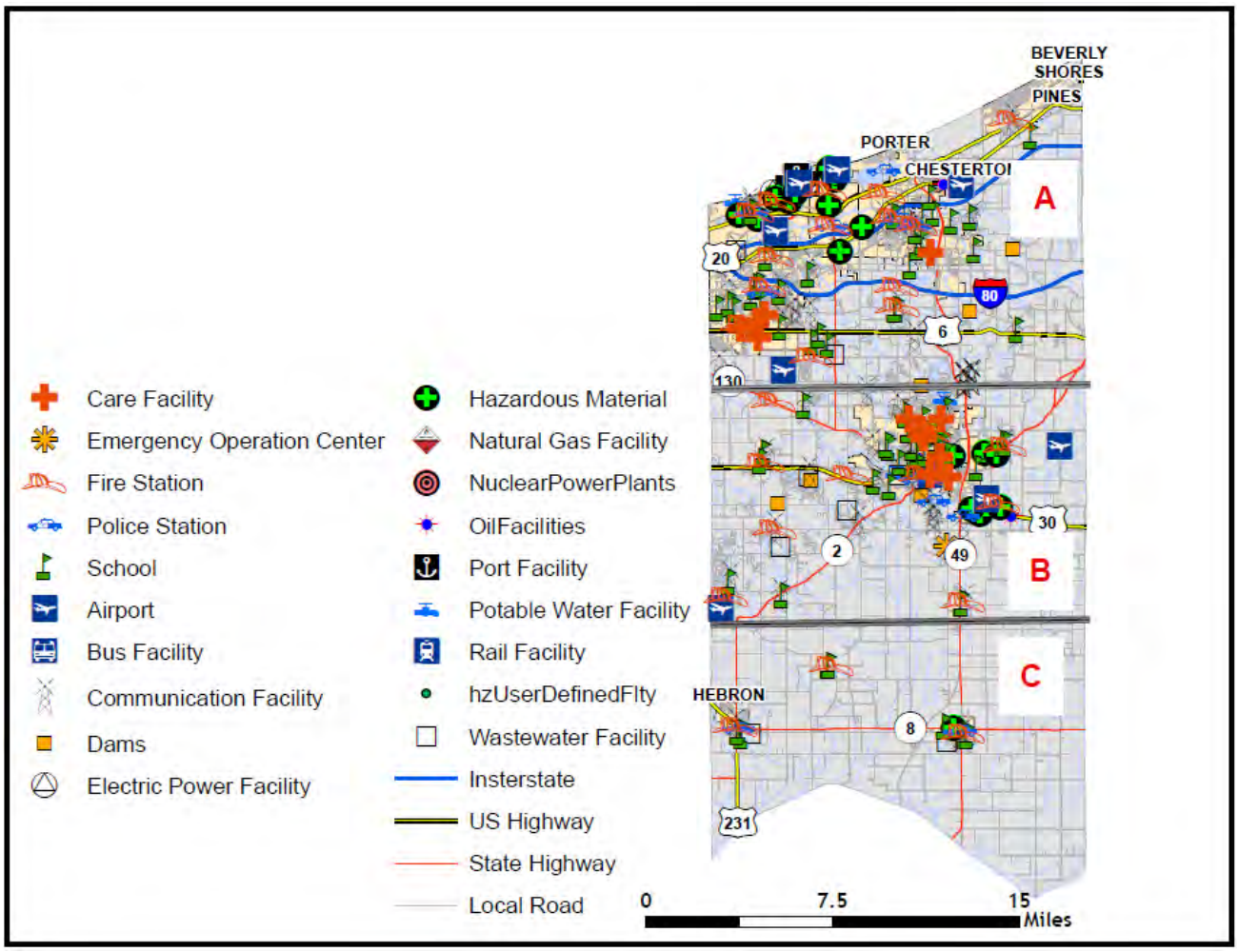

VALPARAISO
LAKE-PORTER COUNTY LINE RD.
Tornado Touchdown
Severe Thunderstorm (Hail Event)
Severe Thunderstorm (Wind Event)
100 Year Flood Area
Tornado Track
F Scale
F1
F2
F3
F4
F5
0
2.5
5
Miles

Region C

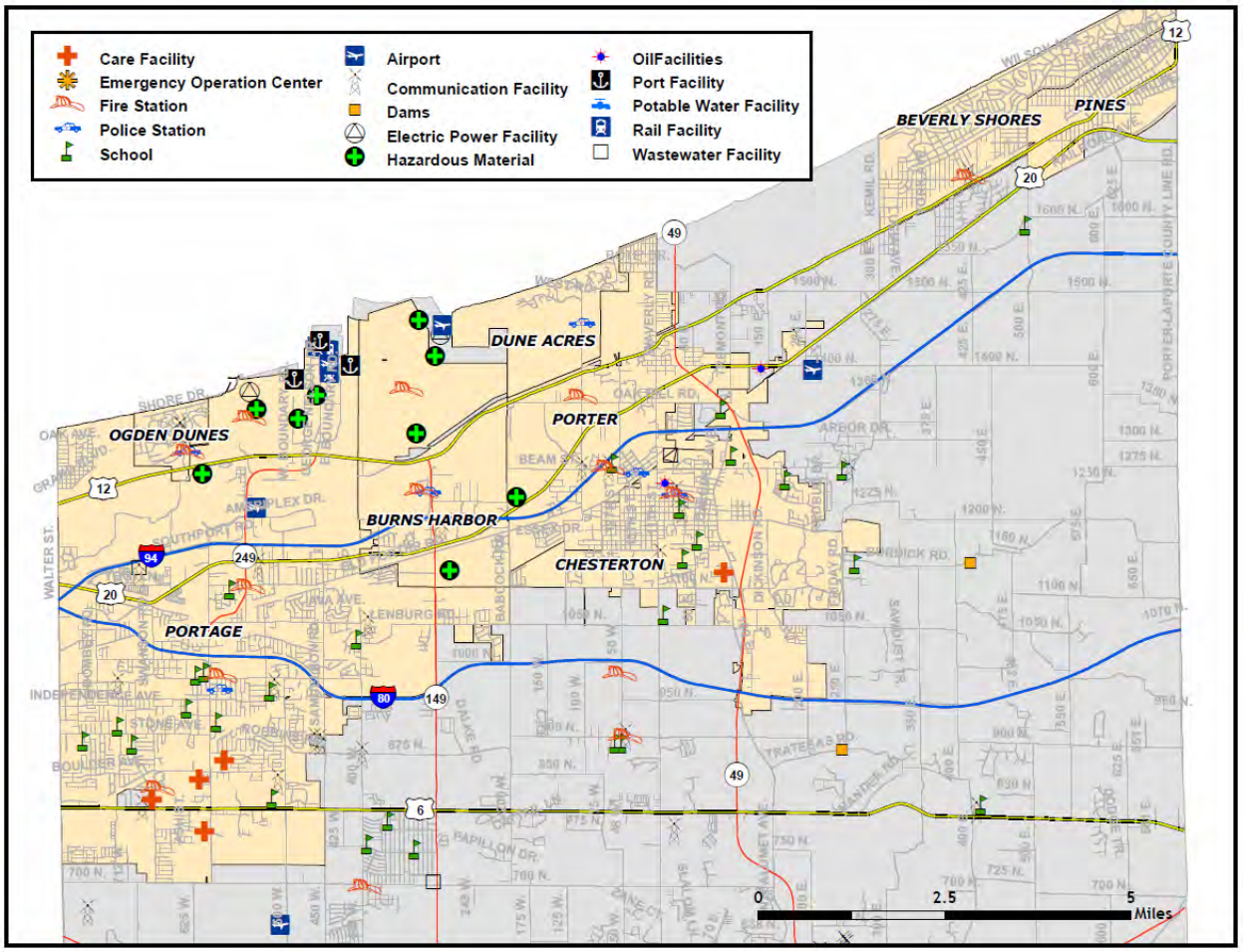

HEBRON
KOUTS
LAKE-PORTER COUNTY LINE RD
Tornado Touchdown
Severe Thunderstorm (Hail Event)
Severe Thunderstorm (Wind Event)
100 Year Flood Area
Tornado Track
F Scale
F1
F2
F3
F4
F5
0
2.5
5
Miles

Appendix F – Map of Critical Facilities

The following map shows the locations of Porter County's critical facilities. Figures A through C on the following pages depict magnified views of the demarcated regions on the county map. Each magnified view includes a table with the facility identification number, name, and type of critical facility. The facility identification number can be matched to the numbers listed above the facilities in the map. The numbers were automatically assigned through HAZUS-MH and may repeat; the legend clarifies types of facilities.



Region A

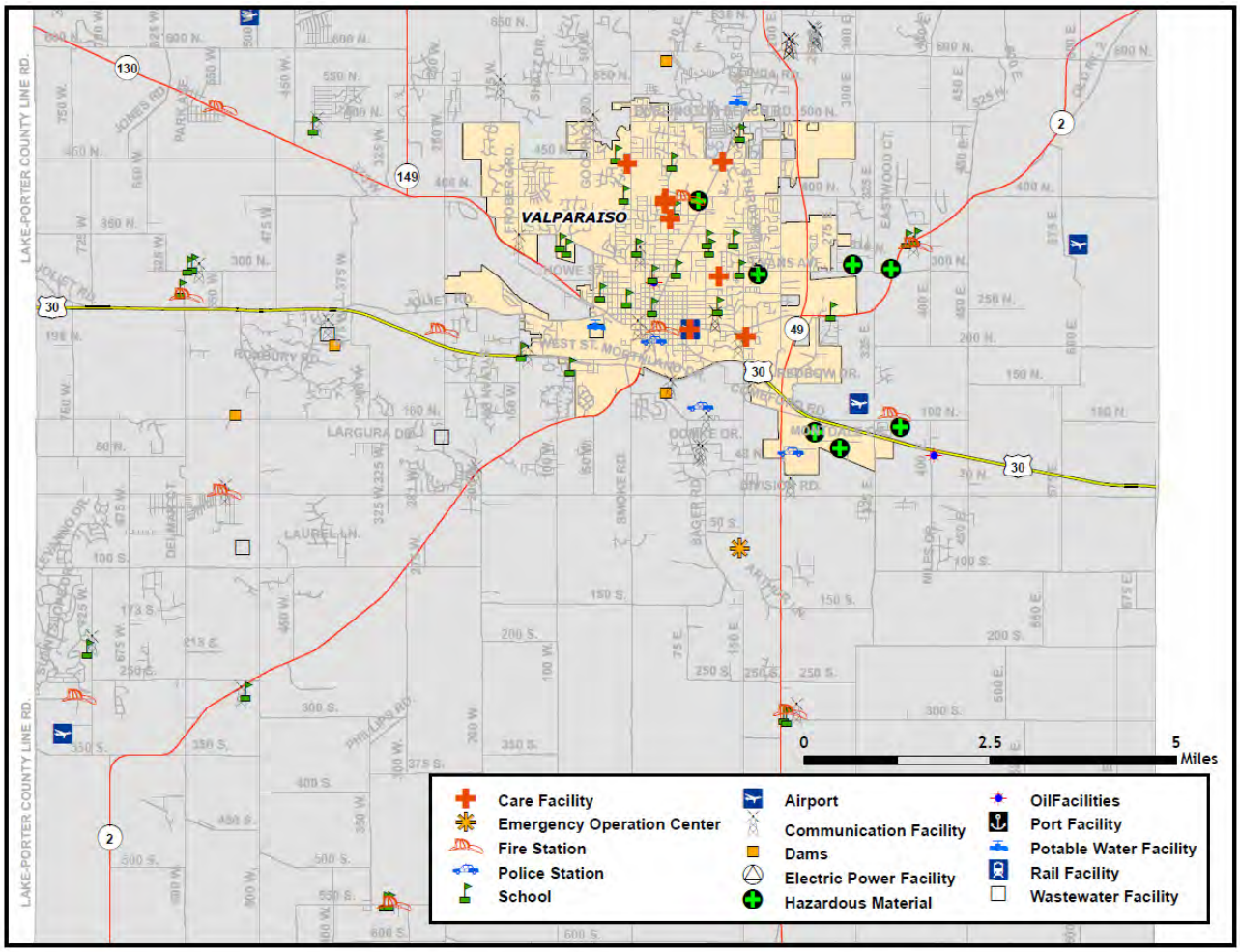


ID#	Name	Facility Type	ID#	Name	Facility Type
1	BODIN	Air Port	25	USS Midwest Plant	Fire Station
2	BAILEY GENERATION STATION	Air Port	26	Mittal Fire Department	Fire Station
4	CARLSON FARM	Air Port	28	Porter County Fire Investigative Strike	Fire Station
5	BURNS INTERNATIONAL HARBOR	Air Port	2	Ancelor/Mittal	Hazmat
6	MIDWEST STEEL	Air Port	125	Indiana American Water NWI	Hazmat
12	BEVERLY LIVING CENTER-PORTAGE	Care Facility	38	MAGNETICS INTL. INC.	Hazmat
13	WATERS OF DUNELAND, THE	Care Facility	39	NORTHERN INDIANA PUBLIC SERVICE CO. - BA	Hazmat
19	Porter Memorial Hospital	Care Facility	49	U.S. CAN CO. - PLANT #10 BURNS HARBOR	Hazmat
15	MILLER'S MERRY MANOR	Care Facility	57	WORTHINGTON STEEL	Hazmat
18	STERLING HOUSE OF PORTAGE	Care Facility	63	BETA STEEL CORP.	Hazmat
1	WNDZ	Communications	79	USS Midwest Plant	Hazmat
2	WNDZ	Communications	85	INDIANA PICKLING & PROCESSING CO.	Hazmat

ID#	Name	Facility Type	ID#	Name	Facility Type
7	W13BQ/WODN	Communications	86	"SEQUA COATINGS CORP., PRECOAT METALS DI	Hazmat
9	W04CQ	Communications	2	Paulson/POCO	Oil
10	W04CQ	Communications	3	Pinkerton Oil	Oil
11	W24AW	Communications	2	Ogden Dunes Police Dept	Police
12	W54BK	Communications	3	Burns Harbor Police Dept	Police
14	WLJE	Communications	7	Portage Police Dept	Police
15	WLJE	Communications	9	Porter Police Dept	Police
16	W272BZ	Communications	10	Chesterton Police Dept	Police
64	Siren#xxOD	Communications	12	Dune Acres Town Marshal	Police
21	980512MP	Communications	1	US Steel, Midwest Plant	Port
22	980512MP	Communications	3	Ancelor/Mittal Steel	Port
23	971112MA	Communications	7	Indiana Port Commission, Burns Internati	Port
24	980512MV	Communications	3	84 Diana Rd	Potable Water
25	WDSO	Communications	4	200 Shore Drive	Potable Water
36	Siren#016	Communications	1	Indiana Port Comm-Burns Intl Harbor	Rail Facility
37	Siren#049/019	Communications	2	Cargill Inc Burns Harbor Elevator	Rail Facility
38	Siren#020	Communications	3	Tanco Terminals Inc: Burns Harbor	Rail Facility
39	Siren#021	Communications	1	Pine Elementary School	School
40	Siren#024	Communications	5	Jackson Elementary School	School
41	Siren#027	Communications	6	Brummitt Elementary School	School
46	Siren#038	Communications	7	Liberty Intermediate School	School
47	Siren#039	Communications	8	Liberty Elementary School	School
48	Siren#040	Communications	9	Chesterton Senior High School	School
49	Siren#041	Communications	10	Westchester Intermediate School	School
50	Siren#043	Communications	11	Bailly Elementary School	School
52	Siren#033	Communications	12	Chesterton Middle School	School
56	Siren#015	Communications	13	Newton Yost Elementary School	School
58	Siren#028	Communications	26	Portage High School	School
61	Siren#035	Communications	27	Wallace Aylesworth Elementary	School
62	Siren#036	Communications	28	William Fegely Middle School	School
63	Siren#037	Communications	29	Crisman Elementary School	School
2	LOOMIS LAKE DAM	Dam	30	Central Elementary School	School
3	RICE LAKE DAM	Dam	31	Ethel R Jones Elem School	School
5	OLD LONGS MILL DAM	Dam	32	Willowcreek Middle School	School
1	PORTSIDE ENERGY CORP	Electric Power	33	Rowena Kyle Elementary School	School
2	NIPSCO - BAILLY GENERATING STATION	Electric Power	34	Paul Saylor Elementary School	School
3	Burns Harbor Fire Dept	Fire Station	35	George L Myers Elem Sch	School
5	South Haven Fire Dept	Fire Station	36	South Haven Elementary School	School
7	Porter Fire Dept	Fire Station	49	Saint Patrick School	School
8	Portage Fire Department #3	Fire Station	50	Nativity Of Our Savior School	School
9	Chesterton Fire Dept	Fire Station	57	Chesterton Montessori School	School
13	Beverly Shores Fire Department	Fire Station	60	Portage Christian School	School
15	National Lakeshore Fire Department	Fire Station	62	Fairhaven Baptist Academy and College	School

ID#	Name	Facility Type	ID#	Name	Facility Type
19	Liberty Township Fire Department	Fire Station	63	South Haven Christian School	School
21	Ogden Dunes Fire Department	Fire Station	68	Wee Care Child Development Center	School
22	Portage Fire Department #1	Fire Station	69	Sandpiper Pre-School	School
23	Portage Fire Department #2	Fire Station	7	Portage Wastewater	WWPLT
9	South Haven WWTP	WWPLT	8	Chesterton Municipal WWTP	WWPLT

Region B

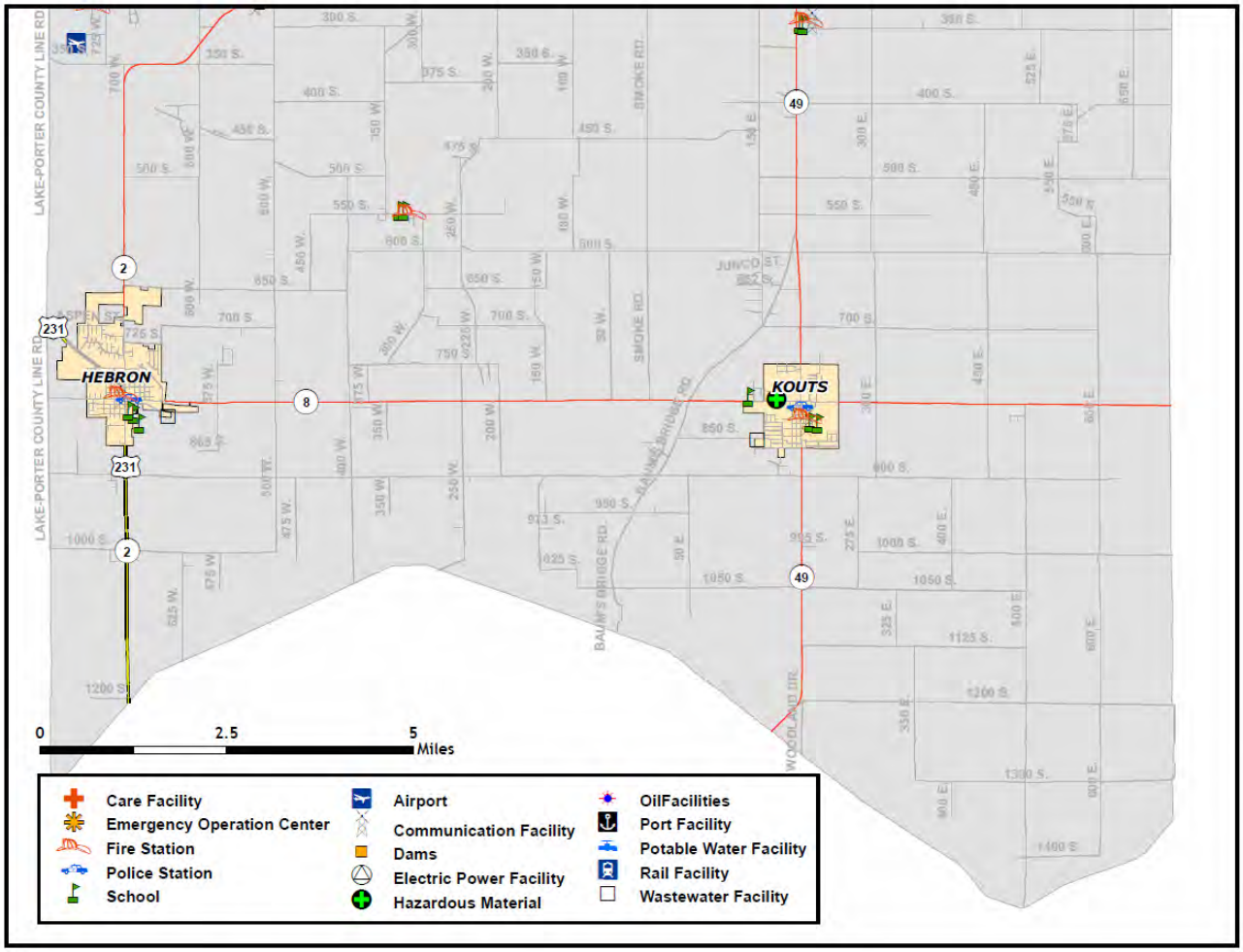


ID#	Name	Facility Type	ID#	Name	Facility Type
8	CARLSON FARMS	Air Port	27	Union Township Fire Department #2	Fire Station
7	WYCKOFF AIRSTRIP	Air Port	1	UGN	Hazmat
8	PORTER COUNTY MUNI	Air Port	98	Arch Wood Protection	Hazmat
9	PORTER MEMORIAL HOSPITAL	Air Port	101	MCGILL MFG. CO. INC.	Hazmat
1	Porter Hospital-Valparaiso	Care Facility	102	ISK MAGNETICS INC.	Hazmat
9	BEVERLY LIVING CENTER-VALPARAISO	Care Facility	103	URSCHEL LABS. INC.	Hazmat
10	LIFE CARE CENTER OF THE WILLOWS	Care Facility	108	POWDERTECH CORP.	Hazmat

ID#	Name	Facility Type	ID#	Name	Facility Type
11	VALPARAISO CARE AND REHABILITATION CENTE	Care Facility	115	AOC L.L.C	Hazmat
20	Clare Bridge-Memory Care	Care Facility	123	UNION ELECTRIC STEEL CORP.	Hazmat
14	WHISPERING PINES HEALTH CARE CENTER	Care Facility	1	Mateer Oil	Oil
16	LIFE CARE CENTER OF VALPARAISO	Care Facility	4	Quality Oil	Oil
17	STERLING HOUSE OF VALPARAISO	Care Facility	4	Porter County Sheriff Dept	Police
3	WAKE	Communications	5	Valparaiso Police	Police
4	WAKE	Communications	11	Valparaiso University Police	Police
13	W295BC	Communications	1	END OF STOKES STREET	Potable Water
17	WVLP-LP	Communications	2	1903 PUMPING STATION RD	Potable Water
18	WVUR-FM	Communications	2	Special Education Division	School
19	WITW-LP	Communications	14	Morgan Township Middle/High School	School
20	W216AC	Communications	15	Morgan Township Elementary School	School
26	Siren#001	Communications	18	Washington Twp Middle/High School	School
27	Siren#002	Communications	19	Washington Twp Elementary School	School
28	Siren#003	Communications	20	Boone Grove High School	School
29	Siren#004	Communications	21	Porter Lakes Elementary School	School
30	Siren#005	Communications	22	Wheeler High School	School
31	Siren#006	Communications	23	Union Township Middle Sch	School
32	Siren#008	Communications	24	Union Center Elementary Sch	School
33	Siren#009	Communications	25	John Simatovich Elem Sch	School
34	Siren#011	Communications	37	Valparaiso High School	School
35	Siren#014	Communications	38	Benjamin Franklin Mid Sch	School
42	Siren#030	Communications	39	Thomas Jefferson Middle Sch	School
43	Siren#032	Communications	40	Thomas Jefferson Elem Sch	School
44	Siren#048	Communications	41	Central Elementary School	School
51	Siren#047	Communications	42	Flint Lake Elementary Sch	School
53	Siren#007	Communications	43	Cooks Corners Elementary School	School
54	Siren#010	Communications	44	Hayes-Leonard Elementary Sch	School
55	Siren#012	Communications	45	Memorial Elementary School	School
57	Siren#031	Communications	46	Northview Elementary School	School
59	Siren#034	Communications	47	Parkview Elementary School	School
1	LAKE LOUISE DAM	Dam	48	Porter County Career Center	School
4	NORMAN OLSON LAKE DAM	Dam	51	Saint Paul School	School
6	LAKE OF THE WOODS DAM	Dam	52	Immanuel Lutheran School	School
1	Porter County EMA	Emergency Center	59	Montessori Sch of Valparaiso Inc	School
1	Valparaiso Fire Department #1	Fire Station	61	Saint Paul Tiny Tim Child Dev	School
2	Valparaiso Fire Department #2	Fire Station	64	Tall Oaks Christian School	School
4	Washington Twp Fire Dept #1	Fire Station	65	Valpo's Own Private School	School
6	Boone Grove/Porter Twp. FD #2	Fire Station	66	Victory Christian Academy	School
11	Union Township Fire #1	Fire Station	67	Wee Care Child Development Center	School

ID#	Name	Facility Type	ID#	Name	Facility Type
12	Valparaiso Fire Department #3	Fire Station	1	LAKE ELIZA CONSERVANCY DIST.	WWPLT
18	Lake of Four Seasons	Fire Station	2	INTERSECTION OF S.R. 2 AND	WWPLT
20	Morgan Township Fire Department	Fire Station	5	ELDEN KUEHL POLLUTION CON FAC	WWPLT
24	Washington Twp Fire Dept #2	Fire Station	6	SHOREWOOD FOREST UTILITIES	WWPLT

Region C

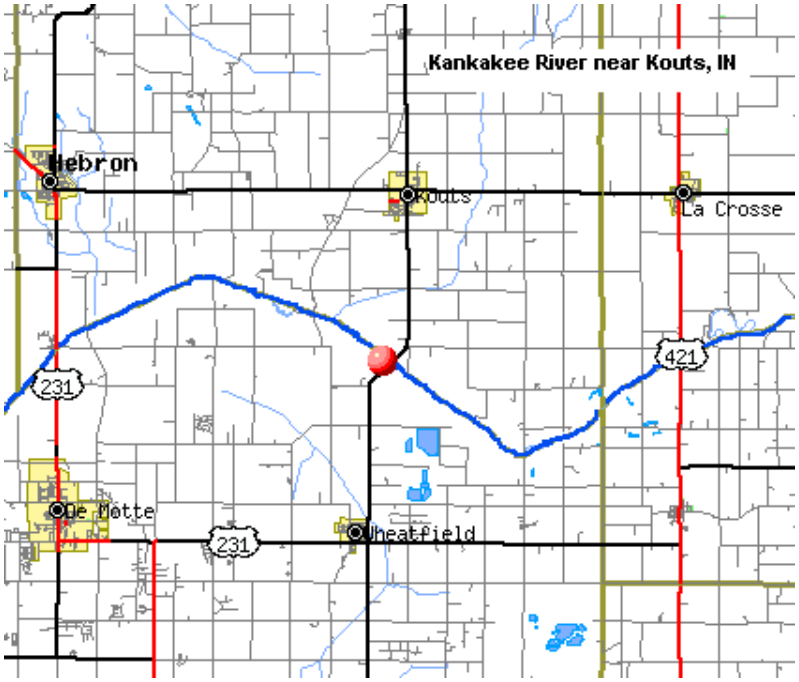


ID#	Name	Facility Type	ID#	Name	Facility Type
45	Siren#018	Communications	4	Hebron Elementary School	School
60	Siren#029	Communications	16	Kouts Middle/High School	School
14	Boone Grove/Porter Twp. FD #1	Fire Station	17	Kouts Elementary School	School
16	Hebron Fire Department	Fire Station	53	Boone Grove Elementary School	School
17	Kouts Fire Department	Fire Station	54	Boone Grove Middle School	School
61	MERIT STEEL CO. INC.	Hazmat	55	Hebron	School
1	Hebron Police Dept	Police	58	Midwest Academy MCYF	School
8	Kouts Village Police	Police	3	HEBRON MUNICIPAL WWTP	Waste Water
3	Hebron Jr-Sr High Sch	School	4	KOUTS MUNICIPAL WWTP	Waste Water

Appendix G – Recorded NOAA Flood Data

The following gauge information was obtained from The National Oceanic and Atmospheric Administration (NOAA) Advanced Hydrologic Prediction Service website (www.weather.gov/ahps). For Porter County, data is provided for two points: Kankakee River 5 S Kouts and Kankakee River at Dunns Bridge.

Kankakee River 5 S Kouts



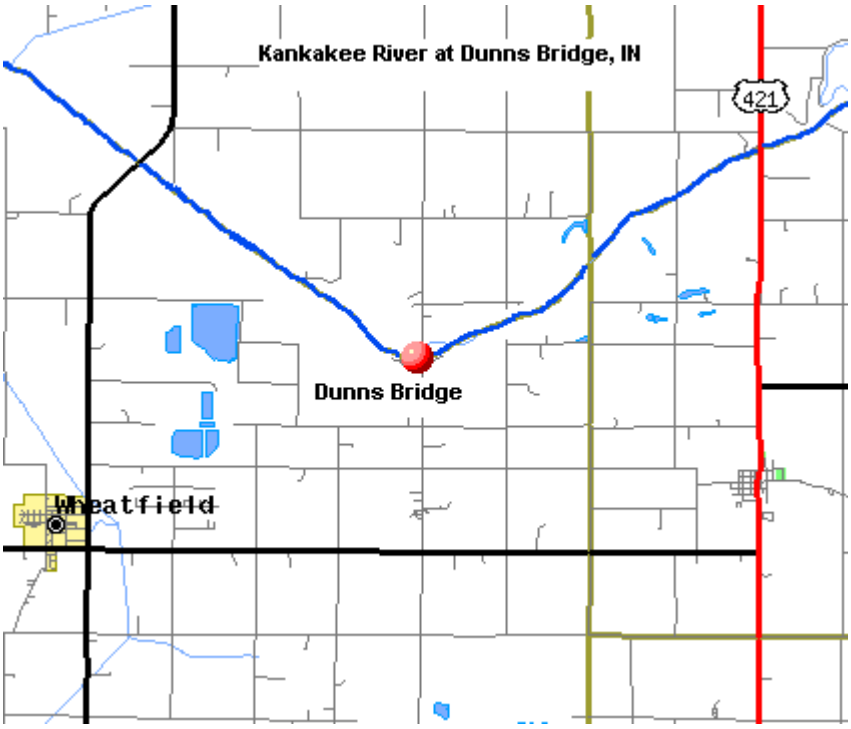
Flood Categories (in feet)

Major Flood Stage:	14
Moderate Flood Stage:	13
Flood Stage:	11
Action Stage:	10.5

Historical Crests
(1) 14.52 ft on 03/24/1982
(2) 13.98 ft on 03/05/1985
(3) 13.75 ft on 07/24/1996
(4) 13.74 ft on 01/10/1994
(5) 13.73 ft on 01/08/1993
(5) 13.73 ft on 01/04/1991
(7) 13.59 ft on 06/18/1981
(8) 13.48 ft on 03/01/1997
(9) 13.32 ft on 01/17/2005
(10) 13.10 ft on 01/13/1998

Feet	Flood Impacts
13.0	Some county roads begin to be affected by high water.
11.0	Agricultural areas begin to flood. Some backwaters begin to fill drainage ditches.

Kankakee River at Dunns Bridge



Flood Categories (in feet)

Major Flood Stage:	13
Moderate Flood Stage:	12
Flood Stage:	10
Action Stage:	9.5

Historical Crests
(1) 13.38 ft on 03/20/1982
(2) 13.20 ft on 10/22/1954
(3) 13.18 ft on 03/04/1985
(4) 13.08 ft on 04/12/1950
(5) 12.94 ft on 01/10/1993
(6) 12.89 ft on 07/25/1996
(7) 12.64 ft on 01/03/1991
(8) 12.59 ft on 06/18/1981
(9) 12.50 ft on 03/01/1997
(10) 12.23 ft on 01/12/1998

Feet	Flood Impacts
12.0	Secondary roads near the river flood.
10.0	Flooding begins of low lying agricultural areas near the river.