MULTI-HAZARD MITIGATION PLAN UPDATE

Lake County, Indiana

Prepared for:

Lake County, Indiana
Town of Cedar Lake, Indiana
City of Crown Point, Indiana
Town of Dyer, Indiana
City of East Chicago, Indiana
City of Gary, Indiana
Town of Griffith, Indiana
City of Hammond, Indiana
Town of Highland, Indiana
City of Hobart, Indiana
City of Lake Station, Indiana
Town of Lowell, Indiana
Town of Merrillville, Indiana
Town of Munster, Indiana
Town of New Chicago, Indiana
Town of Schererville, Indiana
Town of Schneider, Indiana
Town of St. John, Indiana
City of Whiting, Indiana
Town of Winfield, Indiana

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CBBEL Project No. 17-120

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CHAPTER 1 INTRODUCTION

1.1 DISASTER LIFE CYCLE

The Federal Emergency Management Agency (FEMA) defines the disaster life cycle as the process through which emergency managers respond to disasters when they occur; help people and institutions recover from them; reduce the risk of future losses; and prepare for emergencies and disasters. The disaster life cycle, **Figure 1-1** includes 4 phases:

Figure 1-1 Disaster Life Cycle

- **Response** – the mobilization of the necessary emergency services and first responders to the disaster area (search and rescue; emergency relief)
- **Recovery** – to restore the affected area to its previous state (rebuilding destroyed property, re-employment, and the repair of other essential infrastructure)
- **Mitigation** – to prevent or to reduce the effects of disasters (building codes and zoning, vulnerability analyses, public education)
- **Preparedness** – planning, organizing, training, equipping, exercising, evaluation and improvement activities to ensure effective coordination and the enhancement of capabilities (preparedness plans, emergency exercises/training, warning systems)

The Lake County Multi-Hazard Mitigation Plan (MHMP) focuses on the mitigation phase of the disaster life cycle. According to FEMA, mitigation is most effective when it's based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs. The MHMP planning process identifies hazards, the extent that they affect the municipality, and formulates mitigation practices to ultimately reduce the social, physical, and economic impact of the hazards.

1.2 PROJECT SCOPE AND PURPOSE

REQUIREMENT §201.6(d)(3):
A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grant funding.

A MHMP is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). According to DMA 2000, the purpose of mitigation planning is for State, local, and Indian tribal governments to identify the natural hazards that impact them, to identify actions and activities to reduce any losses from those hazards, and to establish a coordinated process to implement the plan, taking advantage of a wide range of occurrences.

A FEMA-approved MHMP is required in order to apply for and/or receive project grants under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and Severe Repetitive Loss (SRL). FEMA may require a MHMP under the Repetitive Flood Claims (RFC) program. Although the Lake County MHMP meets the requirements of DMA 2000 and eligibility requirements of these grant programs, additional detailed studies may need to be completed prior to applying for these grants.

For National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt either their own MHMP or participate in the development of a multi-jurisdictional MHMP. The Indiana Department of Homeland Security (IDHS) and the United States Department of Homeland Security (US DHS)/FEMA Region V offices administer the MHMP program in Indiana. As noted above, it is required that local jurisdictions review, revise, and resubmit the MHMP every 5 years. MHMP updates must demonstrate that progress has been made in the last 5 years to fulfill the commitments outlined in the previously approved MHMP. The updated MHMP may validate the information in the previously approved Plan or may be a major plan rewrite. The updated MHMP is not intended to be an annex to the previously approved Plan; it stands on its own as a complete and current MHMP.

The Lake County MHMP Update is a multi-jurisdictional planning effort led by the Lake County Homeland Security & Emergency Management Agency (EMA). This Plan was prepared in partnership with Lake County, the towns of Cedar Lake, Dyer, Griffith, Highland, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, and Winfield; and the cities of Crown Point, East Chicago, Gary, Hammond, Hobart, Lake Station and Whiting. Representatives from these communities attended the Committee meetings, provided valuable information about their community, reviewed and commented on the draft MHMP, and assisted with local adoption of the approved Plan. As each of the communities had an equal

opportunity for participation and representation in the planning process, the process used to update the Lake County MHMP satisfies the requirements of DMA 2000 in which multi-jurisdictional plans may be accepted.

Throughout this Plan, activities that could count toward Community Rating System (CRS) points are identified with the NFIP/CRS logo. The CRS is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the 3 goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote education and awareness of flood insurance. Savings in flood insurance premiums are proportional to the points assigned to various activities. A minimum of 500 points are necessary to enter the CRS program and receive a 5% flood insurance premium discount. This MHMP could contribute as many as 382 points toward participation in the CRS. At the time of this planning effort, two of the Lake County communities, the Town of Dyer and the Town of Merrillville, participate in the CRS program.

Funding to update the MHMP was made available through a FEMA/DHS PDM grant awarded to the Lake County EMA and administered by IDHS. Lake County provided the local 25% match required by the grant. Christopher B. Burke Engineering, LLC (CBBEL) was hired to facilitate the planning process and prepare the Lake County MHMP under the direction of an American Institute of Certified Planners (AICP) certified planner.

1.3 PLANNING PROCESS

REQUIREMENT §201.6(c)(1):
The plan shall document the planning process used to prepare the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Preparation for the Lake County MHMP Update began in 2016 when the County EMA submitted a PDM Grant application to IDHS. The grant request was approved by FEMA and grant funds were awarded in 2017.

Once the grant was awarded, the planning process to update the 2010 MHMP took 16 months. This included a 12-month planning process, followed by a review period by IDHS and FEMA for the draft MHMP Update, and another month for Lake County and communities to adopt the final MHMP Update.

1.3.1 Planning Committee

In July of 2017, the EMA compiled a list of Planning Committee members to guide the MHMP Update planning process. These individuals were specifically invited to serve on the Committee because they were knowledgeable of local hazards; have

been involved in hazard mitigation; have the tools necessary to reduce the impact of future hazard events; and/or served as a representative on the original Planning Committee in 2010. **Table 1-1** lists the individuals that actively participated on the Committee and the entity they represented.

Table 1-1 MHMP Update Committee

NAME	OFFICE	REPRESENTING
Nick Bellar	Town Administrator/Planning and Zoning	Town of Winfield
Ken Belshaw	Fire Chief	West Creek Twp/Schneider
Paul Bremer	Trustee	Center Township
Robert Bubala	Volunteer Emergency Services Team	Town of Griffith
Dean Button	City Engineer	City of Hammond
Rodney Cross	Fire Chief	Shelby / Wildwood
Alice Dahl	Trustee	Cedar Creek Township
Gus Danielides	Fire Chief	City of Whiting
Jason Dravet	IT Director	Town of St. John
Bill Emerson	Surveyor	Lake County
Bob Fulton	Assistant to the Mayor	City of Hobart
Dan Gossman	Drainage Administrator	Lake County
Matt Lake	Stormwater Utility, Executive Director	Town of Merrillville
Bryan Lane	Stormwater Management Director	Town of Dyer
David Meyer	Fire Chief	Town of Schererville
Rosie Marie Morrow	Trustee	Eagle Creek Township
Frank Mrvan	Trustee	North Township
Jill Murr	Town Administrator	Town of Cedar Lake
Dan Niksch	GIS Coordinator	City of Crown Point
Robert Novich	Code Enforcement	Lake Station
Paul Petrie	Deputy Director, Lake County HSEMA	Lake County
Jodi Richmond	Director, Lake County HSEMA	Lake County
Kimberly Robinson	Trustee	Calumet Township
Rick Ryfa	President, Town Council	Town of Griffith
Diana Sandlin	Gary Health Department	City of Gary
Steve Scheckel	Police Chief	Town of Munster
Paulette Skinner	Trustee	Winfield Township
Anthony Serna	Fire Chief	City of East Chicago
Thomas Silich	Trustee	Hobart Township
Martin Stevens	Admin Assistant, Lake County HSEMA	Lake County
Sharon Szwedo	President, Town Council	Town of New Chicago
Bill Timmer	Fire Chief	Town of Highland
Jerry Tippy	Commissioner	Lake County
Camila Trevino-Olivera	Lake County Coroner's Office	Lake County
Matt VanDrunen	Fire Chief	Town of Lowell
Robert Woodworth	Town Marshal	Town of Schneider

Members of the Committee participated in the MHMP Update as a Planning Committee member or through various other group meetings. During these meetings, the Committee:

- revisited existing (in the 2010 MHMP) and identified new critical infrastructure and local hazards
- reviewed the State's mitigation goals and updated the local mitigation goals
- reviewed the most recent local hazard data, vulnerability assessment, and maps
- evaluated the effectiveness of existing mitigation measures and identified new mitigation projects
- reviewed materials for public participation.

A sign-in sheet recorded those present at each meeting to document participation. Meeting agendas and summaries are included in **Appendix 2**. Due to the number of incorporated municipalities within Lake County, two sessions were held for each working meeting, providing Planning Committee members with an option for attendance at a session best fitting their schedule.

Members of the Committee also reviewed a draft MHMP, provided comments and suggestions, and assisted with adoption of the Lake County MHMP Update.

1.3.2 Public Involvement

A draft of the Lake County MHMP Update was posted online on the Lake County Homeland Security and EMA website (www.lakecountyin.org/mhmp) for public review and comment. A media release indicating the posting of the draft MHMP and the ability to comment and complete the brief survey was submitted for publishing to *The Times of Northwest Indiana.* Committee members were provided with an informational flyer regarding the same information to display in their respective offices and to provide to family, friends and colleagues. The media release, informational flyer, and comments from submitted surveys are in **Appendix 3**.

1.3.3 Involvement of Other Interested Parties

Interested agencies, businesses, academia, and nonprofits were invited to review and comment on the draft Lake County MHMP Update (Appendix 3). Neighboring EMAs were also invited to review and comment on Update. Information related to the planning process and the availability of the draft Lake County MHMP was directly provided to such potentially interested parties via personal conversations, informational flyer, and email correspondence. Successful implementation and future updates of the Lake County MHMP Update will rely on the partnership and coordination of efforts between such groups.

[insert table of name/title/organization/comments if comments are received]

1.4 PLANS, STUDIES, REPORTS, AND TECHNICAL INFORMATION

REQUIREMENT §201.6(c)(1):
The plan shall include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

During the development of the Lake County MHMP Update, several relevant sources of information were reviewed either as a document or through discussions with local personnel. This exercise was completed to gather updated information since the development of the original Lake County MHMP, and to assist the Committee in developing potential mitigation measures to reduce the social, physical, and economic losses associated with hazards affecting Lake County.

For the purposes of this planning effort, the following materials (among others) were discussed and utilized:

- Lake County Indiana Comprehensive Plan, Draft, June 2018
- Town of Dyer Ordinances, Chapter 10: Flood Hazard Areas
- City of Crown Point Comprehensive Plan, 2005
- City of East Chicago Comprehensive Plan, 2008
- Town of Merrillville Stormwater Master Plan, 2014
- Town of St. John Ordinances
- Lake County MHMP, 2010
- Lake County CEMP, 2003
- GIS data from several local municipal and contractual contacts

Planning and Building ordinances and comprehensive planning efforts for many of the other communities were also reviewed and utilized to develop portions of this MHMP or further develop potential mitigation measures to be ranked by the Planning Committee.

In addition to local agencies and offices such as those listed above, several regional and state agencies were contacted and subsequently provided data for this planning effort. Those contacts, and the information they provided, include:

- Indiana Department of Natural Resources, Division of Water – *Flood insurance policies, claims, and payment information*
- Indiana Department of Natural Resources, Division of Water – *Dam records*
- FEMA, Region V – *Repetitive loss structure counts and payments*

The CRS program credits NFIP communities a maximum of 155 points for organizing a planning committee composed of staff from various departments; involving the public in the planning process; and coordinating among other agencies and departments to resolve common problems relating to flooding and other known natural hazards.

CHAPTER 2 COMMUNITY INFORMATION

Although much of the information within this section is not required by DMA 2000, it is important background information about the physical, social, and economical composition of Lake County necessary to better understand the Risk Assessment discussed in **Chapter 3**.

Lake County, established in 1837, is named for its location on Lake Michigan. The total area of Lake County is approximately 627 square miles. The location of Lake County within the State of Indiana is identified in **Figure 2-1**.

2.1 POPULATION AND DEMOGRAPHICS

Figure 2-1 Lake County Location

The most recent data for Lake County estimates that the 2016 population was 485,846, which ranks 2nd in the State. Of that total, the City of Hammond accounts for 77,134 or 15.9% of the county's population while the City of Gary is the second largest community with 76,424 or 15.7% of the population.

In 2016, the median age of the population in the County was 38.7 years of age. The largest demographic age groups in the County are older adults (45-64 years) with a population of 130,646, and young adults (25 to 44) with a population of 120,316. School-aged children (5 to 17) are the third largest age group with a population of 86,667 individuals living in Lake County. The approximate median household income in 2015 was reported to be $50,613 while the poverty rate in the same year was reported at 16.6% county-wide. In total, 17.3% of households are married with children, and 27.2% of households are married without children.

Within the County, nearly 87.2% of the adults older than 25, have reportedly completed a High School education. Further, 20.4% of those same adults have also completed a Bachelor of Arts or higher degree.

2.2 EMPLOYMENT

US Census data indicates that of the Lake County work force, 14.7% are employed in Health Care/Social Services positions. Retail Trade and Manufacturing account for 11.9% and 10.2% respectively. The total resident labor force according to estimates in 2016 is 232,458 with 14,696 unemployed and an unemployment rate of 6.3% which ranks the 2nd highest in the State out of 92 counties.

Table 2-1 List of Major Employers

US Steel Corporation – Gary	St. Margaret Mercy Healthcare - Hammond
Community Hospital – Munster	Horseshoe Casino – Hammond
The Methodist Hospital – Merrillville	Ameristar Casino – East Chicago
BP Pipeline North America – Whiting	Franciscan Alliance – throughout County
NiSource – Merrillville	Americall Group, Inc. – Hobart
Canadian National Railway – Whiting	Majestic Star Casino – Gary
Radisson Hotel at Star Plaza – Merrillville	St. Catherine Hospital – East Chicago
St. Mary Medical Center – Hobart	The Times Media Company – Munster
ArecelorMittal – East Chicago	Unilever HPC-NA – Whiting
Cargill, Inc. - Hammond	

(Lake County Economic Alliance, 2017)

2.3 TRANSPORTATION AND COMMUTIING PATTERNS

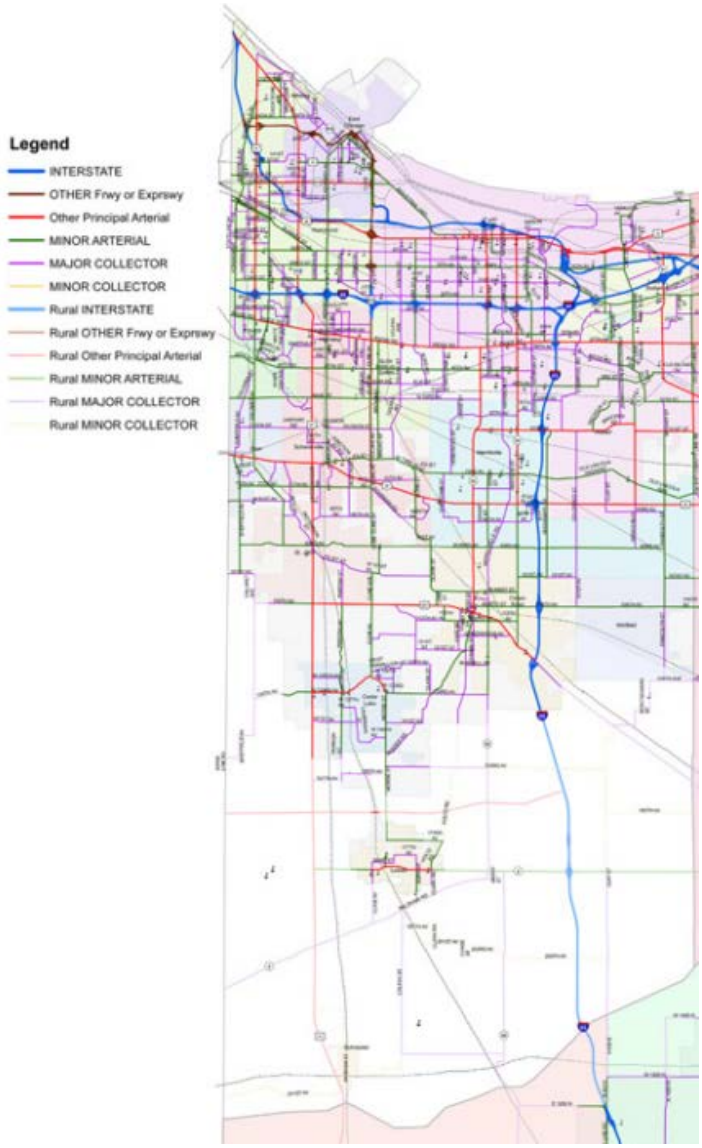


Figure 2-2 Lake County Transportation Routes

There are several major transportation routes passing through Lake County and the municipalities within. Interstates 65, 90, and 94; US Highway 30, 41, and 231, and State Roads 2, 53, and 55 serve as main routes between the various municipalities. Several rail lines also traverse the county. These transportation routes, taken from the Lake County Unincorporated Comprehensive Plan are identified in **Figure 2-2**..

According to the Indiana Business Research Center, nearly 14.5%, or nearly 41,530 people commute into Lake County daily. Approximately 46% of commuters travel from Porter County. Further, approximately 49,152 Lake County residents commute to other counties, with the majority traveling to Illinois (73%).

Figure 2-3 indicates the number of workers 16 and older who do not live within Lake County but commute into Lake County for employment purposes. Similarly, **Figure 2-4** indicates the number of Lake County residents 16 and older that commute out of the county for employment.

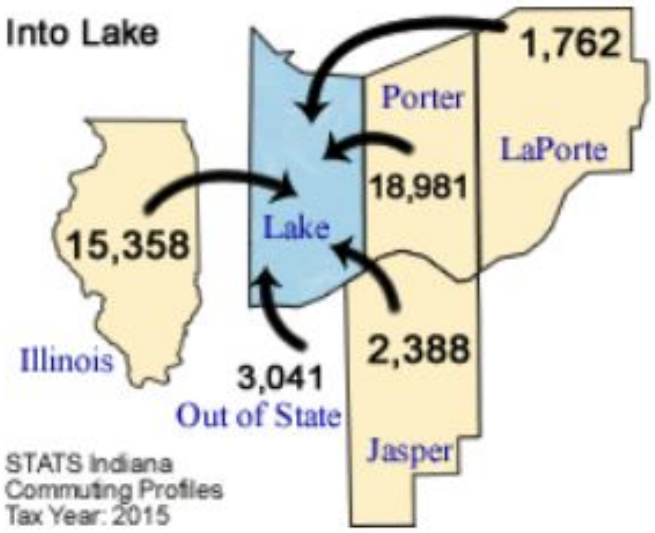


Figure 2-3 Workers Commuting into Lake County

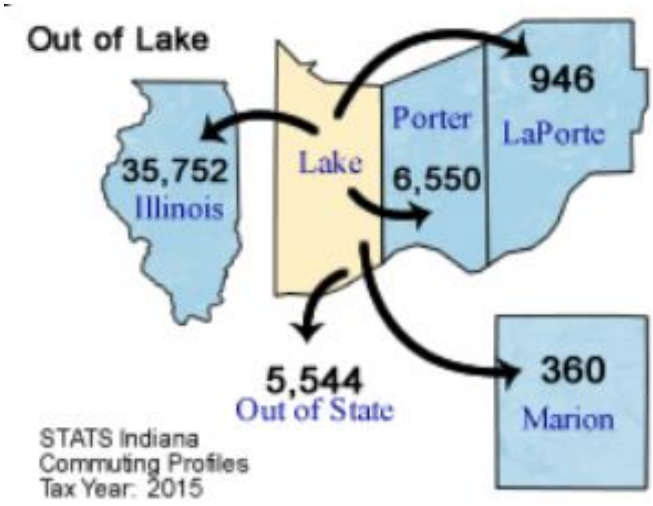


Figure 2-4 Workers Commuting out of Lake County

2.4 CRITICAL AND NON-CRITICAL INFRASTRUCTURE

REQUIREMENT §201.6(c)(2)(ii)(A):
The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas….

Critical facilities, or critical infrastructure, are the assets, systems, and networks, whether physical or virtual, so vital to the local governments and the United States that their incapacitation or destruction would have a debilitating effect on security, economic security, public health or safety, or any combination thereof.

These structures are vital to the community's ability to provide essential services and protect life and property, are critical to the community's response and recovery activities, and/or are the facilities the loss of which would have a severe economic or catastrophic impact. The operation of these facilities becomes especially important following a hazard event.

The Lake County EMA provided the listing and locations of the following 1,755 critical infrastructure points for the MHMP Update:

- 8 Airports
- 294 Communications Facilities/Towers
- 17 Dams
- 32 Daycare Centers
- 1 Emergency Management Facility
- 17 Emergency Operations Facilities
- 70 Fire Departments
- 114 Government Facilities
- 391 Hazardous Materials Facilities
- 38 Heliports
- 155 Hospital/Medical Facilities
- 28 Large Gathering Facilities
- 21 Nursing Homes
- 259 Parks
- 25 Police Department
- 84 Potable Water Facilities
- 5 Power/Electric Facilities
- 168 Schools
- 14 Transportation Facilities
- 10 Wastewater Treatment Facilities

Information provided by the EMA, GIS Department, and the MHMP Planning Committee members was utilized to identify the types and locations of critical structures throughout Lake County. Draft maps were provided to the EMA and

Planning Committee for their review and all comments were incorporated into the maps and associated databases.

Exhibits 1 - 20 illustrate the critical infrastructure identified throughout unincorporated Lake County and the individual municipalities. **Appendix 4** lists the critical structures in Lake County by NFIP Community. Non-critical structures include residential, industrial, commercial, and other structures not meeting the definition of a critical facility and are not required for a community to function. The development of this MHMP focused only on critical structures; non-critical structures are neither mapped nor listed.

2.5 MAJOR WATERWAYS AND WATERSHEDS

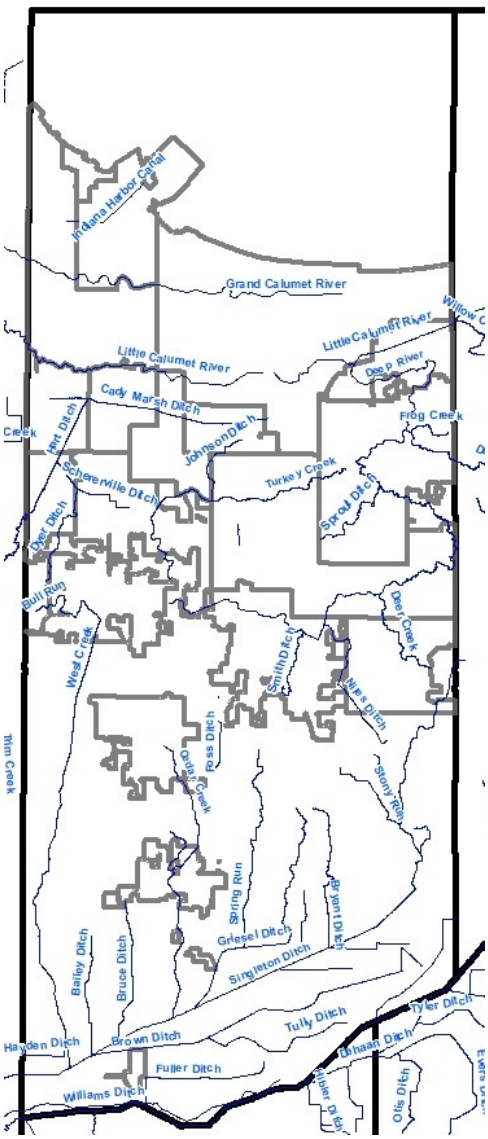


Figure 2-5 Lake County Waterways

According to the United States Geological Survey (USGS) there are 47 waterways in Lake County; which are listed in Appendix 5. The County's main waterways are the Deep, Calumet, Grand Calumet, Kankakee Rivers. The county lies within three 8-digit Hydrologic Unit Codes (HUC): the Little Calumet-Galien (04040001), the Chicago (07120003), and the Kankakee (07120001). These major waterways, and others, are identified on **Figure 2-5**.

2.6 NFIP PARTICIPATION

The NFIP is a FEMA program that enables property owners in participating communities to purchase insurance protection against losses from flooding. Lake County and several municipalities are participants in the NFIP. Any smaller communities within Lake County may also be provided coverage by the MHMP through the County's program. Since the development of the 2010 Lake County MHMP, these communities continue to participate in the NFIP program.

At the time of preparing this MHMP, only the Town of Dyer and the Town of Merrillville participate in the CRS program, both at a Class 8. The CRS program is a voluntary incentive program that recognizes and encourages community floodplain activities which exceed the minimum NFIP requirements. As a result, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the 3 goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating; and 3) promote education and awareness of flood insurance. For CRS participating communities, flood insurance premium rates are discounted in increments of 5% for each class level achieved. **Table 2-2** lists the NFIP number, effective map date, and the date each community joined the NFIP program.

Table 2-2 NFIP Participation

NFIP COMMUNITY	NFIP NUMBER	EFFECTIVE MAP DATE	JOIN DATE
Lake County	180126B	03/16/16	09/02/81
Town of Cedar Lake	180304#	01/18/12(M)	03/15/82
City of Crown Point	180128#	01/18/12	03/18/80
Town of Dyer	180129#	01/18/12	05/15/84
City of East Chicago	180130#	01/18/12	06/04/80
City of Gary	180132B	03/16/16	03/16/81
Town of Griffith	188175B	03/16/16	04/14/72
City of Hammond	180134#	01/18/12	03/16/82
Town of Highland	185176B	06/16/16	05/19/72
City of Hobart	180136#	01/18/12	12/04/79
City of Lake Station	180131#	01/18/12	09/05/79
Town of Lowell	180137#	01/18/12	12/04/79
Town of Merrillville	180138#	01/18/12	10/15/81
Town of Munster	180139B	03/16/16	05/16/83
Town of New Chicago	180140#	01/18/12	01/02/80
Town of Schererville	180142B	03/16/16	05/01/80
Town of Schneider	180143#	01/18/12	08/01/80
Town of St. John	180141#	01/18/12	11/01/79
City of Whiting	180313#	01/18/12	03/06/81
Town of Winfield	180515#	01/18/12	11/14/97

(FEMA, 2017)

2.7 TOPOGRAPHY

Lake County is bordered geographically to the east by Porter County, to the west by the State of Illinois, to the north by Lake Michigan, and to the south by Jasper and Newton Counties. The County's landscape consists of three different regions; the Calumet Lacustrine Plain in the northern region, the Valparaiso Morainal Area in the central region, and the Kankakee Outwash Plain in the southern region. Just south of Crown Point dividing the county west to east, is the division between the Mississippi River watershed and the St. Lawrence watershed

2.8 CLIMATE

The Midwestern Regional Climate Center (MRCC) provided climate data that includes information retrieved from a weather station located in Lowell, identified as station USC00125174. The average annual precipitation is 39.46 inches per year, with the wettest month being June averaging 4.69 inches of precipitation and the driest month being February with an average of 1.75 inches of precipitation. The highest 1-day maximum precipitation was recorded in June of 1972 with 5.85 inches of rain. On average, there are 74 days of precipitation greater than or equal to 0.1 inches; 24.1 days with greater than or equal to 0.5 inches; and 9.5 days with greater than or equal to 1.0 inch of precipitation.

CHAPTER 3 RISK ASSESSMENT

REQUIREMENT §201.6(c)(2):
[The risk assessment shall provide the] factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessment must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

A risk assessment measures the potential loss from a hazard incident by assessing the vulnerability of buildings, infrastructure, and people in a community. It identifies the characteristics and potential consequences of hazards, how much of the community may be affected by a hazard, and the impact on community assets. The risk assessment conducted for Lake County and the NFIP communities is based on the methodology described in the Local Multi-Hazard Mitigation Planning Guidance published by FEMA in 2011 and is incorporated into the following sections:

Section 3.1: Hazard Identification lists the natural, technological, and political hazards selected by the Planning Committee as having the greatest direct and indirect impact to the County as well as the system used to rank and prioritize the hazards.

Section 3.2: Hazard Profile for each hazard, discusses 1) historic data relevant to the County where applicable; 2) vulnerability in terms of number and types of structures, repetitive loss properties (flood only), estimation of potential losses, and impact based on an analysis of development trends; and 3) the relationship to other hazards identified by the Planning Committee.

Section 3.3: Hazard Summary provides an overview of the risk assessment process; a comparative hazard ranking with other methodologies used by the Lake County EMA; a table summarizing the relationship of the hazards; and a composite map to illustrate areas impacted by the hazards.

3.1 HAZARD IDENTIFICATION

3.1.1 Hazard Selection

The MHMP Planning Committee reviewed the list of natural and technological hazards from the 2010 Lake County MHMP and discussed recent events and the potential for future hazard events. The Committee identified those hazards that affected Lake County and the NFIP communities and selected the hazards to study in detail as part of this planning effort. As shown in **Table 3-1** these hazards include: dam/levee failure; drought; earthquake; extreme temperature; fire; flooding; hailstorms, thunderstorms, and windstorms; hazardous materials incident; land subsidence/landslides; snow storms and ice storms; tornado.

All hazards studied with the 2010 Lake County MHMP, and within the 2014 Indiana MHMP, are included in the update.

Table 3-1 Hazard Identification

TYPE OF HAZARD	LIST OF HAZARDS	DETAILED STUDY	
		2010 MHMP	MHMP UPDATE
Natural	Drought	No	Yes
	Earthquake	Yes	Yes
	Extreme Temperature	No	Yes
	Fire	Yes	Yes
	Flood	Yes	Yes
	Hail/Thunder/Wind	Yes	Yes
	Land Subsidence/Landslide	No	Yes
	Snow / Ice Storm	Yes	Yes
	Tornado	Yes	Yes
Technological	Dam/Levee Failure	No	Yes
	Hazardous Material Incident	Yes	Yes

3.2 HAZARD RANKING

The Planning Committee ranked the selected hazards in terms of importance and potential for disruption to the community using a modified version of the Calculated Priority Risk Index (CPRI). The CPRI, adapted from MitigationPlan.com, is a tool by which individual hazards are evaluated and ranked according to an indexing system. The CPRI value (as modified by CBBEL) can be obtained by assigning varying degrees of risk probability, magnitude/severity, warning time, and the duration of the incident for each event, and then calculating as index value based on a weighted scheme. For ease of communications, simple graphical scales are used.

3.2.1 Probability

Probability is defined as the likelihood of the hazard occurring over a given period. The probability can be specified in one of the following categories:

- Unlikely – incident is possible, but not probable, within the next 10 years (1)
- Possible – incident is probable within the next 5 years (2)
- Likely - incident is probable within the next 3 years (3)
- Highly Likely – incident is probable within the next calendar year (4)

3.2.2 Magnitude / Severity

Magnitude/severity is defined by the extent of the injuries, shutdown of critical infrastructure, the extent of property damage sustained, and the duration of the incident response. The magnitude can be specified in one of the following categories:

- Negligible – few injuries OR critical infrastructure shutdown for 24 hours or less OR less than 10% property damaged OR average response duration of less than 6 hours (1)
- Limited – few injuries OR critical infrastructure shut down for more than 1 week OR more than 10% property damaged OR average response duration of less than 1 day (2)
- Critical – multiple injuries OR critical infrastructure shut down of at least 2 weeks OR more than 25% property damaged OR average response duration of less than 1 week (3)
- Significant – multiple deaths OR critical infrastructure shut down of r1 month or more OR more than 50% property damaged OR average response duration of less than 1 month (4)

3.2.3 Warning Time

Warning time is defined as the length of time before the event occurs and can be specified in one of the following categories:

- More than 24 hours (1)
- 12-24 hours (2)
- 6-12 hours (3)
- Less than 6 hours (4)

3.2.4 Duration

Duration is defined as the length of time that the actual event occurs. This does not include response or recovery efforts. The duration of the event can be specified in one of the following categories:

- Less than 6 hours (1)
- Less than 1 day (2)
- Less than 1 week (3)
- Greater than 1 week (4)

3.2.5 Calculating the CPRI

The following calculation illustrates how the index values are weighted and the CPRI value is calculated. CPRI = Probability x 0.45 + Magnitude/Severity x 0.30 + Warning Time x 0.15 + Duration x 0.10. For the purposes of this planning effort, the calculated risk is defined as:

- **Low** if the CPRI value is between 1 and 2
- **Elevated** if the CPRI value is between 2 and 3
- **Severe** if the CPRI value is between 3 and 4

The CPRI value provides a means to assess the impact of one hazard relative to other hazards within the community. A CPRI value for each hazard was determined for each NFIP community in Lake County, and then a weighted CPRI value was computed based on the population size of each community. **Table 3-2** presents each community, population, and the weight applied to individual CPRI values to arrive at a combined value for the entire County. Weight was calculated based on the average percentage of each community's population in relation to the total population of the County. Thus, the results reflect the relative population influence of each community on the overall priority rank.

Table 3-2 Determination of Weighted Value for NFIP Communities

COMMUNITY	POPULATION (2016)	% OF TOTAL POPULATION	WEIGHTED VALUE
Lake County	41,719	8.6%	0.09
Town of Cedar Lake	12,183	2.5%	0.03
City of Crown Point	29,176	6.0%	0.06
Town of Dyer	15,941	3.3%	0.03
City of East Chicago	28,418	5.9%	0.06
City of Gary	76,424	15.7%	0.16
Town of Griffith	16,252	3.3%	0.03
City of Hammond	77,134	15.9%	0.16
Town of Highland	22,737	4.7%	0.05
City of Hobart	28,248	5.8%	0.06
City of Lake Station	11,952	2.5%	0.02
Town of Lowell	9,519	2.0%	0.02
Town of Merrillville	34,994	7.2%	0.07
Town of Munster	22,825	4.7%	0.05
Town of New Chicago	1,956	0.4%	0.00
Town of Schererville	28,701	5.9%	0.06
Town of Schneider	270	0.1%	0.00
Town of St. John	16,800	3.5%	0.03
City of Whiting	4,831	1.0%	0.01
Town of Winfield	5,560	1.1%	0.01
Total	**485,640**	**100.0%**	**1.00**

3.3 HAZARD PROFILES

The hazards studied for this report are not equally threatening to all communities throughout Lake County. While it would be difficult to predict the probability of an earthquake or tornado affecting a specific community, it is much easier to predict where the most damage would occur in a known hazard area such as a floodplain or near a facility utilizing an Extremely Hazardous Substance (EHS). The magnitude and severity of the same hazard may cause varying levels of damages in different communities.

This section describes each of the hazards that were identified by the Planning Committee for detailed study as a part of this MHMP Update. The discussion is divided into the following subsections:

- **Hazard Overview** provides a general overview of the causes, effects, and characteristics that the hazard represents
- **Historic Data** presents the research gathered from local and national courses on the hazard extent and lists historic occurrences and probability of future incident occurrence
- **Assessing Vulnerability** describes, in general terms, the current exposure, or risk, to the community regarding potential losses to critical infrastructure and the implications to future land use decisions and anticipated development trends
- **Relationship to Other Hazards** explores the influence one hazard may have upon another hazard.

NATURAL HAZARDS

3.3.1 Drought

Drought: Overview

Figure 3-1 Drought Affected Soil

Drought, in general, means a moisture deficit extensive enough to have social, environmental, or economic effects. Drought is not a rare and random climate incident; rather, it is a normal, naturally recurring feature of climate. Drought may occur in virtually all climactic zones, but its characteristics vary significantly from one region to another. Drought is a temporary aberration and is different from aridity, which is restricted to low rainfall regions.

There are four academic approaches to examining droughts; these are meteorological, hydrological, agricultural, and socio-economic. Meteorological drought is based on the degree, or measure, of dryness compared to a normal, or average amount of dryness, and the duration of the dry period. Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply. Agricultural drought is related to agricultural impacts; focusing on precipitation shortages, differences between actual and potential evapo-transpiration, soil water deficits, reduced ground water or reservoir levels, and crop yields. Socioeconomic drought relates the lack of moisture to community functions in the full range of societal functions, including power generation, the local economy, and food sources. **Figure 3-1** shows soil affected by drought conditions.

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: ▪ short-term dryness slowing planting, growth of crops or pastures Coming out of drought: ▪ some lingering water deficits ▪ pastures or crops not fully recovered
D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low, some water shortages developing or imminent ▪ Voluntary water-use restrictions requested
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water emergencies

Figure 3-2 US Drought Monitor Drought Severity Classification

Drought: Recent Occurrences

Data gathered from the U.S. Drought Monitor indicated that between September 2010 and March 2018, there were 26 weeks where some portion of Lake County was in a "Moderate Drought", 117 weeks where conditions were considered "Abnormally Dry". Further, conditions worse than a D1 or Moderate Drought, were not reported during this timeframe. **Figure 3-2**, from the U.S. Drought Monitor, describes the rational to classify the severity of droughts. Those weeks of Moderate Drought are largely associated with the summer 2012 event.

In July and August 2012, nearly 100% of Indiana was experiencing drought conditions ranging from "D0-Abnormally Dry" to "D4-Exceptional Drought". **Figure 3-3** identifies those areas and categories of drought throughout Indiana for August 7, 2012, the peak of the drought. Lake

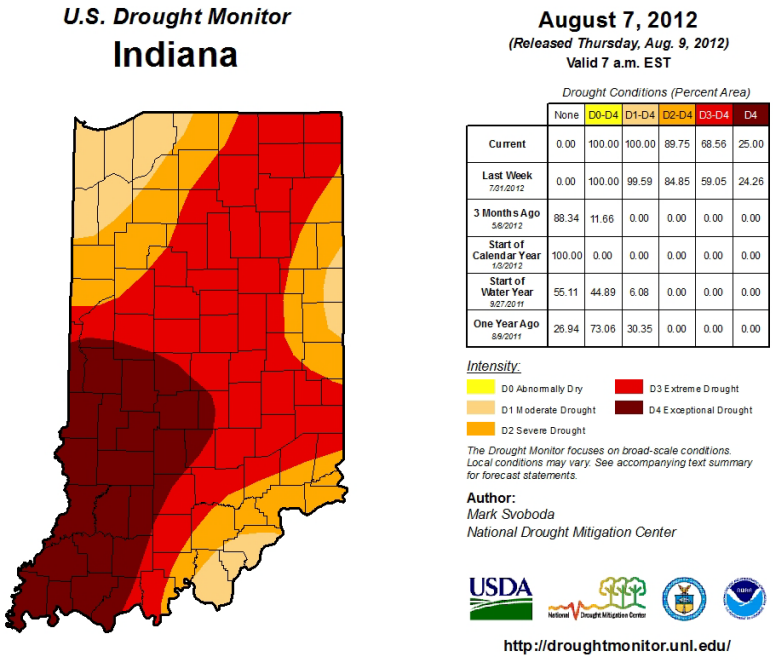


Figure 3-3 August 2012 Indiana Drought Map

County is located entirely in the "D1-Moderate Drought" area. D1 includes some crop or pasture damages, and shortages of water in streams and reservoirs may be developing. The September 4, 2012 report shows all of Lake County within the "D0-Abnormally Dry" consideration. It wasn't until the March 12, 2013 report that the entire county was considered out of drought condition status.

The National Data Climate Center (NCDC) does not report any events of property or crop losses within Lake County since 1950.

Utilizing the CPRI, the Planning Committee determined the overall risk of drought throughout Lake County is "Possible" (to occur within the next 5 years). The impact of drought was determined to vary throughout the County; largely based on water supply and land use considerations. Those communities utilizing wells or groundwater for drinking purposes, and located in a more rural setting, anticipated a higher severity of damages associated with a drought in this area. The committee agreed that the magnitude of drought is anticipated to range from "Negligible" to "Critical". The Town of Cedar Lake anticipates their severity level somewhere between the "Limited" and "Critical" considerations as the residents rely on wells for drinking water and the Town's fire response somewhat relies upon lake levels. The Town of Schneider has similar concerns with fire response, resulting in the "Critical" selection. Further, it is anticipated that with the enhanced weather forecasting abilities, the warning time for a drought is greater than 24 hours and the duration will be greater than 1 week. A summary is shown in **Table 3-3**.

Table 3-3 CPRI for Drought

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Possible	Limited	> 24 Hours	> 1 Week	Elevated
Town of Cedar Lake	Possible	Critical	> 24 Hours	> 1 Week	Elevated
City of Crown Point	Possible	Limited	> 24 Hours	> 1 Week	Elevated
Town of Dyer	Possible	Limited	> 24 Hours	> 1 Week	Low
City of East Chicago	Possible	Negligible	> 24 Hours	> 1 Week	Low
City of Gary	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Griffith	Possible	Negligible	> 24 Hours	> 1 Week	Low
City of Hammond	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Highland	Possible	Limited	> 24 Hours	> 1 Week	Elevated
City of Hobart	Possible	Negligible	> 24 Hours	> 1 Week	Low
City of Lake Station	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Lowell	Possible	Limited	> 24 Hours	> 1 Week	Elevated
Town of Merrillville	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Munster	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of New Chicago	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Schererville	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Schneider	Possible	Critical	> 24 Hours	> 1 Week	Elevated
Town of St. John	Possible	Limited	> 24 Hours	> 1 Week	Elevated
City of Whiting	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Winfield	Possible	Limited	> 24 Hours	> 1 Week	Elevated

According to the National Drought Mitigation Center, scientists have difficulty predicting droughts more than 1 month in advance due to the numerous variables such as precipitation, temperature, soil moisture, topography, and air-sea interactions. Further anomalies may also enter the equation and create more dramatic droughts or lessen the severity of droughts. Based on the previous occurrences of droughts and drought-related impacts felt within Lake County, the Committee estimated that the probability of a drought occurring in the area is "Possible"; or probable within the next 5 years.

Varying degrees of damages, from "Negligible" to "Critical" are anticipated throughout the county as those municipalities who rely on surface water for fire response efforts face a higher risk during times of drought. Throughout the unincorporated county, crop damages would be expected as a result of a prolonged drought.

Drought: Assessing Vulnerability

This type of hazard will generally affect entire counties and even multi-county regions at one time. Within Lake County, direct and indirect effects from a long period of drought may include:

Direct Effects:

- Urban and developed areas may experience revenue losses from landscaping companies, golf courses, restrictions on industry cooling and processing demands, businesses dependent on crop yields; and increased potential for fires.
- Rural areas within the county may experience revenue losses from reductions in livestock and crop yields as well as increased field fires.
- Citizens served by drinking water wells may be impacted during low water periods and may require drilling of deeper wells or loss of water service for a period of time.

Indirect Effects:

- Loss of income of employees from businesses and industries affected; loss of revenue to support services (food service, suppliers, etc.)
- Loss of revenue from recreational or tourism sectors associated with reservoirs, streams, and other open water venues.
- Lower yields from domestic gardens, thereby increasing the demand on purchasing produce and increased domestic water usage for landscaping
- Increased demand on emergency responders and firefighting resources

Figure 3-4 Crops Affected by Drought

Estimating Potential Losses

It is difficult to estimate the potential losses associated with a drought for Lake County because of the nature and complexity of this hazard and the limited data on past occurrences. However, for this MHMP Update, a scenario was used to estimate the potential crop loss and associated revenue lost due to a drought similar to that experienced during the drought of record from 1988. In 2017, Lake County produced approximately 9.9M bushels of corn and 2.7M bushels of soybeans, as reported by the United States Department of Agriculture (USDA) National Agricultural Statistics Service. Using national averages of $3.45 per bushel of corn and $9.55 per bushel of soybeans, the estimated crop receipts for 2017 would be $59.9M. Using the range of crop yield decreases reported in 1988 and 1989, just after the 1988 drought period (50%-86%) and assuming a typical year, economic losses could range between $30.0M-$51.5M; depending on the crop produced and the market demand. Effects of drought on corn crops can be seen in **Figure 3-4**.

Purdue Agriculture News reports that by March 2013, Indiana producers received more than $1.0B in crop insurance payments for 2012 corn, soybean, and wheat losses. This amount is nearly double that of the previous record, $522M following 2008 losses, also due to drought.

According to a July 5, 2012 article in *The Times* (Noblesville, IN), "The effects of drought also could touch agricultural businesses, such as handlers and processors, equipment dealers, and see, fertilizer and pesticide providers". Further, "…consumers are likely to see an increase in food prices of 2.5 percent to 3.5 percent into 2013".

Additional losses associated with a prolonged drought are more difficult to quantify. Drought has lasting impacts on urban trees: death to all or portions of a tree, reduction in the tree's ability to withstand insects and diseases, and interruption of normal growth patterns. Such effects on trees, especially urban trees can lead to additional impacts, both environmentally and monetarily. Examples include the spread of Emerald Ash Borer insect and the weakening of tree limbs and trunks which may lead to increased damages during other hazard events such as wind and ice storms.

Future Considerations

Advancements in plant hybrids and crop management may help to ease the impacts from short-lived droughts. Seeds and plants may be more tolerant of dryer seasons and therefore fewer crop losses may be experienced.

As the more urban areas of the county continue to grow in population and expand in size, protocols may need to be developed which create a consistency throughout the communities and the unincorporated portions of the county to issue burn bans and water usage advisories during times of drought.

Many smaller communities and the townships, such as Cedar Lake, Lowell, and Schneider, rely on groundwater wells for drinking water and similar local water supplies for fire-fighting efforts. Prior to these municipalities expanding, provisions and considerations should be given regarding the potential additional demand for both water usage and fire response efforts. Following such expansion or development plans, alternative water sources should be explored. Many additional communities are serviced by Indiana American Water Company and such provisions may already exist as communities set to expand utility services such as water.

Drought: Relationship to Other Hazards

A drought will not be caused by any other hazard studied during this planning effort. Discussions with the Planning Committee were held regarding the similar effects of prolonged periods of extreme heat and the similar impacts that may be experienced during these times. Planning and mitigation efforts for one hazard may benefit the other. It is anticipated that rural areas of the county (southern reaches) may be more

susceptible to cropland or woodland fires during a drought, while urban areas may experience these impacts in areas where several abandoned buildings or overgrown lots exist, and this may lead to increased losses associated with a fire.

3.3.2 **Earthquake**

Earthquake Overview

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 the 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 the plates.

Ground shaking from 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 move off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

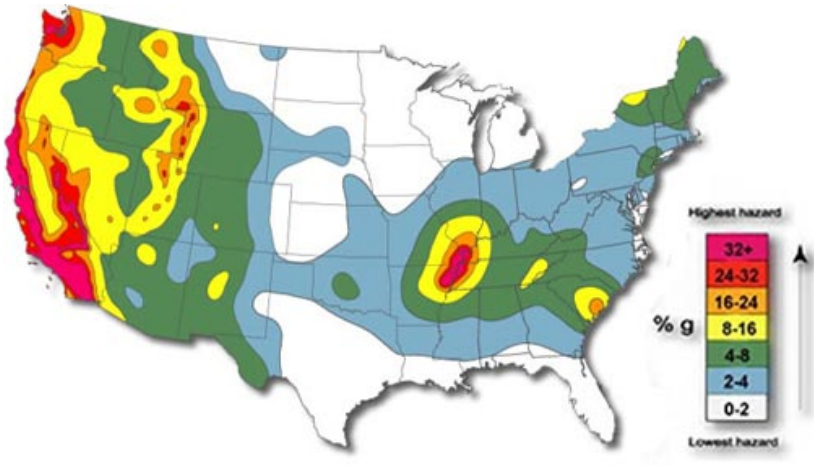


Figure 3-5 Earthquake Hazard Areas in the US

Earthquakes strike suddenly, without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70-75 damaging earthquakes occur throughout the world. Estimates of losses from a future earthquake in the United States approach $200B. Scientists are currently studying the New Madrid fault area and have predicted that the chances of an earthquake in the M8.0 range occurring within the next 50 years are approximately 7%-10%. However, the chances of an earthquake at a M6.0 or greater, are at 90% within the next 50 years.

There are 45 states and territories in the United States at moderate to very high risk from earthquakes, and they are located in every region of the country (**Figure 3-5**). California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes, most of which are located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, when a three-month long series of quakes from 1811 to 1812 occurred over the entire Eastern United States, with Missouri, Tennessee,

Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

Earthquake: Recent Occurrences

Indiana, as well as several other Midwestern states, lies in the most seismically active region east of the Rocky Mountains. Regarding Lake County, the nearest area of concern is the Wabash Seismic Zone (Figure 3-5).

On April 18, 2008, an M5.2 quake, reported by the Central United States Earthquake Consortium, struck southeast Illinois in Wabash County and included reports of strong shaking in southwestern Indiana, Kansas, Georgia, and the upper peninsula of Michigan. Although there were 25,000 reports of feeling the earthquake, no injuries or fatalities were reported.

On December 30, 2010, central Indiana experienced an earthquake with a magnitude of 3.8; rare for this area in Indiana as it is only the 3rd earthquake of notable size to occur north of Indianapolis. Even rarer is the fact that scientists believe that the quake was centered in Greentown, Indiana approximately 13 miles southeast of Kokomo, Indiana. According to *The Kokomo Tribune,* "113 people called 911 in a 15-minute period after the quake, which was the first tremblor centered in Indiana since 2004". Further, a geophysicist from the USGS in Colorado stated, "It was considered a minor earthquake", and "Maybe some things would be knocked off shelves, but as far as some significant damage, you probably wouldn't expect it from a 3.8".

Figure 3-6 Earthquake Damaged Porch

Most recently, an M5.8 centered in Mineral, Virginia affected much of the East Coast on August 23, 2011. According to USA Today, 10 nuclear power plants were shutdown for precautionary inspections following the quake, over 400 flights were delayed, and the Washington Monument was closed indefinitely pending detailed inspections by engineers.

Based on historical earthquake data, local knowledge of previous earthquakes, and the results of HAZUS-MH scenarios, the Committee determined that the probability of an earthquake occurring in Lake County or any of the communities is "Unlikely to Possible". Representatives at each meeting discussed the overall possibility in a general sense while others discussed the possibility in terms of previous occurrences of an earthquake in the area. Should an earthquake occur, the impacts associated with this hazard are anticipated to be "Negligible" to "Significant" dependent upon

the amount of infrastructure and resources within the impacted area and the estimation of that municipality's ability to respond to such an event.

As with all earthquakes, it was determined that the residents of Lake County would have little to no warning time (less than six hours) and that the duration of the main earthquake event would also be expected to be less than six hours. A summary is shown in **Table 3-4**.

Table 3-4 CPRI for Earthquake

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Cedar Lake	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
City of Crown Point	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Dyer	Unlikely	Significant	< 6 Hours	< 6 Hours	Elevated
City of East Chicago	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
City of Gary	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Griffith	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
City of Hammond	Unlikely	Limited	< 6 Hours	< 6 Hours	Low
Town of Highland	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
City of Hobart	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
City of Lake Station	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Lowell	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Merrillville	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Munster	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of New Chicago	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Schererville	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Schneider	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of St. John	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
City of Whiting	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Winfield	Possible	Significant	< 6 Hours	< 6 Hours	Elevated

According to the Ohio Department of Natural Resources Division of Geological Survey, "…it is difficult to predict the maximum-size earthquake that could occur in the state and certainly impossible to predict when such an event would occur. In part, the size of an earthquake is a function of the area of a fault available for rupture. However, because all known earthquake-generating faults in Ohio are concealed beneath several thousand feet of Paleozoic sedimentary rock, it is difficult to directly determine the size of these faults." Further according to the Indiana Geological Survey, "…no one can say with any certainty when or if an earthquake strong enough to cause significant property damage, injury, or loss of life in Indiana will occur…we do indeed face the possibility of experiencing the potentially devastating effects of a major earthquake at some point in the future".

The Committee felt that an earthquake occurring within the next 5 years within or near to Lake County is "Unlikely" to "Possible". During the Planning Committee

meetings, several attendees determined that while the hazard is largely unpredictable, it was still "Possible" to occur. However, representatives from Dyer, Hammond, and Whiting contemplated historical occurrences in the area to arrive at the ultimate probability of "Unlikely".

Earthquake: Assessing Vulnerability

Earthquakes generally affect broad areas and potentially many counties at one time. The ranges of damage and destruction are determined by the location of the epicenter as well as the strength of earthquake. Within Lake County, direct and indirect effects from an earthquake may include:

Direct Effects:

- Urban areas may experience increased damages due to the number of structures and critical infrastructure located in these areas
- Rural areas may experience losses associated with agricultural structures such as barns and silos
- Bridges, buried utilities, and other infrastructure may be affected throughout the County and municipalities

Indirect Effects:

- Provide emergency response personnel to assist in the areas with more damage
- Provide shelter for residents of areas with more damage
- Delays in delivery of goods or services originating from areas more affected by the earthquake

Figure 3-7 Minor Earthquake Damages

Types of loss caused by an earthquake could be physical, economic, or social in nature. Due to the unpredictability and broad impact regions associated with an earthquake, all critical and non-critical infrastructure are at risk of experiencing earthquake related damages. Damages to structures, infrastructure, and even business interruptions can be expected following an earthquake. Examples of varying degrees of damages are shown in **Figure 3-6** and **Figure 3-7**.

Estimating Potential Losses

In order to determine the losses associated with an earthquake, HAZUS-MH software is often utilized. Following discussions with the Lake County EMA representatives, it was agreed upon that while the previous MHMP was completed in 2010, many communities have not significantly changed with regards to number and type of structures. Additionally, it is not anticipated that this hazard is one which routinely impacts the region. Therefore, the earthquake

scenario from the 2010 MHMP utilizing a M7.1 earthquake with an epicenter within the Wabash Valley will be again reviewed as a part of this effort.

Figure 5-53: Wabash Valley Scenario-Building Economic Losses in Thousands of Dollars

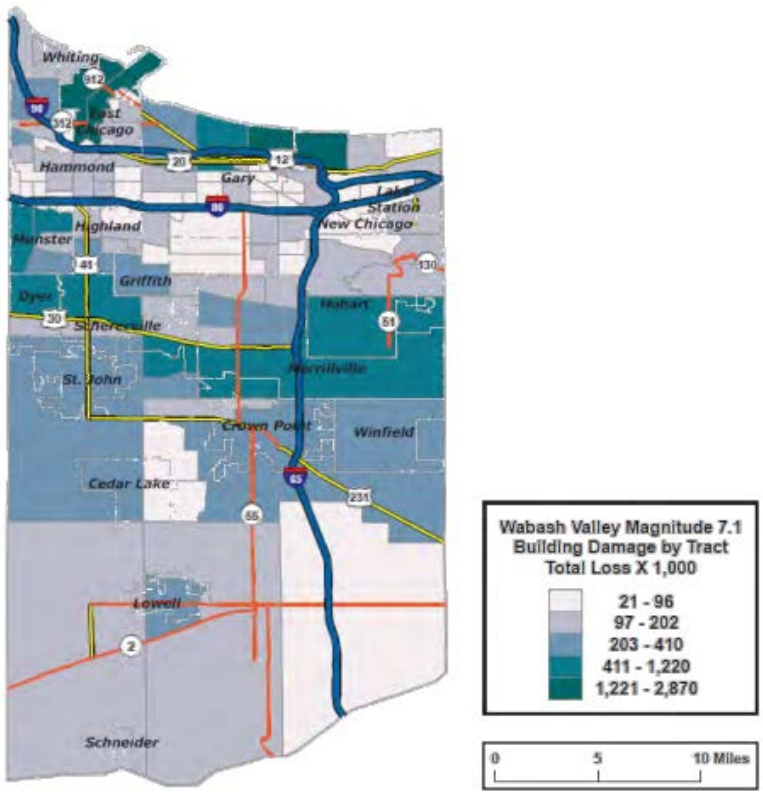


Figure 3-8 Anticipated Building Damages from Earthquake Scenario

According to the HAZUS-MH scenario, total economic loss associated with this earthquake is anticipated to be near $26.25M; which includes 845 buildings with slight damage and 60 buildings with moderate damage. The HAZUS-MH model computes anticipated economic losses for the hypothetical earthquake due to direct building losses and business interruption losses. Direct building losses are the costs to repair or to replace the damage caused to the building and contents, while the interruption losses are associated with the inability to operate a business due to the damage sustained. Business interruption losses also include the temporary living expenses for those people displaced from their homes. **Figure 3-8**, from the 2010 Lake County MHMP, indicates the estimated damages by tract as a result of the hypothetical earthquake.

The HAZUS-MH Earthquake Model allows local building data to be imported into the analysis. However, these local data are imported as "general building stock", meaning that the points are randomly assigned to a census tract rather than a specific XY coordinate. HAZUS performs the damage analysis as a county wide analysis and reports losses by census tract. While the results of the hypothetical scenario appear to be plausible, care should be taken when interpreting these results.

Future Considerations

While the occurrence of an earthquake in or near to Lake County may not be the highest priority hazard studied for the development of the Plan, it is possible that residents, business owners, and visitors may be affected should an earthquake occur. For that reason, Lake County should continue to provide education and outreach regarding earthquakes and even earthquake insurance along with education and outreach for other hazards. As Lake County and the communities within the county continue to grow and develop, the proper considerations for the potential of an earthquake to occur may help to mitigate against social, physical, or economic losses in the future.

Earthquake: Relationship to Other Hazards

Hazardous materials incidents may occur as a result of damage to material storage containers or transportation vehicles involved in road crashes or train derailments. Further, dam and levee failures may occur following an earthquake or associated aftershocks due to the shifting of the soils or structures in these hazard areas. These types of related hazards may have greater impacts on Lake County communities than the actual earthquake itself. While not a direct hazard studied within this planning effort, the Planning Committee also noted the potential for earthquakes to have an impact on buried utilities such as electric and natural gas as well as potential disruptions to groundwater supplies. It is not expected that earthquakes will be caused by other hazards studied within this plan.

3.3.3 Extreme Temperature

Extreme Temperatures: Overview

Extreme heat is defined as a temporary elevation of average daily temperatures that hover 10 degrees or more above the average high temperature for the region for the duration of several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a dome of high atmospheric pressure traps water-laden air near the ground. In a normal year, approximately 175 Americans die from extreme heat.

According to the NWS, "The Heat Index or the "Apparent Temperature" is an accurate measure of how hot it really feels when the Relative Humidity is added to the actual air temperature". To find the Heat Index Temperature, refer to the Heat Index Chart in **Figure 3-9**. As an example, if the air temperature is 96°F and the relative humidity is 65%, the heat index – how hot it feels – is 121°F. The Weather Service will initiate alert procedures when the Heat Index is expected to exceed 105°-110°F for at least 2 consecutive days.

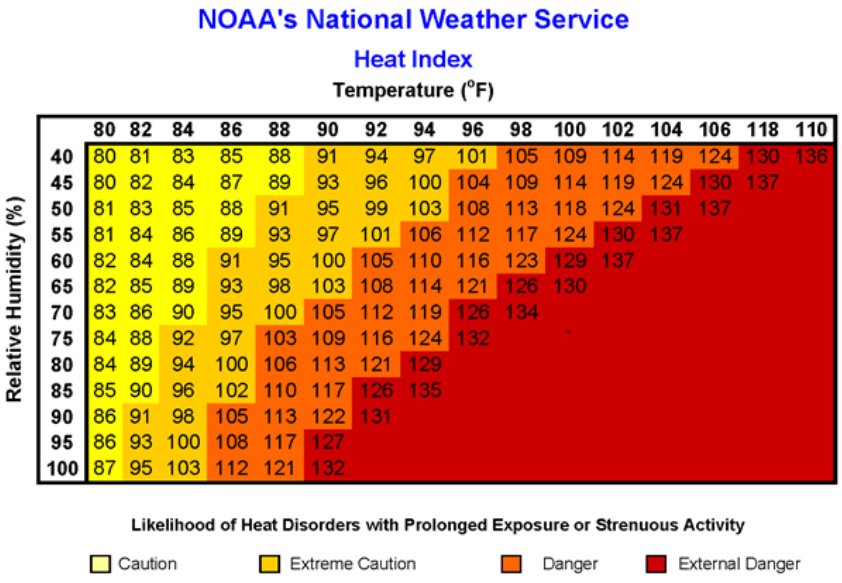


Figure 3-9 Heat Index Chart

It is important to also note that these heat index values were devised for shady, light wind conditions. Exposure to full sunshine may increase heat index values by up to 15°F. Further, strong winds, particularly with very hot, dry air, can also be extremely hazardous.

As Figure 3-7 indicates, there are 4 cautionary categories associated with varying heat index temperatures.

- **Caution**: 80°-90°F: Fatigue is possible with prolonged exposure and physical activity
- **Extreme Caution**: 90°-95°F: Sunstroke, heat cramps, heat exhaustion may occur with prolonged physical activity
- **Danger**: 105°-130°F: Sunstroke, heat cramps, or heat exhaustion is likely
- **Extreme Danger**: >130°F: Heatstroke is imminent

Extreme cold is defined as a temporary, yet sustained, period of extremely low temperatures. Extremely low temperatures can occur in winter months when continental surface temperatures are at their lowest point and the North American Jet Stream pulls arctic air down into the continental United States. The jet stream is a current of fast moving air found in the upper levels of the atmosphere. This rapid

current is typically thousands of kilometers long, a few hundred kilometers wide, and only a few kilometers thick. Jet streams are usually found somewhere between 10-15 km (6-9 miles) above the Earth's surface. The position of this upper-level jet stream denotes the location of the strongest surface temperature contrast over the continent. The jet stream winds are strongest during the winter months when continental temperature extremes are greatest. When the jet stream pulls arctic cold air masses over portions of the United States, temperatures can drop below 0° F for 1 week or more. Sustained extreme cold poses a physical danger to all individuals in a community and can affect infrastructure function as well.

In addition to strictly cold temperatures, the wind chill temperature must also be considered when planning for extreme temperatures. The wind chill temperature, according to the NWS, is how cold people and animals feel when outside and it is based on the rate of heat loss from exposed skin. **Figure 3-10** identifies the Wind Chill Chart and how the same ambient temperature may feel vastly different in varying wind speeds.

Wind chill is a guide to winter danger

New wind chill chart

Frostbite occurs in 15 minutes or less

Wind (MPH) \ Temperature (°F)	30	25	20	15	10	5	0	-5	-10	-15	-10	-25
5	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40
10	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47
15	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51
20	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55
25	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58
30	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60
35	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62
40	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64
45	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65
50	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67
55	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68
60	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69

Figure 3-10 NWS Wind Chill Chart

Extreme Temperature: Recent Occurrences

The effects of extreme temperatures extend across large regions, typically affecting several counties, or states, during a single event. According to the NCDC, there have been 3 reported occurrences of extreme heat or extreme cold between September 2010 and March 2018. Two events have been classified as extreme cold and occurred in January 2014 and January 2018. During the 2014 event, wind gusts up to 40 mph, wind chills of -40° to -50°, and blowing snow led to numerous vehicle accidents and slide-offs. In 2018, nearly the same conditions led to numerous school delays and closures throughout the region.

NCDC reports one event of excessive heat, during July of 2012. Temperatures were in the upper 90s to lower 100s with lows only getting to the upper 70s. Peak heat index values were in the range of 105 to 115 each day. While not specific to Lake County, the following reports provide a regional view of the extremes that were occurring.

In July 2012, the RTV6 *TheIndyChannel.com* reported that "The average high temperature in Indianapolis from June 28 to July 6 was a little more than 100 degrees, and Friday's high temperature of 105 was the hottest since 1936, just one-degree shy

of the all-time highest temperature in Indianapolis since records began in 1871". Further, the article highlighted the average temperature for the 10-day period was nearly 101 degrees. The record 10-day average high temperature of 103 degrees was set in 1936.

It is difficult to predict the probability that an extreme temperature event will affect Lake County residents within any given year. However, based on historic knowledge and information provided by the NFIP representatives, an extreme temperature event is "Likely" (possible within the next 3 years) to occur and if an event did occur, it would result in "Limited" to "Critical" magnitude. **Table 3-5** identifies the CPRI for extreme temperature events for all NFIP communities in Lake County.

Table 3-5 CPRI for Extreme Temperatures

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Cedar Lake	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Crown Point	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Dyer	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of East Chicago	Likely	Critical	> 24 Hours	> 1 Week	Elevated
City of Gary	Likely	Critical	> 24 Hours	> 1 Week	Elevated
Town of Griffith	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Hammond	Likely	Critical	> 24 Hours	> 1 Week	Elevated
Town of Highland	Likely	Critical	> 24 Hours	> 1 Week	Elevated
City of Hobart	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Lake Station	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Lowell	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Merrillville	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Munster	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of New Chicago	Likely	Critical	> 24 Hours	> 1 Week	Elevated
Town of Schererville	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Schneider	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of St. John	Likely	Critical	> 24 Hours	> 1 Week	Elevated
City of Whiting	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Winfield	Likely	Limited	> 24 Hours	> 1 Week	Elevated

As shown in the table, index values remain nearly identical throughout each NFIP community due to the regional extent and diffuse severity of this hazard event. The areas anticipated to experience "Critical" severity due to Extreme Temperature events are heightened due to the estimated larger elderly populations in these communities. Further, in the southern rural areas of the county, as well as the communities such as Schneider and Lowell, the damages are anticipated to be lower or "Limited" as many residents and business are equipped with generators and other supplies to outlast these events.

Extreme Temperatures: Assessing Vulnerability

As noted above, this type of hazard will generally affect entire counties and even multi-county regions at one time; however, certain portions of the population may be more vulnerable to extreme temperatures. For example, outdoor laborers, very young and very old populations, low income populations, and those in poor physical condition are at an increased risk to be impacted during these conditions.

By assessing the demographics of Lake County, a better understanding of the relative risk that extreme temperatures may pose to certain populations can be gained. In total, nearly 15.4% of the County's population is over 65 years of age, more than 6.3% of the population is below the age of 5, and approximately 17% of the population is considered to be living below the poverty line. People within these demographic categories are more susceptible to social or health related impacts associated with extreme heat.

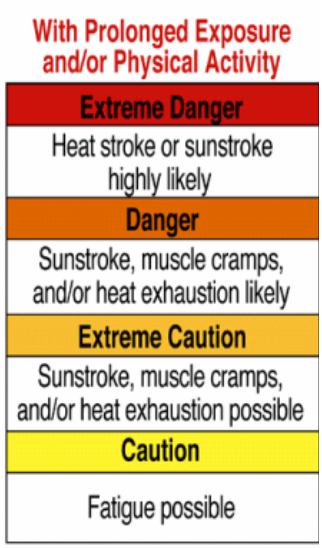


Figure 3-11 Danger Levels with Prolonged Heat Exposure

Extreme heat can affect the proper function of organ and brain systems by elevating core body temperatures above normal levels. Elevated core body temperatures, usually in excess of 104°F are often exhibited as heat stroke. For weaker individuals, an overheated core body temperature places additional stress on the body, and without proper hydration, the normal mechanisms for dealing with heat, such as sweating to cool down, are ineffective. Examples of danger levels associated with prolonged heat exposure are identified in **Figure 3-11**.

Extreme cold may result in similar situations as body functions are impacted as the temperature of the body is reduced. Prolonged exposure to cold may result in hypothermia, frostbite, and even death if the body is not warmed.

Within Lake County, direct and indirect effects from a long period of extreme temperature may include:

Direct Effects:

- Direct effects are primarily associated with health risks to the elderly, infants, people with chronic medical disorders, lower income families, outdoor workers, and athletes.

Indirect Effects:

- Increased need for cooling or warming shelters
- Increased medical emergency response efforts
- Increased energy demands for heating or cooling

Estimating Potential Losses

It is difficult to estimate the potential losses due to extreme temperatures as damages are not typically associated with buildings but instead, with populations and persons.

This hazard is not typically as damaging to structures or critical infrastructure as it is to populations so monetary damages associated with the direct effects of the extreme temperature are difficult to estimate. Indirect effects would cause increased expenses to: facilities such as healthcare or emergency services; manufacturing facilities where temperatures are normally elevated may need to alter work hours or experience loss of revenue if forced to limit production during the heat of the day; and energy suppliers may experience demand peaks during the hottest and/or coldest portions of the day.

Future Considerations

As more and more citizens are experiencing economic difficulties, local power suppliers along with charitable organizations have implemented programs to provide cooling and heating mechanisms to residents in need. Often, these programs are donation-driven and the need for such assistance must be demonstrated. As susceptible populations increase, or as local economies are stressed, such programs may become more necessary to protect Lake County's at-risk populations.

Planning Committee members also discussed the existence of large, and growing, elderly populations. The concern with these populations while in retirement stage of life, are routinely on fixed or low incomes, and may not have or utilize resources necessary to properly warm or cool their residences. An extenuating factor from this recognition is that several communities, such as East Chicago, Hammond, Highland, Munster, and Whiting, provide personal phone calls to those over 65 years of age, and have programs where neighbors check on neighbors during events such as these. As other communities recognize their aging populations, or other vulnerable populations, such programs should be initiated to better prepare and protect their citizens.

Extreme Temperatures: Relationship to Other Hazards

While extreme temperatures may be extremely burdensome on the power supplies in Lake County, the Committee concluded that this type of hazard is not expected to cause any hazards studied, with the exception of a potential civil disturbance. It is anticipated that due to prolonged extreme temperatures, primarily long periods of high temperatures, citizens may become increasingly agitated and irritable and this may lead to a disturbance requiring emergency responder intervention.

3.3.4 **Fire**

Fire: Overview

A wildfire, also known as a forest fire, vegetation fire, or a bushfire, is an uncontrolled fire in wildland areas, most often caused by lightening; other common causes are human carelessness and arson. Small wildfires may be contained to areas less than one acre, whereas larger wildfires can extend to areas that cover several hundred or even thousands of acres. Generally, ambient weather conditions determine the nature and severity of a wildfire event. Very low moisture and windy conditions can help to exacerbate combustion in forested or brush areas (**Figure 3-12**) and turn a small brush fire into a major regional fire event in a very short period. Wildfires can be very devastating for residents and property owners.

Figure 3-12 Wildfire in Forested Area

A structural fire is an incident where a fire starts within a structure and is largely contained to that structure. Causes of structure fires can be related to electrical shorts, carelessness with ignition sources, poor storage of flammable materials, as well as arson. These types of fires can be deadly if no warning or prevention measures are present. The most dangerous aspect of structural fires is the production of toxic gases and fumes that can quickly accumulate in enclosed areas of structures and asphyxiate those who might be in the structure.

Problems associated with structural fires are compounded when high-rise buildings catch fire. High-rise fires hinder the ability of rescue workers to fight the fire, reach impacted building occupants, and evacuate impacted occupants. Rescue efforts also become more complicated when handicapped or disabled persons are involved. Complications associated with high-rise fires typically increase as the height and occupancy levels of the buildings increase. Structural collapse is another concern associated with high-rise fires. Structural collapse often results in persons becoming trapped and severely injured. However, it is important to note that the concern associated with structural collapse, is not limited to high-rise buildings.; the collapse of smaller residential buildings can also lead to severe injury and death.

Typically, a fire will incinerate all structures and objects in its path. A resident may lose all possessions and structures to a fire event. Additionally, combating a wildfire or a structure fire may be extremely dangerous. If weather conditions change suddenly, the fire may change course and quickly overtake firefighters and other responders, causing severe injuries or deaths. Fires can travel at speeds greater than 45 mph. Therefore, these hazard events can pose a serious threat to county residents and response agencies.

Fire: Recent Occurrences

Within the NCDC, there are no reports of wildfires occurring within Lake County between January 1950 and March 2018. Within the same time parameter, there were only 2 reported events within the State of Indiana, both within Pike County and both within 2006. During each of these events over 350 acres were burned.

The NCDC does not report structural fires; therefore, local sources were utilized to provide historical information. *The Times* reported a structure fire in Lake Station on March 27, 2018 that destroyed the majority of ten business and resulted in the hospitalization of one firefighter and injuries to another. The rapid spread of the fire was attributed to a shared attic space, a south wind, and older, wooden structural supports. In total, 14 departments responded with four ladder trucks.

Figure 3-13 Lake County Sheriff Department Aviation Unit

Brush fires, such as the event occurring on November 27, 2017 and reported by Indiana 105.5 FM, may also be a concern for the area. The Lake County Sheriff Department Aviation Unit (**Figure 3-13**) was required to fight a brush fire in the area of 93rd and Colfax. Typical firefighting units and trucks were unable to reach the impacted area due to muddy conditions and the risk of the equipment getting stuck. To prevent the fire from reaching nearby homes, the Aviation Unit made four drops for fire suppression, and units from Lake Hills, Crown Point, and Cedar Lake Departments also provided much needed assistance.

Due to the expansive acreage of cropland and woods in the southern areas of Lake County, and the potential for large urban areas to be at risk because of abandoned homes, blighted areas, or high density residential areas, the Planning Committee determined the probability to be "Possible" or "Likely" throughout the County. **Table 3-6** identifies the CPRI rankings for large fire in Lake County.

Table 3-6 CPRI for Fire

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Cedar Lake	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of Crown Point	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Dyer	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of East Chicago	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of Gary	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Griffith	Possible	Critical	< 6 Hours	< 1 Week	Elevated
City of Hammond	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Highland	Possible	Significant	< 6 Hours	< 1 Week	Elevated
City of Hobart	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
City of Lake Station	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Lowell	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Merrillville	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Munster	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of New Chicago	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Schererville	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Schneider	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of St. John	Possible	Critical	< 6 Hours	< 1 Week	Elevated
City of Whiting	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Winfield	Possible	Limited	< 6 Hours	< 6 Hours	Elevated

Few reports were provided for small to moderate wildfires within Indiana, but none provided information related to property or structural damages, or any injuries or deaths resulting from the fire. An article from the UPI discusses an event from 2010 affecting several counties in east-central Indiana. Several homes were evacuated, and the fire reached nearly 1,000 acres. At this same time, the Mayor of Indianapolis issued a burn ban due to the extremely dry weather.

Information provided by the City of Merrillville Fire Department in Error! Reference source not found. includes loss value statistics between 2012 and 2017. As can be observed from this information, annual damages to structure, contents, and vehicles have been routinely near or over $1.0M. Social losses, such as being unable to work following a residential structure fire or losses associated with a business fire are not included in these statistics. As many other municipalities face fires daily, it can be assumed these figures are relevant throughout Lake County.

Table 3-7 Lake County Example Annual Fire Loss Values

	2013	2014	2015	2016	2017	2018
Merrillville	$0.2M	$1.0M	$2.4M	$1.7M	$0.9M	$0.6M

Fire: Assessing Vulnerability

A fire typically affects a large regional area with potential for physical, economic, and/or social losses. Typically, a structural fire affects one or two structures, as one of the main functions of fire response is to prevent the fire from spreading to neighboring structures. This type of action works to reduce the magnitude and severity to primarily "Limited" throughout the County and municipalities. In some areas, such as Griffith, Highland, and St. John, severity is anticipated to be higher due to the increased number of structures at-risk, in close proximity to each other, and based on historical reference. Direct and indirect effects of a such an event within Lake County may include:

Direct Effects:

- Loss of structures
- Loss of production crop
- Loss of natural resources

Indirect Effects:

- Loss of revenue as businesses may be closed
- Increased emergency response times based on safety of roads
- Loss of income if dependent on crop production

Estimating Potential Losses

Given the nature and complexity of a potentially large hazard such as a fire, it is difficult to quantify potential losses to property and infrastructure. As a result, all critical and non-critical structures and infrastructure may be at some degree of risk.

Monetary damages associated with the direct effects of the fires are difficult to estimate, other than utilizing historic information as provided in **Table 3-7**. Indirect effects would cause increased efforts associated with emergency response services as wildfires are difficult to contain and may accelerate very quickly. Further, multi-level business or residential structures place increased risks to those who work or live within those structures or nearby structures.

Future Considerations

As populations increase and communities continue to grow, the need to respond to large fires will remain an important municipal effort. As new construction or re-development occurs, especially new or existing critical infrastructure, it is important to ensure that these new structures are equipped to deal with the potential risks associated with this hazard. These may include increased risk for wooden or flammable outer structures and potential lengthy power outages.

In addition, increased populations require increased housing. Many urban communities develop large multi-family residential structures, or apartment complexes, where structures are not only in close proximity to each other, but also

contain a large number of citizens. As communities then age, some structures, perhaps even the same complexes just mentioned, may become abandoned, significantly increasing the risk of fire due to potential vagrant populations and lack of maintenance. These areas should be considered at-risk and potentially demolished to avoid such risk and potential hazard.

Fires can also result in substantial indirect costs. Increased emergency response times, loss of work or the inability to get to work, as well as business interruption, are possible indirect effects of a fire and how it may affect those businesses directly related to cropland or natural resource areas.

Fire: Relationship to Other Hazards

Fires may certainly result in a hazardous materials incident if storage structures are within the path of the burn. Material storage containers farther away from the burn path may become damaged by high winds and embers resulting in a spill or release of materials.

Fires may result from lightning associated with a thunderstorm. Typical wind speeds during a thunderstorm may also exacerbate the impacts from any ignitions from the lightning.

3.3.5 **Flood**

Flood: Overview

Floods are the most common and widespread of all the natural disasters. Most communities in the United States have experienced some degree of flooding after spring rains, heavy thunderstorms, or winter snow melts. A flood, as defined by the NFIP, is "a general and temporary condition of partial or complete inundation or 2 or more acres of normally dry land area or of 2 or more properties from overflow of inland or tidal waters and unusual and rapid accumulation or runoff of surface waters from any sources, or a mudflow". Floods can be slow or fast-rising but generally develop over a period of days.

Flooding (and the associated flood damages) is most likely to occur during the spring because of heavy rains combined with melting snow. However, provided the right saturated conditions, intense rainfall of short duration during summer rainstorms are capable of producing damaging flash flood conditions.

The traditional benchmark for riverine or coastal flooding is a 1% Annual Exceedance Probability (AEP), or the 100-year flood. This is a benchmark used by FEMA to establish a standard of flood protection in communities throughout the country. The 1% AEP is referred to as the "regulatory" or "base" flood. Another term commonly used, the "100-year flood", is often incorrectly used and can be misleading. It does not mean that only 1 flood of that size will occur every 100 years. What it actually means is that there is a 1% chance of a flood of that intensity and elevation happening in any given year. In other words, the regulatory flood elevation has a 1% chance of being equaled, or exceeded, in any given year and it could occur more than once in a relatively short time period.

Flood: Recent Occurrences

The NCDC reports that between September 2010 and March 2018, there were 24 flood events (11 floods and 23 flash floods) that resulted in approximately $70K in property damages, and $5K additional crop damages. NCDC indicates that many events occurred during March of 2014 in several communities. While not many damage reports are provided, event narratives include reports of stranded cars, water overtopping roads and the flooding of major intersections which impeded traffic.

During the planning process for this MHMP Update, northwest Indiana experienced record flooding following snow melt and several inches of rain during February 2018. In Lake Station, more than 50 homes were voluntarily evacuated, and the town blocked several roads impacted by flood waters. The City of Hobart was also impacted as flood waters filled a bank, several roads, and the library. Sandbags were made available in several locations and dams were watched for impacts associated with flood waters and water overtopping spillways.

Appendix 6 provides the NCDC information regarding flood events that have resulted in injuries, deaths, or monetary damages to property and/or crops.

Figure 3-14 View of USGS Gage location on Kankakee River at Shelby

Stream gages are utilized to monitor surface water elevations and/or discharges at key locations and time periods. Some such gages are further equipped with NWS's Advanced Hydrologic Prediction Service (AHPS) capabilities. These gages have the potential to provide valuable information regarding historical high and low water stages, hydrographs representing current and forecasted stages, and a map of the surrounding areas likely to be flooded. Within Lake County, there are four active USGS stream gage equipped with AHPS capabilities where during times of high water, forecasted river stages are made available: Deep River at Hobart, Hart Ditch at Dyer, Little Calumet River at Munster, and Kankakee River at Shelby (**Figure 3-14**).

Any property having received two insurance claim payments for flood damages totaling at least $1,000, paid by the NFIP within any 10-year period since 1978 is defined as a repetitive loss property. These properties are important to the NFIP because they account for approximately one-third of the country's flood insurance payments. According to FEMA Region V, there are a total of 179 repetitive loss properties within Lake County outlined further in **Table 3-8**.

There have been several claims made for damages associated with flooding in Lake County. Within the Town of Griffith, there have been 69 paid losses resulting in approximately $1.2M in payments. Further, within the City of Hammond, there were 67 payments totaling approximately $406K. Table 3-6 also identifies the number of claims per NFIP community as well as payments made.

Table 3-8 Repetitive Loss Properties, Claims, and Payments

COMMUNITY	# OF REPETITIVE LOSS PROPERTIES	CLAIMS SINCE 1978	$$ PAID
Lake County	14	122	$0.7M
Town of Cedar Lake	0	4	$2.0K
City of Crown Point	3	41	$229.8K
Town of Dyer	11	143	$2.0M
City of East Chicago	1	2	$71.7K
City of Gary	7	99	$802.9K
Town of Griffith	25	279	$2.6M
City of Hammond	30	477	$1.5M
Town of Highland	27	804	$9.3M
City of Hobart	0	15	$157.1K
City of Lake Station	18	109	$4.2M
Town of Lowell	0	8	$66.8K
Town of Merrillville	13	132	$902.7K
Town of Munster	27	575	$24.6M
Town of New Chicago	0	0	$0
Town of Schererville	1	36	$916.9K
Town of Schneider	2	15	$43.9K
Town of St. John	0	5	$19.0K
City of Whiting	0	7	$7.5K
Town of Winfield	0	0	$0
TOTAL	**179**	**2,873**	**$48.0M**

(IDNR, 2017)
(FEMA Region V, 2017)

Mandatory flood insurance purchase requirements apply to structures in the 1% AEP. Total flood insurance premiums for Lake County and the NFIP communities is approximately $1.6M. Total flood insurance coverage for Lake County is nearly $401.3M. **Table 3-9** further indicates the premiums and coverage totals for individual NFIP communities.

Table 3-9 Insurance Premiums and Coverage

COMMUNITY	FLOOD INSURANCE PREMIUMS	FLOOD INSURANCE COVERAGE
Lake County	$199.2K	$31.5M
Town of Cedar Lake	$23.2K	$5.0M
City of Crown Point	$50.8K	$12.2M
Town of Dyer	$135.5K	$41.5M
City of East Chicago	$2.4K	$1.5M
City of Gary	$95.0K	$23.0M
Town of Griffith	$152.0K	$23.9M
City of Hammond	$221.4K	$50.4M
Town of Highland	$161.3K	$48.1M
City of Hobart	$47.7K	$12.2M
City of Lake Station	$58.3K	$4.8M
Town of Lowell	$46.3K	$6.7M
Town of Merrillville	$125.5K	$35.6M
Town of Munster	$118.8K	$63.6M
Town of New Chicago	$373	$0.4M
Town of Schererville	$107.5K	$31.4M
Town of Schneider	$47.1K	$3.9M
Town of St. John	$12.1K	$4.6M
City of Whiting	$0	$0
Town of Winfield	$1.5K	$1.1M
TOTAL	**$1.6M**	**$401.3M**

(IDNR, 2017)

As determined by the Committee, the probability of a flood occurring throughout Lake County ranges from "Possible" in East Chicago and Whiting; "Likely" within Cedar Lake, Crown Point, Hammond, Hobart, Lowell, and Munster; and "Highly Likely" in all other areas of the county. Impacts from such an event are anticipated to range from "Negligible" to "Significant" based primarily on the amount of floodplain present within or near each community and the estimated number of structures within those areas. The Committee also determined that the warning time would vary based on stream gage location, forecasting methods and local knowledge of stream activities, and that the duration of such an event is anticipated to last between less than one day in some areas and greater than one week for others. A summary is shown in **Table 3-10**.

Table 3-10 CPRI for Flood

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Highly Likely	Critical	12-24 Hours	> 1 Week	Severe
Town of Cedar Lake	Likely	Limited	6-12 Hours	< 1 Week	Elevated
City of Crown Point	Likely	Critical	6-12 Hours	< 1 Week	Elevated
Town of Dyer	Likely	Limited	12-24 Hours	< 1 Week	Elevated
City of East Chicago	Possible	Limited	6-12 Hours	< 1 Week	Elevated
City of Gary	Highly Likely	Limited	6-12 Hours	< 1 Week	Severe
Town of Griffith	Highly Likely	Critical	12-24 Hours	< 1 Week	Severe
City of Hammond	Likely	Critical	> 24 Hours	< 1 Week	Elevated
Town of Highland	Highly Likely	Significant	12-24 Hours	< 1 Week	Severe
City of Hobart	Highly Likely	Critical	12-24 Hours	> 1 Week	Severe
City of Lake Station	Highly Likely	Critical	> 24 Hours	> 1 Week	Severe
Town of Lowell	Highly Likely	Critical	6-12 Hours	> 1 Week	Severe
Town of Merrillville	Highly Likely	Critical	6-12 Hours	> 1 Week	Severe
Town of Munster	Likely	Significant	6-12 Hours	> 1 Week	Severe
Town of New Chicago	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Schererville	Likely	Limited	6-12 Hours	> 1 Week	Elevated
Town of Schneider	Highly Likely	Critical	6-12 Hours	> 1 Week	Severe
Town of St. John	Highly Likely	Limited	12-24 Hours	< 1 Week	Elevated
City of Whiting	Possible	Negligible	6-12 Hours	< 1 Day	Low
Town of Winfield	Highly Likely	Limited	6-12 Hours	> 1 Week	Severe

As mentioned within this section, there is a 1% chance each year that the regulatory flood elevation will be equaled or exceeded, and these types of events may occur more than once throughout each year. Further, based on information provided by the USGS/NWS stream gages, the NCDC, and previous experiences, the Committee determined that flooding is "Unlikely" in New Chicago to "Highly Likely" in many municipalities throughout Lake County. These differences are based primarily on the presence or absence of riverine systems and their associated floodplains.

Flood: Assessing Vulnerability

Flood events may affect large portions of Lake County at one time as large river systems and areas with poor drainage cover much of the county and several communities. Within Lake County, direct and indirect effects of a flood event may include:

Direct Effects:

- Structural and content damages and/or loss of revenue for properties affected by increased water
- Increased costs associated with additional response personnel, evacuations, and sheltering needs

Indirect Effects:

- Increased response times for emergency personnel if roads are impassable
- Increased costs associated with personnel to carry out evacuations in needed areas
- Increased risk of explosions and other hazards associated with floating propane tanks or other debris
- Losses associated with missed work or school due to closures or recovery activities
- Cancellations of special events in impacted areas or water related activities that become too dangerous due to high water

Estimating Potential Losses

Figure 3-15 Car Submerged on Flooded Street

Critical and non-critical structures located in regulated floodplains, poorly drained areas, or low-lying areas (**Figure 3-15**) are most at risk for damages associated with flooding. For this planning effort, a GIS Desktop Analysis methodology was utilized to estimate flood damages.

For the GIS Desktop Analysis method, an analysis was completed utilizing the effective Digital FIRMs (DFIRMs) overlaid upon the Modified Building Inventory provided by Lake County and structures located within each flood zone were tallied using GIS analysis techniques.

An analysis was completed utilizing the effective Digital FIRMs (DFIRMs) overlaid upon the parcel data provided by Lake County. It was assumed that a building was located on a parcel if the value listed in the "Assessed Value (Improvements)" showed a value greater than zero dollars. Parcels that intersected any portion of the FEMA flood zones were considered to be flood prone, and subsequently, further analyzed separately from parcels without structures. Structure values were calculated using:

Residential = Assessed Value x 0.5
Commercial = Assessed Value x 1.0
Industrial = Assessed Value x 1.5
Agricultural = Assessed Value x 1.0
Education = Assessed Value x 1.0
Government = Assessed Value x 1.0
Religious = Assessed Value x 1.0

The resulting Modified Building Inventory was used in the GIS analyses.

To estimate anticipated damages associated with each flood in Lake County and NFIP communities, it was estimated that 25% of structures in the flood zones would

be destroyed, 35% of structures would be 50% damaged, and 40% of structures would be 25% damaged. **Table 3-11** identifies the estimated losses associated with structures in the floodway, the 1% AEP (100-year floodplain), and the 0.2% AEP (500-year floodplain) areas by NFIP community within Lake County.

Table 3-11 Manual GIS Analysis Utilizing Most Recent Preliminary DFIRM Data and Lake County Building Inventory

	FLOODWAY		1% AEP		0.2% AEP		UNNUMBERED	
	#	$	#	$	#	$	#	$
Lake County	626	$42.6M	2,799	$177.6M	4,673	$270.0M	452	$27.0M
Town of Cedar Lake	2	$0.1M	27	$1.5M	1	$0.05M	29	$1.8M
City of Crown Point	42	$2.7M	98	$5.7M	132	$7.3M	0	$0
Town of Dyer	7	$0.4M	167	$9.6M	161	$9.0M	0	$0
City of East Chicago	1	$0.2M	3	$0.7M	1	$0.2M	0	$0
City of Gary	42	$2.4M	244	$20.4M	35	$2.4M	45	$2.5M
Town of Griffith	4	$0.2M	446	$28.3M	234	$13.2M	0	$0
City of Hammond	0	$0	160	$9.1M	1,056	$58.7M	331	$20.0M
Town of Highland	27	$2.0M	172	$15.4M	1,207	$70.0M	331	$20.0M
City of Hobart	55	$3.3M	106	$6.2M	142	$8.9M	0	$0
City of Lake Station	84	$5.0M	65	$3.6M	192	$10.9M	0	$0
Town of Lowell	22	$2.0M	48	$3.5M	32	$2.2M	0	$0
Town of Merrillville	51	$3.1M	137	$8.0M	63	$3.8M	14	$0.8M
Town of Munster	1	$0.06M	11	$0.6M	1,171	$69.3M	0	$0
Town of New Chicago	11	$0.7M	1	$0.06M	2	$0.1M	0	$0
Town of Schererville	68	$7.7M	204	$14.9M	96	$5.4M	3	$0.2M
Town of Schneider	0	$0	135	$9.4M	0	$0	0	$0
Town of St. John	27	$2.1M	51	$3.2M	40	$2.5M	21	$1.3M
City of Whiting	0	$0	1	$0.2M	0	$0	0	$0
Town of Winfield	11	$0.6M	10	$0.5M	0	$0	0	$0
Total	**1,081**	**$75.16M**	**4,885**	**$318.5M**	**9,238**	**$534.4M**	**1,226**	**$73.6M**

Structures and damages within each zone are not inclusive

Utilizing the same GIS information and process, **Error! Reference source not found.** identifies the number of critical infrastructure within each of the Special Flood Hazard Areas (SFHA) in Lake County. These buildings are included in the overall number of structures and damage estimate information provided in Table 3-7.

Table 3-12 Critical Infrastructure in SFHA

COMMUNITY	FLOODWAY	1% AEP	0.2% AEP
Lake County	Lake Dalecarlia Dam (East and West)	Shelby Fire Dept, Lowell Library-Shelby Branch, Mobil Oil Studer's Corner, Proedge, Inc, Range Line Presbyterian Church, Grand Kankakee Marsh Park, Shelby Community Park	
City of Crown Point	Will Tree Park		
Town of Dyer		Small Wonders Daycare, Fire Station #1, Exxon, Franciscan St. Margaret Health, Fresenius Medical Center, Elmer Miller Park, Pheasant Hills Park, Police Station	Veterans Park
City of East Chicago	Tower	Tower	
City of Gary		Tower (3), Airport, Dams (4), Fire Station 10, Flying J Travel Plaza, Gas City, Lovely Mobil, Fresenius Medical Care, Gleason Park, Industrial Park, Lake Etta County Park, Potable Water (2), Lighthouse Charter School	Cell Tower
Town of Griffith		Towers (4), Prazair Services	Internal Medicine Center
City of Hammond			Target
Town of Highland	Sheppard Park	Towers (3), Prompt Ambulance Service, Industrial Engine Service, Mobil, Carlson/Oxbow Park, Meadows Outlet Park, Petit Park	Markley Memorial Park, Terrace Park, Southridge Elementary
City of Hobart	Lake George Dam		Lakefront Park, Riverfront Park
City of Lake Station	Tower, Hobart Deep River Dam, Flying J Travel Plaza, Road Ranger #239, Independence Park		Towers (4), Miller Park

Town of Merrillville	Devonshire Park	Tower, Race Way Gas Station, Speedway, Independence Park, Indiana American Water	Towers (2), Deep River County Park
Town of Munster		Centennial Park Club House, Lakewood Park	Franciscan Health Heliport, Lansing Airport, Hammond Clinic, Water Tower, South Side Christian Church, Munster Schools Transportation, North Side Marathon, Medical Offices, ARA Dialysis, Broadmoor Clinic, Cardiovascular Consultants, Care Center at Hartsfield Village, Diagnostic Center, Fountain View, Franciscan Physicians, Health Center, The Commons, Hartfield Village, Beech Park, Cobblestone Park, Veterans Memorial Park, West Lakes Park, White Oak Park, River Bend Water Tanks, Superior Ave Water Tank, Water Tanks, James B Eads Elementary, Bus Barn, Cobblestone Pump Station
Town of Schererville	Tower	Tower, Schererville Public Works, Avery Dennison, Buckeye Terminals, Midwest Pipe Coating, WWTP	
Town of Schneider		Tower, Fire Station, Community Building, Municipal Park, Carb-Rite, Police Dept, Water Tower	
Town of St. John	Fire Training Site, Homestead Acres Park	Tower, Lake Hills Dam, Well	

The Town of Cedar Lake, City of Hammond, Town of Lowell, Town of New Chicago, and City of Whiting had no critical infrastructure within the SFHA and therefore, were not included in the Table 3-12.

Utilizing the information in Table 3-7 regarding the number of structures within each Flood Hazard Area, it is also important to note the number of flood insurance policies within each NFIP area in Lake County. **Table 3-13** provides the comparison between the number of structures in the SFHA and the number of flood insurance policies. It is also important to note that flood insurance is voluntary unless the property owner carries a federally subsidized mortgage; insurance coverage may be discontinued when the mortgage is completed.

Table 3-13 Number of Structures in the SFHA and Number of Flood Insurance Policies

COMMUNITY	# STRUCTURES IN SFHA	# POLICIES
Lake County	8,098	222
Town of Cedar Lake	59	28
City of Crown Point	272	52
Town of Dyer	335	157
City of East Chicago	5	7
City of Gary	321	78
Town of Griffith	684	108
City of Hammond	1,216	258
Town of Highland	1,406	217
City of Hobart	303	50
City of Lake Station	341	35
Town of Lowell	102	32
Town of Merrillville	251	150
Town of Munster	1,183	231
Town of New Chicago	14	1
Town of Schererville	368	128
Town of Schneider	0	40
Town of St. John	118	16
City of Whiting	1	0
Town of Winfield	21	4
Total	**15,098**	**1,814**

(IDNR, 2017)

Future Considerations

As the municipalities within Lake County continue to grow in population, it can be anticipated that the number of critical and non-critical infrastructure will also increase accordingly. Location of these new facilities should be carefully considered and precautions should be encouraged to ensure that school, medical facilities,

community centers, municipal buildings, and other critical infrastructure are located outside the 0.2% AEP (500-year) floodplain and/or are protected to that level along with a flood-free access to reduce the risk of damages caused by flooding and to ensure that these critical infrastructure will be able to continue functioning during major flood events. Flooding along Lake Michigan is also an important consideration for several Lake County municipalities. East Chicago, Gary, Hammond, and Whiting have significant portions of their community situation on the shores of Lake Michigan. It will be important for recognition of potential flood impacts to residents and businesses in these areas to be coupled with proper planning for future development and redevelopment of the coastal flood zones.

In several areas along the Kankakee River in southern Lake County, local landowners have enhanced existing dredge spoil piles or created new berms meant to provide limited, local flood control. It is important to note that these spoil piles or berms are not levees, are not accredited through the Army Corps of Engineers, and do not provide flood protection such that reductions in flood insurance premiums can be provided. However, under the direction of the Kankakee River Basin Commission, several reports and studies have been completed which propose recommendations to reduce impacts associated with flood events. The most recent effort, through the assistance of Christopher B. Burke Engineering, LLC, still underway as of the writing of this plan, is the Kankakee River Flooding and Erosion Management Workplan. This plan will outline several recommendations meant to address the main issues of drainage, flood control, and sedimentation of the Kankakee River. Implementing recommendations within this plan, and from previous plans, may assist Lake County in reducing the overall vulnerability to flooding in the entire southern half of the county.

It is also important to ensure that owners and occupants of residences and businesses within the known hazard areas, such as delineated or approximated flood zones, are well informed about the potential impacts from flooding incidents as well as proper methods to protect themselves and their property.

Despite these efforts, the overall vulnerability and monetary value of damages is expected to increase in the area unless additional measures, such as those discussed later in Chapter 4 of this report, are implemented.

Indirect effects of flooding may include increased emergency response times due to flooded or redirected streets (**Figure 3-16**), the danger of dislodged and floating propane tanks causing explosions, and the need for additional personnel to carry out the necessary evacuations. Additional effects may include sheltering needs for those evacuated, and the loss of income or revenue related to business interruptions. As many communities within Lake County are closely tied to the river systems, special events occurring near to or on these rivers and waterways may be cancelled or postponed during periods of flooding or high-water levels.

Flood: Relationship to Other Hazards

While flooding creates social, physical, and economic losses, it may also cause other hazards to occur. For example, flooding may increase the potential for a hazardous materials incident to occur. Above ground storage facilities may be toppled or become loosened and migrate from the original location. In less severe situations, the materials commonly stored in homes and garages such as oils, cleaners, and de-greasers, may be mobilized by flood waters. Should access roads to hazardous materials handlers become flooded, or if bridges are damaged by flood waters, response times to more significant incidents may be increased, potentially increasing the damages associated with the release.

Increased volumes of water during a flood event may also lead to dam or levee failures. As the water levels rise in areas protected by dams or levees, at some point, these structures may over-top or breach leading to even more water released. These two hazards, flood and dam and levee failure, when combined, may certainly result in catastrophic damages.

Figure 3-16 Fire Engine in Flood Waters

In a similar fashion, a snow storm or ice storm can also lead to flooding on either a localized or regional scale. When a large amount of snow or ice accumulates, the potential for a flood is increased. As the snow or ice melts, and the ground becomes saturated or remains frozen, downstream flooding may occur. Ice jams near bridges and culverts may also result in flooding of localized areas and potentially damage the bridge or culvert itself.

Flooding in known hazard areas may also be caused by dams that experience structural damages or failures not related to increased volumes or velocities of water. These "sunny day failures", while not typical, may occur wherever these structures exist.

3.3.6 Hailstorms, Thunderstorms, and Windstorms

Hailstorms, Thunderstorms, and Windstorms: Overview

Hail occurs when frozen water droplets form inside a thunderstorm cloud, and then grow into ice formations held aloft by powerful thunderstorm updrafts. When the weight of the ice formations becomes too heavy, they fall to the ground as hail. Hail size ranges from smaller than a pea to as large as a softball, and can be very destructive to buildings, vehicles (**Figure 3-17**), and crops. Even small hail can cause significant damage to young and tender plants. Residents should take cover immediately in a hailstorm, and protect pets and livestock, which are particularly vulnerable to hail, and should be under shelter as well.

Figure 3-17 Damaging Hail on Vehicles

Thunderstorms are defined as strong storm systems produced by a cumulonimbus cloud, usually accompanied by thunder, lightning, gusty winds, and heavy rains. All thunderstorms are considered dangerous as lightening is one of the by-products of the initial storm. In the United States, on average, 300 people are injured, and 80 people are killed each year by lightning. Although most lightning victims survive, people struck by lightning often report a variety of long-term, debilitating symptoms. Other associated dangers of thunderstorms included tornadoes, strong winds, hail, and flash flooding.

Windstorms or high winds can result from thunderstorm inflow and outflow, or downburst winds when the storm cloud collapses, and can result from strong frontal systems, or gradient winds (high or low-pressure systems). High winds are speeds reaching 50 mph or greater, either sustained or gusting.

Hailstorm, Thunderstorm, and Windstorm: Recent Occurrences

In Lake County, the NCDC has recorded 52 hailstorms, 14 high wind events, and 72 thunderstorms/windstorms between September 2010 and March 2018. The largest recorded hailstone was 2.75 inches in diameter and has occurred on July 13, 2015 in Calumet City.

Significant windstorms are characterized by the top wind speeds achieved during the incident, characteristically occur in conjunction with thunderstorms, and have historically occurred year-round with the greatest frequency and damage occurring in May, June, and July. Within Lake County, NCDC reports 69 instances between September 2010 and March 2018 where top wind speeds were greater than 60 mph.

Total NCDC recorded damages for hailstorms, thunderstorms, and windstorms throughout Lake County are $1.134M in property damages, an additional $25.0K in crop damages, and no injuries or deaths have been reported regarding these events.

Many event reports included in the NCDC did not provide descriptive information on the social, physical, and economic losses resulting from individual storms specific to Lake County. Appendix 6 provides the NCDC information regarding hailstorms, thunderstorms, and windstorms that have resulted in injuries, deaths, and monetary damages to property and/or crops.

During the June 4, 2011 event in Dinwiddie, approximately $300K in property damages was caused as a semi-truck was blown over, a roof of the weigh station was damaged, and hundreds of trees were snapped or uprooted. Additional reports included garages, outbuildings, and grain buildings damaged along with five metal tress electrical towers collapsed near Route 2 and Clay Street.

A later event May 20, 2012 occurred near the unincorporated areas of Gary, causing severe damages to a strip mall, shattering windows and collapsing a wall of the building. Trees were blown onto homes, many were snapped, and the majority of the damages were located between 41st Ave and 45th Ave near Cleveland Street, totaling approximately $250K.

According to the Institute for Business and Home Safety, central Indiana can expect to experience damaging hailstorms 3-4 times over 20 years; the average life of a residential roof. Further, thunderstorms and windstorms are considered a high frequency hazard and may occur numerous times per year.

The Committee determined the probability of a hailstorm, thunderstorm, or windstorm occurring in Lake County is "Highly Likely" and will typically affect broad portions of the county at one time resulting in potentially "Limited" to "Critical" damages. As advancements in technologies such as weather radar systems and broadcast alerts are continually made, the warning time for such incidents may increase. Currently, the Committee feels that the warning time is anticipated to be 6 to 12 hours for most of the communities and 12 to 24 hours for others. The duration of such an event is expected to last less than 1 day.

Indicative of a regional hazard, the probability, magnitude, warning time, and duration of a hailstorm, thunderstorm, or windstorm are expected to be much the same throughout the county. These events are highly unpredictable, and the occurrences are distributed through the county. Therefore, the CPRI values reflect the equally distributed risk and associated priority for a hailstorm, thunderstorm, or windstorm. A summary is provided in **Table 3-14**.

Table 3-14 CPRI for Hailstorm, Thunderstorm, and Windstorm

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Highly Likely	Limited	12-24 Hours	< 1 Day	Elevated
Town of Cedar Lake	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
City of Crown Point	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Dyer	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
City of East Chicago	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
City of Gary	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Griffith	Highly Likely	Limited	12-24 Hours	< 1 Day	Elevated
City of Hammond	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Highland	Highly Likely	Critical	12-24 Hours	< 1 Day	Severe
City of Hobart	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
City of Lake Station	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Lowell	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Merrillville	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Munster	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of New Chicago	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Schererville	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Schneider	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of St. John	Highly Likely	Limited	12-24 Hours	< 1 Day	Elevated
City of Whiting	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Winfield	Highly Likely	Limited	6-12 Hours	< 6 Hours	Elevated

Specific locations and frequency of hailstorms, thunderstorms, and windstorms are difficult to predict as many of these individual events are without significant warning time and may have impacts to very limited areas or may affect broader areas. However, based on NCDC data and personal experiences of the Committee, it was determined that all areas within the County are anticipated to experience a hailstorm, thunderstorm, or windstorm within the calendar year. More likely, these communities will be impacted by several of these hazard events each year.

Hailstorm, Thunderstorm, and Windstorm: Assessing Vulnerability

The effects of a hailstorm, thunderstorm, or windstorm may be minimal to extensive in nature and may affect small or broad ranges of land area. Within Lake County, direct and indirect effects from a hailstorm, thunderstorm, or windstorm may include:

Direct Effects:

- Damages to infrastructure (power lines)
- Damages to individual properties (homes, cars)

Indirect Effects:

- Downed power lines due to falling tree limbs
- Losses associated with power outages
- Damages sustained from blowing debris

Estimating Potential Losses

Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Lake County are at risk of damage including temporary or permanent loss of function. For hailstorms, thunderstorms, and windstorms, it is not possible to isolate specific critical infrastructure or non-critical structures that would be vulnerable to damages. However, areas where utility lines are above ground and areas where dead or dying trees have not been removed may be at a higher risk of property damages or power outages during hailstorms, thunderstorms, and windstorms. Additionally, mobile homes and accessory buildings such as pole barns and sheds may also be at a higher risk of damages from hailstorms, thunderstorms, and windstorms if not properly anchored to the ground. Damages from falling limbs or uprooted trees such as that shown in **Figure 3-18**, are common.

Figure 3-18 Home Damaged During Windstorm

Future Considerations

As the populations of the communities in Lake County continue to grow, it can be anticipated that the number of critical and non-critical structures will also increase. To reduce the vulnerability for damages resulting from a hailstorm, thunderstorm, or windstorm, measures such as proper anchoring, enforcement of the International Building Codes, and burial of power lines should be completed. While measures can be taken to remove existing structures or prevent future structures from being built in known hazard areas such as floodplains and hazardous materials facility buffers, such measures are not applicable to hailstorms, thunderstorms, and windstorms due to the diffuse nature and regional impacts of this hazard.

Indirect effects resulting from a hailstorm, thunderstorm, or windstorm can include power outages caused by downed tree limbs, damages resulting from prolonged power outages, and damages to structures or property as a result of debris.

Hailstorm, Thunderstorm, and Windstorm: Relationship to Other Hazards

Hailstorms, thunderstorms, and windstorms may be the precursor for other hazards. For example, hazardous materials incidents can be the result of a hailstorm, thunderstorm, or a windstorm. Material storage containers can become damaged by high winds, debris, or even lightning, and can result in a spill or release of materials.

With wind speeds greater than 58 mph, tankers and other transportation vehicles carrying hazardous materials are also at risk while on the road. High winds may also cause gaseous substances to travel farther distances at a much faster rate, increasing the evacuation area necessary to protect residents and visitors of Lake County.

Additionally, rainfall typically occurs with a thunderstorm and this additional precipitation may lead to localized flooding or riverine flooding depending on the amount of rain during the event. Debris from a windstorm may also lead to localized flooding if debris is deposited over drains or if obstructions are created by downed limbs, trees, or other storm related debris. A similar concern due to the potential precipitation would be dam and levee failure. High winds may also lead to structural damages to a dam or levee or may cause damages to nearby trees or other structures, leading to indirect damages to the dam or levee.

The risk of social losses also increases during a hailstorm, thunderstorm, or windstorm, as these hazards often result in downed power lines, utility poles, and trees. Debris such as this may impede traffic patterns and make it difficult for emergency vehicles (Fire, EMS, and Police) to pass through affected areas or people may be directly injured because of falling debris.

3.3.7 **Landslide/Subsidence**

Landslide/Subsidence: Overview

The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors. For example, erosion by rivers, glaciers, or ocean waves can cause rock to fall. Rock and soil slopes may be weakened through saturation by snowmelt or heavy rains, earthquakes can create stresses that make weak slopes fail, and excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or man-made structures that may stress weak slopes to the point of collapse.

Land subsidence, according to the USGS, is "a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials". Further, there are three processes that attribute to subsidence: compaction of aquifer systems, drainage and subsequent oxidation of organic soils, and dissolution and collapse of susceptible rocks.

Landslide/Subsidence: Recent Occurrences

The potential for any of landslides or land subsidence within Lake County was discussed by the Planning Committee. To the knowledge of the Planning Committee, there are no Karst areas, underground mines, or many existing areas where a landslide could occur. To date, there has not been any landslides or subsidence events in Lake County.

The Committee determined the probability of a landslide or subsidence occurring in Lake County is "Unlikely" resulting in potentially "Negligible" damages. Currently, the Committee feels that the warning time is anticipated to be less than 6 hours and the duration is also expected to last less than 6 hours. These events are highly unpredictable and the risk, although very low according to the Committee, is distributed throughout the county. Therefore, the CPRI values reflect the distributed risk and associated priority for a landslide or subsidence event. A summary is provided in **Table 3-15.**

Table 3-15 CPRI for Landslide/Subsidence

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Cedar Lake	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Crown Point	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Dyer	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of East Chicago	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Gary	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Griffith	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Hammond	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Highland	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Hobart	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Lake Station	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Lowell	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Merrillville	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Munster	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of New Chicago	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Schererville	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Schneider	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of St. John	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Whiting	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Winfield	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low

Landslide/Subsidence: Assessing Vulnerability

Lake County, without the presence of Karst geology or underground mines, is at a low risk of land subsidence or sink holes. Further, as there is little relief within most of the county, the Planning Committee does not consider landslides to be of much concern.

The effects of a landslide or subsidence event may be minimal to extensive in nature and may affect small or broad ranges of land area. Within Lake County, direct and indirect effects may include:

Direct Effects:

- Damages to infrastructure (power lines, roads, bridges)
- Damages to individual properties (homes, cars)

Indirect Effects:

- Increased response time for emergency vehicles
- Losses associated with affected land (crop loss)
- Potential contamination of groundwater resources

Figure 3-19 Home Swallowed by Land Subsidence

Estimating Potential Losses

Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Lake County are at risk of damage including temporary or permanent loss of function. For landslide and subsidence, it is difficult to isolate specific critical infrastructure or non-critical structures that would be vulnerable to damages. However, areas where karst geology or underground mines have been identified may be at a higher risk of property damages caused by such events (**Figure 3-19)**. To prepare a basic "what-if" scenario, the Indiana karst geology and underground mines GIS layers were overlaid onto aerial photography and parcel data provided by the County. There are no areas of Karst geology or underground mines within Lake County.

Future Considerations

As the populations of the communities in Lake County continue to grow, it can be anticipated that the number of critical and non-critical structures will also increase. To reduce the vulnerability for damages resulting from a landslide or land subsidence, soils GIS layers should be integrated into the building permit or approval process.

Indirect effects resulting from a landslide or land subsidence event can include power outages caused by downed tree limbs, increased response times for emergency personnel if transportation routes are damaged, and the potential shutdown of businesses.

Landslide/Subsidence: Relationship to Other Hazards

A landslide or a subsidence may be the precursor for other hazards. Depending on the location of the event, material storage containers can become damaged resulting in a spill or release of materials and potentially contaminating groundwater reserves. Dam or levee failures may occur in much the same fashion if located in the potential hazard areas, or resulting from heavy saturation following a rainstorm, heavy snow, or rapid snow melt.

Similarly, these types of an event may be caused by hail, thunder, or windstorms and their effects on the soils; an earthquake may release the ground enough to set a slide in motion; or a flood may add increased soil saturation or weight to at-risk areas increasing the potential for an event and resulting damages.

3.3.8 **Tornado**

Tornado: Overview

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 funnel cloud may reach the ground very quickly – becoming a tornado. If there is debris lifted and blown around by the "funnel cloud", then it has reached the ground and has become a tornado.

A tornado is generated when conditions in a strong cell are produced that exhibit a wall of cool air that overrides a layer of warm air. The underlying layer of warm air rapidly rises, while the layer of cool air drops – sparking the swirling action. The damage from a tornado is a result of the high wind velocity and wind-clown debris. Tornado season is generally April through June in Indiana, although tornadoes can occur at any time of year. Tornadoes tend to occur in the afternoons and evenings; over 80 percent of all tornadoes strike between 3:00 pm and 9:00 pm but can occur at any time of day or night as shown in **Figure 3-20**. Tornadoes occur most frequently in the United States east of the Rocky Mountains. Tornadoes in Indiana generally come from the south through the east.

Figure 3-20 Funnel Cloud During a Lightning Storm at Night

While most tornadoes (69%) have winds of less than 100 mph, they can be much stronger. Although violent tornadoes (winds greater than 205 mph) account for only 2% of all tornadoes, they cause 70% of all tornado deaths. In 1931, a tornado in Minnesota lifted an 83-ton rail car with 117 passengers and carried it more than 80 feet. In another instance, a tornado in Oklahoma carried a motel sign approximately 30 miles and dropped it in Arkansas. In 1975, a Mississippi tornado carried a home freezer more than a mile.

Tornado: Recent Occurrences

The classification of tornadoes utilizes the Enhanced Fujita Scale of tornado intensity and damages, described in **Table 3-16**. Tornado intensity ranges from low intensity (EF0) tornadoes with effective wind speeds of 65-85 mph to high intensity (EF5+) tornadoes with effective wind speeds of 200+ mph. According to the NCDC, Lake County has experienced 6 tornadoes since the last planning effort. All have been a category EF1 and all occurred on June 30, 2014, in various locations throughout the county.

Table 3-16 Enhanced Fujita Scale of Tornado Intensity

EF-SCALE	WINDS	CHARACTER OF DAMAGE	RELATIVE FREQUENCY	TYPICAL DAMAGES
EF0	65-85 mph	Light damage	29%	Shallow rooted trees blown over; damage to roofs, gutters, siding
EF1	86-110 mph	Moderate damage	40%	Mobile homes overturned, roofs stripped, windows broken
EF2	111-135 mph	Considerable damage	24%	Large trees snapped, light-object missiles generated, cars lifted
EF3	136-165 mph	Severe damage	6%	Severe damages to large buildings, trains overturned
EF4	166-200 mph	Devastating damage	2%	Whole houses destroyed, cars thrown
EF5	200+ mph	Incredible damage	<1%	High-rise buildings with significant damage, strong framed homes blown away

The NCDC reports for June 30, 2014 affected six different communities and resulted in approximately $220K in property damages. Damages for North Hayden were estimated to be $100K. The tornado began at 197th Avenue, west of Hwy 41 and damage reports included downed trees and the roof of a large barn. Power poles and grain bins were damaged east of Harrison Street, while a wooden barn was destroyed by winds estimated at 110 mph. Reports near Schneider described a tornado formation near Colfax St and Whitcomb St, causing snapped tree limbs and a twisted five-foot diameter tree in the area of 265th Ave west of Shelby.

The Committee estimated the probability of a tornado occurring in Lake County would be "Possible" and the magnitude and severity of such an event to be "Critical" within all areas of the County. As with many hazardous events, the Committee anticipated a short warning time, less than 6 hours, and a short duration, also less than 6 hours. The summary is shown in **Table 3-17**.

Table 3-17 CPRI for Tornado

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Cedar Lake	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
City of Crown Point	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Dyer	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
City of East Chicago	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
City of Gary	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Griffith	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
City of Hammond	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Highland	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
City of Hobart	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
City of Lake Station	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Lowell	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Merrillville	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Munster	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of New Chicago	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Schererville	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Schneider	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of St. John	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
City of Whiting	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Winfield	Possible	Critical	< 6 Hours	< 6 Hours	Elevated

The Indiana State Climate Office estimates that throughout Indiana, there is an average of 20 tornado touchdowns per year. Based on the number of tornado touchdowns previously reported through the NCDC and local weather agencies, the Committee determined the general probability of a future tornado occurring in Lake County is "Possible" (within the next 5 years).

Tornado: Assessing Vulnerability

As a path of a tornado is not pre-defined, it is difficult to isolate specific critical infrastructure and non-critical structures, or areas of Lake County that would be vulnerable to a tornado. Direct and indirect effects from a tornado may include:

Direct Effects:

- Damages to older construction structures, mobile homes, and accessory structures (pole barns, sheds, etc.)
- Damages to above ground utility lines and structures

Indirect Effects:

- Expenses related to debris clean-up and/or reconstruction
- Loss of revenue for affected businesses

- Loss of work if employers are affected

Estimating Potential Losses

Due to the unpredictability of this hazard, all critical and non-critical structures within the County are at risk of future damage or loss of function. Estimates of potential physical losses were determined through a hypothetical exercise where an EF2 intensity tornado traveled through portions of the County. This is intended to present a "what-if" scenario of a tornado incident and associated damages. Damage estimates were derived by assuming that 25% of all structures in the path of the tornado would be completely destroyed, 35% of the structures would be 50% damaged, and 40% of the structures would sustain 25% damage. These estimations were also determined utilizing 3 wind speed zones based on distance from the tornado path. Zone A is nearest the center of the tornado path, while Zone C is the farthest from the path and with a theoretically lower wind speed. **Table 3-18** provides summary data for the hypothetical tornado, which is identified on Exhibit 3.

Table 3-18 Summary of Hypothetical Tornado Damages

	Zone 1		Zone 2		Zone 3		Total	
	#	$	#	$	#	$	#	$
County	202	$12.3M	106	$6.0M	109	$6.1M	**417**	**$24.4M**
Gary	265	$15.7M	192	$11.4M	214	$12.7M	**671**	**$39.8M**
Griffith	60	$3.3M	40	$2.2M	46	$2.5M	**146**	**$8.0M**
Hobart	98	$6.1M	80	$4.9M	67	$4.1M	**245**	**$15.1M**
Lake Station	116	$7.2M	68	$4.1M	87	$4.9M	**271**	**$16.2M**
New Chicago	492	$27.2M	31	$1.8M	29	$1.8M	**552**	**$30.8M**
Totals	202	$12.3M	106	$6.0M	109	$6.1M	**417**	**$24.4M**

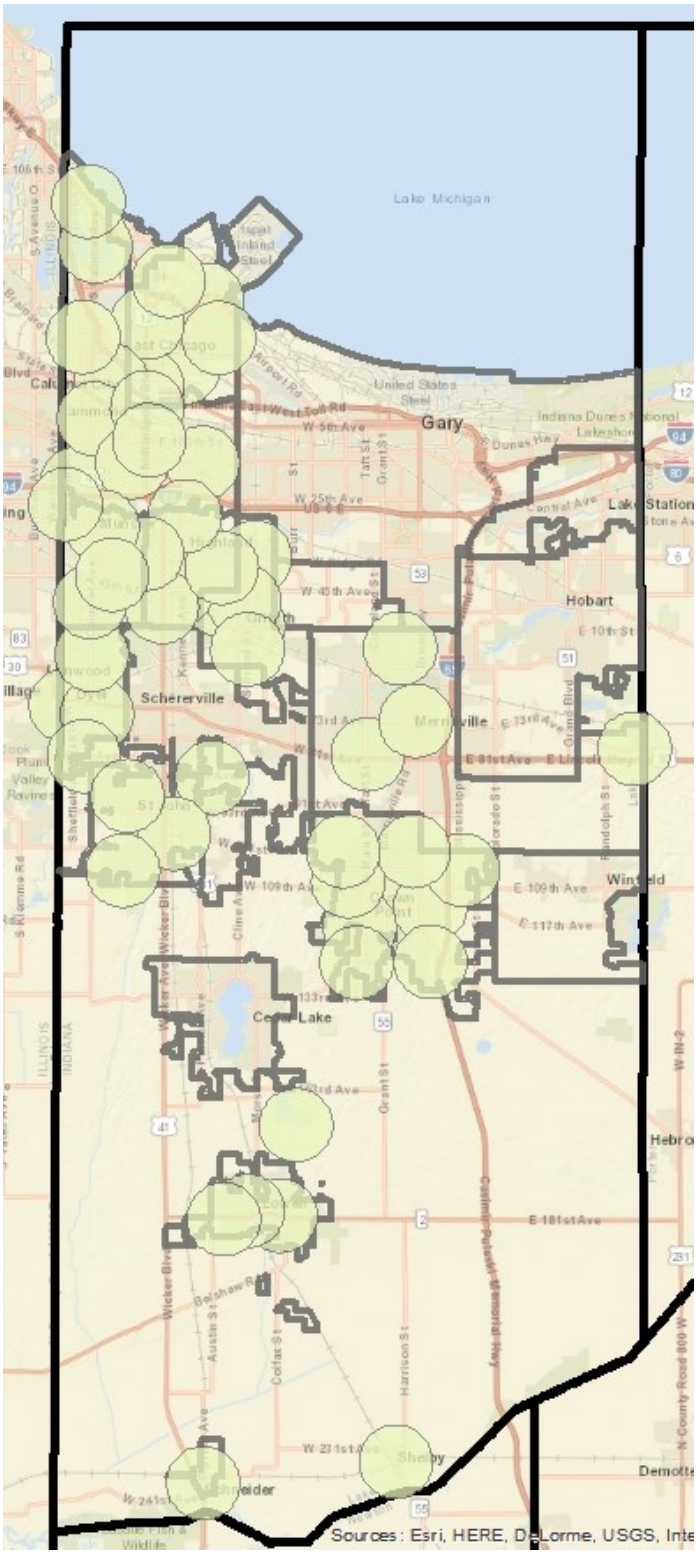


Figure 3-21 Lake County Outdoor Warning Sirens

Future Considerations

Within Lake County, there are numerous events each year that draw thousands of guests. Due to this, it is imperative that the EMA place continued importance on the need to maintain, and as necessary, upgrade their outdoor warning siren coverage. Currently, much of the more populous areas of the County are covered by the audible ranges of the existing outdoor warning sirens. The existing siren locations and their coverage areas are provided in **Figure 3-21**.

There may also be indirect effects of a tornado event. For example, post-event clean-up may result in high expenses or inability to work for property owners that have experienced damages from either the tornado directly or by debris from high winds. Affected business owners may experience loss of revenue if they are unable to continue operations following the event. Similarly, if a business is affected and unable to operate, employees may experience a loss of wages during the period of recovery.

Tornado: Relationship to Other Hazards

Tornadoes may result in a hazardous materials incident. Material storage containers can become damaged by high winds and debris can result in a spill or release of materials. As wind speeds increase, the potential for damages to above ground storage containers also increases. Tankers and other transportation vehicles carrying hazardous materials are also at an increased risk while on the road or rail.

Tornadoes may also result in a dam or levee failure as the increased wind speeds, and debris caused by the tornado, may directly impact the dam, or cause indirect damages through large debris or downed trees. In addition, tornadoes may lead to structural fires as the destruction path is sometimes long and broad, leading to an increased number of potentially damaged homes, exposed power lines, and large amounts of debris.

3.3.9 **Winter Storm & Ice**

Winter Storm & Ice: Overview

A winter storm can range from moderate snow over a few hours to blizzard conditions with high winds, ice storms, freezing rain or sleet, heavy snowfall with blinding wind-driven snow, and extremely cold temperatures that can last for several days. Some winter storms may be large enough to affect several states while others may affect only a single community. All winter storms are accompanied by cold temperatures and blowing snow, which can severely reduce visibility. A winter storm is defined as one that drops 4 or more inches of snow during a 12-hour period, or 6 or more inches during a 24-hour span. An ice storm occurs when freezing rain falls from clouds and freezes immediately on impact. All winter storms make driving and walking extremely hazardous. The aftermath of a winter storm can affect a community or region for days, weeks, and even months.

Figure 3-22 Ice Covered Power Lines

Storm effects such as extreme cold, flooding, and snow and ice accumulation (**Figure 3-22**) can cause hazardous conditions and hidden problems for people in the affected area. People can become stranded on the road or trapped at home, without utilities or other services, including food, water, and fuel supplies. The conditions may overwhelm the capabilities of a local jurisdiction. Winter storms are considered deceptive killers as they may indirectly cause transportation accidents, and injury and death resulting from exhaustion/ overexertion, hypothermia and frostbite from wind chill, and asphyxiation. House fires occur more frequently in the winter due to lack of proper safety precautions.

Wind chill is a calculation of how cold it feels outside when the effects of temperature and wind speed are combined. On November 1, 2001, the NWS implemented a replacement Wind Chill Temperature (WCT) index for the 2001/2002 winter season. The reason for the change was to improve upon the current WCT Index, which was based on the 1945 Siple and Passel Index.

A winter storm watch indicates that severe winter weather may affect your area. A winter storm warning indicates that severe winter weather conditions are on the way. A blizzard warning means that large amounts of falling or blowing snow and sustained winds of at least 35 mph are expected for several hours. Winter storms

are common in Lake County. Such conditions can result in substantial personal and property damage, even death.

Winter Storm & Ice: Recent Occurrences

Since September 2010, the NCDC has recorded 4 winter storms, 2 blizzards, 5 lake-effect snows, and 6 heavy snow events. NCDC reports totaled $110K in property damages and did not include injuries, deaths associated with any of the events. Narrative descriptions indicated poor travel conditions, power outages and debris associated with similar events.

The most recently recorded winter storm event occurred on February 8, 2018. Snowfall totals for the area ranged from 12 inches east of Gary; 9.3 inches northwest of Dyer; and 9.9 inches northwest of Munster. A blizzard occurring on February 1, 2011 is credited with $100K in property damages as the roof of a steel company in Griffith collapsed due to the heavy snow. Many of the region's communities had to assist stranded motorists using plow trucks and even police officers began riding in plow trucks, so they would not become stuck in the snow. Rescue responders used plow truck escorts or personal snowmobiles when responding to emergency calls. Snowfall for this event totaled 20.8 inches in Highland, 15.3 inches in Lowell, and 20.4 inches just west of Schererville.

The probability, magnitude, warning times, and duration of a snow storm or ice storm causing disruption to residents and businesses in Lake County, as determined by the Planning Committee, is expected to be consistent throughout the County and NFIP communities. It is "Highly Likely" that this type of hazard will occur in this area and will typically affect the entire county, and possibly several surrounding counties at one time, resulting in primarily "Limited" severity, although representatives from the Town of Highland anticipate "Significant" damages due to the overall aging population within their community. The Town of St. John anticipates "Critical" damages based on the previous experiences with major crossroads shutdown due to auto crashes and incidents related to heavy snow and ice and traveling. The warning time for severe temperatures or several inches of snow associated with a winter storm is usually greater than 24 hours while the duration of the incident is anticipated to last less than 1 week. A summary is shown in **Table 3-19**.

Table 3-19 CPRI for Winter Storm and Ice

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Cedar Lake	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of Crown Point	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Dyer	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of East Chicago	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of Gary	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Griffith	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of Hammond	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Highland	Highly Likely	Significant	> 24 Hours	< 1 Week	Severe
City of Hobart	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of Lake Station	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Lowell	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Merrillville	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Munster	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of New Chicago	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Schererville	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Schneider	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of St. John	Highly Likely	Critical	> 24 Hours	< 1 Day	Severe
City of Whiting	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Winfield	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated

The Planning Committee determined that the probability for a snow storm or ice storm to occur in Lake County or any of the communities within is "Highly Likely" or will occur within the calendar year. Based on historical data and the experience of the Planning Committee, snow storms are common within Lake County and will continue to be an annual occurrence.

Winter Storm & Ice: Assessing Vulnerability

A snow storm typically affects a large regional area with potential for physical, economic, and/or social losses. Direct and indirect effects of a snow storm or ice storm within Lake County may include:

Direct Effects:

- More urban area employers may experience loss of production as employees may not be able to get to work
- Rural (County) roads may impassable
- Expenses related to snow removal or brine/sand applications

Indirect Effects:

- Loss of revenue as businesses are closed
- Increased emergency response times based on safety of roads

- Loss of income if unable to get to place of employment

Estimating Potential Losses

Given the nature and complexity of a regional hazard such as a snow storm, it is difficult to quantify potential losses to property and infrastructure. As a result, all critical and non-critical structures and infrastructure are at risk from snow storm and ice storm incidents.

For planning purposes, information collected in snow storms impacting other communities around the nation is also useful in assessing the potential social, physical, and economic impact that a winter storm could have on Lake County communities. For example, a March 2003 snow storm in Denver, Colorado dropped approximately 31 inches of snow and caused an estimated $34M in total damages. In addition, a February 2003 winter storm dropped an estimated 15-20 inches of snow in parts of Ohio. The Federal and Ohio Emergency Management Agencies and U.S. Small Business Administration surveyed damaged areas and issued a preliminary assessment of $17M in disaster related costs. These costs included snow and debris removal, emergency loss prevention measures, and public utilities repair. The agencies found over 300 homes and businesses either damaged or destroyed in 6 counties. Snow storms and blizzards also make road travel difficult and dangerous, as in **Figure 3-23**.

Figure 3-23 Travel Impacted During Snow Storm

The Denver, Colorado area snowstorms from December 2006 through January 2007 surpassed the expenses and damages of the 2003 winter storms. In snow removal costs alone, it is estimated that over $19M was spent throughout the area, with approximately $6.4M of that allocated to clearing Denver International Airport. Additional economic expenses are realized when such a large storm closed local businesses and Denver International Airport for nearly 48 hours.

While the above examples indicate the wide-ranging and large-scale impact that winter storms can have on a community or region, winter storms generally tend to result in less direct economic impacts than many other natural hazards. According to the Workshop on the Social and Economic Impacts of Weather, which was sponsored by the U.S. Weather Research Program, the American Meteorological Society, the White House Subcommittee on Natural Disaster Relief, and others, winter storms resulted in an average of 47 deaths and more than $1B in economic

losses per year between 1988 and 1995. However, these totals account for only 3% of the total weather-related economic loss and only 9% of fatalities associated with all weather-related hazards over the same period.

Future Considerations

As populations increase and communities continue to grow, the need to respond to snow storms or ice storms will remain an important municipal effort. As new construction or re-development occurs, especially new or existing critical infrastructure, it is important to ensure that these new structures are equipped to deal with the potential risks associated with this hazard. Those may include lengthy power outages and potentially impassable transportation routes, making it difficult to obtain supplies or for passage of response vehicles.

Winter storms can also result in substantial indirect costs. Increased emergency response times, loss of work or the inability to get to work, as well as business interruption, are possible indirect effects of a winter storm. According to a report by the National Center for Environmental Predictions, the cold and snowy winter in late 1977 and early 1978, which impacted several heavily populated regions of the country, was partially responsible for reducing the nation's Gross Domestic Product (GDP) from an estimated growth rate of between 6% and 7% during the first 3 quarters of 1977 to approximately -1% in the last quarter of 1977 and 3% during the first quarter of 1978.

Winter Storm & Ice: Relationship to Other Hazards

Figure 3-24 Flooding Caused by Snow Melt

Winter storms and ice storms can lead to flooding as the precipitation melts and enters local receiving waters. This increased volume of water on already saturated, or still frozen ground can quickly result in flood-related damages to structures and properties (**Figure 3-24**) as well as within the stream or river channel. The increased flooding may then lead to a dam or levee failure within the same area, further exacerbating the damages.

Hazardous materials incidents may be caused by poor road conditions during winter storms or ice storms. Many hazardous materials are transported by rail or by tanker over highways and interstates. In the more rural areas of Lake County, or where open areas are more susceptible to snow drifts on roads, the possibility of a traffic related hazardous materials incident may increase.

Power outages and other infrastructure failures may also occur during a winter storm. Weight from snow and ice accumulations can directly or indirectly cause power lines to fail. During extreme cold temperatures, power outages may prove deadly for certain populations such as the elderly or ill.

TECHNOLOGICAL HAZARDS

3.3.10 Dam/Levee Failure

Dam/Levee Failure: Overview

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams typically are constructed of earth, rock, concrete, or mine tailings. A dam failure is a collapse, breach, or other failure resulting in downstream flooding.

A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

Of the approximately 80,000 dams identified nationwide in the National Inventory of Dams, the majority are privately owned. Each dam is assigned a downstream hazard classification based on the potential loss of life and damage to property should the dam fail. The three classifications are high, significant, and low. With changing demographics and land development in downstream areas, hazard classifications are updated continually. The following definitions of hazard classification currently apply to dams in Indiana:

- High Hazard Dam: a structure, the failure of which, may cause the loss of life and serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads.

- Significant Hazard Dam: a structure, the failure of which, may damage isolated homes and highways or cause the temporary interruption of public utility services.

- Low Hazard Dam: a structure, the failure of which, may damage farm buildings, agricultural land, or local roads.

A levee is a flood control structure designed to hold water away from a building. Levees protect buildings from flooding as well as from the force of water, from scour at the foundation, and from impacts of floating debris. The principle causes of levee failure are like those associated with dam failure and include overtopping, surface erosion, internal erosion, and slides within the levee embankment or the foundation walls. Levees are designed to protect against a particular flood level and may be overtopped in a more severe event. When a levee system fails or is overtopped, the result can be catastrophic and often more damaging that if the levee were not there, due to increased elevation differences and water velocity. The water flowing through

the breach continues to erode the levee and increase the size of the breach until it is repaired or water levels on the two side of the levee have equalized.

Dam/Levee Failure: Recent Occurrences

Within Lake County, there are six DNR-regulated High Hazard dams as shown on Exhibit 2. These are the Doubletree Lake Dam (North), Lake Dalecarlia (East and West), Lake George, Lake Hills, and Lakes of the Four Seasons (Lower), which is shown in **Figure 3-25**. In addition to these dams, there is one Significant Hazard and five Low Hazard dams. There have been no recorded dam failures within Lake County. At the time of this planning effort, information related to Doubletree Lake Dam was unavailable due to on-going litigation between IDNR and the dam owners. However, county agencies are aware of the hazard associated with the dam and will attempt to collaborate with dam owners related to hazard mitigation as feasible.

Figure 3-25 Lakes of the Four Seasons Lower Dam

No reports have been provided regarding the High Hazard dams within Lake County, or the levees along the Little Calumet River which would indicate damages caused by the February 2018 flooding event. Damages associated with levees along the Kankakee River in the southern area of the county were realized by Newton County as the southern levee breached.

Based on the information provided to them and their local knowledge, experience, and expertise, the Committee determined the probability of a dam failure is "Possible" in those areas where a dam exists, or in areas anticipated to be directly impacted by a dam breach. In areas of the county without a dam, or those not anticipated to be affected by a dam breach, the probability, according to the Planning Committee, was determined to be "Unlikely". With similar regard, the magnitude ranges from "Limited" (areas within the potential inundation area) to "Negligible" (areas not anticipated to be within the inundation area) damages. For a dam failure that occurs on a sunny day, the warning time is anticipated to be less than six hours (those areas without a dam will have a much longer warning time); and the duration in all cases is anticipated to last less than six hours as well. **Table 3-20** provides a summary of the Planning Committee's expectations during a dam failure.

Table 3-20 CPRI for Dam Failure

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Cedar Lake	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Crown Point	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Dyer	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of East Chicago	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Gary	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Griffith	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Hammond	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Highland	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Hobart	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of Lake Station	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Lowell	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Merrillville	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Munster	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of New Chicago	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Schererville	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Schneider	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of St. John	Possible	Negligible	< 6 Hours	< 6 Hours	Low
City of Whiting	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Winfield	Possible	Limited	< 6 Hours	< 6 Hours	Elevated

The levees located along the Little Calumet River are considered to be consequential in terms of buildings identified as in or out of the 1% AEP floodplain. While there may be numerous other levees constructed within Lake County, for example, those along the Kankakee River, they do not provide protection for the 1% AEP flood and are not accredited through FEMA. As such, these unaccredited levees are not included in this planning effort.

Planning Committee members representing those communities with accredited levees (City of Hammond, Town of Highland, and Town of Munster) determined the probability of a levee breach is "Possible" and if such an event were to occur, it would cause "Critical" damages in many of the areas. Further, as with such an event, all communities anticipate a short warning time of less than six hours and a moderate duration of less than one week for the entire event.

Dam/Levee Failure: Assessing Vulnerability

The actual magnitude and extent of damages due to a dam or levee failure depend on the type of breach, the volume of water that is released, and the width of the floodplain valley to accommodate the flood wave. According to the most recent inspection reports obtained from the IDNR, the Lake George Dam and the Lake Hills Dam are both ranked "Satisfactory" with only slight attention needed in areas regarding vegetative growth and reseeding in bare areas. Further, the Lake Dalecarlia

dams are in "Fair" condition with similar needs in addition to the need to address rodent damage. Finally, the Lakes of the Four Seasons (Lower) dam was in "Conditionally Poor" status in need of slope protection and repairs to the observed outlet damage.

Within Lake County, direct and indirect effects from a dam or levee failure may include:

Direct Effects:

- Loss of life and serious damage to downstream homes, industrial and commercial buildings, public utilities, major highways, or railroads

Indirect Effects:

- Loss of land in the immediate scour area
- Increased response times due to damaged or re-routed transportation routes and/or bridges

The Lake Dalecarlia (East and West), Lake George, and Lakes of the Four Seasons (Lower) dams have an Incident and Emergency Action Plan (IEAP) with a detailed potential dam failure inundation area identified. An example of such a potential dam failure inundation map, created for the Lake Dalecarlia is illustrated in **Figure 3-26**.

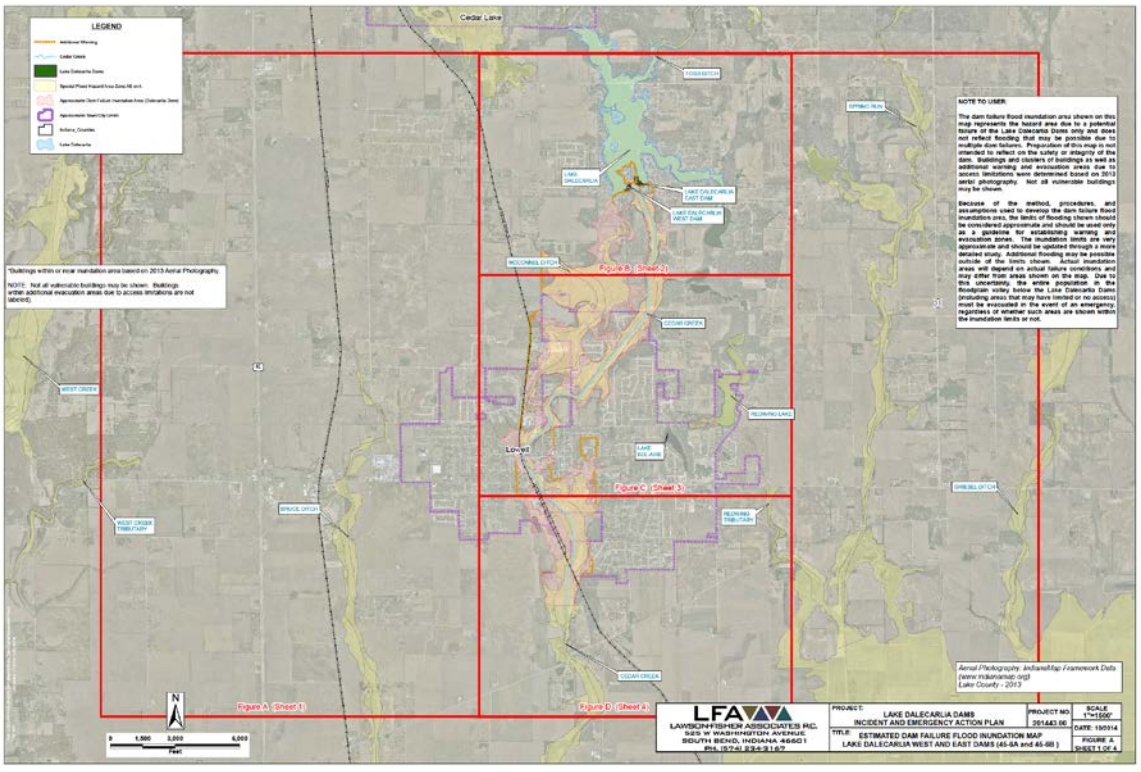


Figure 3-26 Potential Dam Failure Inundation Map, Lake Dalecarlia (IEAP)

Unfortunately, neither the Doubletree Lake or Lake Hills Dams have an IEAP prepared.

Due to the conditions beyond the control of the dam or levee owner or engineer, there may be unforeseen structural problems, natural forces, mistakes in operation, negligence, or vandalism that may cause a dam or levee to fail.

Estimating Potential Losses

To provide an example of anticipated damages, the potential dam failure inundation area maps (created during the development of the IEAP) for the Lake Dalecarlia (East and West), Lake George, and Lakes of the Four Seasons (Lower) Dams were reviewed to estimate the number of critical and non-critical structures that may be affected by a dam failure. The actual magnitude and extent of damages depend on the type of dam break, volume of water that is released, and the width of the floodplain valley to accommodate the dam break flood wave. The estimated number of structures, and the estimated damages for each High Hazard dam with an IEAP prepared, are outlined in **Table 3-21**.

Table 3-21 Estimated Dam Failure Damages

STRUCTURE	ESTIMATED DAMAGES	
	#	$
Lake Dalecarlia (East and West)	82	$5.4M
Lake George	158	$9.1M
Lakes of the Four Seasons (Lower)	150	$8.1M

As mentioned earlier, there are FEMA accredited levees in Lake County. FEMA accredits levees as providing adequate risk reduction on the FIRM if the certification and adopted operation and maintenance plan provided by the levee owner are confirmed to be adequate. This accreditation process is not a standard of safety; it only affects insurance and building requirements for the areas protected by the levee. The areas protected by FEMA accredited levees are show on FIRMs as the Zone A99. This area in Lake County, along the Little Calumet River with the City of Hammond along the northern bank and the Town of Highland and the Town of Munster along the southern banks, is illustrated in **Figure 3-27.** The area shown with orange hatching is the area provided protection from the 1% AEP flood due to the presence of accredited levees.

To determine the potential losses associated with a levee breach, a process like that used in the flooding section was employed. The effective DFIRMs were overlaid upon the Modified Building Inventory, structures located within Zone A99 were tallied, and estimated damages were calculated.

Table 3-22 provides the results of this exercise. Information is only provided for the City of Hammond and the Towns of Highland and Munster as these are the only municipalities with FEMA accredited levees present.

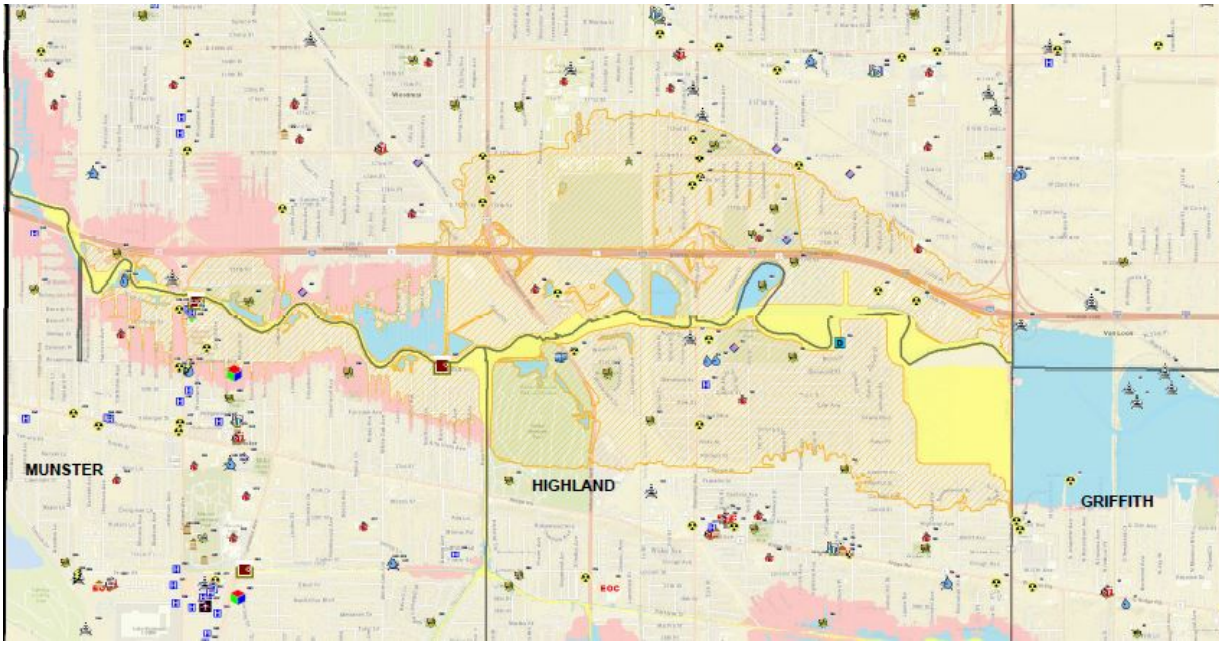


Figure 3-27 Area Protected Against 100-Year Flood by Levee System

Table 3-22 Estimated Levee Failure Damages

COMMUNITY	ESTIMATED DAMGES		CRITICAL INFRASTRUCTURE
	#	$	
Hammond	1,827	$108.1M	1 communication; 10 hazmat; 1 large gathering area; 1 military installation; 6 parks; 2 schools
Highland	2,002	$113.0M	1 communication; 1 dam; 3 hazmat; 1 hospital/medical; 1 large gathering area; 3 parks; 2 potable water; 1 school; 1 transportation
Munster	450	$25.4M	1 hazmat; 1 nursing home; 2 WWTP
Total	**4,279**	**$256.5M**	

The Little Calumet River Basin Development Commission was created in 1980 to provide structural flood protection along the main channel of the Little Calumet River from the Illinois State line to Martin Luther King Drive in Gary. Direct project benefits, according to the Little Calumet River Basin Development Commission's website include:

- Construction of 12.2 miles of levees and floodwalls in Hammond, Highland, and Munster
- Construction of 9.7 miles of set-back levees in Gary and Griffith
- Installation of flow diversion structure at the Hart Ditch confluence in Hammond/Munster
- Creation of 16.8 miles of trails connecting recreational developments
- Protection of over 9,500 structures from flooding
- Protection of over 3.500 acres from flooding

- Creation of a 2,000-acre river/recreation corridor system

Future Considerations

As areas near existing dams and levees continue to grow in population, it can be anticipated that the number of critical and non-critical structures will also increase accordingly. Location of these new facilities should be carefully considered, and precautions should be taken to ensure that schools, medical facilities, municipal buildings, and other critical infrastructure are located outside of the delineated or estimated dam and levee failure inundation areas. Also, flood-free access should be provided for these facilities.

It is also very important to all downstream communities and property owners that dam IEAPs are developed, kept up-to-date, and routinely exercised to ensure the greatest safety to those within the hazard area.

In regard to levee structures, a document similar to the IEAP for dams should be prepared levees, the Flood Warning and Emergency Evacuation Plan, FWEEP. Along with the development of the FWEEP, it is important that recommendations from studies completed along the Little Calumet River be implemented to provide additional protection, especially in areas where interior drainage remains the primary concern. This will continue to reduce risk in these areas, as well as provide additional protections to existing structures and potentially allow additional acres to be used in economic development projects.

Dam/Levee Failure: Relationship to Other Hazards

With the potentially large volumes and velocities of water released during a dam or levee breach, it can be expected that such a failure would lead to flooding within the inundation areas downstream of the dam and behind the levee. Nearby bridges and roads are also in danger of being destroyed or damaged due to a dam or levee failure. Bridges may become unstable and portions of road surfaces may be washed away, or the entire road may be undermined. Other infrastructure such as utility poles and lines may be damaged as the water flows along the surface or pipes may become exposed due to scouring; all of which may lead to utility failures within the area downstream of the dam or levee failure.

Several other independent hazards may also lead to a dam or levee failure. Hazards such as flooding, the melting of snow or ice, or rapid precipitation associated with thunderstorms, may all lead to increased pressure on the dam structures or overtopping of the structures, leading to failure. Additionally, earthquakes or tornadoes may cause damage to the structures or earthen components of the dam or levee resulting in irreparable damages or failure.

3.3.11 **Hazardous Materials Incident**

Hazardous Materials Incident: Overview

Hazardous materials are substances that pose a potential threat to life, health, property, and the environment if they are released. Examples of hazardous materials include corrosives, explosives, flammable materials, radioactive materials, poisons, oxidizers, and dangerous gases. Despite precautions taken to ensure careful handling during manufacture, transport, storage, use, and disposal, accidental releases are bound to occur. These releases create a serious hazard for workers, neighbors, and emergency response personnel. Emergency response may require fire, safety/law enforcement, search and rescue, and hazardous materials response units.

Figure 3-28 Drums of Potentially Hazardous Waste

As materials are mobilized for treatment, disposal, or transport to another facility, all infrastructure, facilities, and residences near the transportation routes are at an elevated risk of being affected by a hazardous materials release. Often these releases can cause serious harm to Lake County and its residents if proper and immediate actions are not taken. Most releases are the result of human error or improper storage (**Figure 3-28**), and corrective actions to stabilize these incidents may not always be feasible or practical in nature.

Railways often transport materials that are classified as hazardous and preparations need to be made and exercised for situations such as derailments, train/vehicle crashes, and/or general leaks and spills from transport cars.

Hazardous Materials Incident: Recent Occurrences

During conversations with Committee members and through information provided by local news outlets, it was noted that numerous small and moderately sized incidents involving manufacturing facilities and transportation routes have occurred since the development of the original MHMP. However, the number of facilities utilizing, storing, and/or manufacturing chemicals and the number of high volume transportation routes increase the likelihood of an incident.

To combat this likelihood, the Lake County Hazardous Materials Response Team (HMRT) was formed through staffing from several departments throughout the county. The team responds to approximately 100 calls each year of varying degree, not including fuel spills and natural gas leaks. Each fire department is equipped to respond to fuel spills of less than 200 gallons but require assistance from the HMRT for larger incidents.

According to the Committee, the probability of a hazardous materials release or incident is "Possible" within Griffith, Hobart, New Chicago, St. John, and Winfield; "Likely" within the areas of Cedar Lake, Dyer, and Schererville; and "Highly Likely" within the County, Crown Point, East Chicago, Gary, Hammond, Highland, Lake Station, Lowell, Merrillville, Munster, Schneider, and Whiting; due to the number of facilities and transportation routes within and through these municipalities. "Limited" to "Significant" damages are anticipated to result from an incident dependent upon the location of the incident. As with hazards of this nature, a short warning time and duration of less than 6 hours is anticipated in the event of a hazardous materials incident. A summary is shown in **Table 3-23**.

Table 3-23 CPRI for Hazardous Materials Incident

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Lake County	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of Cedar Lake	Likely	Critical	< 6 Hours	< 1 Day	Severe
City of Crown Point	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of Dyer	Likely	Limited	< 6 Hours	< 1 Day	Elevated
City of East Chicago	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
City of Gary	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of Griffith	Possible	Critical	< 6 Hours	> 1 Week	Elevated
City of Hammond	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of Highland	Highly Likely	Significant	< 6 Hours	< 1 Day	Severe
City of Hobart	Possible	Critical	< 6 Hours	< 1 Week	Elevated
City of Lake Station	Highly Likely	Critical	< 6 Hours	< 1 Week	Severe
Town of Lowell	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of Merrillville	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of Munster	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of New Chicago	Possible	Limited	< 6 Hours	< 1 Day	Elevated
Town of Schererville	Likely	Limited	< 6 Hours	< 1 Day	Elevated
Town of Schneider	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of St. John	Possible	Significant	< 6 Hours	< 1 Week	Elevated
City of Whiting	Highly Likely	Limited	< 6 Hours	< 6 Hours	Severe
Town of Winfield	Possible	Critical	< 6 Hours	< 1 Day	Elevated

Relatively small hazardous materials incidents have occurred throughout Lake County in the past and may, according to the Committee, occur again. As the number of hazardous materials producers, users, and transporters increase within or surrounding Lake County, it can be anticipated that the likelihood of a future incident will also increase.

Hazardous Materials Incident: Assessing Vulnerability

Within Lake County, direct and indirect effects from a hazardous materials incident may include:

Direct Effects:

- More densely populated areas with a larger number of structures, railroad crossings, and heavily traveled routes are more vulnerable
- Expense of re-construction of affected structures

Indirect Effects:

- Loss of revenue or production while recovery and/or reconstruction occurs
- Anxiety or stress related to event
- Potential evacuation of neighboring structures or facilities

While the possibility of an incident occurring may be likely, the vulnerability of Lake County has been lowered due to the enactment of Superfund Amendments and Reauthorization Act (SARA) Title III national, state and local requirements. SARA Title III, also known as the Emergency Planning and Community Right to Know Act (EPCRA), establishes requirements for planning and training at all levels of government and industry. EPCRA also establishes provisions for citizens to have access to information related to the type and quantity of hazardous materials being utilized, stored, transported or released within their communities.

One local result of SARA Title III is the formation of the Local Emergency Planning Commission (LEPC). This commission has the responsibility for preparing and implementing emergency response plans, cataloging Material Safety Data Sheets (MSDS), creating chemical inventories of local industries and businesses, and reporting materials necessary for compliance.

Figure 3-29 Fuel Tanker Fire

In Lake County, several facilities are subject to SARA Title III provisions due to the presence of listed hazardous materials in quantities at or above the minimum threshold established by the Act. These facilities are also required to create and distribute emergency plans and facility maps to local emergency responders such as the LEPC, fire departments, and police departments. With this knowledge on hand, emergency responders and other local government officials can be better prepared to plan for an emergency and the response it would require, and to prevent serious effects to the community involved.

Estimating Potential Losses

In addition, the very nature of these events makes predicting the extent of their damage very difficult. A small-scale spill or release might have a minor impact and would likely require only minimal response efforts. Another slightly larger incident might result in the disruption of business or traffic patterns, and in this situation, might require active control response measures to contain a spill or release. On the

other hand, even small or moderate events could potentially grow large enough that mass evacuations or shelter in place techniques are needed, multiple levels of response are utilized, and additional hazards such as structural fires and/or additional hazardous materials releases (or explosions) may occur. Given the unpredictable nature of hazardous materials incident, an estimate of potential losses was not generated.

Future Considerations

Additional facilities, both critical and non-critical in nature may be affected if a hazardous materials release were to occur along a transportation route

Several routes including numerous railways, Interstate 65, 90, and 94; US Highway 6, 20, 30, 41, and 231; State Routes 2, 53, 55, 130, 312, and 912 are traveled by carriers of hazardous materials.

By restricting development within the known hazardous materials facility buffer zones, future losses associated with a hazardous materials release can be reduced. Critical infrastructure should be especially discouraged from being located within these areas. Further, by restricting construction in these zones, the number of potentially impacted residents may also be greatly reduced, lowering the risk for social losses, injuries, and potential deaths. Future construction of hazardous materials facilities should be located away from critical infrastructure such as schools, medical facilities, municipal buildings, and daycares. Such construction would likely reduce the risk to highly populated buildings and populations with specials needs or considerations such as children, elderly, and medically unfit.

Hazardous Materials Incident: Relationship to Other Hazards

Dependent on the nature of the release, conditions may exist where an ignition source such as a fire or spark ignites a flammable or explosive substance. As the fire spreads throughout the facility or the area, structural and/or property damages will increase. Response times to a hazardous materials incident may be prolonged until all necessary information is collected detailing the type and amount of chemicals potentially involved in the incident. While this may increase structural losses, it may decrease the social losses such as injuries or even deaths.

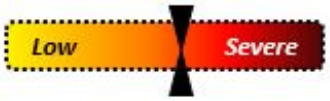
3.4 HAZARD SUMMARY

For the development of this MHMP, the Committee utilized the CPRI method to prioritize the hazards they felt affected Lake County. Hazards were assigned values based on the probability or likelihood of occurrence, the magnitude or severity of the incident, as well as warning time and duration of the incident itself. A weighted CPRI was calculated based on the percent of the County's population present in the individual NFIP communities.

Table 3-24 summarizes the CPRI values for the various hazards studied within this MHMP.

- The hazards that ranked as "Low" included Dam and Levee Failure, Drought, and Landslide and Subsidence.
- "Elevated" risks included Earthquake; Extreme Temperature; Tornado; Winter Storm and Ice; and Fire.
- The hazards with a "Severe" risk included Flood; Hail, Thunder, and Windstorms; and Hazardous Materials Incident.

Table 3-24 Combined CPRI

TYPE OF HAZARD	LIST OF HAZARDS	WEIGHTED AVERAGE CPRI
Natural	Drought	
	Earthquake	
	Extreme Temperature	
	Fire	
	Flood	
	Hail/Thunder/Windstorm	
	Landslide/Subsidence	
	Tornado	
	Winter Storm/Ice	
Technological	Dam Failure	
	Hazardous Materials Incident	
	Levee Failure	

It can be important to understand the cause and effect relationship between the hazards selected by the Committee. **Table 3-25** can be utilized to identify those relationships. For example, a winter storm (along the side of the table) can result in a flood (along the top of the table). In a similar fashion, a hazardous materials incident (along the top of the table) can be caused by an earthquake; flood; tornado; or a winter storm or ice storm (along the side of the table)

Table 3-25 Hazard Relationship Table.

EFFECT → / CAUSE ↓	Drought	Earthquake	Extreme Temperature	Fire	Flood	Hailstorm/ Thunderstorm/ Windstorm	Landslide / Subsidence	Tornado	Winter Storm / Ice	Dam/Levee Failure	Hazardous Materials
Drought											
Earthquake				X			X			X	X
Extreme Temperature											X
Fire											X
Flood							X			X	X
Hailstorm/ Thunderstorm/ Windstorm				X	X		X			X	X
Landslide / Subsidence											X
Tornado				X						X	X
Winter Storm/ Ice					X					X	X
Dam/Levee Failure					X		X				X
Hazardous Materials				X							

As a method of better identifying the potential relationships between hazards, the community exhibits can be referenced to indicate the proximity of one or more known hazard areas such as the delineated floodplains and the locations of EHS facilities. For this reason, many of the communities in Lake County may be impacted by more than one hazard at a time, depending on certain conditions. It can be anticipated that if a flood were to occur within these areas, there would be a potentially increased risk of this facility experiencing a hazardous materials incident. These areas may also be at a greater risk of a dam or levee breach

Future development in areas where multiple known hazard areas (dam failure inundations areas, floodplains and surrounding hazardous materials facilities) overlap should undergo careful design, review, and construction protocol to reduce the risk of social, physical, and economic losses due to a hazard incident. While it may certainly be difficult, critical infrastructure should not be constructed within these regions.

CHAPTER 4 MITIGATION GOALS AND PRACTICES

This section identifies the overall goal for the development and implementation of the Lake County MHMP. A summary of existing and proposed mitigation practices discussed by the Committee is also provided.

4.1 MITIGATION GOAL

REQUIREMENT §201.6(c)(3)(i):
[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The Committee reviewed the mitigation goals as outlined within the 2010 Lake County MHMP and determined that each of these remain valid and effective. In summary, the overall goal of the Lake County MHMP is to reduce the social, physical, and economic losses associated with hazard incidents through emergency services, natural resource protection, prevention, property protection, public information, and structural control mitigation practices.

4.2 MITIGATION PRACTICES

REQUIREMENT §201.6(c)(3)(ii):
[The mitigation strategy shall include a] section that identifies and analyzed a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

REQUIREMENT §201.6(c)(3)(iii):
[The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

In 2005, the Multi-Hazard Mitigation Council conducted a study about the benefits of hazard mitigation. This study examined grants over a 10-year period (1993-2003) aimed at reducing future damages from earthquake, wind, and flood. It found that mitigation efforts were cost-effective at reducing future losses; resulted in significant benefits to society; and represented significant potential savings to federal treasury in terms of reduced hazard-related expenditures. This study found that every $1 spent on mitigation efforts resulted in an average of $4 savings for the community. The study also found that FEMA mitigation grants are cost-effective since they often lead to additional non-federally funded mitigation activities and have the greatest benefits in communities that have institutionalized hazard mitigation programs. Six primary mitigation practices defined by FEMA are:

- **Emergency Services** – measures that protect people during and after a hazard.
- **Natural Resource Protection** – opportunities to preserve and restore natural areas and their function to reduce the impact of hazards.
- **Prevention** – measures that are designed to keep the problem from occurring or getting worse.
- **Property Protection** – measures that are used to modify buildings subject to hazard damage rather than to keep the hazard away.
- **Public Information** – those activities that advise property owners, potential property owners, and visitors about the hazards, ways to protect themselves and their property from the hazards.
- **Structural Control** – physical measures used to prevent hazards from reaching a property.

4.2.1 Existing Mitigation Practices

As part of this planning effort, the Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements, as well as suggested new practices. The following is a summary of existing hazard mitigation practices within Lake County. Mitigation measures that were included in the 2010 Lake County MHMP are noted as such.

Emergency Services

- Lake County has a first response HazMat Team
- The County has developed a centralized system for testing the majority of existing outdoor warning sirens. *(2010 Measure)*
- The County, and nearly all communities, utilize a mass notification system such as NIXLE/Everbridge or Blackboard for mass alerts for weather or hazardous events.
- Many communities utilize Community Emergency Response Teams (CERTs) or similar such as VIPs, VESTs, and COAD *(2010 Measure)*
- Weather radios are encouraged and provided throughout the County during presentations, events, and also available on the EMA website. *(2010 Measure)*
- Stream gages are utilized for flood forecasting and flood warnings for various stream levels.
- Several water rescue teams have been established within the County (County, Crown Point, Gary, Hobart, Merrillville) and several additional partnerships exist with other agencies for assistance as necessary *(2010 Measure)*
- An emergency response command center has been established to serve as centralized communications during an emergency situation *(2010 Measure)*

- As a result of working with Indiana American Water, a new water tower is being constructed within Lake Station and many hydrants are being serviced throughout Hobart, Lake Station, Merrillville, and Winfield. *(2010 Measure)*
- A full-time fire department has been established in Merrillville and additional firefighting equipment has been purchased for Lake Station and Merrillville. *(2010 Measure)*
- Many communities have developed snow removal routes to keep primary streets clean during and after snow storms. *(2010 Measure)*

Natural Resource Protection

- Lake County, Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting and Winfield are in good standing with the NFIP Program and have flood protection ordinances which meet minimum requirements.
- The Northern Indiana Regional Planning Commission (NIRPC) routinely studies watersheds and water quality within the area to determine projects and priorities to assist with flooding and poor drainage. *(2010 Measure)*
- Groups such as the Lake County Surveyor, the Little Calumet River Basin Commission, and the Kankakee River Basin Commission are actively studying areas which routinely flood and implementing recommendations and projects proposed by those studies. *(2010 Measure)*
- Current facility maps and response plans are on file for all Tier II HazMat facilities *(2010 Measure)*

Prevention

- Information related to hazard mitigation has been incorporated, where appropriate, into individual Comprehensive Land Use Plans and other long-range plans.
- Lake County, and other communities, have developed independent GIS databases which are used in land use planning decisions and can be utilized in HAZUS-MH "what-if" scenarios. *(2010 Measure)*
- The Lake County LEPC provides routine training regarding the proper storage, transport, and disposal of hazardous materials.
- Electric providers routinely complete preventative maintenance on trees within the ROW and utility corridor.
- Local developers routinely bury new and retrofitted utilities to minimize exposure to hazards.
- Canadian National and INDOT have partnered with several communities to upgrade or replace railroad crossings and/or warning systems at railroad/road intersections. *(2010 Measure)*

Property Protection

- Lake County and the municipalities follow the International Building Code which includes requirements to minimize damages from natural hazards.

Public Information

- Outreach materials are routinely provided within office and agencies throughout Lake County, large public events, speaking opportunities within schools, etc. *(2010 Measure)*
- Town of Dyer owns three mobile message boards
- Town of Merrillville includes a usage clause for newly approved large billboard type signs; providing the Town the right to use for emergency notifications

Structural Control

- Stormwater conveyances and regulated drains are maintained on a routine basis to prevent localized flooding, increased erosion, and material deposition as a result of rainfall or snowmelt. *(2010 Measure)*
- Lake County, Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, and Whiting are regulated through IDEM's MS4 program and as such, implement programs to reduce pollutants entering streams and waterbodies. *(2010 Measure)*
- High hazard dams within the county are routinely inspected as required by IDNR *(2010 Measure)*

4.2.2 **Proposed Mitigation Practices**

After reviewing existing mitigation practices, the Committee reviewed mitigation ideas for each of the hazards studied and identified which of these they felt best met their needs as a community according to selected social, technical, administrative, political, and legal criteria. The following identifies the key considerations for each evaluation criteria:

- **Social** – mitigation projects will have community acceptance, they are compatible with present and future community values, and do not adversely affect one segment of the population.
- **Technical** – mitigation projects will be technically feasible, reduce losses in the long-term, and will not create more problems than they solve.
- **Administrative** – mitigation projects may require additional staff time, alternative sources of funding, and have some maintenance requirements.
- **Political** – mitigation projects will have political and public support.

- **Legal** – mitigation projects will be implemented through the laws, ordinances, and resolutions that are in place.
- **Economic** – mitigation projects can be funded in current or upcoming budget cycles.
- **Environmental** – mitigation projects may have negative consequences on environmental assets such as wetlands, threatened or endangered species, or other protected natural resources.

Table 4-1 lists a summary of all proposed mitigation practices identified for all hazards, as well as information on the local status, local priority, benefit-cost ratio, project location, responsible entities, and potential funding sources, associated with each proposed practice. The proposed mitigation practices are listed in order of importance to Lake County for implementation. Projects identified by the Committee to be of "high" local priority may be implemented within five years from final Plan adoption. Projects identified to be of "moderate" local priority may be implemented within 5-10 years from final Plan adoption, and projects identified by the Committee to be of "low" local priority may be implemented within 10+ years from final Plan adoptions. However, depending on availability of funding, some proposed mitigation projects may take longer to implement.

The benefit derived from each mitigation practice along with the estimated cost of that practice was utilized to identify the mitigation practices having a high, moderate, or low benefit cost ratio. Preparing detailed benefit cost ratios was beyond the scope of this planning effort and the intent of the MHMP.

The update of this MHMP is a necessary step of a multi-step process to implement programs, policies, and projects to mitigate the effect of hazards in Lake County. The intent of this planning effort was to identify the hazards and the extent to which they affect Lake County and to determine what type of mitigation strategies or practices may be undertaken to mitigate for these hazards. A FEMA-approved MHMP is required to apply for and/or receive project grants under the HMGP, PDM, FMA, and SRL. FEMA may require a MHMP under the Repetitive Flood Claims (RFC) program. Although this MHMP meets the requirements of DMA 2000 and eligibility requirements of these grant programs additional detailed studies may need to be completed prior to applying for these grants. **Section 5.0** of this plan includes an implementation plan for all high priority mitigation practices identified by the Committee.

The CRS program credits NFIP communities a maximum of 97 points for setting goals to reduce the impact of flooding and other known natural hazards; identifying mitigation projects that include activities for prevention, property protection, natural resource protection, emergency services, structural control projects, and public information.

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Table 4-1 Proposed Mitigation Practices

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Management of High Hazard Dams 1. Review regular inspection reports and maintenance records of high hazard dams 2. Encourage Doubletree and Lake Hills Dam owners to develop an IEAP.	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☒ Dam/Levee Failure ☐ HazMat Incident	**Ongoing –** 1. IDNR receives inspection reports 2. Other high hazard dams in Lake County have IEAPs **Proposed Enhancements –** 1. Ensure inspections are completed and required improvements and repairs are completed in a timely manner 2. Encourage and assist Doubletree and Lake Hills Dam owners in completing an IEAP	High	High	Dam Owners *Doubletree – DBL Residential* *Lake Hills – Town of St. John* EMA IDNR	Existing budget
Public Education & Outreach 1. Establish an FM or AM radio station, or develop agreements with existing stations, to alert the public in cases of emergency *(2010 Measure)* 2. Provide multi-lingual hazard preparedness literature (warning sirens, radio stations, go-kits, insurance protection, lightning rods, etc.) during Severe Weather Awareness Week, at public facilities and events and to populations within known hazard areas such as floodplains, downstream of a dam, behind levees, near hazmat facilities, etc. *(2010 Measure)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. St. John has a radio station and others have agreements with WJOB and WZBN to provide announcements as necessary 2. Literature is provided at several public facilities and office locations as well as large public events throughout the County. Populations within the special flood hazard areas are educated through required flood insurance purchases and various website and literature pieces. **Proposed Enhancement –** 1. Determine additional possibilities for radio partnerships or development of publicly owned radio stations 2. Encourage enhancement of messages provided to various cultural groups and neighborhoods; Educate landowners within dam and levee inundation areas and near hazardous materials facilities of potential dangers and what to do in an emergency situation. Include information such as encourage voluntary purchase of flood insurance; formalize neighborhood campaign where representatives familiar with culture and language provide residents with emergency information and protocols.	High	High	EMA Red Cross City/Town Offices *(County, Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting, Winfield)* Event Liaisons	Existing budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Emergency Preparedness & Warning 1. Improve disaster preparedness and emergency response through the StormReady Community Program *(2010 Measure)* 2. Increase awareness and participation in the various mass notification system and various social media outlets 3. Coordinate with private business owners utilizing large dynamic message boards for business to provide messages during hazardous events and recovery efforts. 4. Encourage weather radios in all critical infrastructure and encourage use by residents and businesses. 5. Evaluate and utilize flood forecasting capabilities including stream gages, flood forecast maps, and flood alerts 6. Improve outdoor warning siren coverage to alert population of severe weather conditions *(2010 Measure)* 7. Propose an ordinance to require developers to install additional outdoor warning sirens for new developments or pay into a siren fund as part of new development 8. Review and install a centralized system for testing, maintenance, and operation of outdoor warning sirens 9. Improve disaster preparedness and emergency response at the local level through the COAD, CERT, or similar program 10. Purchase additional mobile electronic messaging boards and develop protocol for local interactions to provide current hazard information. 11. Improve planning and coordination among event coordinators, facility owners, and emergency response teams	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. Purdue NW is a StormReady Campus 2. Various systems are used by individual communities 3. Merrillville includes a "Usage Clause" in approval of outdoor signs 4. Radios are encouraged and provided to interested residents 5. Four AHPS stream gages within the county 6. Many communities are covered by outdoor warning sirens 8. Testing of sirens can be completed through the Lake County 911 Center 9. COAD, VESTs, and VIPs serve a role within the County 10. Dyer has 3 mobile message boards 11. Planning efforts are occurring with various large events **Proposed Enhancements –** 1. Increase participation in StormReady Program 2. Increase number of subscribers and followers for warnings and social media outlets 3. Develop a list of partnering private businesses willing to display hazard related messages 4. Continue to provide and encourage the use of weather radios 5. Two additional gages needed on Deep River 6. Additional outdoor warning sirens needed in areas of Lake County, Cedar Lake, East Chicago, Gary, Hobart, Lake Station, Merrillville, New Chicago, Schererville, and Winfield 8. Select system that can allow 911 Center to see if sirens are functional, as well as allow for centralized maintenance 9. Continue to support the COAD program and evaluate the CERT program to determine feasibility and potential enhancements 10. Inventory needs and purchase additional message boards and develop protocol 11. Develop and distribute templates for event coordinators' use to strengthen planning and response efforts for large events	High *(StormReady, mass notifications, private message boards, weather radios, flood forecasting, sirens, ordinance, centralized system)* Moderate *(COAD/CERT, mobile message boards, large event plans)*	High	EMA COAD, CERT, VIP, VEST Red Cross Floodplain Administrators *(Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, St. John, Whiting)* Large facility or event coordinators	Existing budgets Grants

Emergency Response & Recovery 1. Prepare a detailed Flood Response Plan to improve response and reduce losses from a flood event 2. Inventory needs for mobile data terminals in response vehicles and purchase and install as feasible 3. Develop and implement a voluntary immunization program for all emergency responders, inspection staff, and families *(2010 Measure)* 4. Coordinate communications, documentation, and record keeping between NFIP communities and agencies including a database of accurate and community specific information following each hazard events 5. Create a plan to establish an Emergency Operations Center in each community and coordinate with the county 6. Investigate equipment needs such as snow-fight equipment, mobile sandbagging equipment and generators if needed *(2010 Measure)* 7. Develop listing of at-risk populations and develop appropriate evacuation protocols for various hazards 8. Inventory needs and procure 4WD vehicles for rescue and recovery efforts *(2010 Measure)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☐ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. Some communities have basic plans or protocols 2. Many vehicles are equipped with terminals 3. Immunizations are provided to employees in most communities, Gary and Hobart have extended programs 4. Information is provided in varying degrees 7. Medical facilities and schools have evacuation protocols 8. Many communities have bush trucks, gators and other vehicles with 4WD capabilities **Proposed Enhancement –** 1. Prepare detailed plans for flood response efforts 2. Inventor to determine remaining needs and install where necessary 3. Provide immunizations to all County and municipal staff and extend to families 4. Create a more consistent reporting and documentation effort 5. Establish location of EOC in each community and determine communication liaison between local and county EOCs 6. Investigate equipment and purchase as necessary and as funding allows 7. Review known hazard areas and list at-risk populations, develop evacuation protocols 8. Determine needs of all communities and prioritize purchases	High *(Flood plans, data terminals, immunizations, recordkeeping, EOC, sandbagging/snow equipment)* Moderate *(at-risk populations)* Low *(4WD vehicles)*	High	EMA Sheriff Department Police Departments *Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, St. John, Whiting)* Fire Departments *Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, St. John, Whiting)* Health Department County Highway Street Department *Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, St. John, Whiting)*	Existing budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Floodplain Management 1. Inventory areas with repetitive flooding and prioritize for detailed hydraulic analyses 2. Support FEMA approved flood depth mapping (RiskMAP) to better show the flood risk potential 3. Implement activities and recommendations outlined within the studies and plans developed by the Little Calumet River Basin Commission and Kankakee River Basin Commission *(Will assist with NFIP compliance)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☐ Dam/Levee Failure ☐ HazMat Incident	**Ongoing –** 3. Studies have been completed for various areas along the Little Calumet and Kankakee Rivers **Proposed Enhancements –** 1. Evaluate local areas with repetitive flooding and prepare county prioritized listing for additional studies 2. Support flood depth mapping for prioritized areas when selection occurs 3. Continue to implement recommendations from studies as funding and resources allow	High *(inventory and prioritize, RiskMAP)*	Moderate	Lake County Surveyor Floodplain Administrators *(County, Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting, Winfield)* Little Calumet River Basin Commission Kankakee River Basin Commission	Existing budget Grant
Hazardous Materials Response 1. Inventory equipment and training needs to increase number of certified emergency response personnel for each Department *(2010 Measures)* 2. Develop or update evacuation plans for hazmat facilities or other critical infrastructure within 500 yards of a hazmat facility or transportation route *(2010 Measure)*	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☐ Structural Control	☐ Drought ☒ Earthquake ☐ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. County and Crown Point Fire Departments have HazMat Response Teams 2. Some communities have evacuation plans **Proposed Enhancement –** 1. Increase all first responders to Operations Level and determine need for increased number of Technician Level at each Department 2. All communities review list and determine need to develop or update evacuation plans	High	Moderate	LEPC EMA Fire Department liaisons *(County, Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting, Winfield)* Tier II Facility Owners	Existing Budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Building Protection 1. Investigate reciprocal agreements between neighboring communities and/or counties for structural inspections following hazardous events 2. Develop and complete a Fire Hazard inventory of at-risk structures (large apartment complexes, abandoned buildings in concentration and blighted areas) 3. Assess and upgrade fire hydrant, including dry hydrants, throughout the county 4. Protect existing critical facilities in floodplains noted in Table 3-12 5. Discourage development of new critical facilities in known hazard areas 6. Institute a buy-out program for routinely flooded structures *(2010 Measure)* 7. Harden critical facilities, especially fire stations to withstand severe wind damages *(2010 Measure)* *(Will assist with NFIP compliance)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☒ Earthquake ☐ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. Schererville and St. John have such an agreement 2. Cedar Lake, Gary, and Lake Station have similar lists developed 3. Varied types of hydrants exist in each community **Proposed Enhancements –** 1. Develop agreements between neighboring communities and counties 2. Complete inventories for all other communities 3. Create a GIS layer of hydrant style through inventory and assessment, upgrade hydrants as needed 4. Prioritize protection efforts and complete as funding allows 5. Partner with planning and zoning departments to discourage new critical infrastructure in known hazard areas 6. Complete studies of frequently flooded areas or RepLoss areas to determine number of structures and prioritize for a buyout program **7.** Inventory and harden critical facilities as needed and as feasible	High *(reciprocal agreements, Fire Hazard inventory, hydrants, protect existing facilities in floodplain, discourage new critical facilities, buy-outs)* Moderate *(harden fire stations)*	Moderate	Building Departments *Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, St. John, Whiting)* EMA Fire Departments *Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, St. John, Whiting)* Facility Owners	Grant Existing budget
Community Rating System 1. Reduce flood insurance premiums through increased participation or advancement in the NFIP's CRS Program. *(2010 Measure)* *(Will assist with NFIP compliance)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☐ Dam/Levee Failure ☐ HazMat Incident	**Ongoing –** 1. Dyer and Merrillville currently participate in the CRS program **Proposed Enhancement –** 1. Participation from Lake County, Griffith, Hammond, Highland, Munster, and Schererville (highest number of insurance policies)	High *(Dyer, Hammond, Merrillville)* Moderate *(All other NFIPs)*	Moderate	Floodplain Administrators *(County, Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting, Winfield)*	Existing budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Geographic Information Systems 1. Update and coordinate GIS layers with location and attributes of critical infrastructure and continue to use the most recent GIS data in land use planning efforts 2. Train GIS staff in HAZUS-MH to quantitatively estimate losses in "what-if scenarios".	☒ Emergency Services ☒ Nat. Res. Protection ☐ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. GIS is used independently by several communities **Proposed Enhancement –** 1. Coordinate consistent layers and attributes county-wide 2. Additional training for GIS staff	High *(coordinate)* Moderate *(what if)*	Moderate	GIS Contacts *(Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting, Winfield)*	Existing Budget
Land Use Planning & Zoning 1. Incorporate hazard information, risk assessment, and hazard mitigation practices into the Comprehensive Land Use Plan and Development Review to better guide future growth and development 2. Establish overlay zones in the Zoning Ordinance to discourage construction of new critical facilities in known hazard areas 3. Utilize zoning to manage development of non-critical facilities in known hazard areas	☐ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☒ Flood ☐ Hail/Thunder/Wind ☒ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. Hazard information has been incorporated into some areas of the Comprehensive Land Use Plan **Proposed Enhancement –** 1. Increase the number of hazards considered, more definitively outline higher risk areas and those that should be avoided for future development 2. Establish overlay zones to restrict construction of new critical facilities in hazard areas 3. Manage development of non-critical facilities in known hazard areas	High *(incorporate information, hazard overlay* Moderate *(non-critical facility development)*	Moderate	Planning / Building Departments *(County, Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting, Winfield)*	Existing Budget
Management of Levees 1. Continue accreditation process for additional levee sections along Little Cal River *(2010 Measure)* 2. Improve Dike Ditch and levee west of US 41 in West Creek Township	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☒ Flood ☐ Hail/Thunder/Wind ☒ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☒ Dam/Levee Failure ☐ HazMat Incident	**Ongoing –** 1. Sections of Little Cal levee accredited through Hammond, Highland, and Munster 2. Deteriorating sections protection almost 3,000 acres **Proposed Enhancements –** 1. Continue accreditation of levees through Gary and Griffith, 2. Complete and implement study to improve levee section	High *(accreditation)* Moderate *(Dike Ditch)*	Moderate	Army Corps of Engineers Little Calumet River Basin Commission Lake County Surveyor's Office Lake County Drainage Board	Existing budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Transportation 1. Encourage warning signals (flashing lights, crossing arms, rumble strips, signage) at each intersection between rail and road to reduce the potential for train/vehicular crashes *(2010 Measure)* 2. Complete commodity flow study to determine typical types and quantities of chemicals being transported throughout Lake County	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☐ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☐ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☐ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. Warnings are present at many crossings; Canadian National and INDOT working with several communities for replacements **Proposed Enhancement –** 1. Inventory rail crossings and prioritize for local enhancements outside of the Rail ROW 2. Complete commodity flow study for Lake County	High *(rail warnings)* Moderate *(flow study)*	Moderate	Rail Owners INDOT Lake County Highway Planning Departments *(Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, St. John, Whiting)* LEPC	Existing Budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Safer Rooms and Community Shelters 1. Develop temporary and/or long-term shelter agreements within the County. Potential for tiered levels of shelters, domestic animal shelters, etc., especially in small communities *(2010 Measure)* 2. Clearly advertise location of safe rooms and community shelters for large gatherings of people (live, work, shop, recreate, etc.) 3. Investigate and provide possible incentives for (private) buildings with approved safe rooms	☒ Emergency Services ☐ Nat. Res. Protection ☐ Prevention ☐ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☒ Earthquake ☐ Extreme Temperature ☐ Fire ☐ Flood ☒ Hail/Thunder/Wind ☐ Landslide/Subsidence ☒ Tornado ☐ Winter Storm/Ice ☐ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. Shelters locations are spaced throughout the county as available and as needed Approved safe rooms have been constructed (Lincoln Center in Highland **Proposed Enhancement –** 1. Continue to determine if additional shelter locations are needed 2. Develop education materials for large gatherings 3. Investigate and consider possible incentives to increase number of approved safe rooms	High *(shelter agreements, advertise for large gatherings)* Moderate *(incentives)*	Low	EMA Large gathering liaisons COAD, CERT, VIP, VEST Red Cross Building Departments *Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, St. John, Whiting)*	Existing budget Facility owners Event planners
Power Backup Generators 1. Inventory, prioritize, and retrofit public facilities and/or critical facilities with appropriate wiring and electrical capabilities for utilizing a large generator for power back up *(2010 Measure)* 2. Secure a fuel reserve, or ensure contractual emergency provisions so critical infrastructure may run on power backup for extended periods of time 3. Designate a fuel reserve transportation route through each community 4. Investigate the potential to utilize wind or solar generators	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☐ Structural Control	☐ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident	**Ongoing –** 1. Many critical facilities have generators or have added since the last plan 2. Some communities have verbal agreements for fuel supplies 3. Lake Station utilizes wind and solar power for backup capabilities **Proposed Enhancements –** 1. Re-inventory generator capabilities and needs and prioritize within each community to determine needs for future purchases 2. Secure a fuel reserve via contract service agreement 3. Designate and map a fuel reserve transportation route through each community 4. Review Lake Station solar generators and determine if feasible in other areas or other facilities	High *(inventory, fuel reserve)* Moderate *(fuel route)* Low *(wind or solar)*	Low	EMA Community Contacts *(Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting, Winfield)* Facility Owners	Existing budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Tree Maintenance 1. Maintain and expand Tree City USA participation 2. Procure tree-trimming equipment including trucks, saws, and chippers *(2010 Measure)*	☐ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☐ Extreme Temperature ☒ Fire ☐ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☐ Dam/Levee Failure ☐ HazMat Incident	**Ongoing –** 1. Several communities participate in Tree City USA (Crown Point, Dyer, East Chicago, Merrillville, Munster, Whiting) **Proposed Enhancement –** 1. Expand participation in Tree City USA to other communities 2. Inventory equipment needs by community and procure equipment	Moderate	Moderate	Lake County Highway Municipal Street and/or Utility Department *(Cedar Lake, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, New Chicago, Schererville, Schneider, St. John, Winfield)*	Existing Budget
Water Conservation 1. Propose and adopt a water conservation ordinance and contingency plans to implement during water shortages 2. Establish standard procedures for issuing an open burn ban during periods of dry weather	☒ Emergency Services ☒ Nat. Res. Protection ☐ Prevention ☐ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☐ Earthquake ☒ Extreme Temperature ☐ Fire ☐ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☐ Dam/Levee Failure ☐ HazMat Incident	**Ongoing –** 1. Some burn limitations apply due to air quality restrictions of the region. **Proposed Enhancement –** 1. Review existing ordinances, and if needed, propose water conservation ordinance 2. Establish procedures for further restrictions to include fireworks, campfires, and recreational fires	Moderate	Low	EMA Planning Departments *(County, Cedar Lake, Crown Point, Dyer, East Chicago, Gary, Griffith, Hammond, Highland, Hobart, Lake Station, Lowell, Merrillville, Munster, New Chicago, Schererville, Schneider, St. John, Whiting, Winfield)*	Existing budget

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CHAPTER 5 IMPLEMENTATION PLAN

The following is a proposed plan for implementing all high priority mitigation practices identified in this Plan. It should be noted that implementation of each of these proposed practices may involve several preparatory or intermediary steps. However, to maintain clarity, not all preparatory or intermediary steps are included.

5.1 BUILDING PROTECTION

Investigate reciprocal agreements between neighboring communities and/or counties for structural inspections following hazardous events

- Review existing mutual aid agreements for response agencies such as fire and police
- Determine if such agreements may be tailored to cover activities such as structural inspections following floods or tornadoes
- Revise language as needed
- Propose agreement to municipal elected officials for adoption

Develop and complete a Fire Hazard Inventory of at-risk structures (large apartment complexes, abandoned buildings in concentration and blighted areas)

- Determine if similar hazard surveys are completed by building departments, code enforcement, or municipal agencies to record abandoned structures
- Revise language in survey or assessment to include a metric for fire risk
- Complete assessment throughout municipalities to prioritize areas at risk for large structure fires

Assess and upgrade fire hydrants; including dry hydrants, throughout the county

- Utilize GIS departments or staff and Fire personnel, inventory fire hydrants throughout each municipality noting the location, age, and equipment needed to open each hydrant
- Provide GIS files and information to each municipality through a shared network to allow for streamlined mutual aid response between fire departments
- Prioritize hydrants for upgrades and repairs and complete as funding is secured

Protect existing critical facilities in floodplains noted in Table 3-12

- Review listing of critical facilities within floodplains
- Complete studies to determine localized flood depths
- Provide recommendations for protection measures for each structure
- Prioritize structures and implement recommendations as funding allows

Institute a buyout program for routinely flooded structures

- Identify areas routinely flooded and the structures within them
- Prioritize areas and structures according to those most at risk
- Seek grant funding or other funding source to implement buy-out program for interested property owners

5.2 COMMUNITY RATING SYSTEM

Reduce flood insurance premiums through increased participation or advancement in the NFIP's CRS Program

- Review guidance materials and gather supporting documentation
- Calculate credits and contact ISO representative
- Submit materials for entry or advancement within the CRS program
- Maintain and record information as necessary for annual recertification

5.3 EMERGENCY PREPAREDNESS & WARNING

Improve disaster preparedness and emergency response through the StormReady Community Program

- Review requirements and protocols of the NWS StormReady Program
- Establish a liaison within each community and develop an ad hoc committee purposed with advancing participation within the county
- Complete application and submit for recognition as a StormReady Community/County/Campus
- Implement a public awareness campaign

Increase awareness and participation in the various mass notification systems and various social media outlets

- Continue to encourage participation in the existing programs and determine appropriate systems for communities without mass notification capabilities
- Investigate social media outlets and determine how they can be employed to provide routine updates and information
- Determine an appropriate staff member or department to coordinate social media messages
- Increase awareness and participation in the notification systems and social media outlets to ensure the largest number of residents receive updates and messages

Coordinate with private business owners utilizing large dynamic message boards for business to provide messages during hazardous events and recovery efforts

- Complete an assessment of existing large dynamic message boards at local businesses, schools, churches, etc.
- Contact owners or operators of boards to determine level of willingness or ability to provide altered messages in various situations
- Develop a list of willing participants and contact information
- Annually review contact information to ensure accuracy

Encourage weather radios in all critical infrastructure and encourage use by residents and businesses

- Develop listing of critical infrastructure with weather radios present, determine if radios have been charged and tested to ensure working condition
- Continue education campaigns regarding weather radios
- As feasible, provide weather radios to targeted critical infrastructure, at-risk structures or vulnerable areas, or at-risk populations

Evaluate and utilize flood forecasting capabilities including stream gages, flood forecast maps, and flood alerts

- Review existing capabilities and determine areas of need for increased warning time
- Prioritize areas and determine options for increased forecasting abilities
- Develop partnerships, secure funding and implement recommendations
- Provide updated information to appropriate response agencies

Improve outdoor warning siren coverage to alert populations of severe weather conditions

- Review existing outdoor warning siren coverage
- Determine areas in need of primary or additional coverage
- Investigate potential funding sources and determine local level of interest
- Install additional outdoor warning sirens as feasible

Propose an ordinance to require developers to install additional outdoor warning sirens for new developments or pay into a siren fund as part of a new development.

- Research existing ordinances
- Localize language as necessary for communities interested in such an ordinance or program
- Propose ordinance to appropriate committee
- Implement an education component once ordinance has been adopted

Review options and install a centralized system for testing, maintenance, and operation of outdoor warning sirens

- Review the existing system which allows for testing of outdoor warning sirens throughout the county
- Determine any enhancements or adjustments needed for the system
- Determine any equipment, staffing, or agreement needs to add ability for centralized maintenance and operation of outdoor warning sirens county-wide

5.4 EMERGENCY RESPONSE AND RECOVERY

Prepare detailed Flood Response Plans for all communities to improve response and reduce losses from a flood event.

- Work with municipal Floodplain Administrators to prioritize municipalities most at risk for flood damages
- Review existing plans or protocols within each community and surrounding area
- Secure funding needed and develop municipal specific Flood Response Plan

Inventory needs for mobile data terminals in response vehicles and purchase and install as feasible

- Work with municipal liaisons to inventory existing terminals, software, and accessories throughout all response agencies (fire, police/sheriff, EMS)
- Determine needs to adequately cover each community and to allow cross-communication between agency and between community
- Prioritize purchases, upgrades, or training and implement as feasible.

Develop and implement a voluntary immunization program for all emergency responders, inspection staff, and families

- Determine what immunizations are currently offered within each municipality
- Develop a listing of additional immunizations to be offered for municipal employees and family members
- Designate an agency to oversee the program and administer the immunizations

Coordinate communications, documentation, and record keeping between NFIP communities and agencies including a database of accurate and community specific information following each hazard event

- Review current protocols for post-event communications
- Utilize existing IDHS software or develop a county-wide database

- Review database with each municipality to review what information should be collected and reported in a consistent manner

Create a plan to establish an Emergency Operations Center in each community and coordinate with the county.

- Review existing protocols within each municipality regarding EOC activation
- Revise as necessary and conduct a training exercise utilizing the EOCs to determine if proposed conditions are suitable for an emergency situation
- Establish a local contact to serve as a liaison with the county EOC during emergency situations

Investigate equipment needs such as snow-fight equipment, mobile sandbagging equipment and generator if needed

- Inventory existing equipment within each municipality
- Determine what equipment should be obtained and used as a county asset and what equipment should be procured by individual municipalities
- Determine location for storage of new equipment
- Obtain generator and fuel reserve if needed to operate new equipment

5.5 FLOODPLAIN MANAGEMENT

Inventory areas with repetitive flooding and prioritize for detailed hydraulic analyses

- Review listing of unstudied streams and flood prone areas and prioritize based on previous damages, at-risk populations, or potential for damage to critical infrastructure
- Secure funding, municipal bond, or funds from existing budgets to complete floodplain studies.
- Update the Floodplain Prioritization Study to direct future analyses.

Support FEMA approved flood depth mapping to better show the flood risk potential

- Review areas in process of RiskMAP development
- Support mapping efforts by providing information on local studies and efforts to reduce flooding and associated damages

Implement activities and recommendations outlined within the studies and plans developed by the Little Calumet River Basin Commission and Kankakee River Basin Commission

- Review studies and plans created to reduce flooding and damages along the Little Calumet and Kankakee River

- Work in partnership with the River Basin Commissions to prioritize actions contained within those plans and others completed for similar purposes
- Secure funding through grants or appropriations to implement recommendations
- Routinely review prioritized list and revise as appropriate

5.6 GEOGRAPHIC INFORMATION SYSTEMS

Update and coordinate GIS layers with location and attributes of critical infrastructure and continue to use the most recent GIS data in land use planning efforts

- Review current GIS layers and attribute information
- Include additional data as obtained relative to each critical infrastructure
- Update and maintain one critical infrastructure layer for the entire County, and develop a protocol for updating critical infrastructure information
- Coordinate access to layers for each community within the County

5.7 HAZARDOUS MATERIALS RESPONSE TEAM

Develop or update evacuation plans for hazmat facilities or other critical infrastructure within 500 yards of a hazmat facility or transportation route.

- Review listing of all Tier II facilities within Lake County and obtain facility maps and response plans
- Utilize GIS to identify potential critical facilities and at-risk structures within 500 yards from each Tier II facility
- Prioritize facilities in the buffer zones and work with facility representatives to plan evacuation routes and plans.
- Contact facility representative annually to ensure contact information is accurate and review the plan and routes.

Increase equipment and training needs to increase number of certified emergency response personnel available for responding to hazmat incidents

- Inventory personnel of each fire department and determine the number of staff at each certification level
- Determine ideal number of personnel to adequately cover the county and municipalities
- Prioritize personnel or stations targeted to received additional training dependent on budgets

5.8 LAND USE PLANNING AND ZONING

Incorporate hazard information, risk assessment, and hazard mitigation practices into the Comprehensive Land Use Plan and Development Review to better guide future growth and development

- Review list of hazards and determine which are applicable to individual communities
- Draft language and prepare exhibits to incorporate into the appropriate sections of the Lake County Comprehensive Land Use Plan, individual municipalities' plans, neighborhood redevelopment plans, etc.
- Adopt amendments as appropriate

Establish overlay zones in the Zoning Ordinance to discourage construction of new critical facilities in known hazard areas

- Review existing known hazard areas
- Coordinate between response agencies and planning departments to develop proposed overlay zones
- Propose and adopt an ordinance establishing hazard related overlay zones for each municipality

5.9 MANAGEMENT OF HIGH HAZARD DAMS

Review regular inspection reports and maintenance records of high hazard dams

- Coordinate with high hazard dam owners (Doubletree Lake Estates, LLC and Town of St. John) and IDNR to receive copies of regular inspection reports and maintenance records
- Continue coordination and collaboration to ensure inspections are completed, the dam and surrounding area is maintained, and risks are assessed accordingly

Encourage Doubletree and Lake Hills Dam owners to develop an IEAP

- Meet with dam owners to review example IEAPs and inundation mapping to better understand the IEAP products and information
- Collaborate to develop an IEAP for the dams
- Prepare an exercise to provide training to appropriate planning and response agencies within the area.
- Partner with the dam owners and IDNR to provide outreach materials to property owners within the inundation area

5.10 MANAGEMENT OF LEVEES

Continue accreditation process for additional levee sections along Little Calumet and Kankakee Rivers

- Assess status of unaccredited levee segments throughout the county
- Prioritize areas based on number of structures protected, status of accreditation, and stability of structure
- Collaborate with engineers and Army Corps of Engineers to implement required enhancements to allow for accreditation of levee segment

5.11 POWER BACKUP GENERATORS

Inventory, prioritize, and retrofit public facilities and/or critical facilities with appropriate wiring and electrical capabilities for utilizing a large generator for power backup

- Utilize listing of critical infrastructure and coordinate with facility owners or operators to determine presence or absence of generator, fuel capacity, and fuel reserve
- Determine if additional needs are required to ensure compatibility with generator (wiring) and encourage installation or procurement of necessary equipment
- Encourage private facility owners to install necessary equipment
- Secure or allocate funding for upgrades to public facilities as feasible

Secure a fuel reserve or ensure contractual emergency provisions to ensure that critical infrastructure may run on power backup for extended periods of time.

- Determine where county and municipal vehicles (and generators) routinely receive fuel
- Review contract language to ensure municipal and critical facilities have ability to receive fuel prior to other clients
- If necessary, add such language to contracts

5.12 PUBLIC EDUCATION AND OUTREACH

Establish an FM or AM radio station, or develop agreements with existing stations, to alert the public in cases of emergency.

- Identify communities, or critical facilities such as schools, with existing radio stations
- Develop agreements for public alerts and develop standard messages for emergency situations

- Assist additional communities or critical facilities in developing radio stations as feasible
- Partner with larger, regional radio stations to alert the public in emergency situations

Provide multi-lingual hazard preparedness literature (warning sirens, radio stations, go-kits, insurance protection, lightning rods, etc.) during Severe Weather Awareness Week, at public facilities and events and to populations within known hazard areas such as floodplains, downstream of a dam, behind a levee, near hazmat facilities, etc.

- Review existing materials provided by federal, state, and local programs
- Determine if materials need to be revised, additional hazards need to be covered, or if distribution methods need to be revised
- Develop or provide additional materials targeting at risk populations or areas based on hazards

5.13 SAFER ROOMS AND COMMUNITY SHELTERS

Develop temporary and/or long-term shelter agreements within the county. Potential for tiered levels of accessible shelters or domestic animal shelters, especially in smaller communities

- Review locations and capabilities of existing shelters within the county
- Determine if adequate coverage is provided in populated areas or in centralized areas of the unincorporated areas within the county
- Determine if alternative shelters are available (those which may not be Red Cross certified but may be suitable for short term shelter at the agreement of the client)
- Determine need for sheltering of domestic animals; develop appropriate plans and shelter agreements

Clearly advertise location of safe rooms and community shelters for large gatherings of people (live, work, shop, recreate)

- Partner with event representatives to assess methods possible to advertise safe locations in case of emergencies
- Incorporate advertisement of safe locations into early planning and coordination steps of events such as sporting events, community festivals, and large outdoor events

5.14 STORMWATER MANAGEMENT

Minimize the impacts of flooding by diverting or retaining stormwater onsite using green infrastructure practices

- Investigate and prioritize areas prone to flooding
- Determine the feasibility of incorporating green infrastructure practices on an individual site or regional scale
- Encourage landowners to install the practices or to allow a demonstration project on their property

Maintain channels and regulated drains to prevent localized flooding

- Review and assess information from the Surveyor's Office related to areas in need of maintenance
- Prioritize channels and drains based on flooding impacts or potential impacts
- Allocate funding and perform needed maintenance as feasible

5.15 TRANSPORTATION

Encourage warning signals (flashing lights, crossing arms, rumble strips, signage) at each intersection between rail and road to reduce the potential for train-vehicle crashes

- Inventory each rail and road intersection throughout the county, noting existing warning methods
- Determine which method may be most feasible for each intersection based on amount of traffic, population served, and existing road conditions
- Partner with rail company to plan and install warning practices as prioritized and as budgets allow

CHAPTER 6 PLAN MAINTENANCE PROCESS

6.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

REQUIREMENT §201.6(c)(4)(i):
[The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

To effectively reduce social, physical, and economic losses in Lake County, it is important that implementation of this MHMP be monitored, evaluated, and updated. The EMA Director is ultimately responsible for the MHMP. As illustrated in Section 4.2 Mitigation Practices, this Plan contains mitigation program, projects, and policies from multiple departments within each NFIP community. Depending on grant opportunities and fiscal resources, mitigation practices may be implemented independently, by individual NFIP communities, or through local partnerships. Therefore, the successful implementation of this MHMP will require the participation and cooperation of the entire Committee to successfully monitor, evaluate, and update the Lake County MHMP.

The EMA Director will reconvene the MHMP Committee on an annual basis and follow a significant hazard incident to determine whether:

- the nature, magnitude, and/or type of risk have changed
- the current resources are appropriate for implementation
- there are implementation problems, such as technical, political, legal, or coordination issues with other agencies
- the outcomes have occurred as expected
- the agencies and other partners participated as originally proposed

During the annual meetings, the Implementation Checklist provided in **Appendix 10** will be helpful to track any progress, successes, and problems experienced.

The data used to prepare this MHMP was based on "best available data" or data that was readily available during the development of this Plan. Because of this, there are limitations to the data. As more accurate data becomes available, updates should be made to the list of critical infrastructures, the risk assessment and vulnerability analysis.

DMA 2000 requires local jurisdictions to update and resubmit their MHMP within five years (from the date of FEMA approval) to continue to be eligible for mitigation project grant funding. In early 2023, the EMA Director will once again reconvene the MHMP Committee for a series of meetings designed to replicate the original planning process. Information gathered following individual hazard incidents and annual meetings will be utilized along with updated vulnerability assessments to

assess the risks associated with each hazard common in Lake County. These hazards, and associated mitigation goals and practices will be prioritized and detailed as in Section 3.0 this MHMP. Sections 4.0 and 5.0 will be updated to reflect any practices implemented within the interim as well as any additional practices discussed by the Committee during the update process.

Prior to submission of the updated MHMP, a public meeting will be held to present the information to residents of Lake County and to provide them an opportunity for review and comment of the draft MHMP. A media release will be issued providing information related to the update, the planning process, and details of the public meeting.

6.2 INCORPORATION INTO EXISTING PLANNING MECHANISMS

REQUIREMENT §201.6(c)(4)(ii):
[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as the comprehensive or capital improvements, when appropriate.

Many of the mitigation practices identified as part of this planning process are ongoing with some enhancement needed. Where needed, modifications will be proposed to be made to each NFIP communities' planning documents and ordinances during the regularly scheduled update. Among other things, local planning documents and ordinances may include comprehensive plans, floodplain management plans, zoning ordinances, building codes, site development regulations, or permits. Modifications include discussions related to hazardous material facility buffers, floodplain areas, and discouraging development of new critical infrastructure in known hazard areas.

Based on added language within each of the Comprehensive Plan updates, the appropriate Zoning Ordinances and Floodplain Management Ordinances within each community would also need to be amended. At the time of this planning effort, the City of Crown Point and the City of Gary were beginning the process to update their Comprehensive Plans. As active participants in this effort and because of this effort, all community representatives are encouraged to include information from this update in various community plans.

6.3 CONTINUED PUBLIC INOLVEMENT

REQUIREMENT §201.6(c)(4)(iii):
[The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Continued public involvement is critical to the successful implementation of the Lake County MHMP. Comments gathered from the public on the MHMP will be

received by the EMA Director and forwarded to the MHMP Committee for discussion. Education efforts for hazard mitigation will be the focus of the annual Severe Weather Awareness Week as well as incorporated into existing stormwater planning, land use planning, and special projects/studies efforts. Once adopted, a copy of this Plan will be available for the public to review in the EMA Office and the Lake County website.

Updates or modifications to the Lake County MHMP will require a public notice and/or meeting prior to submitting revisions to the individual jurisdictions for approval.

The CRS program credits NFIP communities a maximum of 28 points for adopting the Plan; establishing a procedure for implementing, reviewing, and updating the Plan; and submitting an annual evaluation report.

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