2014 State of Indiana
Standard Multi-Hazard Mitigation Plan

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Mission Statement

The Indiana Department of Homeland Security will provide statewide leadership, exemplary customer service, and subject matter expertise for the enhancement of public and private partnerships and the assurance of local, state and federal collaboration to continually develop Indiana's public safety capabilities for the wellbeing and protection of our citizens, property and economy.

To learn more about the Indiana Department of Homeland Security visit http://www.in.gov/dhs.

Acknowledgments

The Indiana Department of Homeland Security would like to extend special thanks to The Polis Center at Indiana University-Purdue University Indianapolis for its support in developing the 2014 State Hazard Mitigation Plan. IDHS also recognizes the contributions of the Indiana Silver Jackets, a unique collaboration among federal, state, and local agencies that work together to leverage resources and more effectively address Indiana's natural hazards.

ACRONYMS

CBRNE: Chemical, Biological, Radiological, Nuclear, and Explosives
CDBG: Community Development Block Grant
DHHS: Department of Health and Human Services
DHS: Department of Homeland Security
DNR: Department of Natural Resources
DOA: Department of Administration
DOJ: Department of Justice
DOT: Department of Transportation
EMA: Emergency Management Agency
EMPG: Emergency Management Performance Grants
FEMA: Federal Emergency Management Agency
FHWA: Federal Highway Administration
FSSA: Family and Social Services Administration
HMGP: Hazard Mitigation Grant Program
HSEP: Homeland Security and Emergency Preparedness
HUD: United States Department of Housing and Urban Development
IA: Individual Assistance
IDHS: Indiana Department of Homeland Security
IDNR: Indiana Department of Natural Resources
IDOC: Indiana Department of Correction
IDOE: Indiana Department of Education
IGS: Indiana Geological Survey
IHCDA: Indiana Housing and Community Development Authority
INDOT: Indiana Department of Transportation
IOT: Indiana Office of Technology
IPSC: Integrated Public Safety Commission
ISDH: Indiana State Department of Health
ISP: Indiana State Police
IUPUI: Indiana University Purdue University-Indianapolis
IWRC: Indiana Water Resources Council
NFIP: National Flood Insurance Program
NIH: National Institute of Health
NOAA: National Oceanic
NRCS: Natural Resources Conservation Service
NSF: National Science Foundation
OCRA: Office of Community and Rural Affairs
PA: Public Assistance

REMC: Rural Electric Membership Corporation
RPC: Regional Planning Commission
URC: Utility Regulatory Commission
USACE: United States Army Corps of Engineers
USDA: United States Department of Agriculture
USGS: United States Geological Survey
VA: United States Department of Veterans Affairs
VOAD: Volunteer Organizations Active in Disaster

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Executive Summary

The Indiana Standard Hazard Mitigation Plan was developed in collaboration with government, academic, and private entities for the purpose of preventing, protecting against, responding to, and recovering from disasters that may threaten the state's citizens, infrastructure, and economy. Following the adoption of the last version of this plan in 2011, the Indiana Department of Homeland Security (IDHS) partnered with The Polis Center (Polis) at Indiana University-Purdue University Indianapolis to overhaul the plan and develop a more comprehensive, risk-based approach for assessing the vulnerabilities of the state and its communities. Every section of the plan has been revised with the most current available data. The most significant updates are:

Planning Process: IDHS coordinated a diverse group of state agencies to collect data for historical hazard events, state-owned buildings, essential facilities, insurance claims, and proposed, pending, and approved mitigation projects. Contributing entities include, but are not limited to, the State Geographic Information Officer (GIO), Indiana State Department of Health, Indiana Family and Social Services Administration, Indiana Department of Natural Resources, Indiana Department of Administration, Indiana Geological Survey, and Indiana Department of Transportation.

Throughout the planning process, IDHS engaged the Indiana Silver Jackets, which is comprised of members from many agencies including the US Army Corps of Engineers, FEMA, Indiana University, Purdue University, US Geological Survey, National Weather Services, and more. The Silver Jackets team was instrumental in collecting statewide data and providing peer review and input.

Risk Assessment: The risk assessment includes modeled scenarios for floods, tornadoes, and earthquakes. Using the updated data collected from state agencies during the planning process, Polis created new building inventory that includes state-owned and state-leased properties and facilities, as well as essential facilities (fire stations, police departments, K-12 schools, care facilities, and emergency operations centers) throughout the state. The flood analysis is reported by watershed to integrate seamlessly with FEMA's Risk MAP reports and studies.

Mitigation Prioritization: The risk assessment highlighted communities with greatest vulnerability throughout the state, and IDHS reviewed the local mitigation plans for those communities and integrated top strategies into the state plan as appropriate. For flooding, The Polis Center used the Community Asset Prioritization Index (CAPI), developed for FEMA's Risk MAP program, to rank communities by greatest vulnerability.

Mitigation Goals, Objectives, and Strategies: The 2011 version of the SHMP set mitigation goals and projects as broad, overarching themes in which many strategies could fit. The 2014 version replaces these broad themes with more specific goals and objectives to provide more detailed mitigation strategies that can be easily monitored for progress in future evaluations. Additionally, in Section 5.1, IDHS provides a comprehensive description of the status of each mitigation project proposed in the 2011 plan. New proposed mitigation projects are described following the hazard they relate to. For example, the flood section describes the hazard, estimates potential losses from the hazard, and then examines potential mitigation actions.

Throughout this plan, call-outs boxes highlight some of Indiana's best practices in mitigation. These significant updates to the 2014 Indiana SHMP position it as a strong foundation upon which an enhanced mitigation plan can be developed and submitted in 2017.

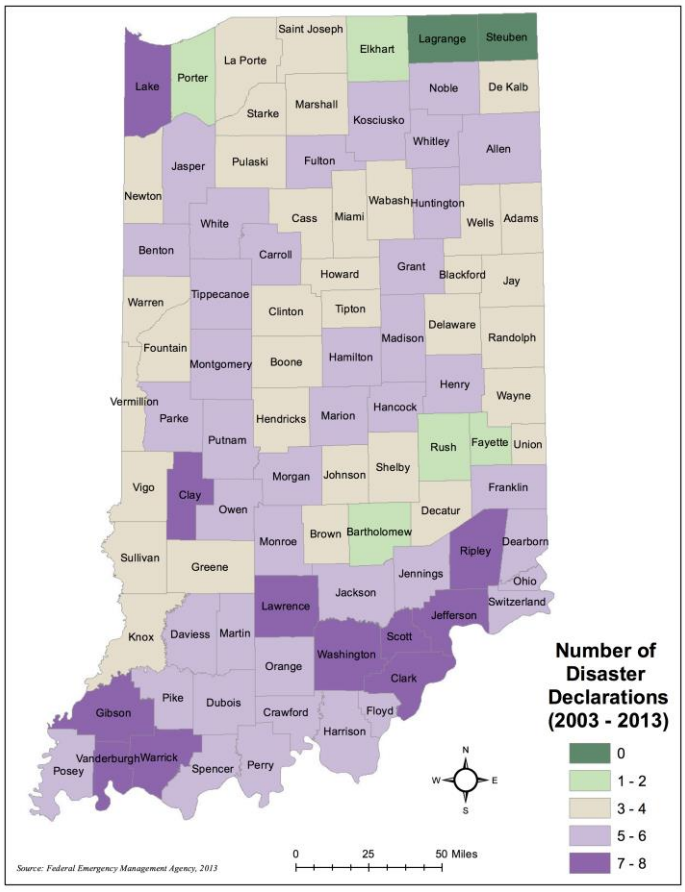
The 2014 Indiana SHMP and IDHS's planning process comply with all applicable Federal statutes and regulations in compliance with 44 CFR 13.11(c), and the State will amend the plan as necessary to reflect changes in State and Federal laws and statutes as required in 44 CFR 13.11(d).

Section 1 Introduction

The Indiana Standard Hazard Mitigation Plan (SHMP) seeks to examine the disasters that have impacted the state, identify high-risk communities and areas of vulnerability, and explore emerging threats. It is the basis by which the State encourages local jurisdictions to adopt sound mitigation principles and activities, and allows the State to provide technical assistance and funding opportunities to help communities become more resilient to disasters. All of the assistance provided through federal and state funding has been, and will continue to be, granted to local and state agencies within the scope and guidance provided as required by federal, state, and local rules, laws, and regulations, outlined in Appendix B.

In the past decade, Indiana has received 16 federal disaster declarations, which have impacted 90 of its 92 counties (Figure 1). The most recent disaster (DR-4058) was declared on March 9, 2012 after an EF-4 tornado ran for more than 40 miles through four southern Indiana counties before continuing for another five miles into Kentucky. Section 5.2.2 includes a GIS model that illustrates the estimated impacts of this tornado.

Figure 1: Federal Disaster Declarations (2003-2013)



Decade of Disasters (2003-2013)

DR-1433: Longest tornado path in US with no deaths over 100 miles

DR-1573: Most widespread flooding

DR-1612: Deadliest tornado in Indiana – killed 26 people in two counties

DR-1766: Most devastating flood

DR-1795: First "Hurricane Disaster;" remnants of Hurricane Ike

EM-3197: Record snow storm in Southern Indiana; 32" fell at a rate of 4" per hour in several locations

DR-4058: Last declared disaster of the decade; tornadoes in six counties killing 13 people in Indiana

In the event of a federally declared disaster, individuals, families, and businesses may apply for financial assistance to help with critical expenses. Assistance may be categorized as Individual Assistance (IA), Public Assistance (PA), or Hazard Mitigation Assistance.

The following types of assistance may be available in the event of a disaster declaration.

Individuals & Household Program: Provides money and services to people in presidentially declared disaster areas.

Housing Assistance: Provides assistance for disaster-related housing needs.

Other Needs Assistance: Provides assistance for other disaster-related needs such as furnishings, transportation, and medical expenses.

Public Assistance: Disaster grant assistance available for communities to quickly respond to and recover from major disasters or emergencies declared by the president.

Emergency Work (Categories A-B): Work that must be performed to reduce or eliminate an immediate threat to life, to protect public health and safety, and to protect improved property that is significantly threatened due to disasters or emergencies declared by the president.

Permanent Work (Categories C-G): Work that is required to restore a damaged facility, through repair or restoration, to its pre-disaster design, function, and capacity in accordance with applicable codes and standards.

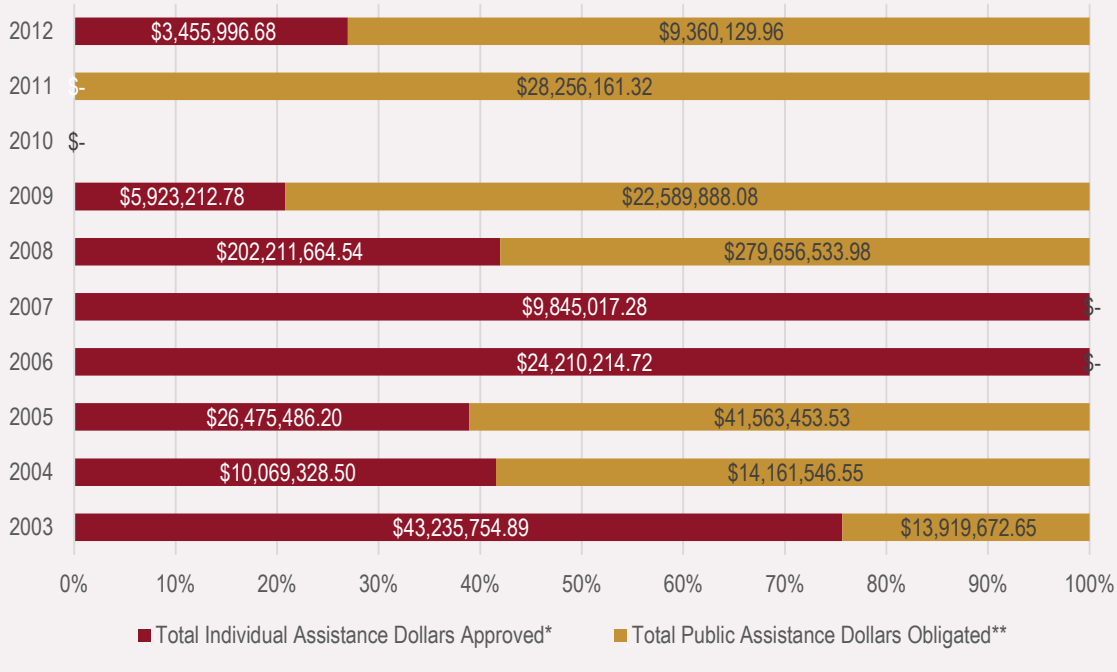
Hazard Mitigation Assistance: Provides assistance to states and local governments through the Hazard Mitigation Grant Program (HMGP) to implement long-term hazard mitigation measures after a major disaster declaration.

The majority of disaster assistance is provided via low-interest disaster loans, which are available after a disaster for homeowners and renters from the US Small Business Administration (SBA) to cover uninsured property losses. These loans are available to individuals for the repair or replacement of homes, automobiles, and damaged personal property; they are also available to businesses for property loss and economic injury.

Total obligated PA between 2003 and 2013 totaled $216,093,412, which averages to more than $15 million per year. Further, more than 25% ($54 million) of the total PA dollars were obligated to county highway departments and rural electrical cooperatives. Highway departments claimed significant damages from flooding and fluvial erosion, and rural electrical cooperatives have historically been vulnerable to ice storms and high winds.

Figure 2 illustrates (by year) how federal dollars were split between IA and PA. There were no federal dollars approved or obligated in 2010.

Figure 2: Federal Disaster Assistance by Type for Indiana Disasters (2003-2013)



*Dollars Approved: assistance dollars approved but not necessarily disbursed

**Dollars Obligated: funds made available to the state via electronic transfer following FEMA's final review and approval of PA projects

Note about Figure 2 Chart:

Total Individual Assistance includes Individuals & Household Program (IHP), Housing Assistance (HA), and Other Needs Assistance (ONA).

Total Public Assistance includes Public Assistance (PA), Emergency Work, and Permanent Work.

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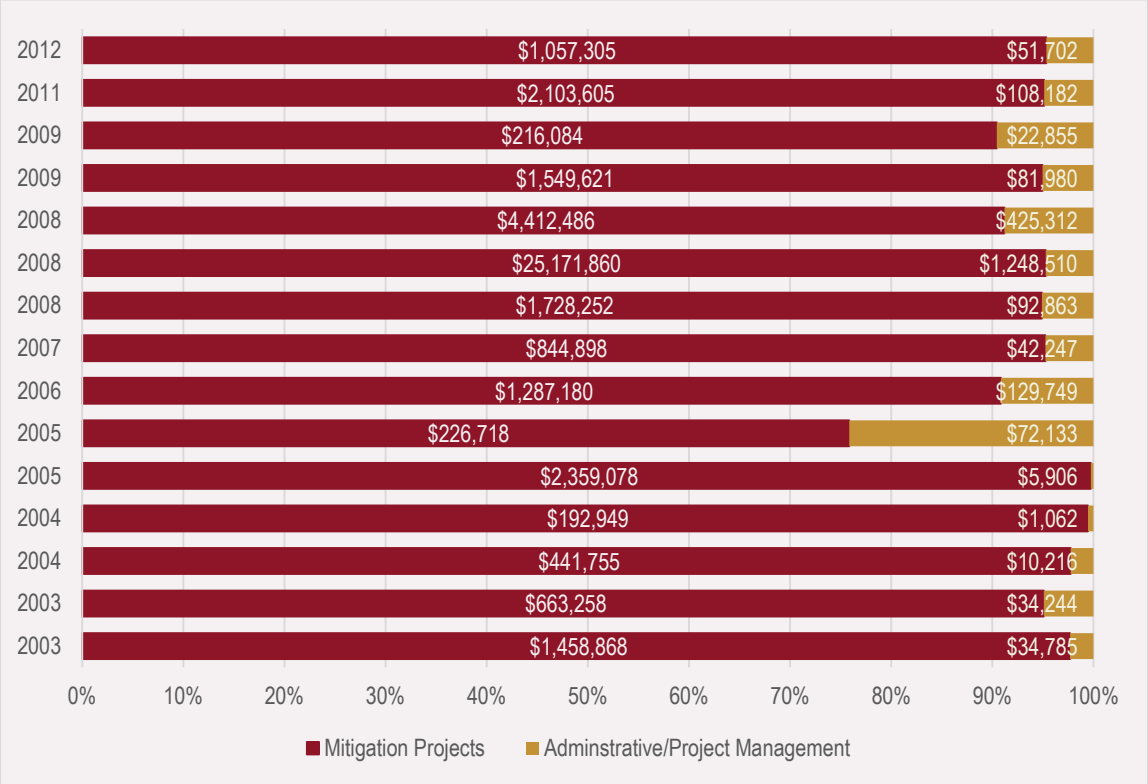
The Indiana Department of Natural Resources (IDNR) developed Floodmaps.IN.gov as a digital repository for hydrologic and hydraulic models and floodplain maps. This information is used to update Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRMs) in a digital format. The new flood maps allow the State and local jurisdictions to better administer their flood management programs.

Total obligated HMGP funding between 2003 and 2013 totaled $46,075,663, which averages to more than $4.6 million per year. More than half of the total obligated in the past decade ($25.2 million) was for assistance related to catastrophic flooding in 2008 (DR-1766). Figure 3 illustrates how HMGP dollars were allocated by year.

Figure 3: HMGP Funding Obligated for Indiana Disasters (2003-2013)



The Indiana State Disaster Relief Fund (SDRF) was established in 2003 to provide infrastructure damage assistance. In 2007, the SDRF was expanded to provide Individual Assistance for home owners and renters whose primary residence was damaged/destroyed. Table 1 provides a summary of total SDRF program costs since 2007.

Table 1: Summary of State Disaster Relief Fund Total Funding (2007-2013)

	Num. Eligible Households	Num. Applicants	Num. Awards	Total Amt. Awarded
Individual Assistance				
Total	400	344	317	$1,459,567.23
Average per Award/ Event	50	49	45	$208,513.89
Public Assistance				
Total	15	15	15	$1,520,308.97
Average per Award/ Event	3	3	3	$304,061.79

Note: Above table does not include the April 2013 flood event. Funding for that event is still in progress.

Program costs for the Public Assistance Infrastructure totals more than $1.5 million since 2007. Table 2 identifies awards related to the Public Assistance Infrastructure Program from 2007 through 2013. The State is currently processing grant awards for one additional flood event that occurred in April 2013.

Table 2: State Disaster Relief Fund Infrastructure Program Funding (2007-2013)

*Funding formula = (Total Eligible Damages - population) * 0.50*					
Date of Event	Event Description	Community	County	Eligible Damage Amount Claimed	Award Amount
November 2007	Tornado - Severe Storms	Napanee	Elkhart		$198,423.35
			Subtotal	$0.00	$198,423.35
Feb. - March 2011	Severe Storms - Flooding	Jay County	Jay		$102,207.98
Feb. - March 2011	Severe Storms - Flooding	Dubois County	Dubois		$204,094.81
Feb. - March 2011	Severe Storms - Flooding	Portland	Jay		$1,137.02
Feb. - March 2011	Severe Storms - Flooding	Jasper	Dubois		$3,972.76
			Subtotal	$0.00	$311,412.57
May-June 2011	Tornado - Severe Storms	Greensburg	Decatur	$190,430.61	$89,469.31
May-June 2011	Tornado - Severe Storms	Bloomington	Monroe	$296,473.45	$108,034.23
May-June 2011	Tornado - Severe Storms	Terre Haute	Vigo	$305,560.72	$122,387.86
May-June 2011	Tornado - Severe Storms	Rensselaer	Jasper	$47,841.07	$20,991.04
May-June 2011	Tornado - Severe Storms	DeMotte	Jasper	$150,020.13	$73,107.00
			Subtotal	$990,325.98	$413,989.44
June 29-July 3 2012	Severe Storms High Winds	Ft Wayne	Allen		$435,364.92
June 29-July 3 2012	Severe Storms High Winds	New Haven	Allen		$73,933.69
June 29-July 3 2012	Severe Storms High Winds	Leo-Cedarville	Allen		$12,711.00
			Subtotal	$0.00	$522,009.61
July 31 2012	Tornado - Severe Storms	Gibson Co	Gibson		$30,145.87
July 31 2012	Tornado - Severe Storms	Oakland City	Gibson		$44,328.13
			Subtotal	$0.00	$74,474.00
			Infrastructure Program Total		**$1,520,308.97**

Program costs for the Individual Assistance Homeowner/Renter Assistance Program totals more than $1.4 million since 2007 with an average of 45 awards at $208,513.89 each. The award threshold for this program is $500 for a minimum award and $5,000/household for a maximum award. Table 3 identifies awards related to the Homeowner/Renter Assistance Program from 2007 through 2013. The State is currently processing grant awards for one additional flood event that occurred in April 2013.

Table 3: State Disaster Relief Fund Individual Assistance Program Funding (2007-2013)

Date of Event	Event Description	SBA Declaration Num.	Num. Awards	Total Amount Awarded
8/19/2009	Severe Storms and Tornadoes	11870	0	$0.00
8/4-9/2009	Severe Storm, flooding	11926	51	$242,772.60
2/27-3/8/2011	Flooding	12499	29	$111,604.70
4/19 - 6/6 2011	Floods, Tornadoes, Hail and Severe Storms	12813	28	$139,294.37
11/14/2011	Tornadoes and Severe Storms	12949	2	$7,526.36
6/29 - 7/3/2012	High Winds and Storms	13174	8	$26,700.20
7/31/2012	Macroburst and Storms	13217	19	$77,309.00
4/17-24/2013	Flooding	13569	180	$854,390.00
		Totals	317	$1,459,597.23
		Average	45	$208,513.89

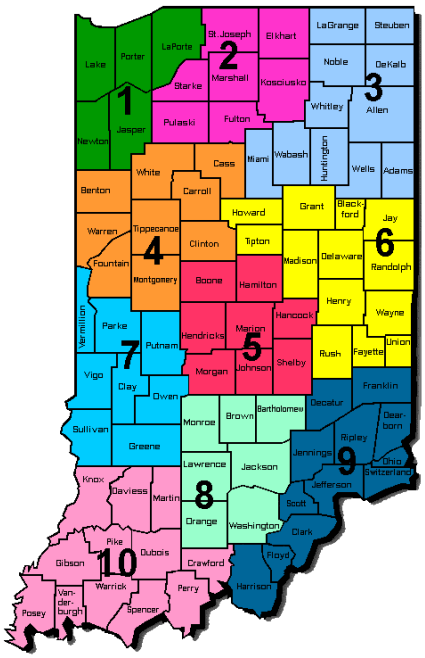
The goals of the SHMP include the following:

- Identify areas of vulnerability throughout the state and estimate the cost and magnitude of potential disasters
- Establish strategies and priorities to mitigate risks to citizens and property from natural, technological, and human hazards
- Identify specific mitigation projects to pursue for identified hazard
- Guide each IDHS district in its risk management priorities and activities
- Establish eligibility for future mitigation project funds

Section 2 State Profile

Located in the Great Lakes region of the United States, Indiana is ranked 16th in the nation in terms of population and 38th in terms of land area. It is comprised of 92 counties, 681 census places, 16 metropolitan statistical areas, and 25 micropolitan statistical areas. The Indiana Department of Homeland Security (IDHS) has divided the state into 10 districts (Figure 4) to more effectively coordinate disaster activities such as response, damage assessment, preparedness, and outreach and education.

Figure 4: IDHS Districts

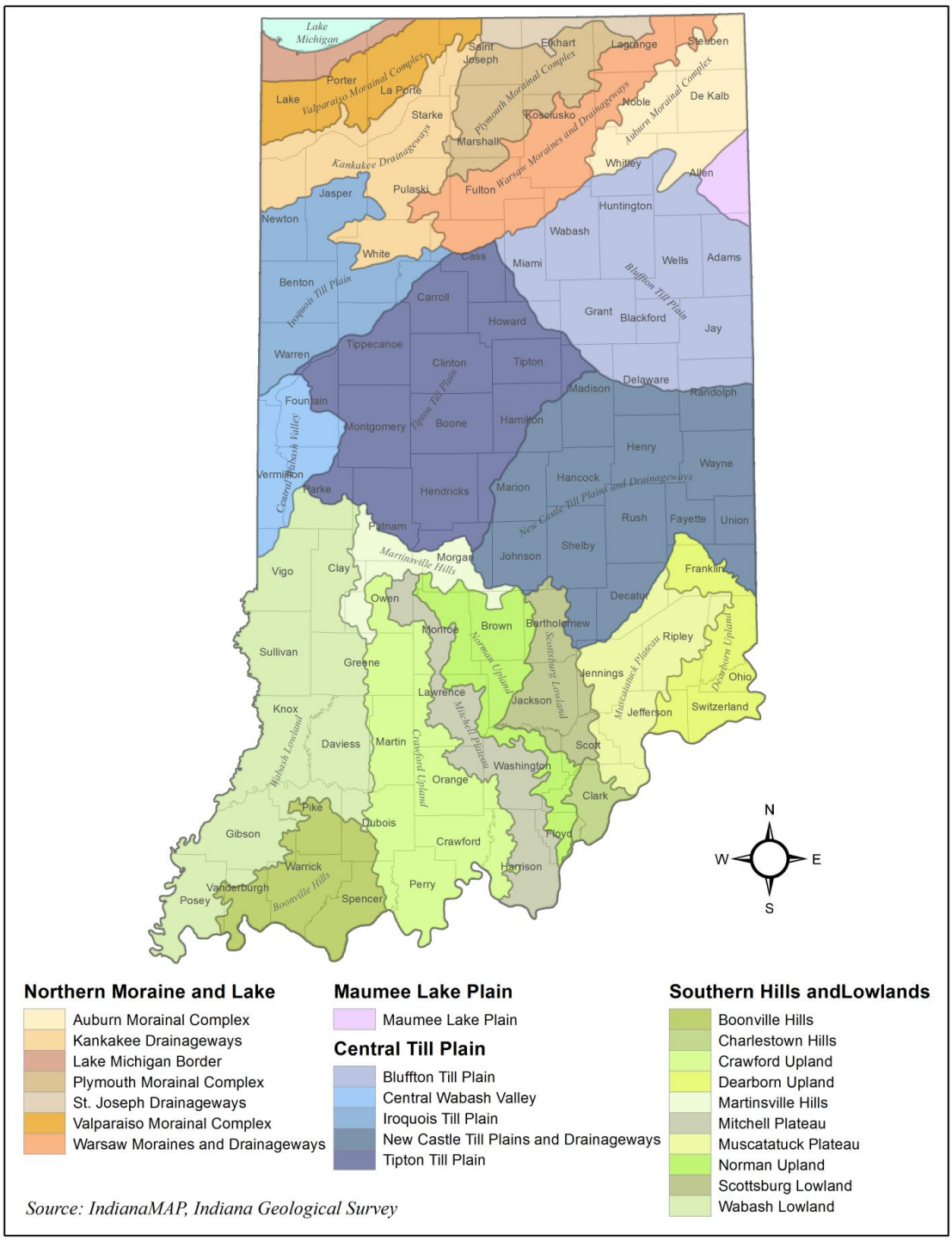


2.1 Geography, Topography, and Climate

In terms of land area, Indiana is one of the smallest states west of the Appalachian Mountains, but its topography and climate vary significantly from the northern portion of the state to the southern portion. The northern two-thirds is characterized primarily by flat plains and numerous small lakes, and the effect of Lake Michigan often induces heavy winter precipitation, especially snowfall. In contrast, the unglaciated southern region is characterized by rolling hills, caves, and waterfalls. Underlying limestone produces soils with poor water retention capacity, making it difficult for crops to grow and develop without frequent rains. The growing season is longer in the southwest part of the state where tomatoes, strawberries, and melons are grown commercially.

The Central Till Plain is primarily drained by the Wabash River system and produces the state's highest crop yields. Corn, soybeans, wheat, and fruit are grown throughout the Wabash River Basin, but the risk of frost, late spring freezes, and severe winter kill must be considered for mitigation purposes. Figure 5 illustrates Indiana's physiographic landscape.

Figure 5: Indiana Physiography



Average temperatures in the state range from 15 to 21 degrees Fahrenheit in January to 80 to 83 degrees in July, the warmest month. In the past decade, Indiana has seen milder winters due to the strong influences of El Niño. Average annual precipitation ranges from 37 inches in the northern part of the state to 47 inches in the southern part. Although Indiana has experienced flooding in every month of the year, the months of greatest flood frequency are from December through May. May is typically the wettest month and averages 4 to 5 inches of rainfall statewide.

Source: Indiana State Climate Office

Indiana's unique geography, geology, and meteorology make it vulnerable to earthquakes, floods, tornadoes/high winds, severe winter storms, droughts, and extreme temperatures. Incidents involving other natural hazards, such as subsidence, landslide, and wildfire have been rare or localized and unreported, making the risk to the state as a whole difficult to assess. According to the USGS and the Indiana Department of Natural Resources, there has been no documented subsidence in urbanized areas of the state.

Most of the underground coal mines and karst topography that would cause these subsidence events are located in southern and south central rural farming areas. However, these areas have begun to convert to residential or mixed commercial developed areas due to the abandonment or reduction of coal activities in the state and the pressures of increased development throughout the first decade of the 21st century. The increased development will likely cause more and more incidents of subsidence affecting the built environment. Where karst topography and reclaimed mines once created sinkholes in pasture or farm fields, they will now impact a residential subdivision or commercial park. Lands once associated with mining have additional hazards associated with abandoned tunnels and entrances, acidic runoff, and the infiltration of carbon dioxide gas into lower levels of buildings.

Also of note but not individually addressed, are the natural hazards, such as hail, that are associated with tornadic-type storms. The SHMP addresses these within the broader category of severe thunderstorms and tornadoes.

In 2006, Indiana reported $1.5 billion in hail claims, topping the *Insurance Journal's* list of states that sustained catastrophic losses in that year. Missouri ranked second with $878 million in claims.

"Indiana is not a Florida or Louisiana where insurance companies expect large storms annually," said Steve Williams, president of the Insurance Institute of Indiana.

In 2012, Indiana reported 23,000 hail claims, ranking seventh on State Farm's "Top 10 States for Hail Claims." The claims did not reflect damages to crops from storms during the growing seasons.

2.2 Demography

Indiana is the 16th most populous state in the nation with 6,457,067 people and a population density of 182 people per square mile (2012 ACS 1-year estimate). The most populous city is the capital of Indianapolis. Table 4 lists the ten counties with the highest total population.

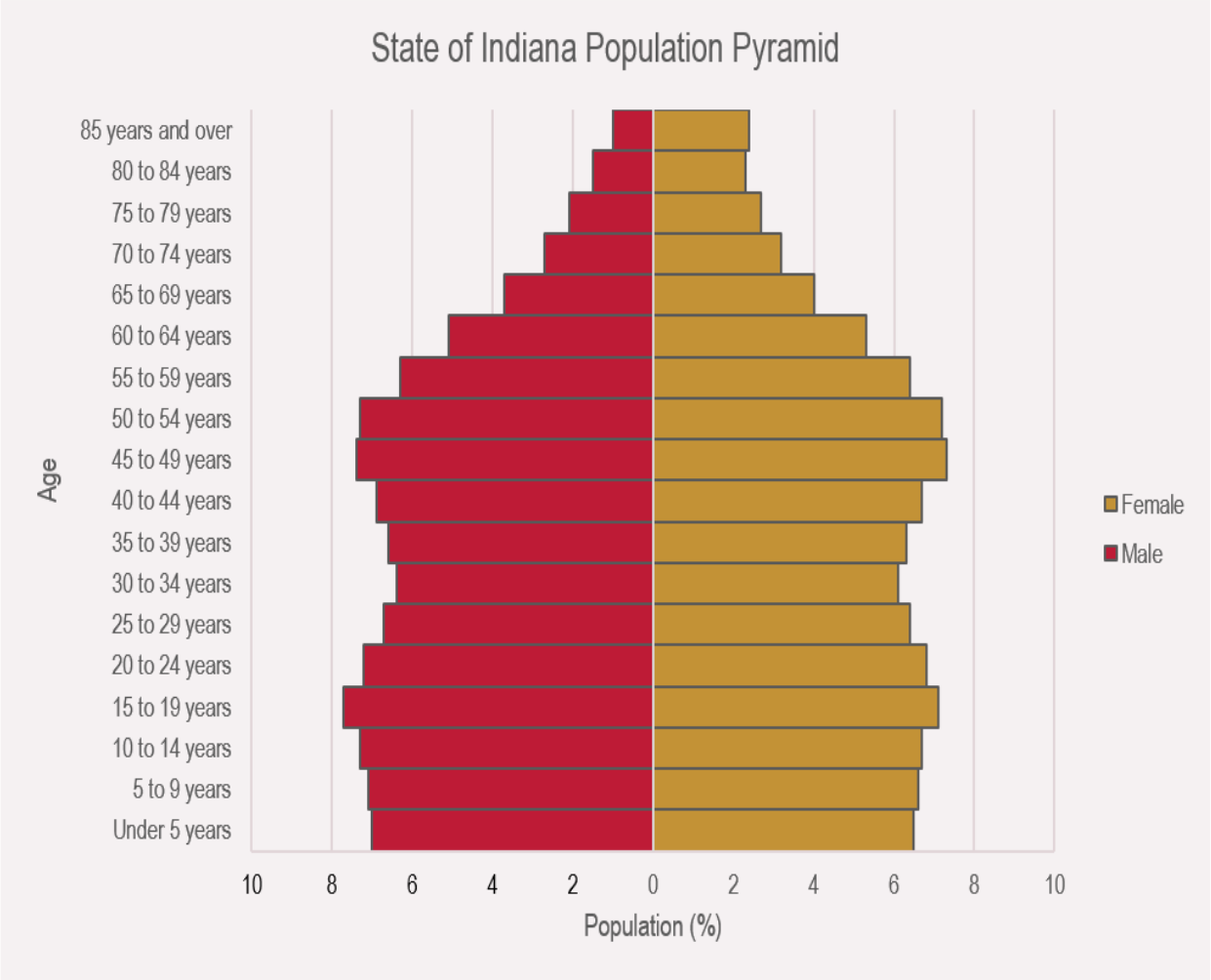
Table 4: Indiana's Most Populous Counties

County	Total Population	Percent of State Population
Marion	903,393	13.9%
Lake	496,005	7.6%
Allen	355,329	5.5%
Hamilton	274,569	4.2%
St. Joseph	266,929	4.1%
Elkhart	197,561	3.0%
Vanderburgh	179,703	2.8%
Tippecanoe	172,780	2.7%
Porter	164,343	2.5%
Hendricks	145,448	2.2%

Figure 6 on the following page shows Indiana's population pyramid, which illustrates the distribution of the state's population in terms of age groups and gender. Population pyramids are used to analyze growth or decline of fertility, mortality, and migration within the specified area.

Indiana's population pyramid is relatively stable indicating slow population growth, long life expectancy, and low infant mortality. It shows the same general shape as a population pyramid of the United States. The slight increase in population from 45 to 59 years represents the tail end of baby boom generation, which is defined as the population cohort born between 1946 and 1964. This increase will continue to travel upward as that population ages.

Figure 6: Indiana Population Pyramid



Source: 2007-2011 American Community Survey 5-Year Estimate

Most of Indiana's counties exhibit a population distribution similar to the state's; however, there are some areas (see the charts on the following page) with atypical distributions, indicating the presence of populations that may require special consideration in terms of disaster mitigation.

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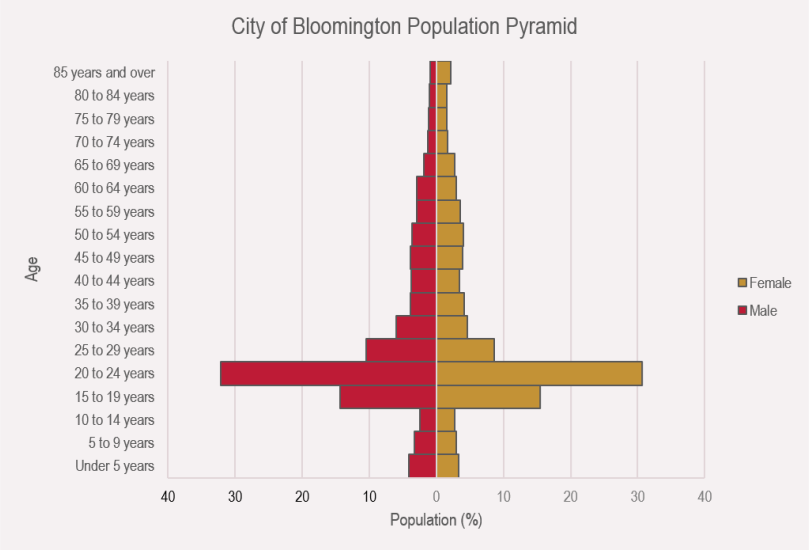
In 2013, IDHS, The Polis Center, and Indiana University (IU) collaborated to develop a comprehensive Disaster-Resistant University (DRU) plan for all eight of the university's campuses. This was one of the first DRUs to include campus-specific, Level 2 Hazus analyses for flood and earthquake.

Figure 7 shows the population pyramid for the City of Bloomington. The spike for the population aged 20 to 24, which accounts for more than 30% of the city's total population, is due to the significant student population at Indiana University.

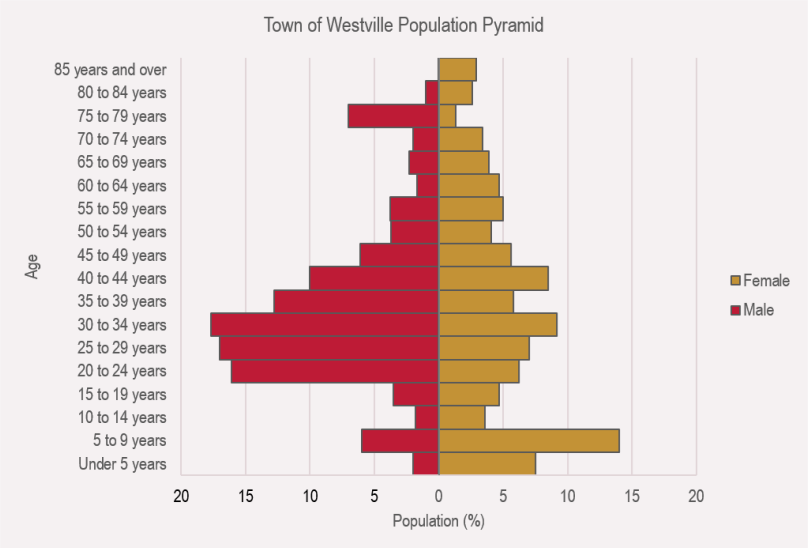
Figure 7: City of Bloomington Population Pyramid



Source: 2007-2011 American Community Survey 5-Year Estimate

Figure 8 shows the pyramid for the Town of Westville. The male population aged 20 to 34 far surpasses the female population in the same age group. This is because the town is home to the state-operated Westville Correctional Facility, a prison for adult males.

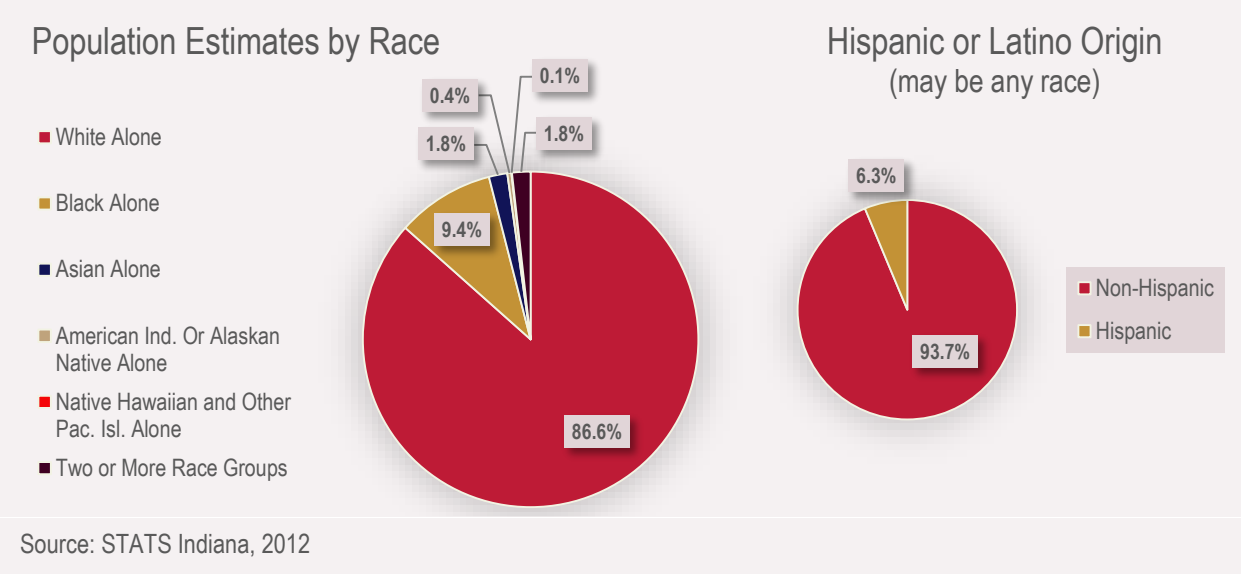
Figure 8: Town of Westville Population Pyramid



Source: 2007-2011 American Community Survey 5-Year Estimate

The state of Indiana is becoming increasingly diverse, comprising many cultures and sub-cultures, which are important to consider in mitigation planning. Figure 9 shows its racial composition as estimated for 2012.

Figure 9: Indiana's Racial/Ethnic Composition



2.3 Population Change

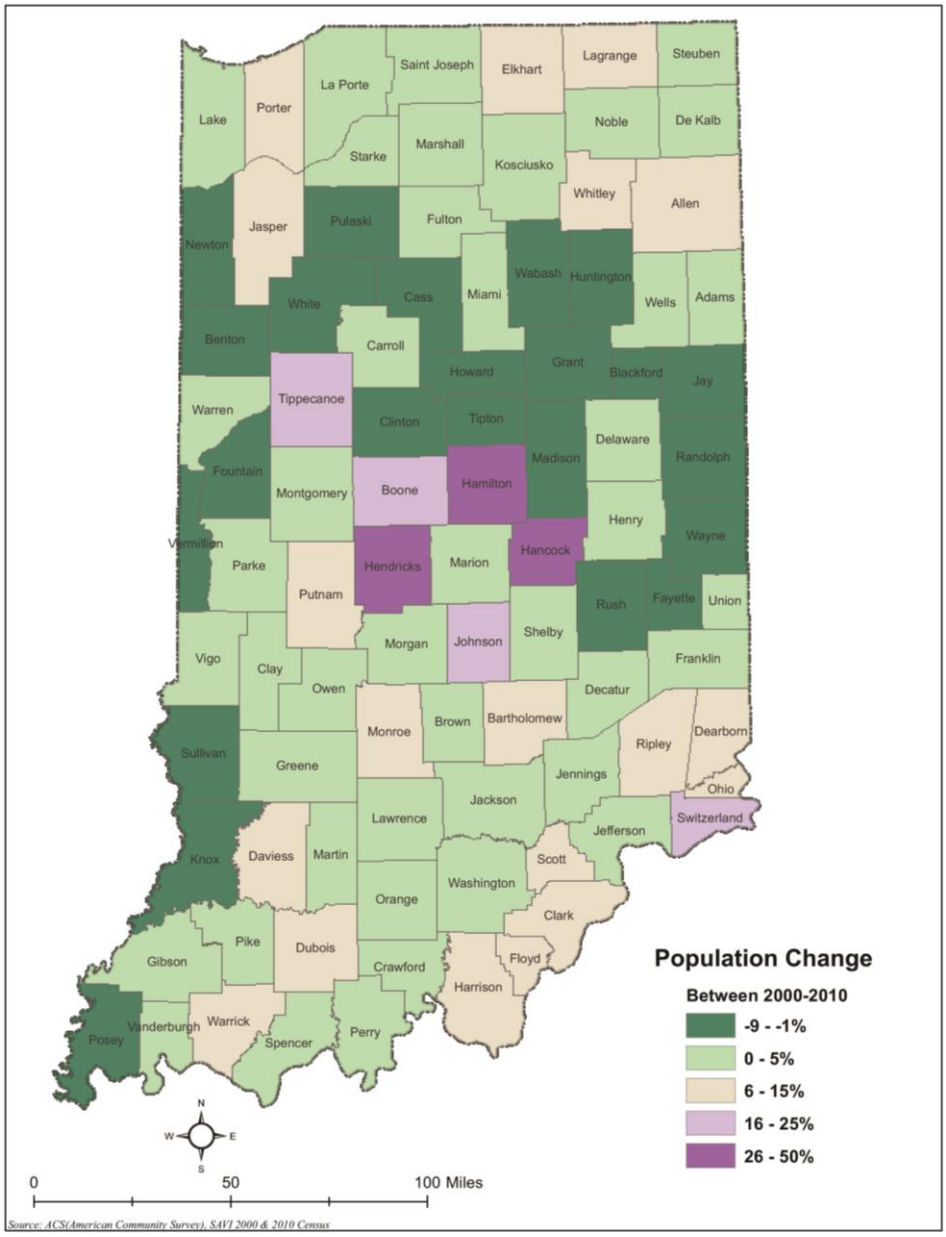
From 2000 to 2010, Indiana's population grew by more than 400,000 or 6.6%, well above the average growth of the Midwest. Hamilton County had the most significant increase (50.3%), and Blackford County had the most significant decrease (-9.1%) in population. Figure 10 on the following page illustrates population change from 2000 to 2010 for each county.

Key Definitions

Net Domestic Migration: The difference between domestic inbound migration to an area and domestic outbound migration from the same area during a specified period of time. Only includes migration within the United States (excluding Puerto Rico).

Natural Increase: Births minus deaths.

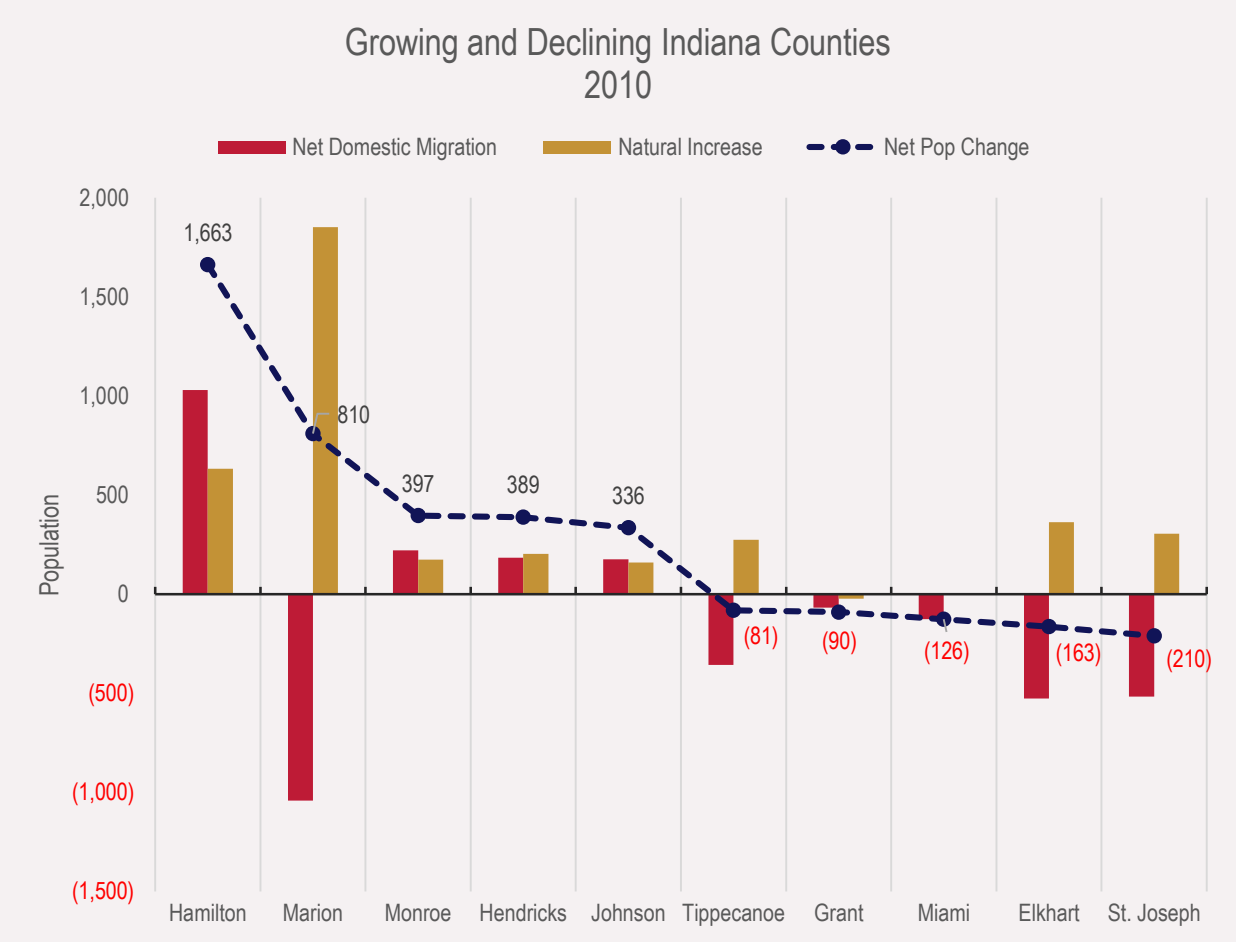
Figure 10: Indiana Population Change by County (2000-2010)



Populations grow or decline through migration and natural increase, and often these two components offset each other. Because international migration data was not as consistent as domestic migration data, this plan only references net domestic trends. From 2000-2010, all but five Indiana counties (Brown, Henry, Sullivan, Vermillion, and Wabash) registered a positive natural increase, but only 30 of the state's 92 counties added population through net in-migration. Figure 10 shows the five counties with the most significant net growth in population and the five counties with the most significant net decline in population.

Source: Kinghorn, M. (2011). Migration Trends and Population Change between the Censuses. Indiana Business Review, Fall 2011, 86*(3), 8-15.*

Figure 11: Counties with Significant Net Population Change*



Source: STATS Indiana, 2010 Components of Population Change

*Net international migration data were not available

INDIANA BEST PRACTICE

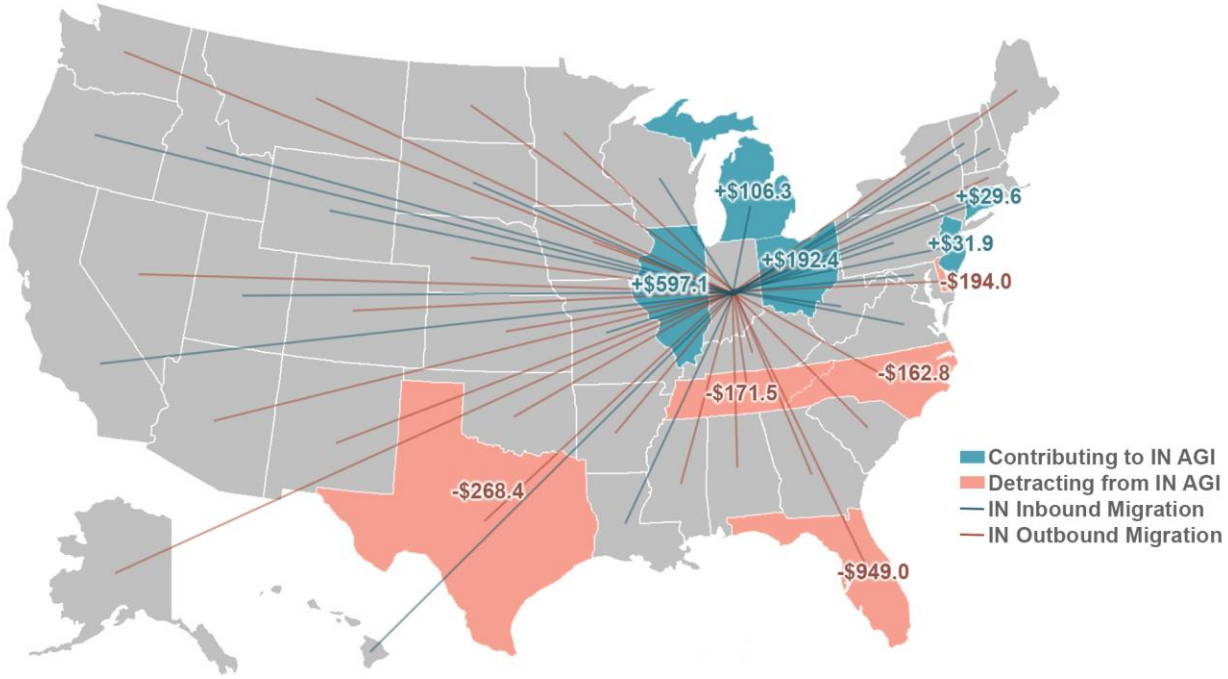
USGS developed the Flood Inundation Mapper, a geospatial tool that allows users to interactively view flood inundation maps and simulate floods at all stages within an online library. Indiana has completed or has in progress 30 libraries across the state. The libraries also include a Hazus-MH component so that users can determine building losses, displaced population and debris generated for each flood stage.

Migration trends inform hazard mitigation by highlighting areas of population growth and decline, revealing immigration and emigration patterns, and informing public officials of changes in net adjusted gross income (AGI) as a result of migration.

The following map shows Indiana's migration patterns between 2005 and 2010 in terms of inbound and outbound domestic migration. It also highlights the states where inbound migration increased Indiana's AGI, as well as the states where outbound migration decreased Indiana's AGI.

Figure 12: Indiana's Net Domestic Migration and Income Gained or Lost (2005-2010)

Population (2010): 6,414,862
Pop. Migrating TO Indiana (2005-2010): 860,201
Pop. Migrating FROM Indiana (2005-2010): 846,661
Net Average Gross Income (2005-2010): -$1.6 billion



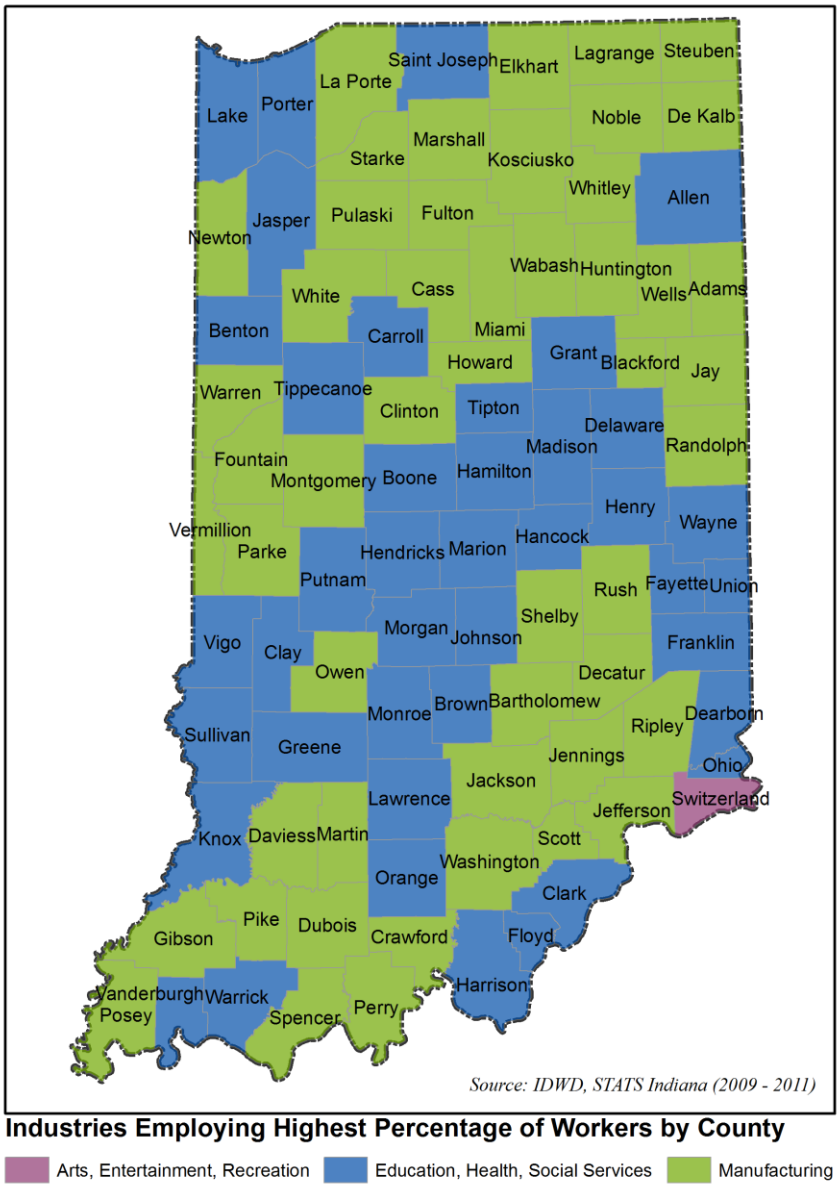
Note: The figure above shows net AGI gained or lost by Indiana from 2005-2010 from migrants to and from other states. Births, deaths, and foreign migration are excluded.

Sources: American Community Survey 1-year estimates, 2005-2010; Internal Revenue Service, Bureau of Economic Analysis, Tax Foundation calculations

2.4 Economy

Disasters can significantly disrupt a community's business operations and overall economy. It is important for key local businesses to have a recovery plan, back-up generator in case of power outage, and disaster insurance. Indiana has a diverse economy with a gross domestic product (GDP) of $298.6 billion, the16th highest in the nation. Its GDP grew 3.3% from 2011 to 2012, primarily in the durable goods manufacturing industry. Figure 13 highlights the industries employing the greatest percentage of workers by county.

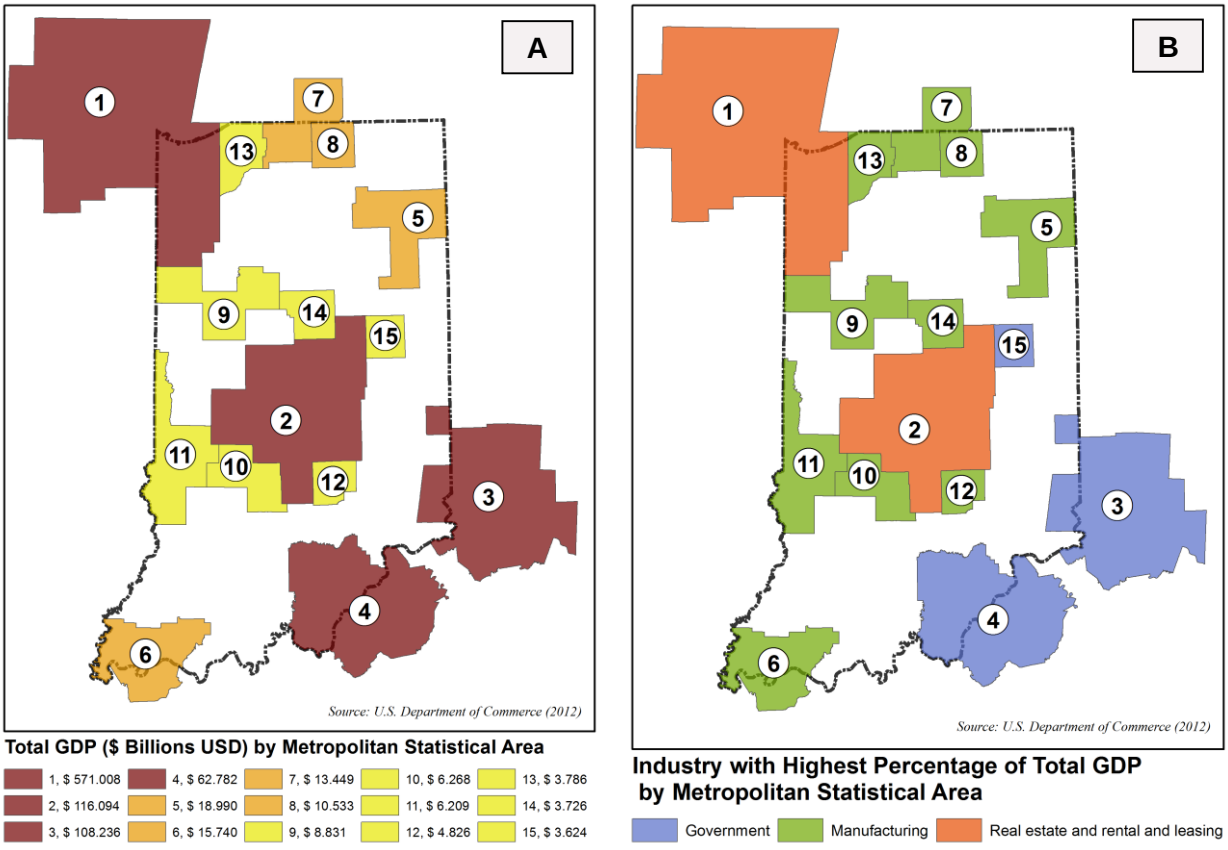
Figure 13: Industries Employing Highest Percentage of Workers by County



Source: US Department of Commerce, Bureau of Economic Analysis, 2012; NAICS Association, LLC

Figures 14A and 14B illustrate the total GDP by metropolitan statistical area (MSA) and the largest contributing industries in that area. The data table beneath the figure lists details of each numbered MSA.

Figure 14: GDP by Metropolitan Statistical Area



	MSA	Lead Industry GDP (Billion USD)	Lead Industry GDP (% Total GDP)	Total GDP (Billion USD)
1	Chicago-Naperville-Elgin, IL-IN-WI	$80.2	16%	$517.0
2	Indianapolis-Carmel-Anderson, IN	$16.3	14%	$116.1
3	Cincinnati, OH-KY-IN	$9.3	9%	$108.2
4	Louisville/Jefferson County, KY-IN	$5.9	9%	$62.8
5	Fort Wayne, IN	$4.1	22%	$19.0
6	Evansville, IN-KY	$5.2	33%	$15.7
7	South Bend-Mishawaka, IN-MI	$3.4	25%	$13.4
8	Elkhart-Goshen, IN	$5.4	51%	$10.5
9	Lafayette-West Lafayette, IN	$2.4	27%	$8.8
10	Bloomington, IN	$1.5	24%	$6.3
11	Terre Haute, IN	$1.7	27%	$6.2
12	Columbus, IN	$2.3	48%	$4.8
13	Michigan City-La Porte, IN	$1.1	29%	$3.8
14	Kokomo, IN	$1.8	49%	$3.7
15	Muncie, IN	$0.7	19%	$3.6

Indiana's 2012 per capita personal income is approximately $38,119 compared to the national average of $43,735. The state poverty rate in 2012 was 15.5%, and although the unemployment rate has been decreasing since 2010, it is still slightly higher at 6.9% than the national rate. Unemployed and impoverished populations will face special needs in the event of disasters. The following section (Section 1.2.5) provides additional information about the unique vulnerabilities of special needs populations.

Sources: U.S. Bureau of Economic Analysis, 2012; STATS Indiana, 2012; Indiana Department of Workforce Development, 2013

2.5 Special Needs Populations

Certain populations require special attention in mitigation planning because they may suffer more severely from the impacts of disasters. It is important to identify these populations and develop mitigation strategies to help them become more disaster-resilient. Although there are numerous types of vulnerable populations, IDHS has identified five significant groups, which include low-income citizens, older adults, non-English-speaking people, people with disabilities, and people without high school diplomas.

By averaging the percent population of each special needs category within each county, we ranked the counties according to highest special needs vulnerability (Figure 15). LaGrange County has the highest overall percentage of special needs populations, primarily because of its large Amish population that reports speaking German, Pennsylvania German, or Dutch at home. The following figure shows the counties with the highest percentages of special needs populations. The maps in Figures 16 through 20 show the distribution of special populations by county.

Figure 15: Counties with Highest Percentage of Special Needs Populations by Category of Need

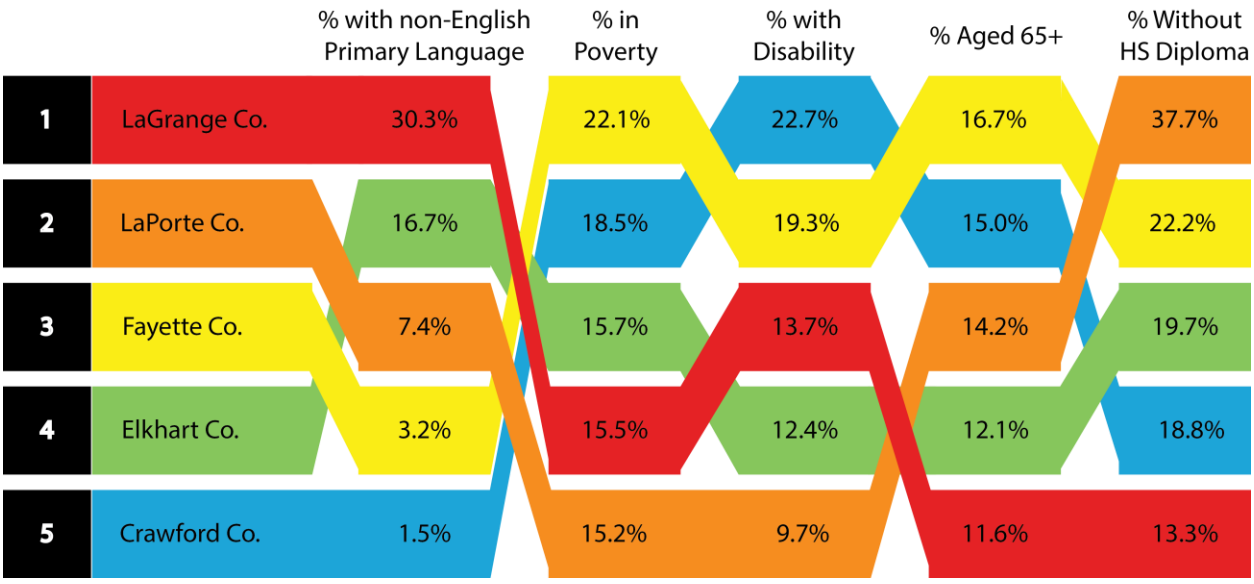
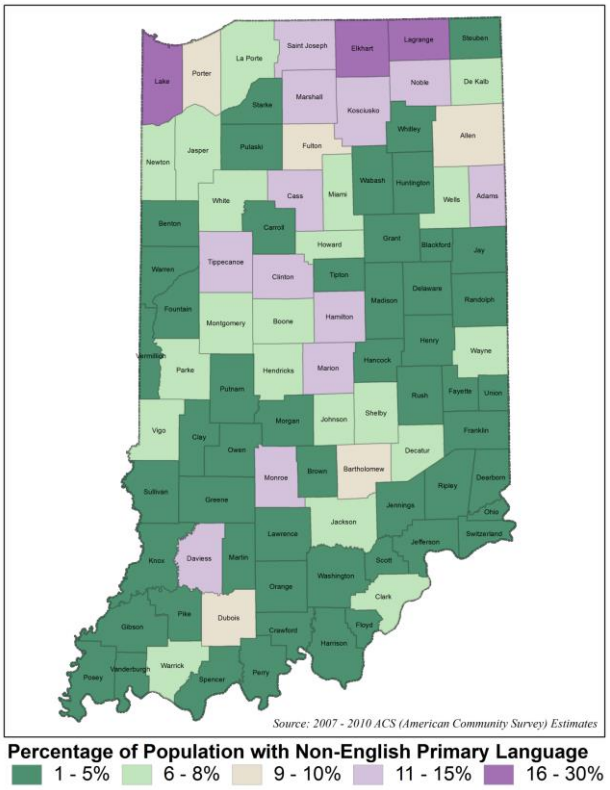
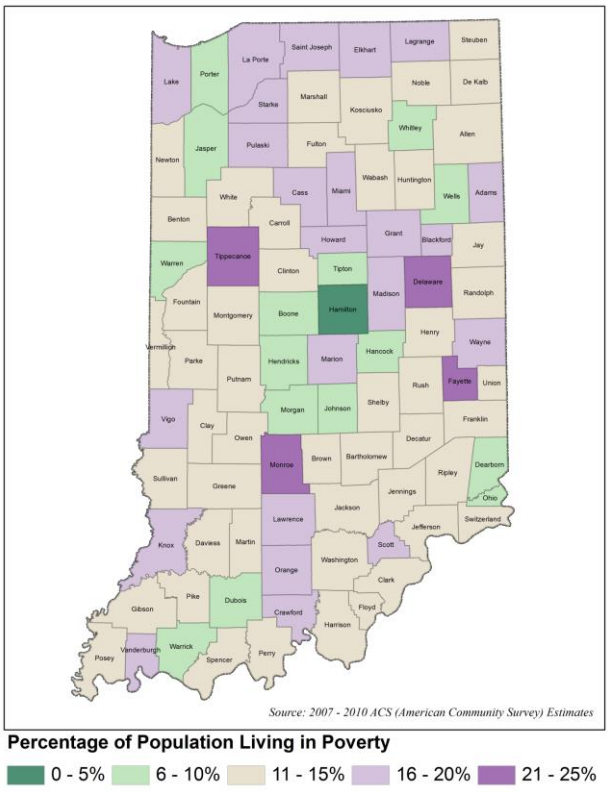


Figure 16: Percent Population Speaking Non-English as Primary Language



Non-English speakers are those who speak a language other than English at home. Some of the challenges emergency managers face in helping non-English speakers mitigate disasters include lack of multi-language emergency communications, cultural differences in the way information is interpreted, and mistrust of government services.

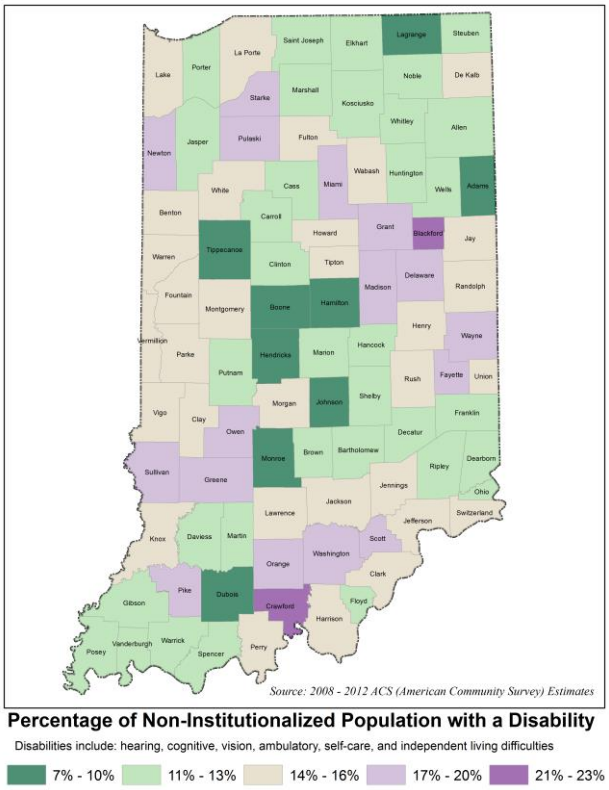
Figure 17: Percent Population Living in Poverty



Disasters disproportionately affect impoverished populations because they are less likely to have the resources to cope with a disaster's impacts, which further entrenches them in the poverty cycle.

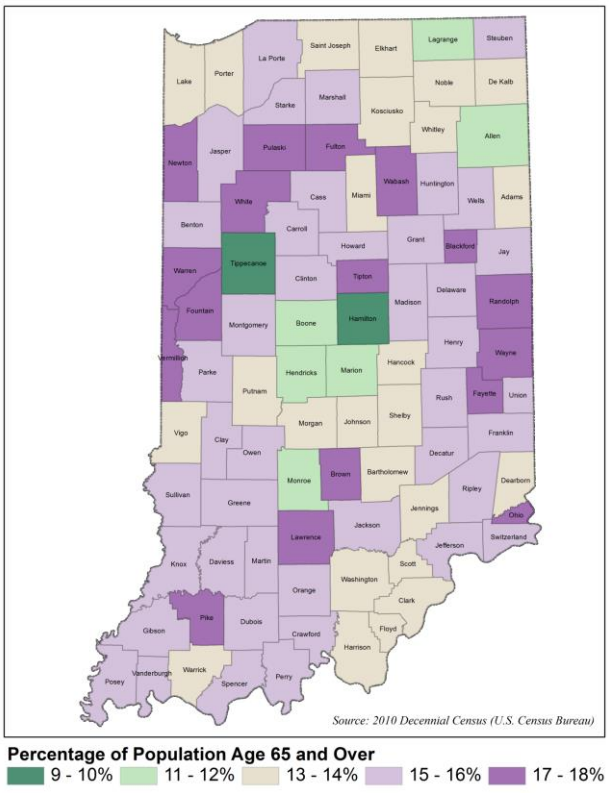
As Figure 17 shows, poverty in Indiana persists in both urban and rural areas.

Figure 18: Percent Population with a Disability



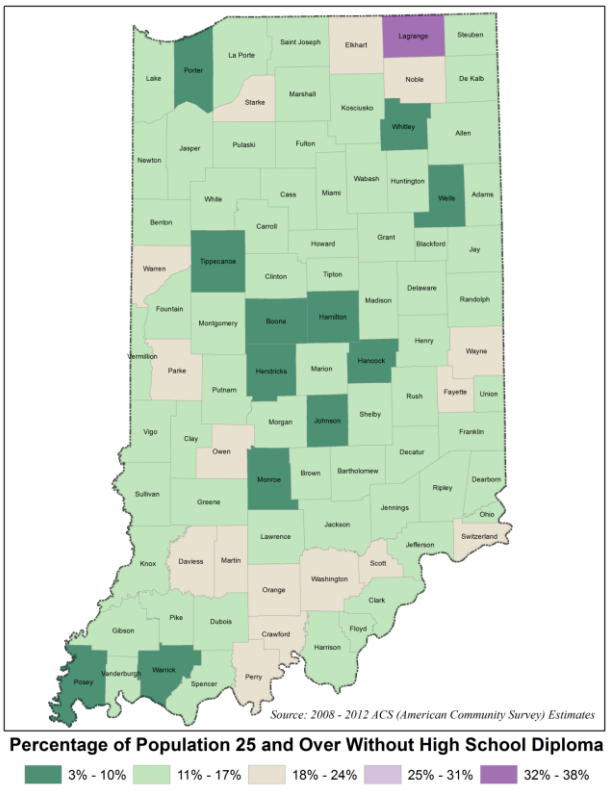
People with disabilities have physical, sensory, or mental impairments that limit their day-to-day activities. They may be physically challenged by lack of accessibility to services and community assets or cognitively challenged in understanding instructions following the event. Those with sensory disabilities, e.g. blind and hearing impaired, may have difficulty communicating.

Figure 19: Percent Elderly Population



As the baby boomer generation continues to age (see p.11 Fig.6), the percent elderly population with increase. Older adults face many of the same challenges as disabled people including lack of transportation and physical or mental impairments. Additionally many older adults may require medication or specialized healthcare.

Figure 20: Percent Population without a High School Diploma



The relationship between education and disaster vulnerability is not well understood. However, education is often associated with both income and poverty. Those with higher education are more likely to have higher incomes and more resources upon which to rely in the event of a disaster.

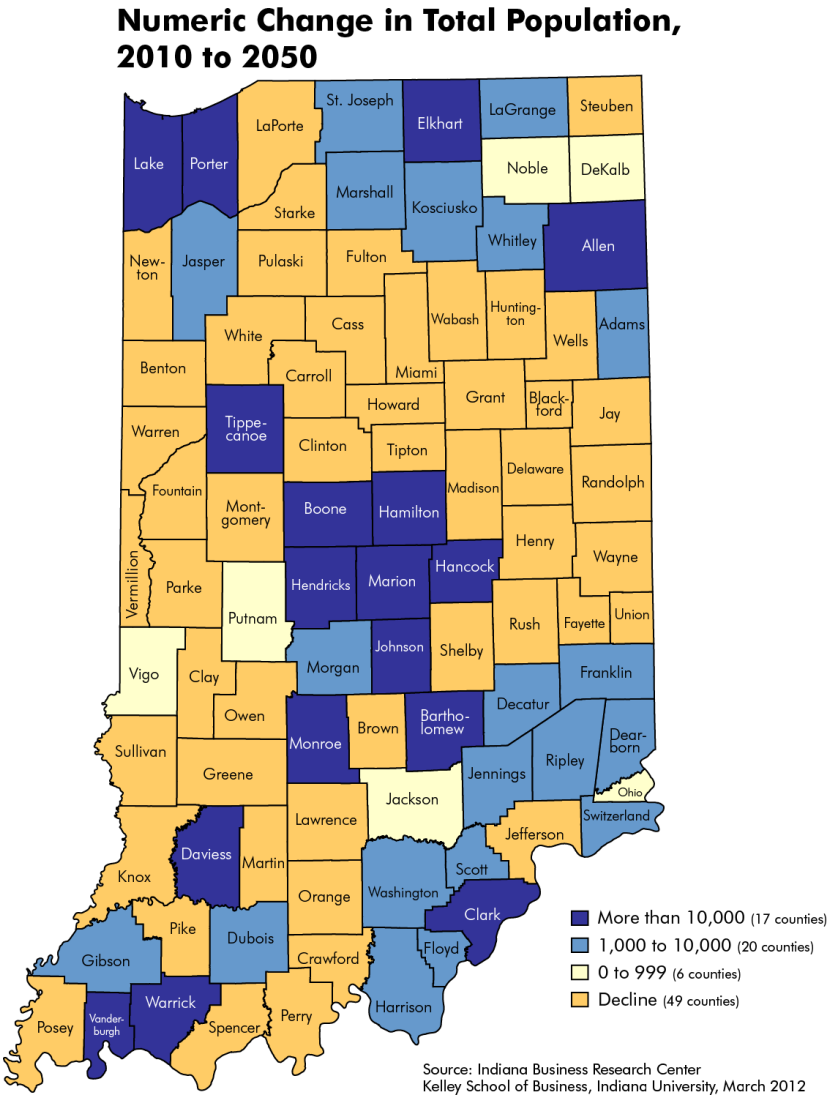
2.6 Land Use

Community development and transportation demand are primarily driven by population growth, urban and economic development, location of utilities, and land use. The Indiana Department of Transportation (INDOT) is responsible for the development and maintenance of Indiana's roadway system, which includes US routes and state routes and the overpasses and ramps for these roadways. The other roadways are regulated by local jurisdictions. In total, INDOT regulates 11,000 of the state's 95,701 roadway miles, as well as approximately 4,500 rail miles.

Source: Indiana Department of Transportation (2013). Indiana's 2013-2035 Future Transportation Needs Report: "Keeping Indiana Moving."

Increased urban development occurs as communities develop new residences and businesses to accommodate a growing population. The distribution of projected population growth is heaviest in the urban fringe areas of metropolitan areas as shown in Figure 21. These 17 counties will see the most significant urban development and the highest levels of conversion of rural land to urban uses.

Figure 21: Future Population Growth (2010-2050)



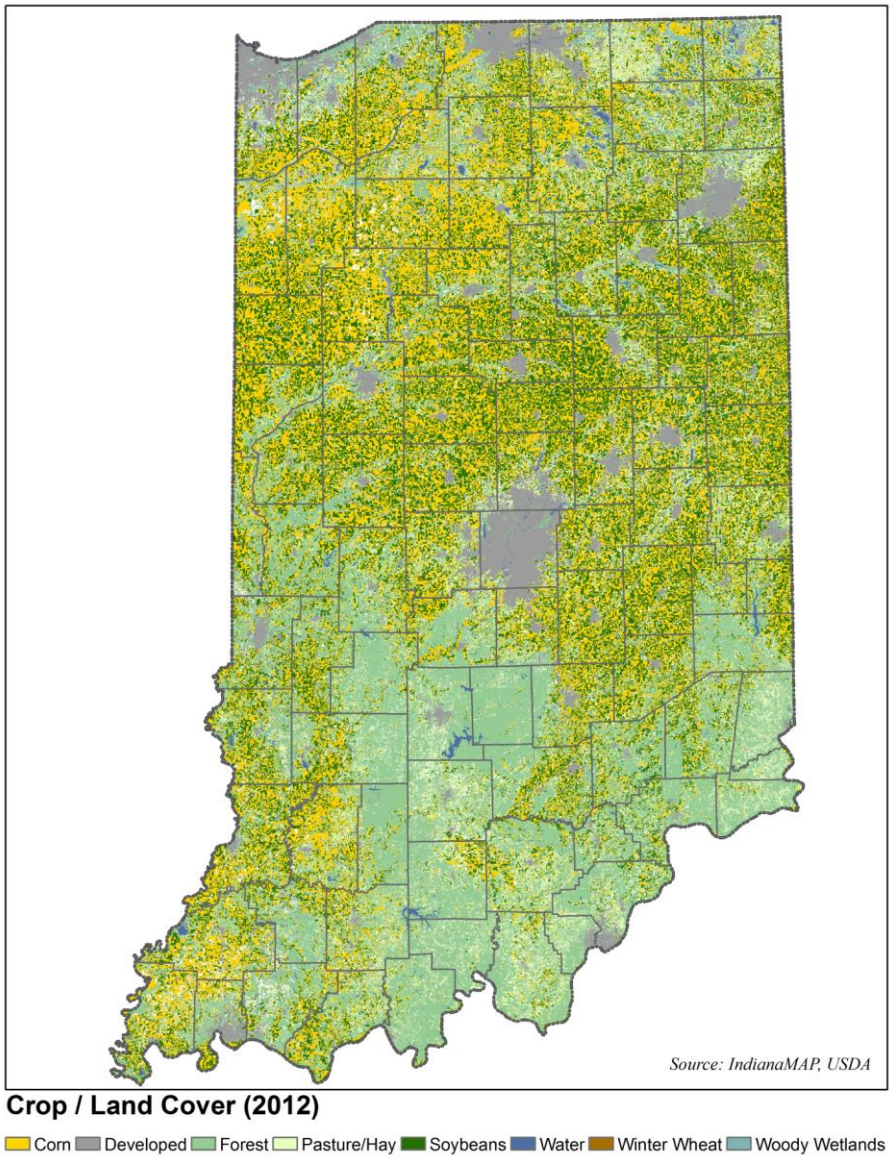
Significant increases in population lead to new development, and it is important to ensure that the new development does not occur in hazard-prone areas. Hamilton, Hancock, Hendricks, and Johnson counties have been identified for greatest population increase. Fortunately, these counties also have some of the most organized and proactive building codes and stormwater ordinances in the state, and they strictly enforce these codes.

However, many communities with intense development also continue to have localized flash flooding. In Hamilton County, for example, this flash flooding manifests as urban flooding but can also cause small streams

and creeks to rapidly rise outside of their banks and floodplains, resulting in damage to infrastructure and uninsured homes and businesses. The storm of June 2008 demonstrateed this, and many communities saw devastating floods along smaller creeks and record levels along larger rivers. Some even reached levels beyond the Great Flood of 1913.

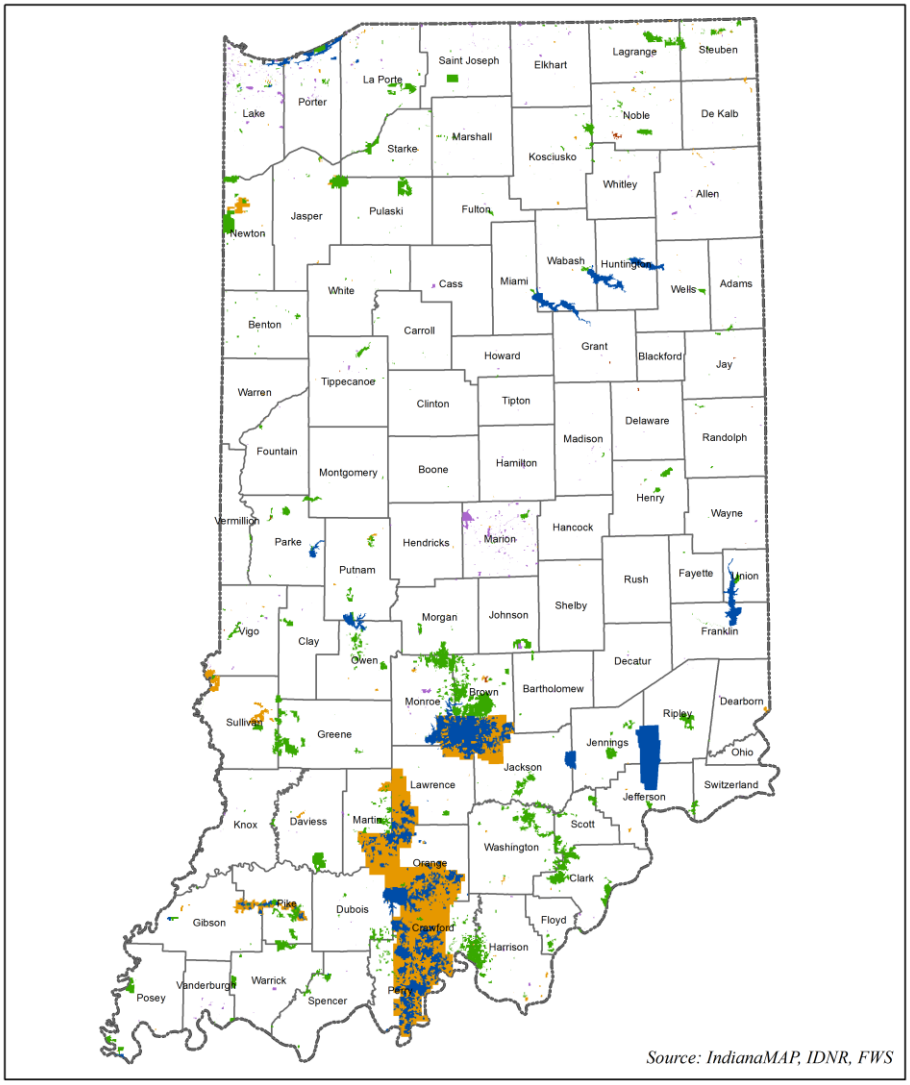
Agriculture is also a significant component of Indiana's existing and future land use. The Indiana Land Resources Council helps local and state decision-makers with land use tools and policies. Part of its mission is to evaluate how Indiana counties can minimize conflicting land uses and ensure that agriculture remains a strong component of the state's economy. Figure 22 shows the state's crop and land cover as of 2012.

Figure 22: Indiana Crop and Land Cover



Land ownership affects how communities can implement mitigation policies and projects. For example, in recent years, the availability for private land for new development has begun to decrease. There is also a small portion of northern Indiana (LaGrange County) designated as tribal land. Figure 23 shows distribution of ownership of significant natural land areas.

Figure 23: Ownership of Significant Natural Lands



Section 3 Planning Process

Based on feedback from FEMA, IDHS has completely updated every section of this plan with major changes including, but not limited to, new vulnerability analyses, new and current data and documentation of historical hazards, updated and new mitigation strategies, and increased integration with other federal, state, and local mitigation planning efforts.

3.1 Plan Update Procedure

The Indiana Department of Homeland Security Mitigation Division is the lead agency responsible for coordinating the State Hazard Mitigation Plan. The State Hazard Mitigation Plan is intended to facilitate mitigation activities throughout the state across the boundaries of federal, state, and local governments and private and nonprofit institutions. To achieve this goal, IDHS collaborated with The Polis Center of Indiana University-Purdue University Indianapolis (IUPUI) and the Indiana Silver Jackets.

The Polis Center has worked with IDHS since 2003 to develop multi-hazard mitigation plans for 72 of Indiana's 92 counties, and is in the process now of updating those local plans. Polis also has been involved in Indiana's Risk MAP activities in conjunction with the Indiana Department of Natural Resources. Risk MAP projects are described more in Section 5 of this plan. In every project, Polis collects the best available data and improves it with input from communities. The new data is then made available to state and federal agencies as appropriate. In this way, every new project begins with the best possible version of available data.

The Indiana Silver Jackets is a multi-agency charter that includes representatives from federal, state, and local agencies who collaborate to share information and leverage resources to develop sustainable solutions to natural hazard issues.

INDIANA BEST PRACTICE

The Indiana chapter of Silver Jackets is very active in risk-reduction and resiliency projects throughout the state. Since 2010, the Indiana Silver Jackets has successfully completed projects in dam safety, fluvial erosion mitigation, levee identification and mapping, flood risk education and outreach, and much more.

The partnership among IDHS, Polis, and the Indiana Silver Jackets has resulted in a contributing planning team of 17 agencies as listed in Table 5. These planning team members provided essential input by reviewing drafts of the plan, contributing data to the risk assessment, providing updates on existing and ongoing mitigation activities, and developing new mitigation strategies.

Table 5: Planning Team Members

Name	Title	Agency
Jan Crider	State Hazard Mitigation Officer	Indiana Dept of Homeland Security
Mary Moran	Hazard Mitigation Coordinator	Indiana Dept of Homeland Security
Manuela Johnson	Hazard Mitigation Director	Indiana Dept of Homeland Security
Ashlee Moore	GIS Critical Infrastructure Planner	Indiana Dept of Homeland Security
Roger Koelpin	GIS/Critical Infrastructure Section Chief, Planning & Assessment	Indiana Dept of Homeland Security
Gary Robison	Safety & Risk Section Chief	Indiana Dept of Homeland Security
Dave Knipe	Section Head/Central Basin Engineering Services	Indiana Dept of Natural Resources
Ken Smith	Assistant Director	Indiana Dept of Natural Resources
Kathleen Weissenberger	Director	Office of Community and Rural Affairs
Jim Sparks	Geographic Information Officer	Indiana Office of Technology
Tom Vanderpool	Emergency Planning & Response Director	Indiana Dept of Transportation
Bob Demuth	Program Director	Indiana Dept of Transportation
Robert Mueller	Director	Indiana State Land Office
Steve Harless	Deputy Commissioner	Indiana Dept of Administration
Jason Larrison	State Architect	Indiana Dept of Administration
Brian Shattuck	Highway Engineer	Indiana Dept of Transportation
Chris Waldron	Broad Band Executive	Indiana State Dept of Health
Scott Hoffman		Family and Social Services Administration
Ryan Stout	Application System Analyst/ Program Manager	Family and Social Services Administration
Roger Setters		US Army Corps of Engineers
Mary Weidel		US Army Corps of Engineers
Scott Morlock		USGS
Bret Robinson		USGS
David Nail		USGS
Chad Menke		USGS
Chris Ritz	Civil Engineer	Natural Resources Conservation Service
Al Shipe	Hydrologist	National Weather Service
Robin Belton-Gerhardt	Hydrologist	National Weather Service
John Buechler	Director of Geoinformatics	The Polis Center at IUPUI
Laura Danielson	Communications Manager	The Polis Center at IUPUI

Name	Title	Agency
Matt Riggs	GIS Analyst	The Polis Center at IUPUI
Chris Schmitz	Technical Writer	The Polis Center at IUPUI
Bob Barr	Research Scientist	Center for Earth and Environmental Science at IUPUI
Walter Gray	Educational Outreach Coordinator	Indiana Geological Survey
Siavash Beik	Vice President, Principal Engineer	Christopher B. Burke Engineering, Ltd

IDHS coordinated with other agencies in a series of three meetings during this planning process. Attendance records and meeting minutes for each are available in Appendix A.

Meeting 1 (August 2013): The Indiana Geographic Information Officer coordinated a meeting with IDHS, Polis, INDOT, the Indiana State Land Office (ISLO), and the Indiana Department of Administration (IDOA). Each agency described ongoing efforts to inventory state-owned assets and collect new asset data. Although existing information is limited, the agencies agreed to share what was available with Polis for use in the SHMP.

Meeting 2 (November 2013): This was a follow-up to Meeting 1 and also included representatives from the Indiana State Department of Health and the Family and Social Services Administration. Each agency described ongoing efforts to inventory essential facilities data for the state and committed to sharing any available data with Polis for use in the SHMP.

Meeting 3 (February 2014): This was a regularly scheduled Indiana Silver Jackets meeting during which the team reviewed past and ongoing mitigation strategies and brainstormed new strategies.

On March 13, 2014, IDHS and IDNR co-hosted the annual Operation Stay Afloat conference—a forum for federal, state, and local government officials, as well as the public, to discuss tools and processes to mitigate flooding, new flood policies, success stories, and more. The Polis Center staffed a display table to present higlights of this SHMP and collect additional mitigation strategies from conference attendees.

Operation Stay Afloat 2014 conference. Above left: More than 150 people attended the conference. Above right: The Polis Center brainstormed new mitigation strategies with attendees during breaks.

3.2 Plan Implementation

The Indiana State Hazard Mitigation Officer (SHMO) is responsible for the maintenance and implementation of this plan. The SHMO is also responsible for monitoring the funding and implementation of mitigation projects in the state administered by the Indiana Department of Homeland Security.

The SHMO will implement the SHMP through the coordination efforts of IDHS, The Polis Center, and the Indiana Silver Jackets. Few states have a Silver Jackets chapter as engaged and active as Indiana's. The group meets monthly to discuss recent and current mitigation projects and share resources to undertake new activities.

Because the 2014 SHMP defines and prioritizes specific projects and vulnerable communities, it will serve as a guide to the Silver Jackets to determine the highest priority mitigation projects, the best suited agencies to lead those projects, and potential sources of funding. As projects begin, The Polis Center will be responsible for coordinating the continued development of the SHMP and finding opportunities for public involvement.

3.3 Integration with Other Planning Efforts

The 2014 SHMP integrates with all of the state's mitigation planning efforts and informs many of the local planning efforts. The Indiana State Hazard Mitigation Council (ISHMC), developed under Executive Order 13-09 to coordinate mitigation efforts for the state, will continue to synchronize, where appropriate, planning efforts of various agencies toward more streamlined and efficient improvement efforts.

ISHMC is assisted by members of its subcommittee, including but not limited to:

- Indiana Department of Homeland Security (IDHS)
  - Earthquake Program Manager
  - Public Assistance Officer
  - State Planner
- Indiana Department of Natural Resources (IDNR)
  - Division of Water, Dam Safety
  - Floodplain Management
  - Indiana Association of Flood and Stormwater Managers
- Indiana Department of Administration (IDOA)
- Indiana Geological Survey (IGS)
- Indiana Geographic Information Office (GIO)
- Indiana Silver Jackets
- Maumee River Basin Commission
- Local EMA Directors

The governor, with the advice of the IDHS, appoints members to serve voluntarily on the ISHMC, and the Director of IDHS serves as the council chairperson. The responsibilities of the ISHMC include but are not limited to: 1) Assisting in the development, maintenance, and implementation of the State Hazard Mitigation Plan; and 2) Soliciting, reviewing, and identifying hazard mitigation projects for funding under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288, as amended, and Sections 553 and 554 of the National Flood Insurance Reform Act, P.L. 103-325.

The planning process considered the planning efforts of a number of other state agencies including the Department of Energy emergency planning effort, IDHS strategic planning effort, and Department of Natural Resources Incident and Emergency Action Planning efforts for high hazard dams in Indiana.

Additionally, the 2014 SHMP integrates with FEMA's Risk MAP program. Since 2010, IDHS, IDNR, and The Polis Center have partnered with local government to complete 31 Resilience initiatives and six Discovery projects (one additional Discovery project is in progress to be completed by the end of 2014). For each Risk MAP initiative, IDHS reviews with participating counties' their mitigation plans and updates existing or builds additional mitigation projects. This collaborative effort helps local governments to take a more holistic approach to planning.

3.4 Plan Adoption

The Indiana State Hazard Mitigation Plan meets the minimum requirements of Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Public Law 93-288 as amended). Additionally, this plan meets the minimum planning requirements under 44 Code of Federal Regulations, Part 78 (Flood Mitigation Assistance).

It is intended that this plan also meet the requirements of the Disaster Mitigation Act of 2000, Section 322. Section 322 requires that states, as a condition of receiving federal disaster mitigation funds, have a mitigation plan in place that describes the planning process for identifying hazards and risks and vulnerabilities. This plan also must identify and prioritize mitigation actions, encourage the development of local mitigation, and provide technical support for these efforts. In addition, the act requires local and tribal governments to have mitigation plans.

Development and implementation of this plan will be carried out in accordance with state regulations and statutes, as well as comform to federal and state laws/statutes that apply when considering intentional, criminal, or unintentional technological and human incidents.

The plan was prepared by IDHS with the assistance of The Polis Center and the Indiana Silver Jackets, who used input from county and local officials following disaster events. This plan was approved by the Federal Emergency Management Agency (FEMA) Mitigation Division on <date>.

The Indiana Department of Homeland Security is responsible for the coordination, preparation, and continuous updating of the SHMP and will ensure that the plan is consistent with federal, county, and municipal plans.

The 2014 State Hazard Mitigation Plan was adopted by the State of Indiana under the executive powers of the governor on <date>.

Section 4 Risk Assessment Overview

4.1 Purpose

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, disruption to local and regional economic activity, and the expenditure of public and private funds for recovery. Sound mitigation must be based on sound risk assessment. A risk assessment involves quantifying the potential losses resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people. It considers historical data but must be sensitive to emerging trends in climate and weather events in order to adapt mitigation activities accordingly and remain cost effective.

This assessment identifies the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets.

4.2 Indiana's Disaster History

In the past decade, Indiana has had 15 federally-declared disasters and 8 state-declared disasters. They are listed in Table 6 in order of highest total cost.

Table 6: Disaster Declarations by Total Cost (2003-2013)

Disaster Number	Disaster Type	Disaster Description	Date Declared	Total IA	Total PA	Total Cost
1476	Federal	Storms, tornado, flooding	7/11/2003	$26,773,677.21	$13,919,672.65	$40,693,349.86
1487	Federal	Storms, tornado, flooding	9/5/2003	$16,462,077.68	$0.00	$16,462,077.68
1520	Federal	Storms, tornado, flooding	6/3/2004	$10,069,328.50	$8,341,946.51	$18,411,275.01
1542	Federal	Tornado, flooding	9/1/2004	$0.00	$5,819,600.04	$5,819,600.04
1573	Federal	Winter storms, flooding	1/21/2005	$24,704,270.90	$36,547,547.14	$61,251,818.04
1612	Federal	Severe storms, tornado	11/8/2005	$1,771,215.30	$5,015,906.39	$6,787,121.69
1662	Federal	Storms, flooding	10/6/2006	$24,210,214.72	$0.00	$24,210,214.72
1732	Federal	Severe storms, flooding	11/30/2007	$9,845,017.28	$0.00	$9,845,017.28
1740	Federal	Storms, flooding	1/30/2008	$15,348,304.14	$9,785,183.60	$25,133,487.74
1766	Federal	Storms, flooding	6/8/2008	$112,933,502.88	$220,907,474.22	$333,840,977.10
1795	Federal	Storms, flooding	9/23/2008	$73,929,857.52	$48,963,876.16	$122,893,733.68
1828	Federal	Severe winter storm	3/5/2009	$0.00	$22,589,888.08	$22,589,888.08
1832	Federal	Storms, tornado, flooding	4/22/2009	$5,923,212.78	$0.00	$5,923,212.78
11870	State	Storms, tornado	8/19/2009	$0.00	$0.00	$0.00
11926	State	Storms, flooding	8/9/2009	$242,772.60	$0.00	$242,772.60

Continued on following page

Disaster Number	Disaster Type	Disaster Description	Date Declared	Total IA	Total PA	Total Cost
Continued from previous page						
12499	State	Flooding	2/27/2011	$111,604.70	$311,412.57	$423,017.27
12813	State	Flooding, tornado, storms	4/19/2011	$139,294.37	$413,989.44	$553,283.81
1997	Federal	Storms, tornado, flooding	6/23/2011	$0.00	$28,256,161.32	$28,256,161.32
12949	State	Storms, tornado	11/14/2011	$7,526.36	$0.00	$7,526.36
4058	Federal	Severe storms, tornado	3/9/2012	$3,455,996.68	$9,360,129.96	$12,816,126.64
13174	State	High winds, storms	6/29/2012	$26,700.20	$522,009.61	$548,709.81
13217	State	Macroburst, storms	7/31/2012	$77,309.00	$74,474.00	$151,783.00
			TOTALS	$326,031,882.82	$410,829,271.69	$736,861,154.51

Note: Above table does not include SBA Declaration 13569 (April 2013 flood event). The State is currently processing awards and does not yet have final numbers.

Most Recent Disaster (DR-4058): On March 2, 2012, an EF4 tornado ran for 49 miles on a path from Fredericksburg, Indiana to Bedford, Kentucky. The most severe damage occurred in the small Indiana communities of New Pekin, Henryville, Marysville, and Chelsea. The disaster destroyed hundreds of homes and resulted in multiple deaths and injuries.

Most Expensive Disaster (DR-1766): The June 2008 Midwest flooding significantly impacted central and southwest Indiana. The highest recorded rainfall occurred in the town of Edinburgh, which received nearly 11 inches in seven hours. Many areas of the state were evacuated, including hospitals, and the flooding caused three deaths.

Most Expensive State Declaration (13569): SBA Declaration 13569 is a flood event that occurred in April 2013. The State is still processing awards, so total estimates are not yet confirmed; however, the amount awarded for IA so far is $854,390, which already far exceeds other state declarations. From April 16 to 19, thunderstorms brought heavy rain to much of Central Indiana., and several areas reported between 4 and 8 inches in just three days. The result was flooding of numerous streams and rivers, some of which reached record levels.

Most Widespread Disaster (DR-1573): In January 2005, heavy rain combined with the melting of near record snowfall in central and southern Indiana caused disastrous flooding that resulted in levee and dam breaches and hundreds of destroyed homes and businesses. More than 90% of Indiana's counties were declared federal disaster areas, with more than $7 million in flood insurance claims paid to Indiana property owners.

4.3 Vulnerability Assessment

This SHMP includes 23 hazards: 9 natural, 8 technological (human-caused, accidental), and 7 human (human-caused, intentional). The hazards are listed in Table 7.

Table 7: Indiana Hazards Addressed in 2014 SHMP

Natural Hazards	Technological Hazards	Human Hazards
Floods	Communications System Failure	Cyber Attack
Severe Thunderstorms and Tornado	Hazardous Materials Release	Active Shooter
Earthquakes	Public Utility Failure	Arson
Winter Storms	Air Transportation Incidents	CBRNE Attack
Drought	Explosion	Hostage Situation
Extreme Temperatures	Dam/Levee Failure	Riot
Wildfire	Structural Fire	Terrorism
Disease Outbreak	Ground Failure (Subsidence)	
Fluvial Erosion		

4.3.1 GIS and Hazus-MH

The 2011 Indiana SHMP incorporated available Hazus-MH analyses from local plans to assess vulnerability for flooding and earthquakes. With the implementation of new technology and additional locally-available parcel datasets, more accurate results are now available. Because of this, multi-hazard mitigation plan updates may document significant variances from the originals developed 3-5 years ago.

For the 2014 SHMP update, the State of Indiana provided more detailed parcel data for all counties except Crawford and Parke counties[1]. The risk analysis quantifies the risk to the population, infrastructure, and economy of the community. Where possible, the hazards were quantified, using GIS analyses and Hazus-MH. This process reflects a Level 2 approach to analyzing hazards as defined for Hazus-MH. The approach includes substitution of selected default data with local data to improve the accuracy of the model predictions.

Hazus-MH generated a combination of site-specific (flood) and aggregated (earthquake) loss estimates. For earthquake, aggregate inventory loss estimates, which include building stock analysis, are based upon the assumption that building stock is evenly distributed across census blocks/tracts.

Site-specific analysis is based upon loss estimations for individual structures. For flooding, analysis of site-specific structures takes into account the depth of water in relation to the structure. Hazus-MH also considers the actual dollar exposure to the structure for the costs of building reconstruction, content, and inventory. Damages, however, are based upon the assumption that each structure will fall into a structural class, and structures in each class will respond in a similar fashion to a specific depth of flooding. Site-specific analysis is

[1] The counties requested additional time to ensure data-sharing agreements with the State were in place. The agreement was not confirmed in time for the 2014 plan but will be in place before submission of the 2017 update.

also based upon a point location rather than a polygon; therefore, the model does not account for the percentage of a building that is inundated.

It is important to note that Hazus-MH is not intended to be a substitute for detailed engineering studies. Rather, it is intended to serve as a planning aid for communities interested in assessing their risk to flood, earthquake, and hurricane-related hazards. This documentation does not provide full details on the processes and procedures completed in the development of this project. It is only intended to highlight the major steps that were followed during the project.

4.3.2 Historical

We conducted historical vulnerability assessments for the hazards we did not model. This process included documentation of previous occurrences in the past 50 years and analysis of how likely and how impactful the hazard would be if it occurred today.

For the 2014 SHMP, we did not include a detailed vulnerability analysis for many of the technological and human hazards due to concerns over publication of sensitive data. These analyses exist in the State of Indiana Threat and Hazard Identification Risk Assessment (THIRA) and the State of Indiana Comprehensive Emergency Plan.

4.4 Hazard Prioritization

In 2010, IDHS conducted a unified State-level Hazard Identification and Risk Assessment (HIRA) to classify Indiana hazards as high risk, moderate risk, or low risk based on the probability of occurrence and the potential impact of the occurrence. The guidelines used to determine probability and impact ratings are listed in Table 8.

Table 8: Guidelines for Hazard Prioritization

PROBABILITY		IMPACT	
Low	Event is probable within the next 10 years	Minimal	▪ Local jurisdiction is able to effectively respond with standard mutual aid support ▪ Local medical services are able to manage volume of injuries and fatalities ▪ Limited evacuations and sheltering required ▪ Loss of public utilities, government, and social services for up to 24 hours ▪ Response operations lasting up to 72 hours may be required
Medium	Event is probable within the next 5 years	Moderate	▪ Local jurisdiction is unable to effectively respond without significant mutual aid support and state assistance ▪ Local medical services unable to manage number of injuries and fatalities. Patients require transportation to outside areas ▪ Local area evacuations, shelter, and care of displaced residents and medical patients ▪ Loss of public utilities, government, and social services for up to 2 weeks ▪ Response operations lasting up to 2 weeks may be required.
High	Event is probable within the calendar year	Significant	▪ Local jurisdiction is overwhelmed and unable to effectively respond to the hazard. Complete loss of communications. Massive state and federal response required. ▪ Local medical services unable to manage the volume of injuries and fatalities. Mass evacuation, sheltering and care of displaced citizens required. ▪ Loss of public utilities, government, and social services for 30 days or more. ▪ Response operations lasting up to 30 days may be required.

The overall hazard risk is determined by multiplying probability and impact. It is important to consider both probability and impact when determining risk.

IDHS plotted each hazard on a risk grid according to probability (y-axis) and potential impact (x-axis). Figure 24 describes the methodology of plotting hazards by risk. In this example, a tornado has a high probability of occurring in a given year with a significant potential impact, while a winter storm has a medium-high probability of occurring but a fairly minimal potential impact.

Figure 24: Risk Grid Methodology

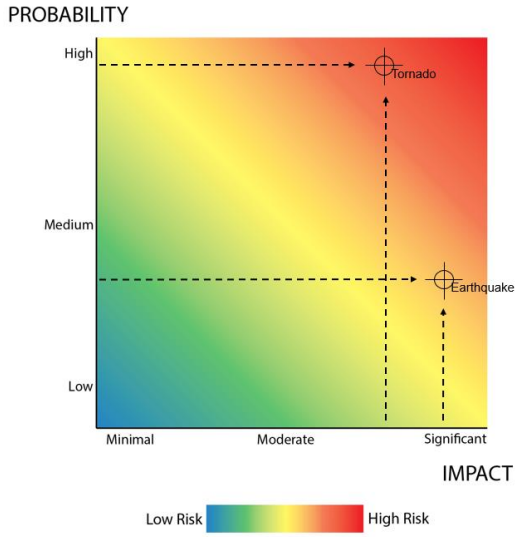


Figure 24 illustrates the risk grid methodology. In this example, a tornado has a high probability (y-axis) and a significant impact (x-axis), so overall, Indiana is at high risk for a tornado.

We developed risk grids for each hazard category (natural, technological, and human). The following grids represent the state's overall vulnerabilities.

Figure 25: Natural Hazards Risk Grid

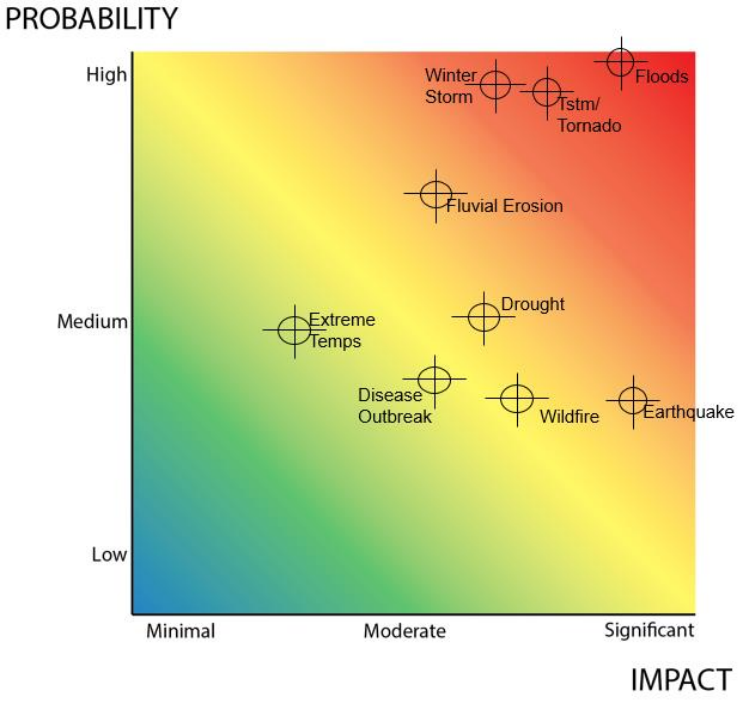


Figure 25 shows Indiana's highest ranked natural hazards as floods, severe storms, earthquakes, and winter storms.

Figure 26: Technological Hazards Risk Grid

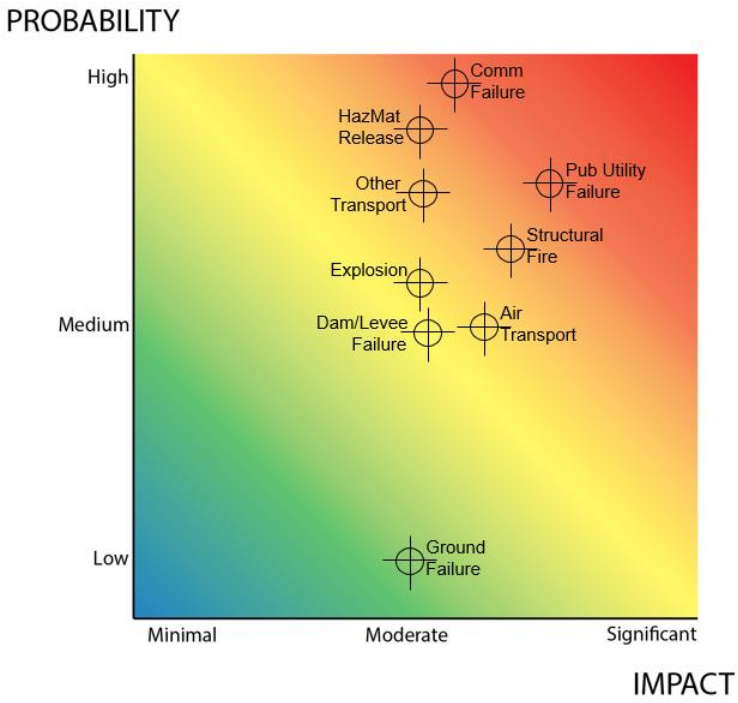


Figure 26 shows Indiana's highest ranked technological hazards as communications failure and public utility failure.

Figure 27: Human Hazards Risk Grid

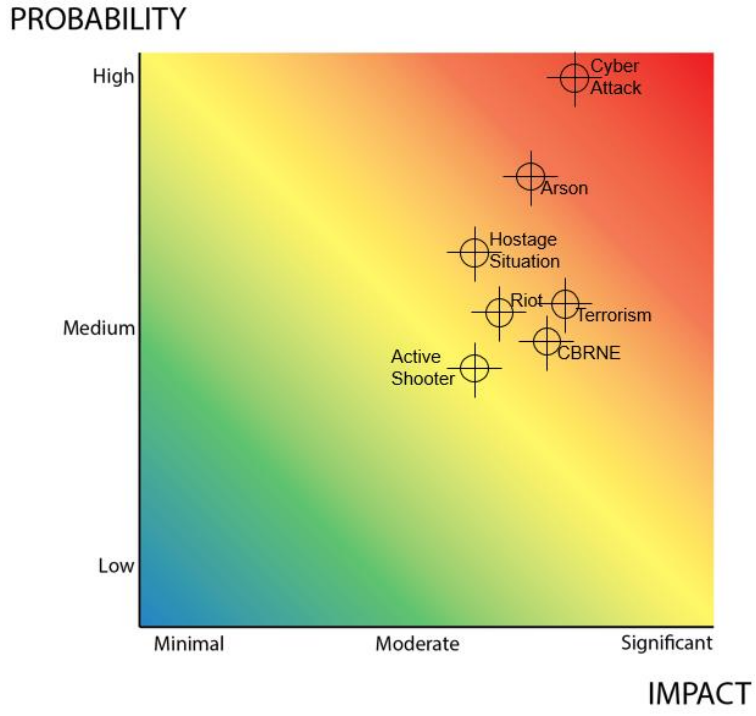


Figure 27 shows Indiana's highest ranked human hazards as cyber attack and arson.

4.5 Essential Facilities and State-Owned Buildings

The State Geographic Information Officer (GIO) organized two meetings with various state agencies to identify state-owned and essential facilities data. A list of participating agencies is included with the meeting minutes in Appendix A.

For the purpose of this plan, essential facilities are defined as those that are vital to the state in the event of a hazard. These include emergency operations centers, police departments, fire stations, schools, and care facilities.

The essential facility updates were applied to the Hazus-MH model using data from local multi-hazard mitigation plans and data from the Indiana Department of Education, Indiana Department of Health, and Indiana Department of Homeland Security. Hazus-MH reports of essential facility losses reflect updated data. A summary of the essential facility updates is included in Table 9.

Table 9: Indiana Essential Facilities

Facility Name	Number of Facilities
Schools	2,722
Police Stations	617
Fire Stations	1,334
EOCs	118
Care	3,453

INDIANA BEST PRACTICE

Hazus-MH is a valuable tool for assessing vulnerability in mitigation planning. Since 2003, IDHS and The Polis Center have partnered with local officials to complete 72 multi-hazard mitigation plans using Hazus Level 2 analyses in the risk assessments. IDHS and Polis are in the process of updating these plans for the 5-year cycle with better data and improved methods for determining and communicating risk.

State-owned facilities were provided by the Indiana Family and Social Services Agency (FSSA), Indiana Department of Transportation (INDOT), and Indiana Department of Administration (IDOA). IDOA data represents a work in progress. Additional data, and specifically more information about the facilities, will be compiled over the next two years. A total of 3,243 state-owned facilities were analyzed.

We also incorporated facility replacement costs and total building exposure for 91 of the 92 counties. The data for Crawford County will be included in the next update of this SHMP.

Building inventory was created using GIS land parcels provided by IndianaMAP and individual counties, and the detailed building characteristics were obtained from the Indiana Department of Local Government and Finance (IDLGF) for 2013. Indiana counties annually submit an extract of property appraisal data to the IDLGF that contains detailed building information such as square footage, construction type, year built, foundation type, and building replacement cost.

Table 10 lists the estimated number of buildings and replacement costs within each occupancy class.

Table 10: Indiana Building Exposure

Occupancy Class	Estimated Total Buildings	Total Building Exposure	
Agricultural	505,139	$	82,169,757,455
Commercial	280,978	$	162,064,804,779
Industrial	57,930	$	98,036,889,740
Residential	6,176,315	$	961,431,310,745
Other	43,940	$	59,208,002,694
Total	7,064,302	$	1,362,910,765,413

Section 5 Mitigation Overview

The goal of mitigation is to build disaster-resistant communities by reducing the impacts of future disasters and lessening the amount of public and private funds spent to assist with disaster recovery. Mitigation actions and projects should be based on a well-constructed risk assessment (Section 6) and should be an ongoing process, adapting over time to accommodate a community's needs.

The format and process used to report goals, objectives, and mitigation strategies is completely different from the previous plan. The 2011 SHMP listed broad overarching goals and objectives in which many mitigation strategies could fit. For this plan update, we replaced these with more specific goals and objectives based on current priorities and concerns in the state. This helped us to develop targeted mitigation actions that can be more easily tracked and evaluated for progress.

5.1 Progress on 2011 Mitigation Strategies

This section lists each mitigation project proposed in the 2011 plan and the current status of each.

Project 1: Develop an effective public awareness program for the natural and man-made hazards that Indiana is most likely to experience.

> **Status:** This is an ongoing project. Indiana has taken the following mitigation actions since 2011.
>
> *Flood Inundation Mapping Library*: This Silver Jackets project—led by the USGS and Christopher B. Burke Engineering, Ltd. (CBBEL)—leveraged previous detailed modeling to develop flood inundation libraries for Fall Creek at Fortville, Haw Creek near Columbus, and Cicero Creek at Tipton. In 2014, the USGS and The Polis Center will continue the second phase of this project by building specific Hazus risk analyses that are tied to flood library grids. USGS is currently conducting workshops with local communities to promote public use of the library.
>
> *North Branch Elkhart River West Lakes Report*: This Silver Jackets project—led by IDNR, USGS, and USACE—began in 2010 and is expected to be complete in October 2014. The project team is currently participating in a series of meetings with local stakeholders to raise community interest in understanding and mitigating floods in the West Lakes Chain Area in Noble County.

Project 2: Promote economic development consistent with floodplain management, earthquake, and tornado guidelines.

Status: This is an ongoing project. One of the key mitigation projects begun since 2011 is the Fluvial Erosion Hazard (FEH) study. Fluvial erosion is defined as the erosion caused by streams, rivers, creeks, and other flowing bodies of water. This Silver Jackets project was designed to create awareness and alleviate risk associated with fluvial erosion, which is a significant concern in areas where human development and infrastructure are established in close proximity to natural waterways. The multi-year project is funded by the Office of Community and Rural Affairs (OCRA) and led by the Center for Earth and Environmental Science at Indiana University Purdue University-Indianapolis (IUPUI), the USGS, The Polis Center at IUPUI, and IDNR. It includes identification, study, and development of mitigation planning resources for individuals and communities that would like to adopt FEH avoidance strategies.

IDHS has also taken steps to work with various groups to promote saferooms in public areas such as schools, community centers, parks, etc. For the past six years, IDHS has had a presence at the Indiana State Fair, which has resulted in an increase by local officials and the public in inquiries about acquisitions, flood insurance, and individual and community saferooms.

Project 3: Use the Hazard Mitigation Assistance (HMA) program to promote recognition of the value of hazard mitigation to public safety and the welfare of the population.

Status: This is an ongoing project. Indiana has taken the following actions since 2011.

Development of Local Multi-Hazard Mitigation Plans (MHMPs): All of Indiana's 92 counties have completed an MHMP, and IDHS is now working with local officials to begin the first round of 5-year updates to these plans.

Map Modernization and Risk MAP Programs: IDHS has used management funds to actively support Map Mod and Risk MAP programs by providing mitigation information and funding opportunities for individuals affected by map changes.

1913 Flood Awareness Campaign: In 2013, the Silver Jackets, led by IDHS and The Polis Center, partnered with WFYI Public Media, Bohlsen Group (Indianapolis public relations firm), NWS, IDNR, USGS, and CBBEL to develop a year-long 1913 Flood Awareness Campaign, communicating information about flood risk and mitigation to the public. The campaign included a 1913 flood exhibit by the Indiana Historical Society and a documentary by WFYI, which is nominated for a 2014 ASFPM media award.

Indiana University Disaster-Resistant University (DRU) Plan: IDHS and The Polis Center partnered with the Indiana University Emergency Management and Continuity group and Indiana Geological Survey to develop a multi-hazard, multi-campus DRU for Indiana University. The plan includes campus-specific Hazus analyses for flood and earthquake, as well as specific mitigation strategies for each of IU's eight campuses. It will be submitted to FEMA for approval in March 2014.

Project 4: Encourage scientific and academic study of natural and human-caused hazards and the development of data to support mitigation strategies for those hazards that are a threat to Indiana.

Status: This is an ongoing project. Indiana has taken the following mitigation actions since 2011.

Zone A Flood Hazard Mapping: In 2013, IDNR began a project, funded by OCRA to complete Zone A flood hazard mapping. The additional Special Flood Hazard Areas (SFHAs) will identify more properties at risk of flooding.

Non-Levee Embankment Identification: This Silver Jackets program, funded by OCRA and led by The Polis Center in collaboration with IDNR, will enable state and local decision makers to more effectively develop strategies to reduce flood peaks. The purposes are: 1) to identify and map uncertified structures that constrict the floodplain; 2) identify the infrastructure at risk behind these levees; 3) provide education and outreach to local jurisdictions; 4) provide IDHS, FEMA, and USACE information for use in ongoing planning programs. This project began in 2013 and is in progress.

Detailed Mapping of National Hydrologic Data (NHD): This project is funded by OCRA and led by IDNR in collaboration with the Indiana Geographic Information Council (IGIC) and AECOM. Development of these detailed NHD (currently in progress) is a key component to improved hydrologic modeling.

Project 5: Develop a program to identify needs for monitoring systems.

Status: This is an ongoing project. Since 2009, Indiana has completed or begun the following activities.

Spencer Flood Response Plan: Led by the USGS and CBBEL, this project included an early warning system and Emergency Operations Plan for flood response. It was funded in-kind and completed in 2010.

Haw Creek Flood Warning Modeling: In this Silver Jackets project funded by OCRA, USGS and CBBEL developed an early warning model for flood response at Haw Creek.

Large Dam Embankment Monitoring System: The USGS, in partnership with USACE, has begun progress on this monitoring system. It is currently active at Rough River, Kentucky, and it is currently being implemented on a small scale at Eagle Creek Reservoir in Indiana. The Indiana Silver Jackets will continue to seek funding to support its progress.

Project 6: Maintain an effective Silver Jackets program that will facilitate implementation of the Indiana Hazard Mitigation Plan

Status: This is an ongoing project. The Indiana Silver Jackets have been very active in the past three years, working collaboratively on several projects, including those listed under many of the mitigation activities in this section of the plan. The Silver Jackets meet monthly to share information about projects and resources, to engage in demonstrations of new tools and products, and to brainstorm potential new mitigation initiatives and partnerships.

Project 7: Identify mitigation opportunities for long-range planning considerations.

Status: This is an ongoing goal, and the Indiana Silver Jackets have completed or begun several mitigation projects since 2011 that fulfill it including the following.

Dam Breach Inundation Mapping and Development of Incident and Emergency Action Plans (IEAPs): This has been a multi-year, phased project funded by FEMA and OCRA and carried out by IDNR, CBBEL, NRCS, IDHS, and The Polis Center. Since 2010, the Silver Jackets team has developed IEAPs for nearly 40 privately-owned dams and held corresponding workshops for the dam owners and emergency responders to prepare for and mitigate potential dam breaches. In 2014 and 2015, IDNR, CBBEL, and Lawson and Fishers Associates will continue this project for approximately 10 dams in Bartholomew County and 5 dams in Monroe County.

Comprehensive Wildlife Strategy: In October 2005, the IDNR Division of Fish and Wildlife worked with conservation partners across the state to develop a Comprehensive Wildlife Strategy (CWS) to protect and conserve Indiana habitats and associated wildlife at a landscape scale. Wildlife and natural resources play an important role in communities, and the CWS helps to sustain economic development and contribute to quality of life of all Indiana citizens and visitors.

Project 8: Conduct workshops to support local mitigation planning.

Status: This is an ongoing project. Since 2011, IDHS has partnered with The Polis Center to hold four Hazus-MH workshops for emergency managers, planners, and other state and local officials.

Additionally, in 2012 and 2013, the Silver Jackets conducted 10 fluvial erosion hazard (FEH) workshops, reaching a cumulative audience of approximately 250 federal, state, and local stakeholders. The workshops introduced general FEH concepts, as well as methods and application of FEH field and mapping techniques.

Project 9: Encourage adoption of building and zoning codes that support floodplain management, earthquake, fire reduction, and tornado objectives in all counties of the state.

Status: This is an ongoing project. IDHS has used Map Mod and Risk MAP Discovery and Resiliency meetings as platforms to encourage communities and individuals to practice good floodplain, seismic, and tornado zoning and building practices to protect the assets of their communities and citizens.

Project 10: Encourage and assist with an update of the State Building Codes and the General Administrative Rules to address the anchoring of industrialized buildings being used for temporary classroom facilities.

Status: This is an ongoing project. The State legistlature introduced and adopted standards for community and individual saferooms. The legislations follows the requirements of FEMA 361 and 320 respectively.

Project 11: Identify critical and government facilities. Determine methods of protection in hazard-prone areas, including relocation, flood-proofing, earthquake/wind retrofit, and back-up systems.

> **Status:** This is an ongoing project. In 2013, IDHS and Polis met with several state agencies to determine the availability of state-owned facilities and essential facilities data. Polis compiled the available data from agencies such as the Indiana State Land Office, Indiana Department of Administration, and Family Social Services and Administration and used this updated data to create building inventory for state-owned, state-leased, and essential facilities throughout the state. The team will continue to communicate regularly to collect better and more data for the next update of the SHMP.

Project 12: Develop a state-wide hazard mitigation training program for local government officials, i.e. building inspectors, community planners and public works, state agencies, and construction professionals.

> **Status:** Prior to the August 2012 National Level Earthquake Exercise, the State Building Department inspectors were trained in the Rapid Evaluation Method for seismic assessment of structures (ATC 20-1) and post-event assessment. This training equips them to assess the vulnerability of structures and to control access to damaged structures as part of the post-event assessment, which is important because it allows time to shore critically damaged structures that may be subject to collapse during aftershocks. The training program reducing the risk to homeowners, as well as federal, state, and local officials in response and recovery.

Project 13: Develop warning systems for all hazards and continue public education as a warning technique for floods and earthquakes.

> **Status:** Indiana has completed or begun several actions to satisfy this goal. The USGS water alert was rolled out nationwide, IDHS has continued the NOAA alert radio distribution to essential facilities and special population, and IDHS has made significant strides in outreach to the public about the importance of weather alert radios in homes. Any effective warning system has redundancies and is not dependent upon warning sirens or radios alone. Through mitigation and Homeland Security funding, IDHS has encouraged the deployment of Reverse 911 programs, weather texts (e.g. Nixle) for smaller communities, and has worked with the Safe Schools program to expand student and faculty alerting systems to include all hazards.

Project 14: Catalog and mitigate repetitive loss and severe repetitive loss properties.

> **Status:** This is an ongoing project. As part of this plan (Section 6.1.2.3), Polis used data collected by IDHS to identify and list the communities with the highest repetitive and severe repetitive loss payments. Additionally Polis aggregated the data by community to map areas in the state with the most repetitive and severe repetitive loss properties and payments respectively.

Project 15: Conduct hazardous commodity flow studies to identify the nature and quantity of hazardous materials being transported by various means throughout the state of Indiana.

> **Status:** This is an ongoing project. IDHS continues to have emergency response personnel assigned to the Division of Fire and Building Safety to serve as on-site technical advisors at large fire and hazardous materials incidents to more than 900 fire departments throughout the state. They work collaboratively with the Indiana State Police, Indiana Department of Environmental Management, and state and local health departments. The Division of Fire and Building Safety provide technical and staff assistance to fire departments to help them identify and respond to threats to public health and safety.

Project 16: Conduct outreach to local EMA and public safety agencies to encourage the development of Memoranda of Agreement for mutual aid efforts.

> **Status:** This is an ongoing project. The State legislature passed legislation that allows for some assets and personnel of the District Task Forces to become State resources for a limited period of time upon declaration of the Governor. This allows for smooth deployment of assets to areas in greatest need by granting IDHS control of the assets while deployed in disaster areas.

5.2 Process

The State Hazard Mitigation Plan (SHMP) should serve as a strategic framework for all of the state's mitigation activities. To facilitate this goal, IDHS integrated the mitigation goals and efforts for several of FEMA's core programs including Multi-Hazard Mitigation Planning, the National Flood Insurance Program, and Risk MAP.

This integrative process allowed IDHS to develop a more comprehensive list of mitigation actions and projects, which are presented by hazard in Sections 6 and 7 of this plan.

5.2.1 Multi-Hazard Mitigation Planning

The Multi-Hazard Mitigation Planning program is the foundation for the SHMP as well as Indiana's local mitigation plans. It creates a framework for planners to make informed, risk-based decisions to reduce damages to lives, property, and the economy in the event of future disasters.

During the planning process, IDHS reviewed the 2011 SHMP as follows:

- Reviewed and revised mitigation goals.
- Reviewed and revised mitigation objectives.
- Updated the status of mitigation actions and projects.

5.2.2 National Flood Insurance Program

The National Flood Insurance Program (NFIP) seeks to reduce the impact of flooding on private and public structures by providing affordable insurance for property owners. It is IDHS's goal to encourage more communities to adopt and enforce floodplain management regulations, which will mitigate the effects of flooding new and improved structures.

Since 1969, the NFIP has paid more than **$36 billion** in flood insurance claims in the United States.

The NFIP has three major functions that focus on reducing flood risk and the impact of flood disasters:

1. **Flood Hazard Mapping and Risk Analysis:** The NFIP requires reliable information about flood risk, which it obtains through FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program. Risk MAP is a multi-year mapping effort designed to meet the FEMA statutory requirement to review flood hazards maps every five years and address flood hazard data updates as funding is available.

2. **Reducing Flood Risk:** Local floodplain managers are encouraged to seek flood-related grants and assistance such as Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL). By law, FEMA can only provide flood insurance to homeowners of communities that adopt and enforce floodplain management regulation and meet NFIP's requirements.

3. **Insuring Flood Risk:** Homeowners in communities participating in the NFIP can purchase affordable protection to insure against flood losses.

As part of the flood vulnerability assessment (Section 6.1), Polis used flood insurance claims and policies data provided by the Indiana Department of Natural Resources to determine the communities with the greatest number of uninsured parcels, which helped to guide development of specific mitigation strategies for those areas. Section 6.1.2.3 of this plan provides the analysis.

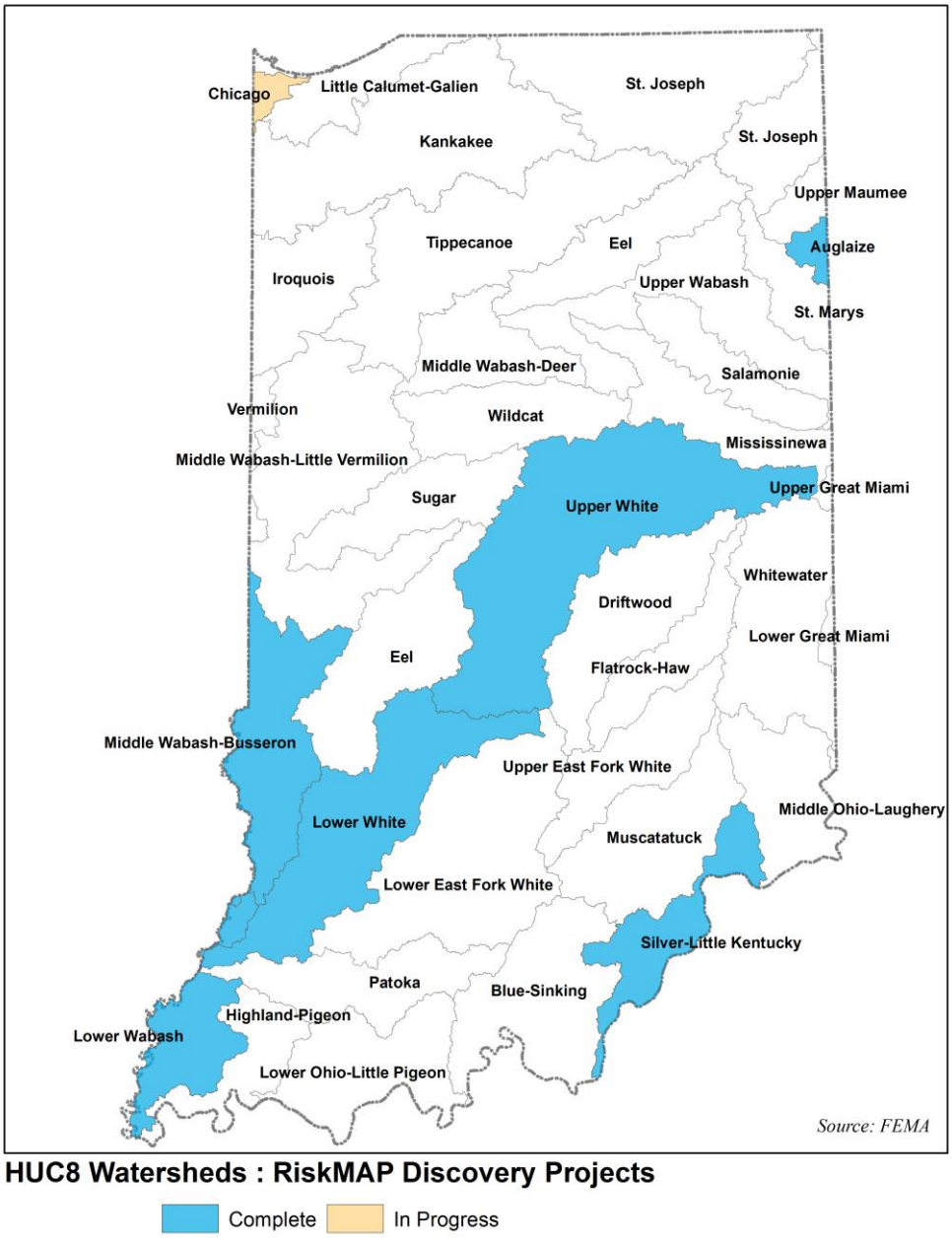
5.2.3 Risk Mapping, Assessment, & Planning (Risk MAP)

The vision for Risk MAP is to deliver quality data that increases public awareness and leads to action that reduces risk to life and property. Since the launch of the program in 2010, Indiana has been actively involved in Risk MAP's various phases, and IDHS and Polis have incorporated key recommendations and mitigation strategies into the flood vulnerability assessment of this plan (Section 6.1).

5.2.3.1 Indiana Risk MAP Activity

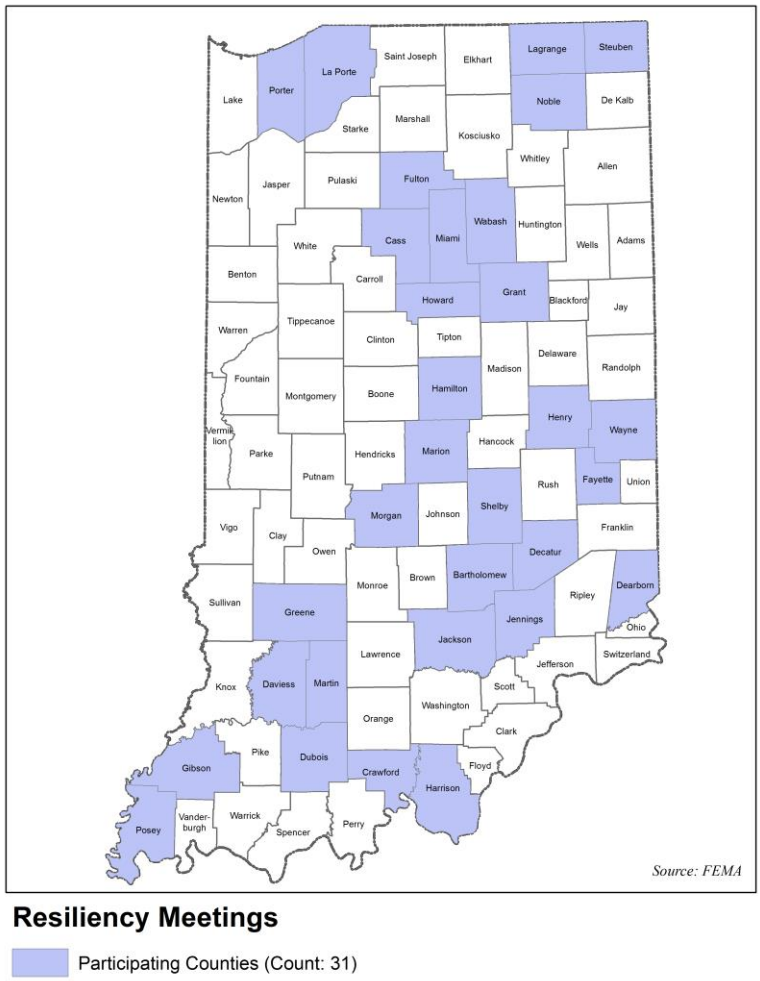
Discovery: The Discovery phase helps communities better understand local flood risk and mitigation efforts and encourages watershed-wide discussions about increasing resilience to flooding. Figure 28 identifies the watersheds in Indiana that have completed Discovery stakeholder meetings and developed final Discovery reports. IDNR, IDHS, and Polis led or participated in each of the Discovery initiatives. GIS data and stakeholder feedback from the projects have been incorporated into this SHMP.

Figure 28: Risk MAP Discovery Projects



Resilience: The purpose of the Resiliency Meeting is to continue to build local capacity for implementing priority mitigation activities within the watershed by reviewing existing mitigation strategies from local plans, identifying new Areas of Mitigation Interest (AOMIs), and exploring other opportunities for action. Figure 29 identifies the Indiana counties that have participated in the Resilience Meetings.

Figure 29: Risk MAP Resiliency Meetings



Non-Regulatory Products: Indiana has been heavily involved in developing Risk MAP regulatory products for all 92 counties in the state. This includes updating Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FIS) that focus on the probability of floods and describe where and how often flooding may occur. In 2010, Indiana participated in a Risk MAP early demonstration project to develop non-regulatory products for reaches of the Big Cicero and Fall creeks in the Upper White River Watershed. The project successfully increased flood risk awareness by communicating that risk varies within the mapped floodplain.

The following series of figures show examples of the key non-regulatory products developed by Christopher B. Burke Engineering, Ltd. for Big Cicero Creek. As more of these products are developed across the state, they will be incorporated into the local and state hazard mitigation plans to help communities better understand and communicate risk.

Figure 30: Big Cicero Creek, Changes Since Last FIRM

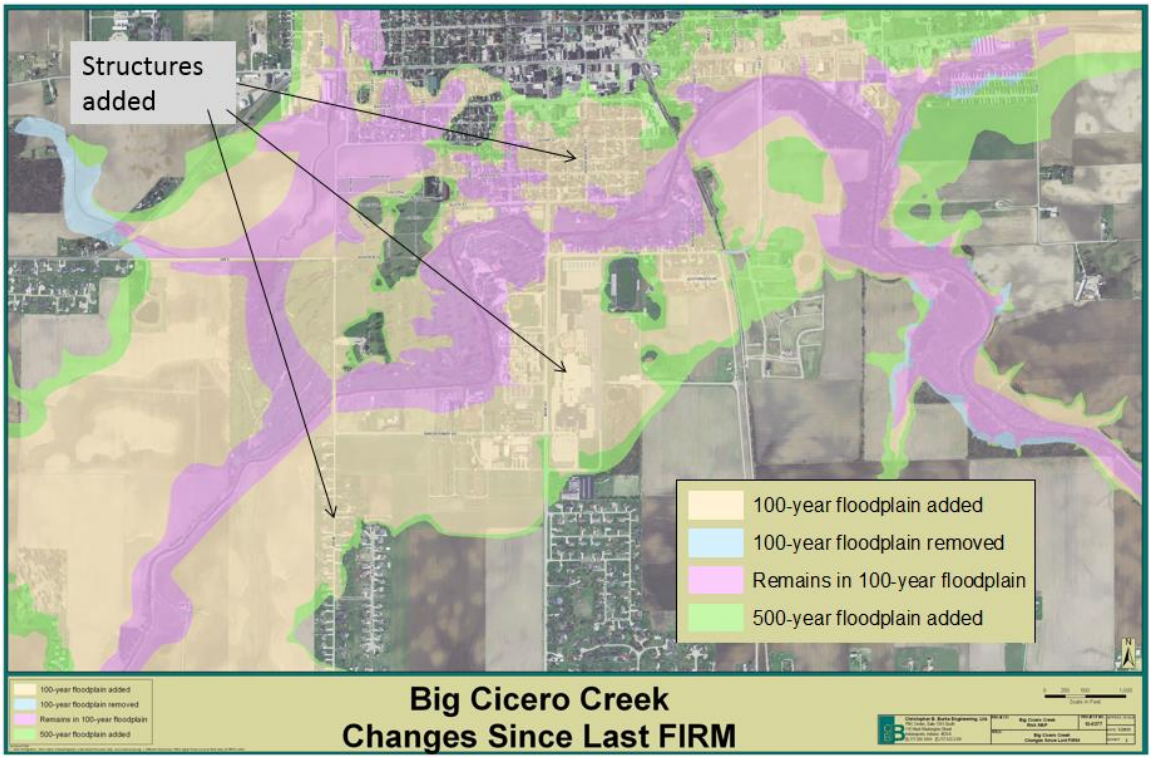


Figure 31: Big Cicero Creek, 500-Year Depth Grid

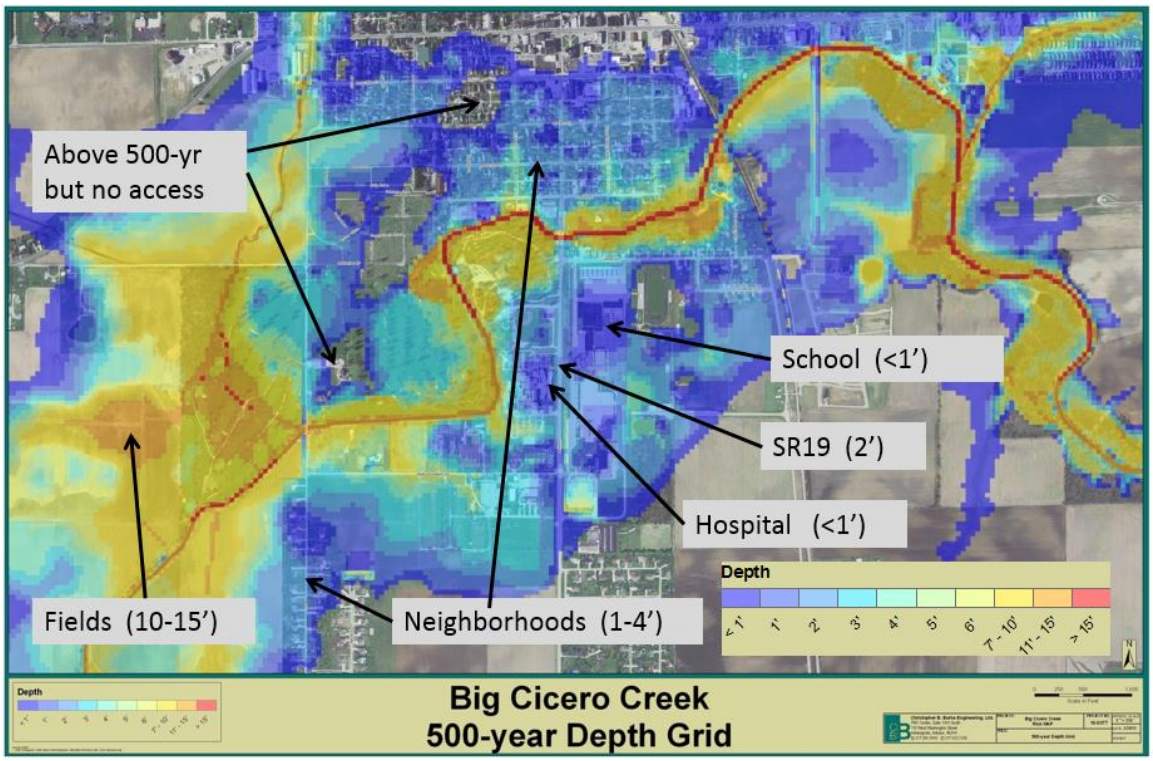
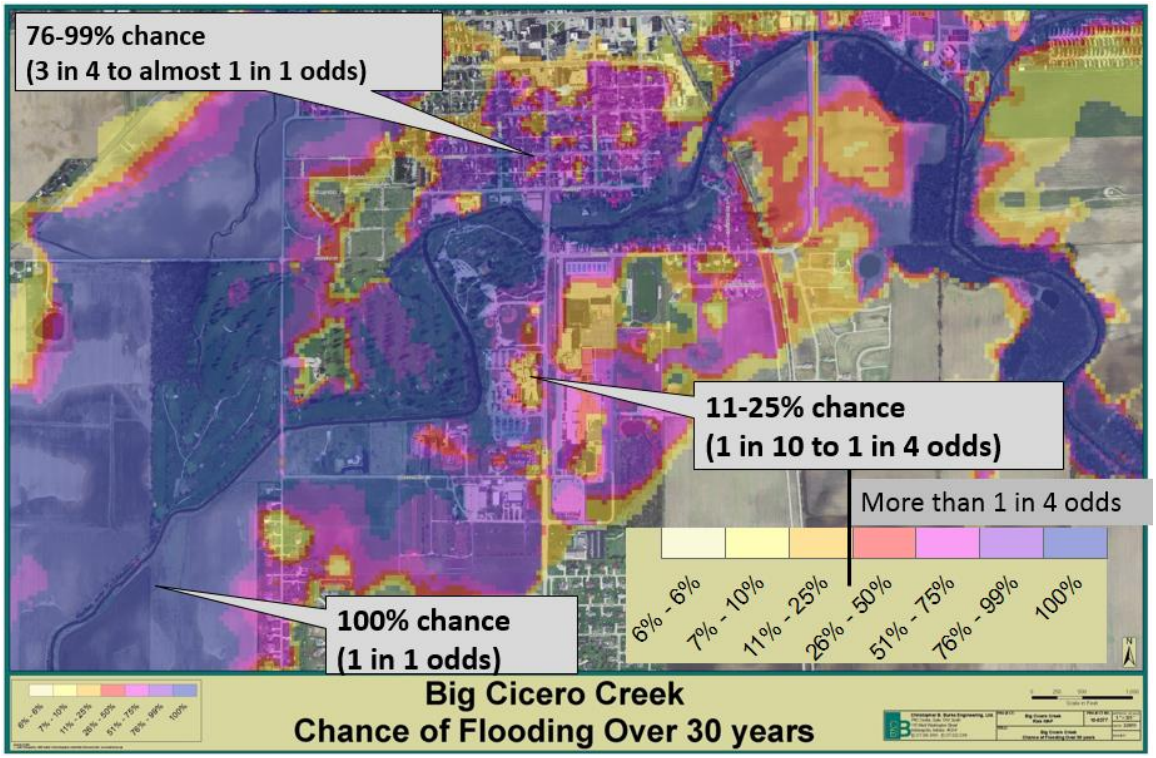


Figure 32: Big Cicero Creek, Percent Chance of Flooding over 30 Years



5.2.3.2 Community Action Potential Index

FEMA Region V mitigation planners developed the Community Action Potential Index (CAPI) in 2013 as a tool to prioritize communities for Risk MAP initiatives and mitigation activities. CAPI includes a number of indicators that, when weighted, sum to a total score for each community in the state. This helps federal and state planners determine which communities would be most likely to advance mitigation strategies through the Risk MAP program.

For this plan, Polis started with FEMA's existing CAPI tool and added the following additional indicators:

- Number and exposure ($) of all buildings in each community
- Number and exposure ($) of buildings located in the Special Flood Hazard Area (SFHA) in each community
- Number of essential facilities located in the SFHA in each community
- Number of buildings damaged in the Hazus Level 2 analysis
- Building losses as reported by Hazus
- Loss ratio as calculated from the Hazus analysis

5.3 Prioritization

As a first step toward prioritizing the state's mitigation strategies, IDHS used the vulnerability analyses in Section 6 of this plan, in addition to the overall risk scores assigned by CAPI, to highlight those communities that are most vulnerable to future disasters. IDHS then used FEMA's STAPLE+E feasibility criteria (Table 11) to evaluate and prioritize the strategies further.

Table 11: STAPLE+E Feasibility Criteria

Criteria	Questions to Answer
Social	• Will the proposed action adversely affect one segment of the population? • Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
Technical	• How effective is the action in avoiding or reducing future losses? • Will it create more problems than it solves? • Does it solve the problem or only a symptom? • Does the mitigation strategy address continued compliance with the NFIP?
Administrative	• Does the jurisdiction have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained? • Can the community provide the necessary maintenance? • Can it be accomplished in a timely manner?
Political	• Is there political support to implement and maintain this action? • Is there a local champion willing to help see the action to completion? • Is there enough public support to ensure the success of the action? • How can the mitigation objectives be accomplished at the lowest cost to the public?
Legal	• Does the community have the authority to implement the proposed action? • Are the proper laws, ordinances, and resolution in place to implement the action? • Are there any potential legal consequences? • Is there any potential community liability? • Is the action likely to be challenged by those who may be negatively affected? • Does the mitigation strategy address continued compliance with the NFIP?
Economic	• Are there currently sources of funds that can be used to implement the action? • What benefits will the action provide? • Does the cost seem reasonable for the size of the problem and likely benefits? • What burden will be placed on the tax base or local economy to implement this action? • Does the action contribute to other community economic goals such as capital improvements or economic development? • What proposed actions should be considered but be "tabled" for implementation until outside sources of funding are available?
Environmental	• How will this action affect the environment (land, water, endangered species)? • Will this action comply with local, state, and federal environmental laws and regulations? • Is the action consistent with community environmental goals?

5.4 Goals and Objectives

The following goals and objectives have been identified to help Indiana build stronger, more resilient communities. The goals represent long-term, broad concepts of the state's overall vision for mitigation, and the objectives are strategies that will help the state and its communities to achieve these goals. In Sections 6 and 7 of this plan, we describe specific mitigation actions and projects within these goals and objectives and specific to each hazard.

GOAL 1: Minimize the loss of life and injuries caused by disasters.

- Objective: Improve emergency sheltering.
- Objective: Develop public awareness and outreach programs.

GOAL 2: Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.

- Objective: Support compliance with the National Flood Insurance Program (NFIP).
- Objective: Retrofit critical and essential facilities and structures to withstand disasters.
- Objective: Evaluate and strengthen communication and transportation abilities of emergency services.

GOAL 3: Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.

- Objective: Ensure better coordination of federal, state, and local mitigation activities.
- Objective: Identify new partners to collaborate on the state hazard mitigation planning team.

GOAL 4: Promote research, education, and outreach to expand Indiana's knowledge about disasters and their impacts.

- Objective: Review and update existing, or create new, community plans, maps, and ordinances.
- Objective: Conduct new studies/research to profile hazards and promote mitigation.
- Objective: Improve education and training of emergency personnel and public officials.

Section 6

Flood, Severe Storm, and Earthquake Vulnerability and Mitigation

6.1 Flood

In Indiana, floods can be classified as one of three types: upstream, downstream, or lake flooding. Upstream and downstream flooding are common throughout the state.

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

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

Lake floods affect Indiana's glacial lakes—primarily those with no natural outlet—and occur when the lake water level and the ground water level rise. The lag time between the time of precipitation and the time of the flood peak is much longer than with upstream or downstream flooding; however, lake flooding is often exacerbated when upstream and downstream areas are also experiencing high water.

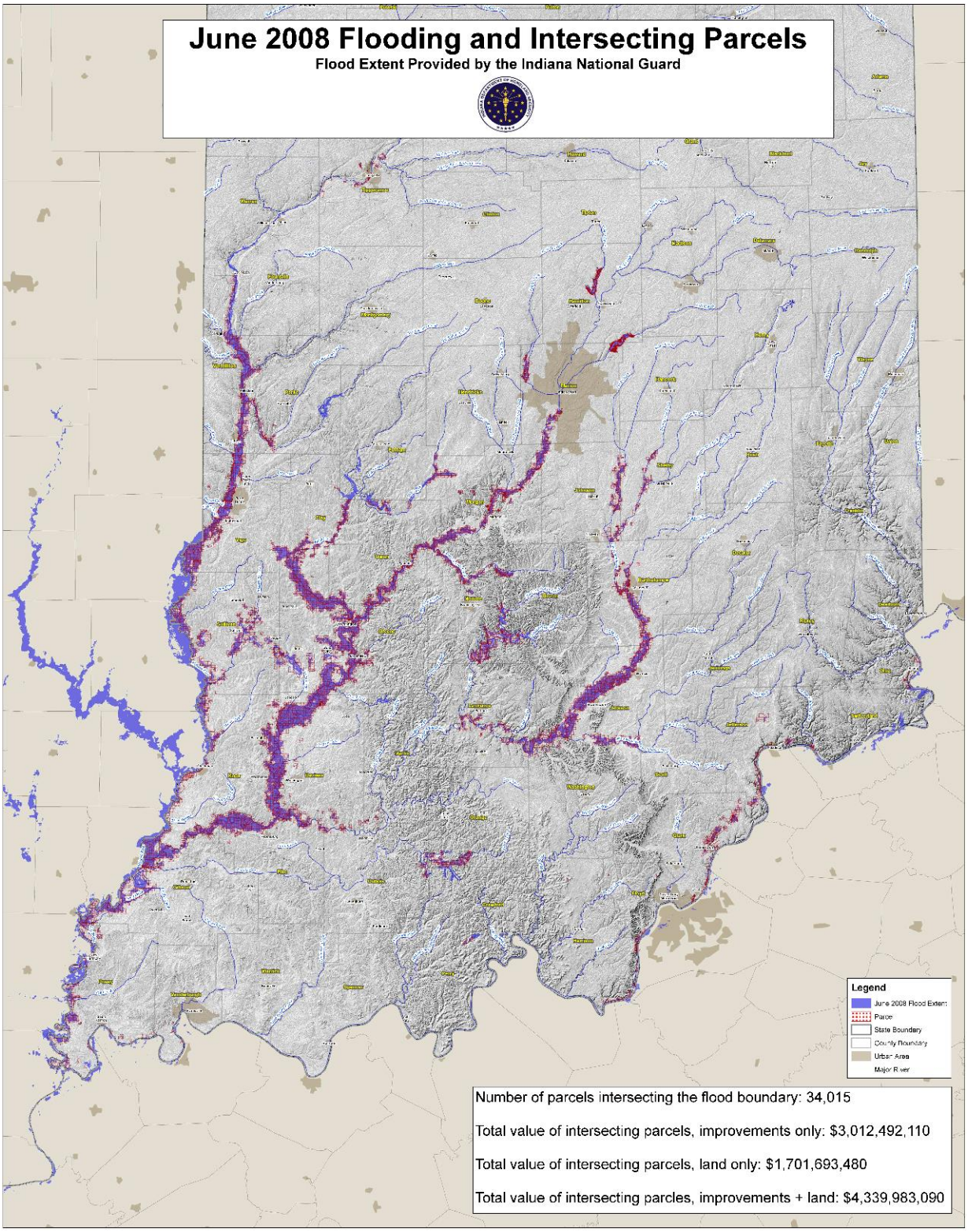
6.1.1. Historical Occurrences

In the past decade, Indiana has received 12 federal disaster declarations related to flooding. Individual Assistance (IA) approved for these declarations totaled $320.2 million and Public Assistance (PA) obligated totaled $372.5 million.

The most destructive and expensive flood event since 2003 occurred in June 2008 in central and southern Indiana. The incident resulted in three deaths, five injuries, and thousands of evacuations. The most severely impacted communities included Martinsville, Franklin, Paragon, Spencer, and Columbus.

Figure 33 shows the extent of the flooding in June 2008.

Figure 33: June 2008 Flood Extent



Since 2008, there have been 1,356 flood events reported to NCDC. These events resulted in 10 deaths, 7 injuries, and more than $1.3 billion in damages. Table 12 lists NCDC-reported events by county and district.

Table 12: NCDC-Reported Flood Events (2008-2013)

County Name	# of Events	Death	Injury	Property Damage	Crop Damage
IDHS DISTRICT #1					
Lake	20	0	0	$27,550,000	$0
Porter	16	2	0	$3,120,000	$0
LaPorte	4	0	0	$900,000	$0
Newton	9	0	0	$2,500,000	$0
Jasper	8	1	0	$3,250,000	$0
District Subtotal	57	3	0	$37,320,000	$0
IDHS DISTRICT #2					
St Joseph	4	0	0	$510,000	$0
Elkhart	2	0	0	$260,000	$0
Starke	1	0	0	$1,000,000	$0
Marshall	0	0	0	$0	$0
Pulaski	1	0	0	$0	$0
Fulton	4	2	1	$340,000	$0
Kosciusko	7	0	0	$315,000	$0
District Subtotal	19	2	1	$2,425,000	$0
IDHS DISTRICT #3					
LaGrange	1	0	0	$100,000	$0
Stuben	3	0	0	$750,000	$0
Noble	2	0	0	$325,000	$0
DeKalb	2	0	0	$2,000	$0
Whitley	5	0	0	$300,000	$0
Allen	3	0	0	$0	$0
Miami	1	0	0	$0	$0
Wabash	9	0	0	$475,000	$0
Huntington	5	0	0	$260,000	$0
Wells	1	0	0	$0	$0
Adams	2	0	0	$0	$0
District Subtotal	34	0	0	$2,212,000	$0
IDHS DISTRICT #4					
Benton	9	0	0	$255,000	$0
Warren	18	0	0	$109,000	$18,500
Fountain	20	0	0	$107,000	$18,000
White	7	0	0	$3,250,000	$0
Cass	4	0	0	$150,000	$0
Carroll	12	0	0	$16,750,000	$7,000
Clinton	10	0	0	$4,250	$2,500

County Name	# of Events	Death	Injury	Property Damage	Crop Damage
Tippecanoe	27	0	0	$1,006,000	$24,000
Montgomery	4	0	0	$12,000	$1,000
District Subtotal	111	0	0	$21,643,250	$71,000
IDHS DISTRICT #5					
Boone	13	0	0	$33,500	$2,000
Hamilton	20	0	0	$84,000	$1,000
Hendricks	16	0	0	$42,000	$4,500
Marion	32	0	0	$363,000	$11,000
Hancock	5	0	0	$3,006,500	$500
Morgan	25	0	0	$80,433,000	$100,035,000
Johnson	18	0	0	$90,104,000	$90,061,000
Shelby	15	0	0	$313,500	$130,500
District Subtotal	144	0	0	$174,379,500	$190,245,500
IDHS DISTRICT #6					
Howard	3	0	0	$5,500	$1,500
Tipton	10	0	0	$12,000	$3,000
Grant	5	1	0	$1,015,000	$0
Madison	8	0	0	$121,000	$22,000
Blackford	2	0	0	$0	$0
Jay	4	0	0	$1,500,000	$0
Delaware	9	0	0	$48,000	$5,000
Randolph	13	0	0	$123,000	$21,600
Henry	5	1	0	$82,000	$20,500
Wayne	5	0	0	$25,000	$0
Rush	5	0	0	$60,000	$0
Fayette	4	0	0	$13,000	$0
Union	3	0	0	$11,000	$0
District Subtotal	76	2	0	$3,015,500	$73,600
IDHS DISTRICT #7					
Vermillion	40	0	0	$270	$80,000
Parke	45	0	0	$172,000	$48,000
Putnam	14	0	0	$536,000	$307,000
Vigo	36	0	0	$50,294,000	$50,070,000
Clay	25	0	0	$45,190,000	$65,000
Owen	29	0	0	$50,292,000	$60,039,000
Sullivan	33	0	0	$15,179,000	$15,047,500
Greene	42	0	0	$20,289,000	$60,068,000
District Subtotal	264	0	0	$181,952,270	$185,724,500
IDHS DISTRICT #8					
Monroe	15	0	0	$1,103,000	$258,000
Brown	9	0	0	$526,000	$512,000
Bartholomew	13	1	0	$150,203,000	$150,041,000

County Name	# of Events	Death	Injury	Property Damage	Crop Damage
Lawrence	32	0	0	$15,159,000	$15,008,000
Jackson	45	0	6	$35,249,000	$35,015,000
Orange	7	0	0	$0	$0
Washington	17	0	0	$3,015,000	$0
District Subtotal	138	1	6	$205,255,000	$200,834,000
IDHS DISTRICT #9					
Decatur	7	0	0	$71,500	$12,500
Franklin	9	0	0	$71,000	$0
Jennings	7	0	0	$318,000	$251,000
Ripley	14	0	0	$87,000	$0
Dearborn	10	0	0	$50,000	$0
Ohio	1	0	0	$1,000	$0
Scott	6	0	0	$0	$0
Jefferson	23	0	0	$35,000	$10,000
Switzerland	4	0	0	$6,000	$0
Clark	25	0	0	$2,000	$0
Floyd	14	0	0	$0	$0
Harrison	15	0	0	$500,000	$0
District Subtotal	135	0	0	$1,141,500	$273,500
IDHS DISTRICT #10					
Knox	74	0	0	$18,350,000	$20,060,000
Daviess	30	0	0	$20,351,000	$30,244,000
Martin	15	2	0	$156,000	$10,007,000
Gibson	65	0	0	$10,081,000	$507,000
Pike	36	0	0	$531	$146,000
Dubois	18	0	0	$10,000	$0
Crawford	17	0	0	$7,000	$0
Posey	38	0	0	$880,000	$223,000
Vanderburgh	19	0	0	$541,000	$0
Warrick	30	0	0	$410,000	$10,000
Spencer	15	0	0	$300,000	$10,000
Perry	21	0	0	$0	$0
District Subtotal	378	2	0	$51,086,531	$61,207,000
State Grand Total	1,356	10	7	$680,430,551	$638,429,100

6.1.2. Vulnerability Assessment

Vulnerability to flooding was determined in three ways: 1) Hazus-MH Level 2 analysis, 2) analysis of community participation in the National Flood Insurance Program (NFIP), and 3) analysis of various risk indicators in the Community Action Potential Index (CAPI).

It is important to note that the losses to buildings, particularly essential facilities and state-owned properties, extends beyond physical damage. The economic and social impacts associated with loss of governmental, public safety, and health care infrastructure are far more significant for a community. When assessing the cost of building construction, it is important for government agencies to consider these impacts.

6.1.2.1 Hazus-MH Analysis

Hazus-MH generated the flood depth grid for a 100-year return period and made calculations by clipping the digital elevation model (DEM) to the 100-year DFIRM boundary; it then utilized a user-defined analysis of the state with site-specific parcel data provided by IndianaMap and counties. Losses are reported by Hydrologic Unit Code (HUC) 8 watersheds.

Hazus-MH estimates the 100-year flood would damage 43,892 buildings at a replacement cost of $2.7 billion. The Upper White River watershed incurred the greatest overall losses (16,647 buildings at a cost of $852.2 million) with a loss ratio of 17%. Loss ratio is calculated by dividing the estimated building damages by the total replacement cost. Figure 34 shows the loss ratio by watershed.

The total estimated numbers of damaged buildings are given in Table 13. Residential structures are by far the most susceptible to damage and comprise 85% of the total buildings damaged. Building losses are mapped in Figures 34 and 35 and listed in Table 14 on the following pages.

Table 13: Building Damage by Occupancy

Watershed	Total Buildings Damaged	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
Auglaize	81	13	1	1	1	1	-	64
Blue-Sinking	1,155	145	155	2	18	17	16	802
Chicago	4,042	138	-	2	21	65	3	3,813
Driftwood	2,733	269	179	3	17	41	31	2,193
Flatrock-Haw	1,008	91	118	1	20	52	11	715
Highland-Pigeon	1,494	39	123	1	12	57	18	1,244
Iroquois	422	36	28	0	1	5	2	350
Kankakee	1,829	135	83	-	25	35	13	1,538
Little Calumet Galien	2,040	24	91	4	26	11	8	1,876
Lower East Fork White	1,591	341	161	-	26	29	27	1,007
Lower Eel	523	159	5	-	10	4	4	341
Lower Great Miami	49	11	18	-	-	3	-	17
Lower Ohio Little Pigeon	1,306	226	79	-	7	38	17	939
Lower Wabash	456	55	20	-	2	5	4	370
Lower White	1,380	223	145	-	20	22	33	937

Watershed	Total Buildings Damaged	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
Middle Ohio Laughery	1,614	245	225	-	32	12	28	1,072
Middle Wabash Busseron	821	130	87	1	10	31	14	548
Middle Wabash Deer	638	86	36	-	12	10	6	488
Middle Wabash-Little Vermillion	1,083	160	39		9	2	11	862
Mississinewa	1,862	145	144	2	78	34	35	1,424
Muscatatuck	701	205	21	-	1	8	11	455
Patoka	485	83	83	-	6	42	9	262
Salamonie	269	46	41	1	7	6	8	160
Silver Little Kentucky	3,268	197	234	3	30	37	41	2,726
St. Joseph	5,178	123	184	6	37	52	26	4,750
St. Joseph Maumee	925	91	22	2	10	5	14	781
St. Mary's	1,197	45	84	2	12	28	14	1,012
Sugar	506	84	23	1	7	6	2	383
Tippecanoe	5,676	143	84	-	23	16	8	5,402
Upper East Fork White	2,312	272	149	4	18	38	11	1,820
Upper Eel	831	86	39	1	10	8	9	678
Upper Great Miami	7	5	-	-	-	-	-	2
Upper Maumee	473	21	45	2	-	16	4	385
Upper Wabash	1,090	104	115	-	21	43	13	794
Upper White	16,647	400	1,036	9	118	233	151	14,700
Vermillion	26	2	-	-	-	-	-	24
Whitewater	1,476	235	150	1	28	29	27	1,006
Wildcat	963	112	54	1	14	13	10	759
TOTAL	43,892	2,399	2,508	35	420	614	393	37,523

Figure 34: Loss Ratio by Watershed

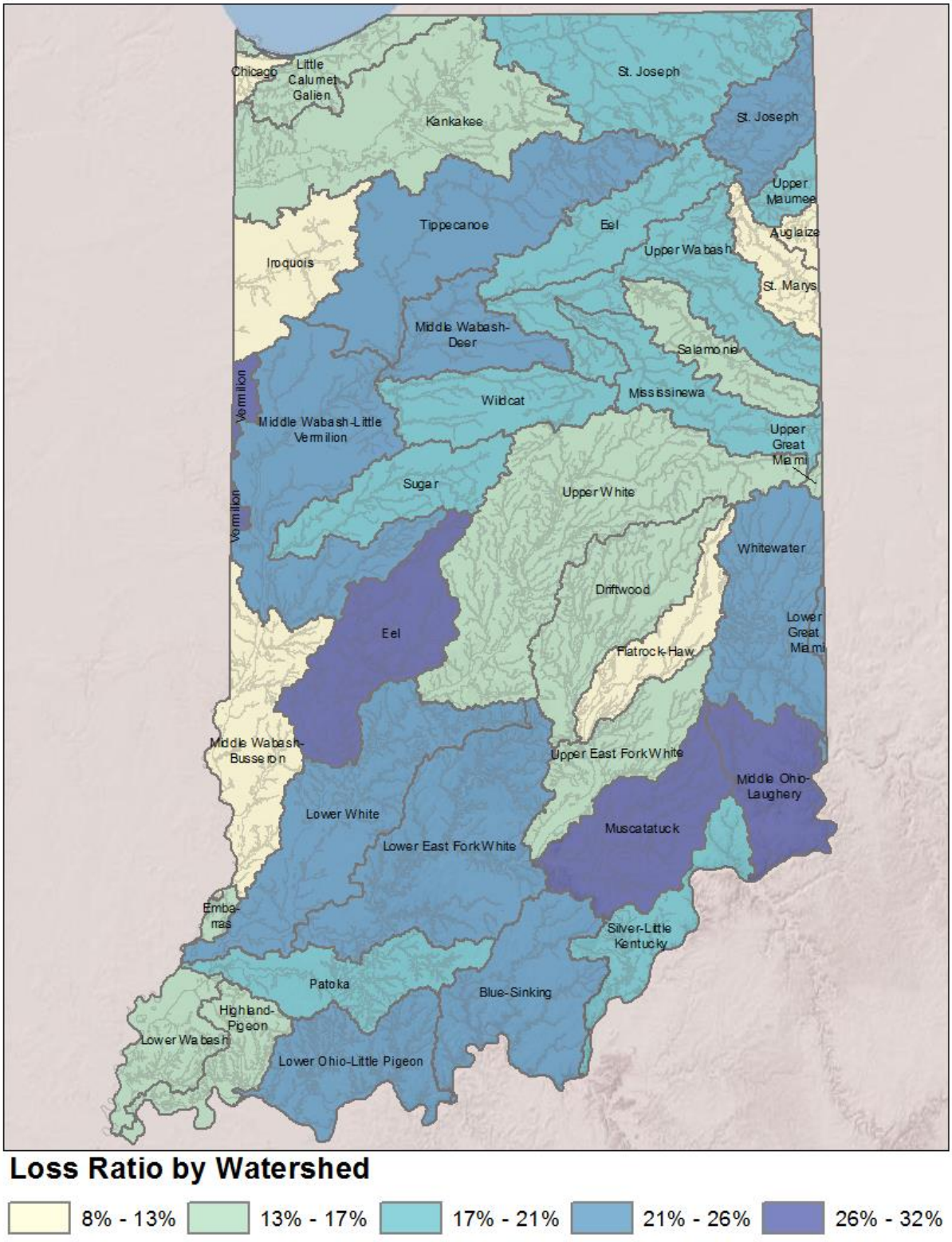


Table 14: Damaged Buildings by Occupancy

Watershed	Total Building Losses	Building Occupancy Class							
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential	Loss Ratio
Auglaize	$1,662,000	$395,000	$8,000	$9,000	$35,000	$276,000	$-	$939,000	11%
Blue-Sinking	$39,780,000	$6,680,000	$8,773,000	$25,000	$686,000	$5,393,000	$603,000	$17,620,000	25%
Chicago	$66,200,000	$-	$7,009,000	$447,000	$910,000	$6,359,000	$6,461,000	$45,014,000	8%
Driftwood	$119,507,000	$11,782,000	$20,911,000	$447,000	$653,000	$5,953,000	$6,735,000	$73,026,000	17%
Flatrock-Haw	$45,020,000	$4,180,000	$3,804,000	$3,242,000	$2,213,000	$13,339,000	$555,000	$17,687,000	13%
Highland-Pigeon	$67,715,000	$1,029,000	$8,378,000	$847,000	$1,427,000	$7,515,000	$960,000	$47,559,000	14%
Iroquois	$9,517,000	$1,185,000	$459,000	$-	$1,000	$393,000	$73,000	$7,406,000	13%
Kankakee	$50,181,000	$3,697,000	$3,750,000	$-	$578,000	$4,853,000	$532,000	$36,771,000	15%
Little Calumet Galien	$76,238,000	$1,386,000	$12,343,000	$758,000	$1,557,000	$1,805,000	$589,000	$57,800,000	17%
Lower East Fork White	$81,095,000	$14,147,000	$25,215,000	$-	$1,442,000	$7,460,000	$1,045,000	$31,786,000	23%
Lower Eel	$20,350,000	$7,715,000	$171,000	$-	$349,000	$231,000	$162,000	$11,722,000	28%
Lower Great Miami	$3,364,000	$595,000	$1,687,000	$-	$-	$494,000	$-	$588,000	22%
Lower Ohio Little Pigeon	$63,578,000	$8,271,000	$17,701,000	$-	$323,000	$2,712,000	$1,207,000	$33,364,000	24%
Lower Wabash	$13,100,000	$1,369,000	$931,000	$-	$95,000	$2,764,000	$165,000	$7,776,000	14%
Lower White	$61,647,000	$11,320,000	$16,950,000	$-	$6,638,000	$2,660,000	$900,000	$23,179,000	24%
Middle Wabash-Little Vermillion	$54,534,000	$6,950,000	$4,434,000	$-	$183,000	$76,000	$3,595,000	$39,296,000	24%
Middle Wabash Deer	$22,768,000	$3,437,000	$1,323,000	$-	$311,000	$4,919,000	$216,000	$12,562,000	22%
Mississinewa	$55,528,000	$5,360,000	$6,950,000	$21,000	$2,213,000	$5,498,000	$1,630,000	$33,856,000	20%
Middle Ohio Laughery	$89,337,000	$13,822,000	$25,472,000	$-	$2,366,000	$3,331,000	$2,592,000	$41,754,000	29%

Watershed	Total Building Losses	Building Occupancy Class							
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential	Loss Ratio
Muscatatuck	$26,900,000	$7,865,000	$990,000	$-	$4,000	$850,000	$405,000	$16,786,000	28%
Middle Wabash Busseron	$26,240,000	$5,660,000	$5,713,000	$47,000	$112,000	$2,787,000	$709,000	$11,212,000	12%
Patoka	$35,673,000	$4,617,000	$4,880,000	$-	$126,000	$16,388,000	$295,000	$9,367,000	19%
Salamonie	$7,186,000	$1,109,000	$595,000	$199,000	$114,000	$648,000	$126,000	$4,395,000	15%
Silver Little Kentucky	$149,150,000	$9,272,000	$28,454,000	$123,000	$2,223,000	$6,929,000	$5,907,000	$96,242,000	20%
St. Joseph	$162,383,000	$3,842,000	$10,436,000	$1,565,000	$1,179,000	$20,456,000	$3,307,000	$121,598,000	21%
St. Joseph Maumee	$37,387,000	$3,712,000	$827,000	$63,000	$139,000	$1,048,000	$851,000	$30,747,000	24%
St. Mary's	$42,623,000	$1,322,000	$4,642,000	$439,000	$901,000	$10,549,000	$932,000	$23,838,000	13%
Sugar	$20,193,000	$4,234,000	$663,000	$124,000	$294,000	$6,340,000	$409,000	$8,129,000	19%
Tippecanoe	$140,159,000	$3,940,000	$3,537,000	$-	$1,079,000	$2,940,000	$184,000	$128,479,000	23%
Upper East Fork White	$70,202,000	$14,860,000	$9,071,000	$535,000	$414,000	$5,580,000	$529,000	$39,213,000	16%
Upper Eel	$25,676,000	$4,265,000	$1,602,000	$22,000	$481,000	$655,000	$731,000	$17,920,000	20%
Upper Great Miami	$182,000	$136,000	$-	$-	$-	$-	$-	$46,000	15%
Upper Maumee	$24,125,000	$818,000	$2,525,000	$182,000	$-	$4,979,000	$316,000	$15,305,000	18%
Upper Wabash	$50,161,000	$4,122,000	$11,002,000	$-	$375,000	$7,367,000	$732,000	$26,563,000	19%
Upper White	$852,186,000	$16,848,000	$101,497,000	$11,783,000	$82,764,000	$51,945,000	$26,932,000	$560,417,000	17%
Vermillion	$822,000	$66,000	$-	$-	$-	$-	$-	$756,000	32%
Whitewater	$63,757,000	$12,388,000	$7,229,000	$674,000	$1,320,000	$8,032,000	$1,442,000	$32,672,000	26%
Wildcat	$41,846,000	$4,285,000	$2,420,000	$28,000	$1,437,000	$1,802,000	$4,397,000	$27,477,000	19%

Figure 35: Total Losses by Watershed in US Dollars

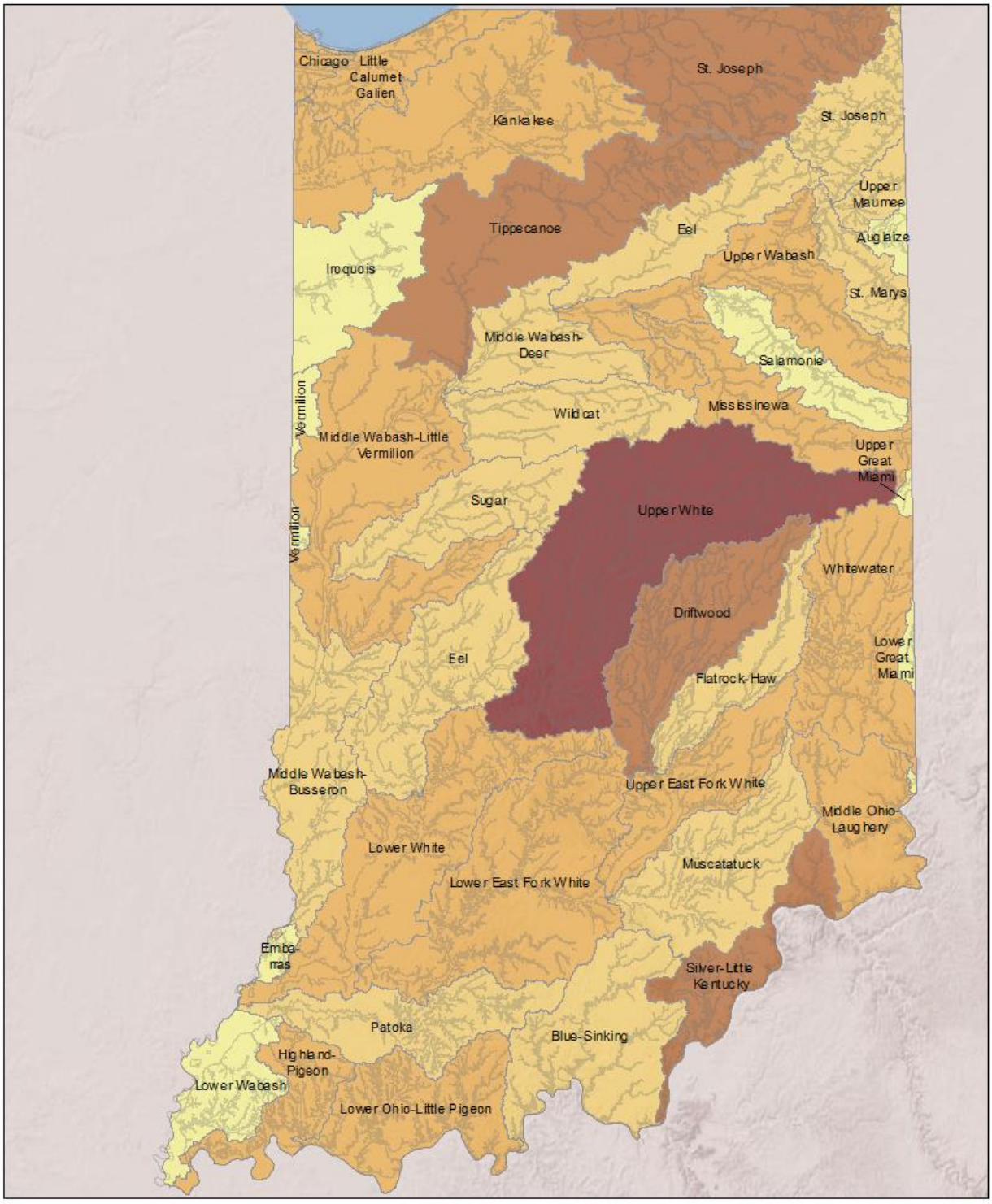


Table 15 identifies Hazus Level 2 building losses from local jurisdiction plans. The information includes analyses prepared between 2004 and 2013 as part of the Boundary Waters, Central Farming, Northern Prairie, and individual county planning grants. The table has been updated since the 2011 SHMP to include new information for Washington County and updated information from Spencer, Hamilton, Marion, Howard and DeKalb counties. For counties recorded as "data is not available," a Hazus Level 2 analysis has not yet been completedas part of their local mitigation plans.

Table 15: Hazus Building Losses from Local MHMPs

County	Num. of Buildings	Building Replacement Cost	Num. Damaged Buildings	Total Building Damage
IDHS District 1				
Lake	180,938	$54,662,733,000	9,791	$11,027,552,000
Porter	55,801	$10,336,307,000	1,001	$28,079,000
Newton	6,483	$868,779,000	354	$5,211,000
Jasper	12,824	$1,749,885,000	671	$11,244,000
Data not available for LaPorte County				
IDHS District 2				
St. Joseph	95,487	$17,347,376,000	640	$17,301,000
Starke	9,542	$1,169,984,000	158	$242,100
Marshall	20,303	$3,200,801,000	501	$10,544,000
Kosciusko	33,773	$5,205,127,000	3,148	$66,173,000
Pulaski	5,366	$649,350,000	293	$4,281,000
Fulton	10,330	$1,724,303,000	483	$9,953,000
Data not available for Elkhart County				
IDHS District 3				
LaGrange	15,509	$2,229,324,000	1,023	$18,327,000
Steuben	20,670	$2,818,507,000	404	$8,050,285
DeKalb	16,916	$3,239,090,000	209	5,363,057
Whitley	13,466	$2,030,354,000	566	$13,434,000
Miami	15,373	$1,821,078,000	399	$9,529,000
Wabash	13,768	$3,590,577,000	311	$10,289,000
Huntington	14,123	$2,115,449,000	167	$3,586,000
Data not available for Noble, Allen, or Adams counties				
IDHS District 4				
Benton	4,728	$609,121,000	50	$523,000
White	13,175			$29,582,000
Carroll	10,856		92	$33,980,000
Cass	16,727	$2,211,564,000	574	$9,865,000
Warren	4,228	$549,145,000	36	$685,000
Fountain	10,221	$1,215,628,000		
Clinton	15,341	$2,420,191,000	89	$2,007,000
Data not available for Tippecanoe or Montgomery counties				

County	Num. of Buildings	Building Replacement Cost	Num. Damaged Buildings	Total Building Damage
IDHS District 5				
Boone	20,795	$3,821,916,000	1,400	$42,666,000
Hamilton	98,331	$45,793,692,000	1,737	$200,000,000
Marion	387,775	$219,117,582,000	9,911	$1,081,685,000
Morgan	28,346	$3,941,814,000	687	$16,840,000
Johnson	45,305	$7,691,754,000	1,503	$45,011,000
Shelby	18,657	$2,831,781,000	1,543	$31,277,000
Data not available for Hendricks or Hancock counties				
IDHS District 6				
Howard	43,066	$8,499,958,000	524	$23,424,000
Grant	29,198	$4,197,183,000	550	$10,631,000
Blackford	6,013	$614,070,000	32	$437,000
Jay	10,335	$1,483,383,000	275	$4,391,000
Tipton	6,970	$1,092,951,000	1	$1,613,000
Rush	8,016	$1,150,463,000	296	$6,259,000
Data not available for Randolph, Henry, Wayne, Fayette, Madison, Delaware, or Union counties				
IDHS District 7				
Data not available for District 7 counties				
IDHS District 8				
Monroe	36,953	$6,697,223,000	691	$26,664,000
Washington	12,154	$533,398,000	217	$637,000
Data not available for Lawrence, Jackson, Orange, Brown, or Bartholomew counties				
IDHS District 9				
Data not available for District 9 counties				
IDHS District 10				
Daviess	12,609	$1,572,422,000	436	$7,178,000
Pike	5,351	$669,137,000	47	$10,144,000
Dubois	17,922	$2,831,036,000	449	$25,111,000
Spencer	10,553	$1,517,130,000	999	$26,462,000
Data not available for Knox, Martin, Gibson, Posey, Vanderburgh, Warrick, Perry, or Crawford counties				

6.2.2.1.1 Hazus-MH Analysis of Essential Facilities

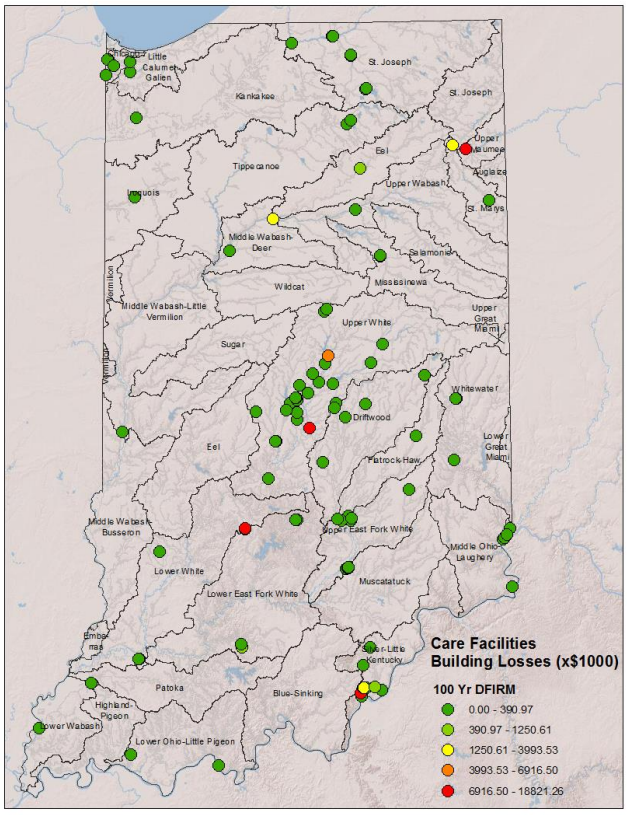
Hazus estimates that 152 essential facilities would be damaged at a replacement cost of $103.3 million. Essential facility replacement costs were populated with best available data from statewide databases. Where local data was not available, default Hazus estimates were used.

Table 16 lists the numbers and types of damaged essential facilities. The loss ratio is calculated by dividing the estimated building damages (Building Loss) by the total replacement cost (Building Cost). Figures 36 through 40 show maps of damaged essential facilities by type.

Table 16: Damaged Essential Facilities

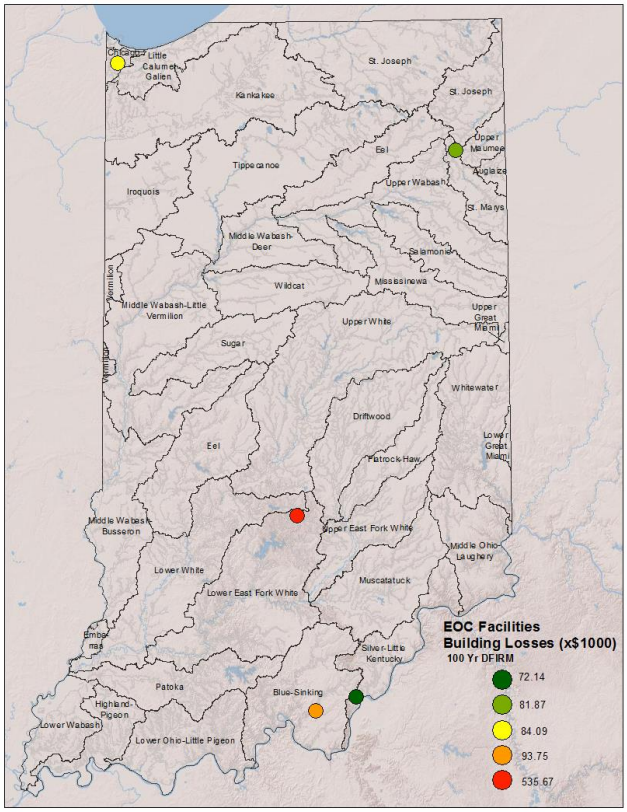
Name	Type of EF	Buildings Damaged	Building Loss ($)	Building Cost ($)	Loss Ratio
Hospitals	Care	1	2,705,000	13,520,000	20%
Nursing Homes	Care	4	56,749,000	200,000,000	28%
Intermediate Care Facilities	Care	25	30,715,000	140,500,000	22%
Ambulatory Surgery Centers	Care	4	471,000	14,720,000	3%
WIC Clinics	Care	2	405,000	1,000,000	40%
WIC Vendors	Care	10	1,506,000	5,000,000	30%
Other	Care	3	406,000	1,250,000	32%
EOC	EOC	5	868,000	5,120,000	17%
Fire Stations	Fire Stations	52	4,259,000	37,715,000	11%
Police Stations	Police Stations	19	4,414,000	28,112,000	16%
Grade Schools	Schools	27	842,000	18,616,000	5%
TOTAL		152	103,340,000	465,553,000	22%

Figure 36: Damaged Care Facilities



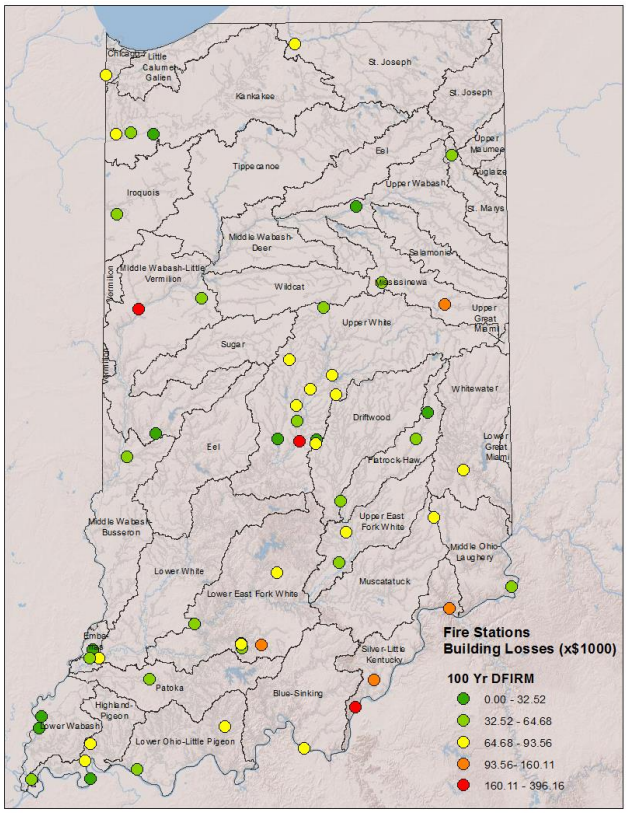
Hazus estimates that 49 care facilities would be damaged at a replacement cost of approximately $93 million. Care facilities include hospitals, surgery centers, WIC facilities, and nursing homes.

Figure 37: Damaged Emergency Operations Centers



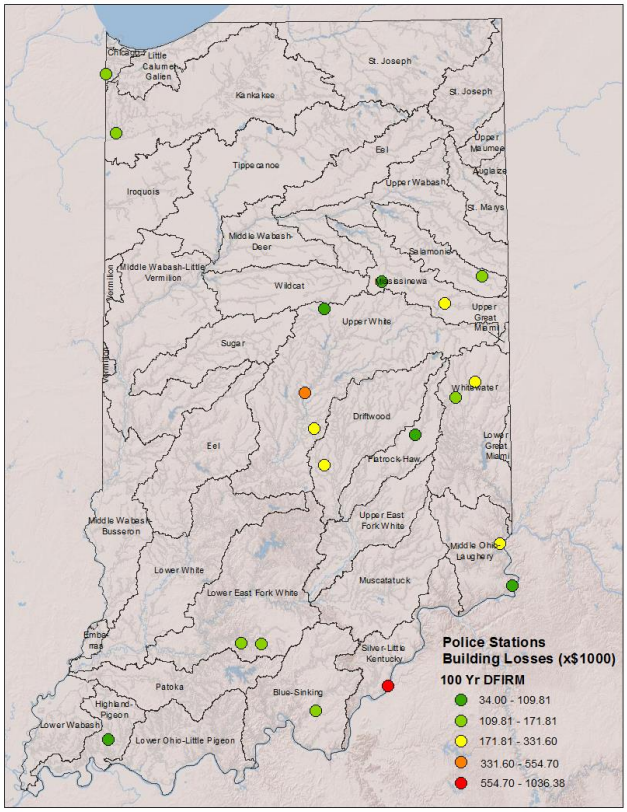
Hazus estimates that 5 EOCs would be damaged at a replacement cost of approximately $868,000.

Figure 38: Damaged Fire Stations



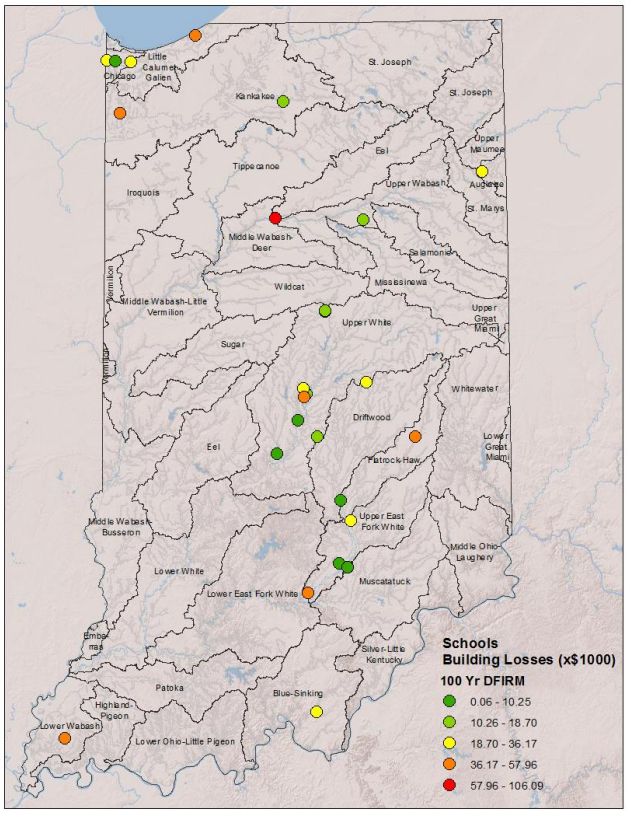
Hazus estimates that 52 fire stations would be damaged at a replacement cost of approximately $4.2 million.

Figure 39: Damaged Police Stations



Hazus estimates that 19 police stations would be damaged at a replacement cost of approximately $4.4 million.

Figure 40: Damaged Schools (K-12)



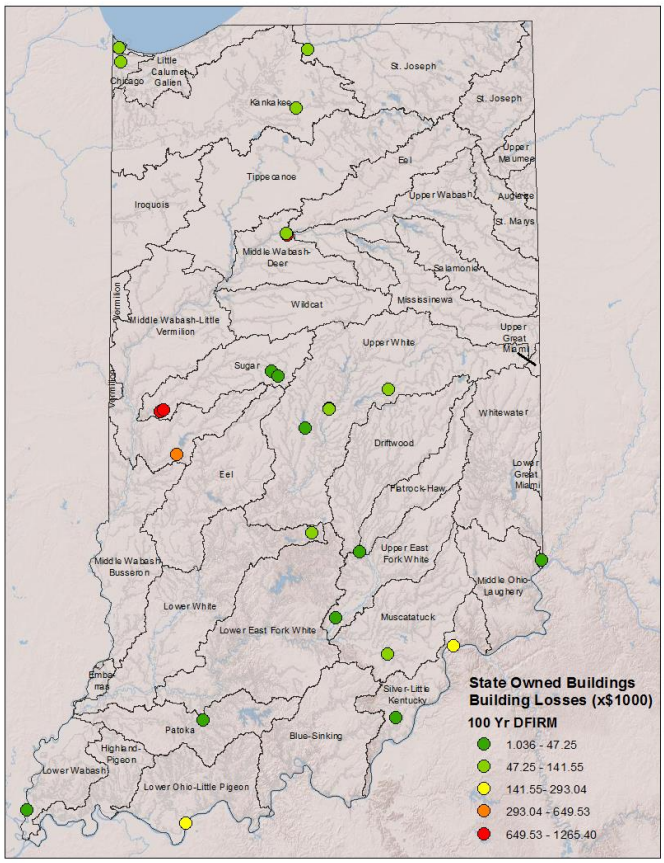
Hazus estimates that 27 schools would be damaged at a replacement cost of approximately $842,000.

6.2.2.1.1 Hazus-MH Analysis of State-Owned Buildings

Hazus estimates that 57 state-owned facilities would be damaged at a total replacement cost of $35.9 million. The loss ratio for state-owned facilities is 38%. Loss ratio is calculated by dividing the estimated building damages (Building Loss) by the total replacement cost (Building Cost).

The replacement cost for state-owned buildings was provided by the Indiana Department of Transportation (INDOT) and the Indiana Department of Administration (IDOA). Figure 41 maps the location and losses of state-owned buildings.

Figure 41: Damaged State-Owned Buildings



Hazus estimates that 57 state-owned buildings would be damaged at a replacement cost of approximately $35.9 million.

6.1.2.2 CAPI Analysis

FEMA Region V's comprehensive Community Action Potential Index (CAPI) assigns a score to every community in the region based on 16 risk indicators, which include, but are not limited to, number of repetitive losses and insurance claims, number of previous disaster events, percent of the community in the Special Flood Hazard Area (SFHA), and total population. The higher the score, the higher the potential risk that community faces in the event of a disaster. The purpose of the tool is to highlight the communities that would be most inclined to take mitigation actions in programs like Risk MAP, the Pre-Disaster Mitigation program, and more.

Table 17 lists the top 20 Indiana communities based on the CAPI score (highest possible score is 131). These are the communities with high vulnerability that should seek to take mitigation actions to protect their residents and infrastructure. The Polis Center also ran a Hazus Level 2 analysis on the top 20 CAPI communities.

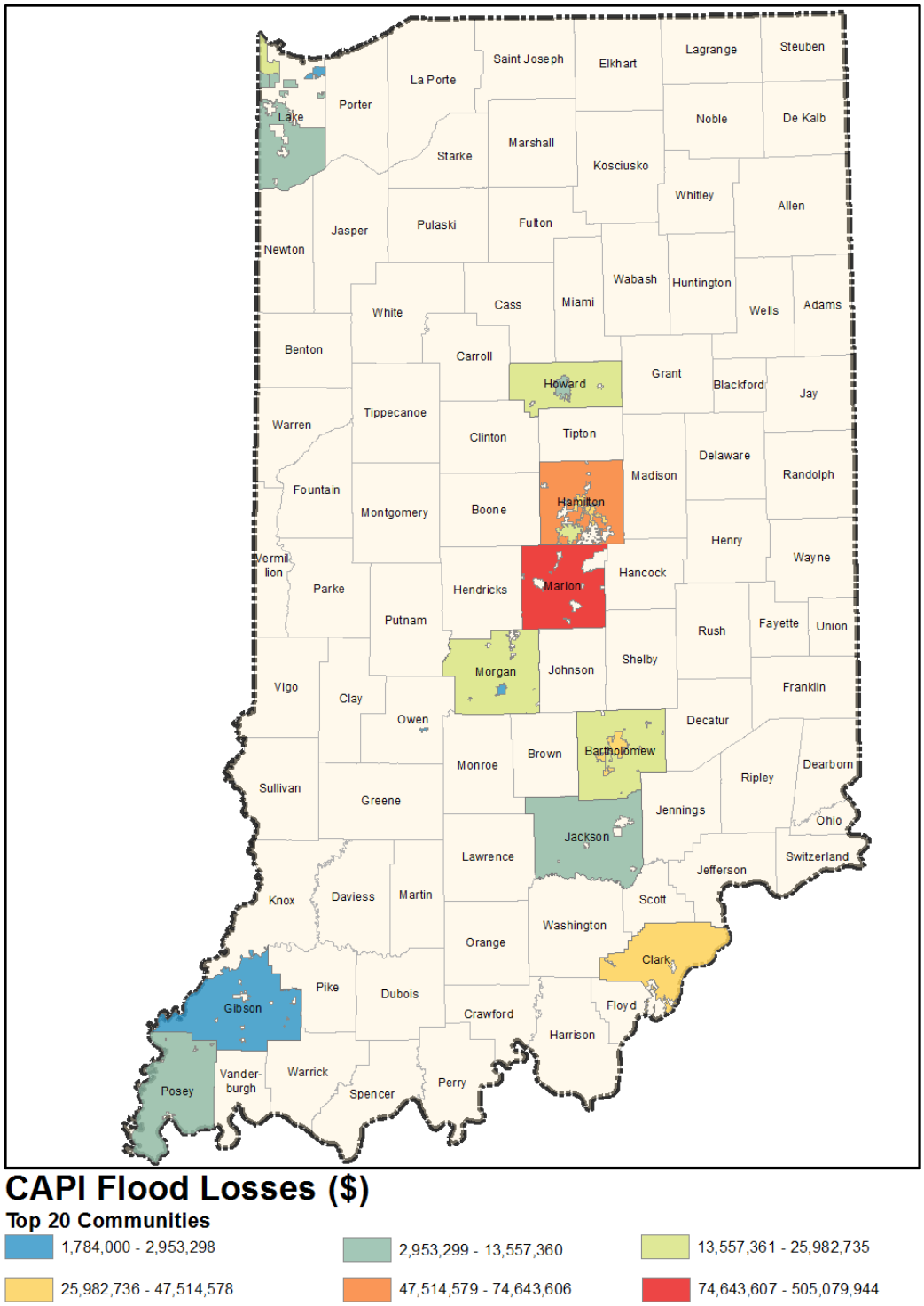
Table 17: Top 20 CAPI Communities

Community Name	CAPI Score
City of Indianapolis	92.24
City of Columbus	83.20
City of Noblesville	79.43
Morgan County	77.30
Bartholomew County	72.29
Clark County	69.34
City of Martinsville	67.46
Town of Munster	67.11
City of Kokomo	66.68
Lake County	66.03
Hamilton County	65.82
City of Hammond	65.10
Town of Highland	64.45
City of Carmel	62.87
Jackson County	61.93
Gibson County	61.83
City of Lake Station	61.47
Howard County	61.11
Town of Spencer	60.31
Posey County	59.93

FEMA Region V identified the top 20 CAPI communities in Indiana as those with high vulnerability that should seek to take mitigation actions to protect their residents and infrastructure.

Figure 42 maps the Hazus flood losses by community. Specific mitigation strategies for each of these communities are available in Section 8 of this plan.

Figure 42: Hazus Flood Losses in US Dollars by CAPI Community



6.1.2.3 NFIP Analysis

FEMA provides annual funding through the National Flood Insurance Fund (NFIF) to reduce the risk of flood damage to existing buildings and infrastructure. These grants include Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and the Severe Repetitive Loss (SRC) program. The long-term goal is to significantly reduce or eliminate claims under the NFIP through mitigation activities.

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

The total amount paid for building replacement and building contents for damages to these repetitive loss structures in the past 30 years is $12,595,826. Tables 18 lists Indiana's top repetitive loss communities.

Table 18: Communities with Highest Repetitive Loss Payments

Community	County	Properties	Losses	Total Pmts
City of Indianapolis	Marion	22	51	$1,517,556.46
Carroll County	Carroll	13	30	$1,155,054.96
City of Fort Wayne	Allen	6	15	$845,145.17
Vigo County	Vigo	8	20	$689,639.73
Tippecanoe County	Tippecanoe	7	15	$571,874.84
Vanderburgh County	Vanderburgh	5	10	$499,471.44
Shelby County	Shelby	6	13	$481,816.41
Clark County	Clark	5	15	$409,506.15
Owen County	Owen	5	12	$371,725.77
Fulton County	Fulton	4	8	$276,079.08

Figure 43 shows total number of repetitive loss properties in each community.

Figure 43: Number of Repetitive Loss Properties by Community

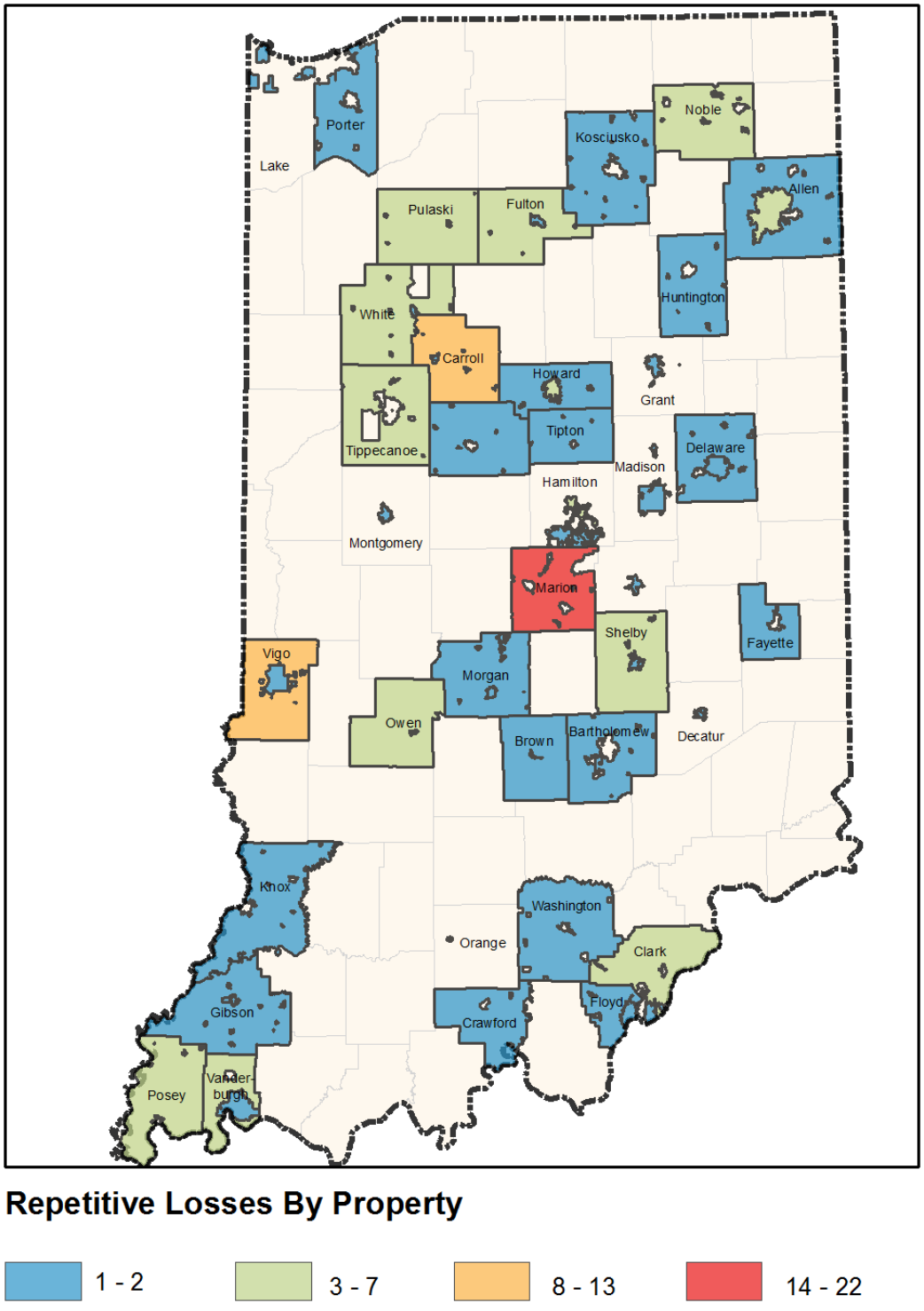
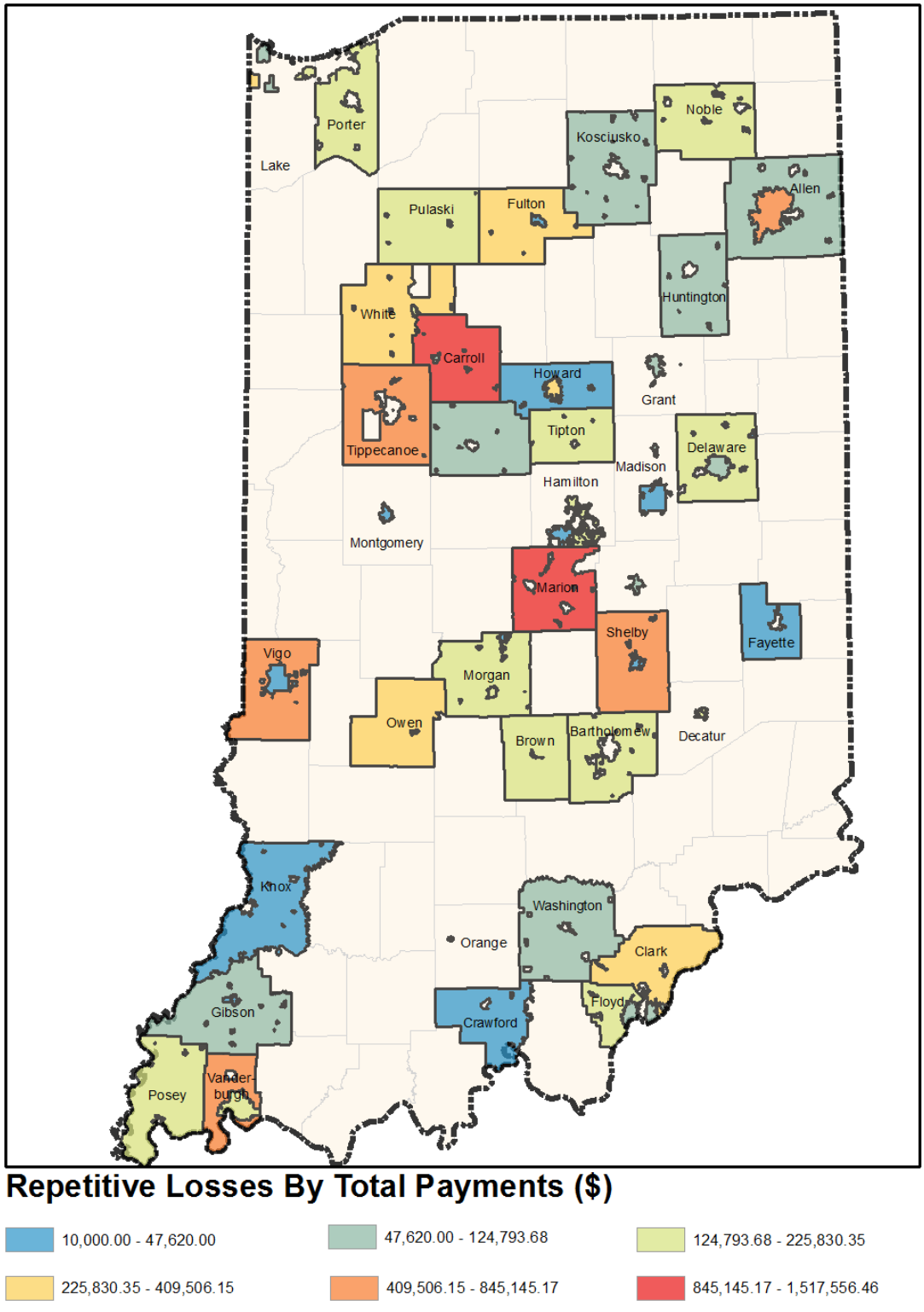


Figure 44 shows total aggregated payments by community.

Figure 44: Repetitive Loss Payments by Community in US Dollars



A severe repetitive loss property is defined as a residential property covered under an NFIP flood insurance policy and:

A) Has at least four NFIP claim payments over $5,000 each with a cumulative payment amount that exceeds $20,000

   OR

B) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion exceeding the market value of the building

For both A and B, at least two of the claims must have occurred within any 10-year period and must be greater than 10 days apart.

The total amount paid for severe repetitive losses in the past 30 years is $14,749,080.94. Table 19 identifies Indiana's top severe repetitive loss communities.

Table 19: Communities with Highest Severe Repetitive Losses

Community	County	Properties	Losses	Total Pmts
City of Indianapolis	Marion	29	169	$2,844,744.66
City of Fort Wayne	Allen	9	42	$1,680,264.50
Carroll County	Carroll	9	40	$1,046,718.91
City of Alexandria	Madison	6	28	$582,336.07
City of Jeffersonville	Clark	5	34	$540,353.99
Vanderburgh County	Vanderburgh	4	16	$427,284.73
City of Evansville	Vanderburgh	2	17	$420,693.80
City of Marion	Grant	3	23	$414,790.59
Shelby County	Shelby	5	18	$399,686.33

Figure 45 shows total number of severe repetitive loss properties in each community.

Figure 45: Number of Severe Repetitive Loss Properties by Community

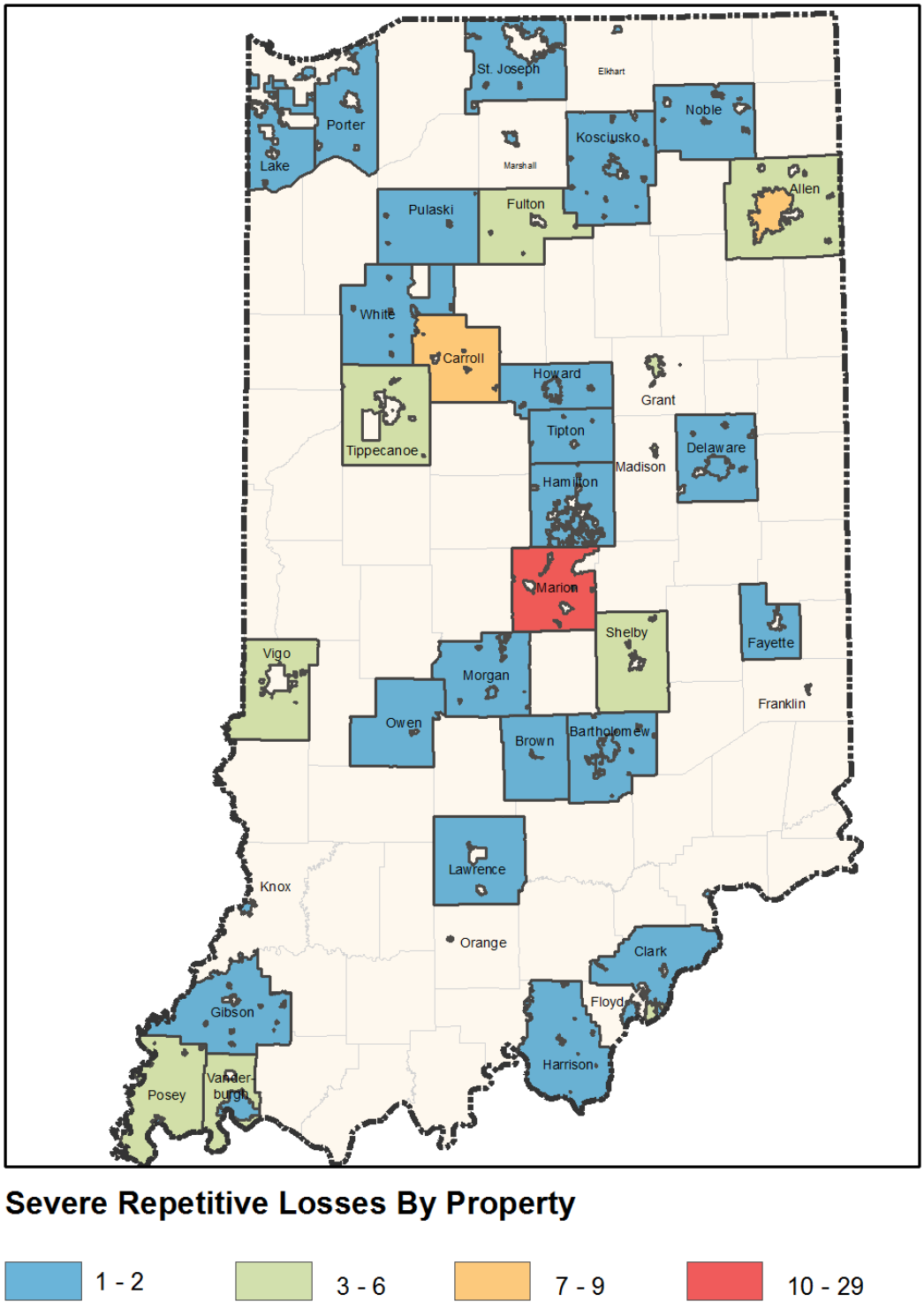
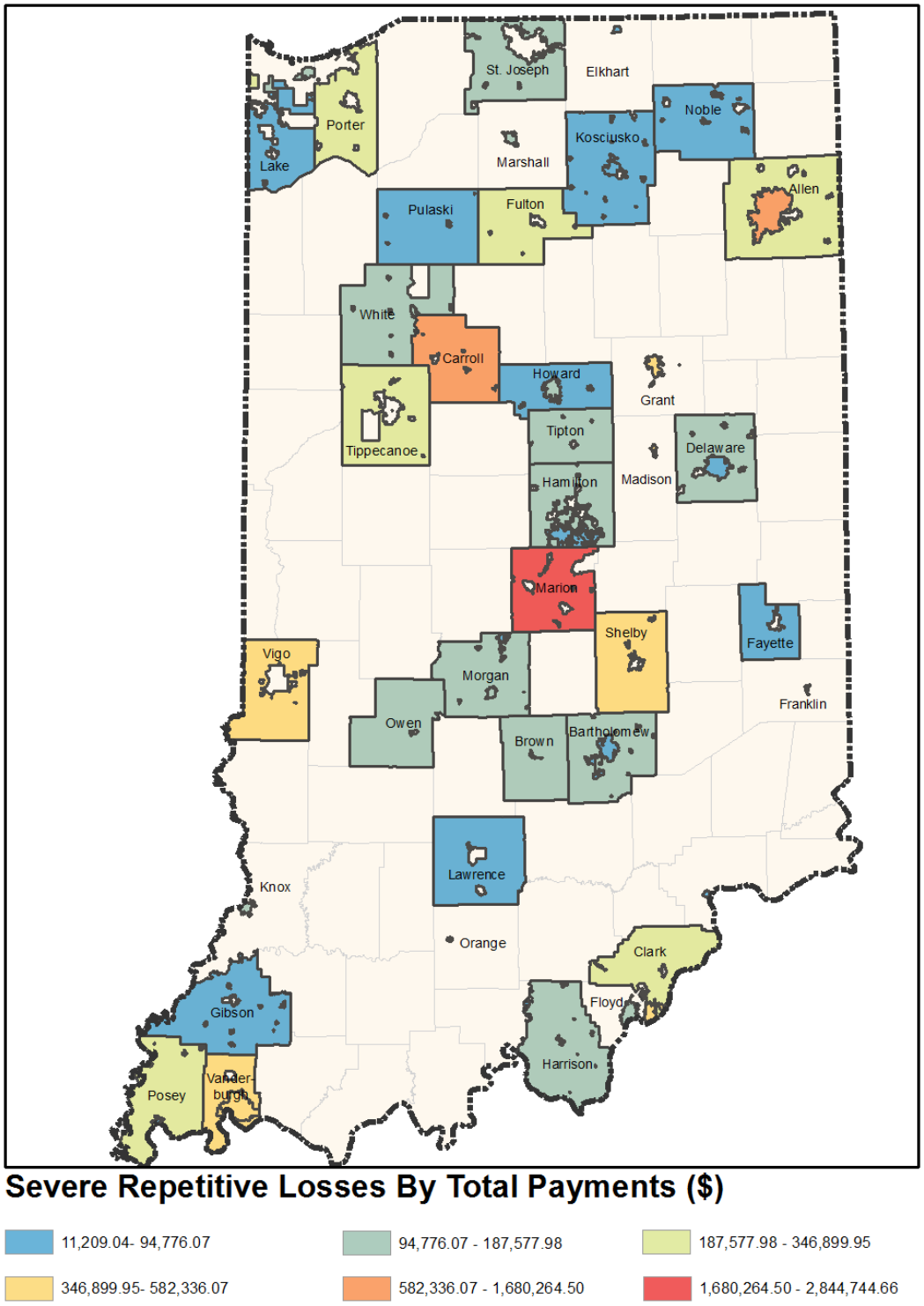


Figure 46 shows total aggregated payments for severe repetitive losses by community.

Figure 46: Severe Repetitive Loss Payments in US Dollars by Community



In an effort to mitigate losses, IDHS targets repetitive loss and severe repetitive loss structures for acquisition so that the land can be converted to wetlands or other green space. Since 1990, there have been an estimated 1,151 buy-outs in Indiana. Table 20 lists the 25 communities with the most buy-outs, and Figure 47 maps total number of buy-outs by community.

Figure 47: Acquisitions by Community

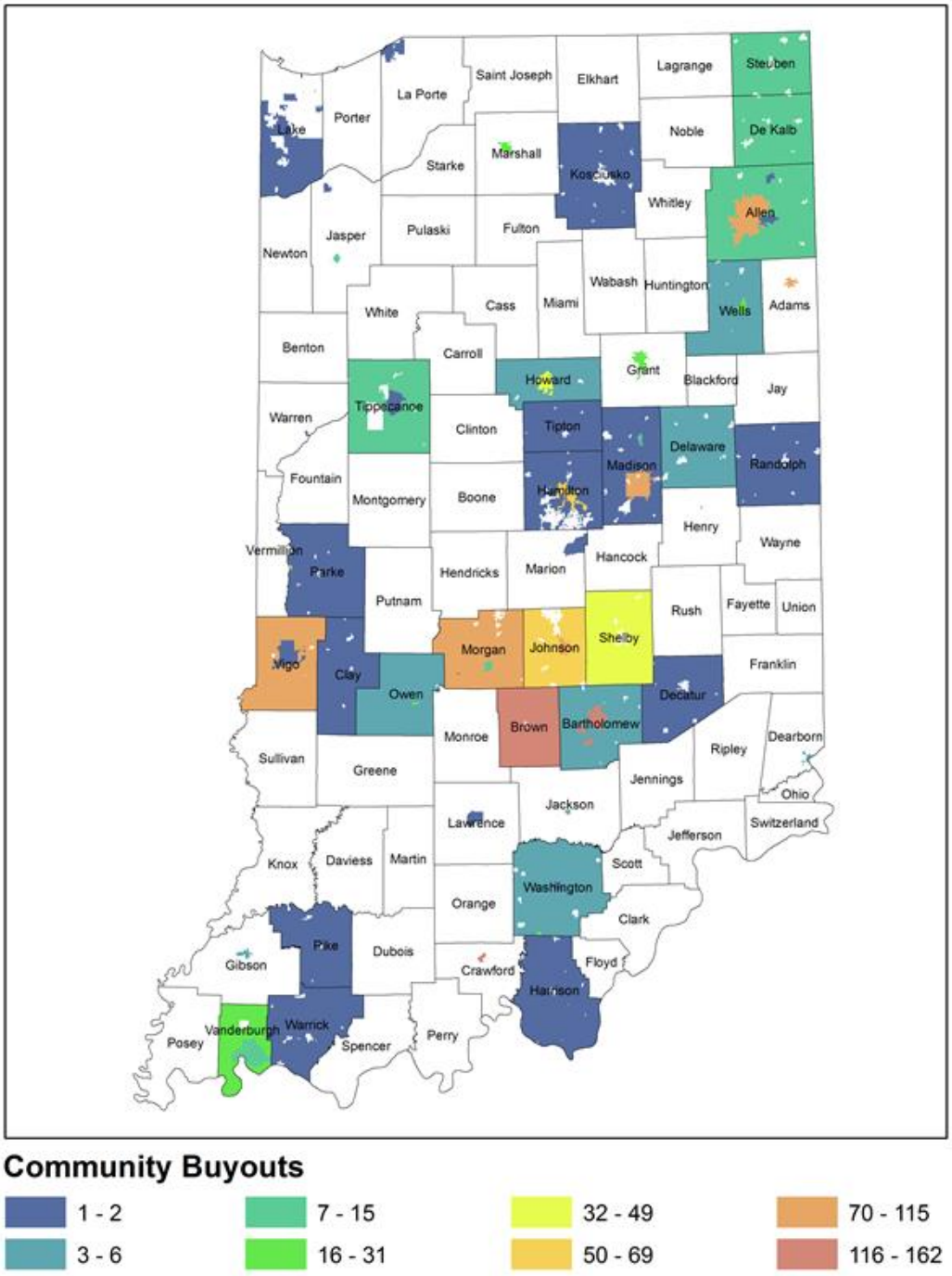


Table 20: Top 25 Communities with the Most Buyouts

Community	County	Buyouts
City of English*	Crawford	162
Vigo County	Vigo	115
City of Fort Wayne	Allen	103
Morgan County**	Morgan	99
City of Franklin	Johnson	81
City of Decatur	Adams	80
Brown County	Brown	70
City of Noblesville	Hamiliton	56
City of Columbus	Bartholomew	54
City of Plymouth	Marshall	54
City of Kokomo	Howard	49
Town of Montezuma	Parke	38
City of Martinsville**	Morgan	32
Vanderburgh County	Vanderburgh	31
City of Marion**	Grant	26
Town of Vera Cruz	Wells	25
Town of Fredericksburg	Washington	21
Shelby County	Shelby	15
Steuben County	Steuben	15
City of Alexandria	Madison	13
City of Auburn	Dekalb	12
Total		1,151

* Multiple funding sources
** HMGP funds only; other funding acquired additional properties that have FEMA restrictions

Polis used flood insurance claims and policies data provided by the Indiana Department of Natural Resources to determine the top 20 CAPI communities (described in Section 6.1.2.2) with the greatest number of uninsured parcels. Data were not available to show how many of the total policies covered buildings in the floodplain; however, in all of the top 20 CAPI communities the total exposure (replacement cost) of flood-prone buildings far exceeded the community's total insurance coverage. Therefore, we can assume that even if every policy covers a home in the floodplain, there are still many flood-prone homes that are uninsured. Table 21 on the following page lists each community's policies, insurance coverage, and replacement cost of buildings located in the floodplain.

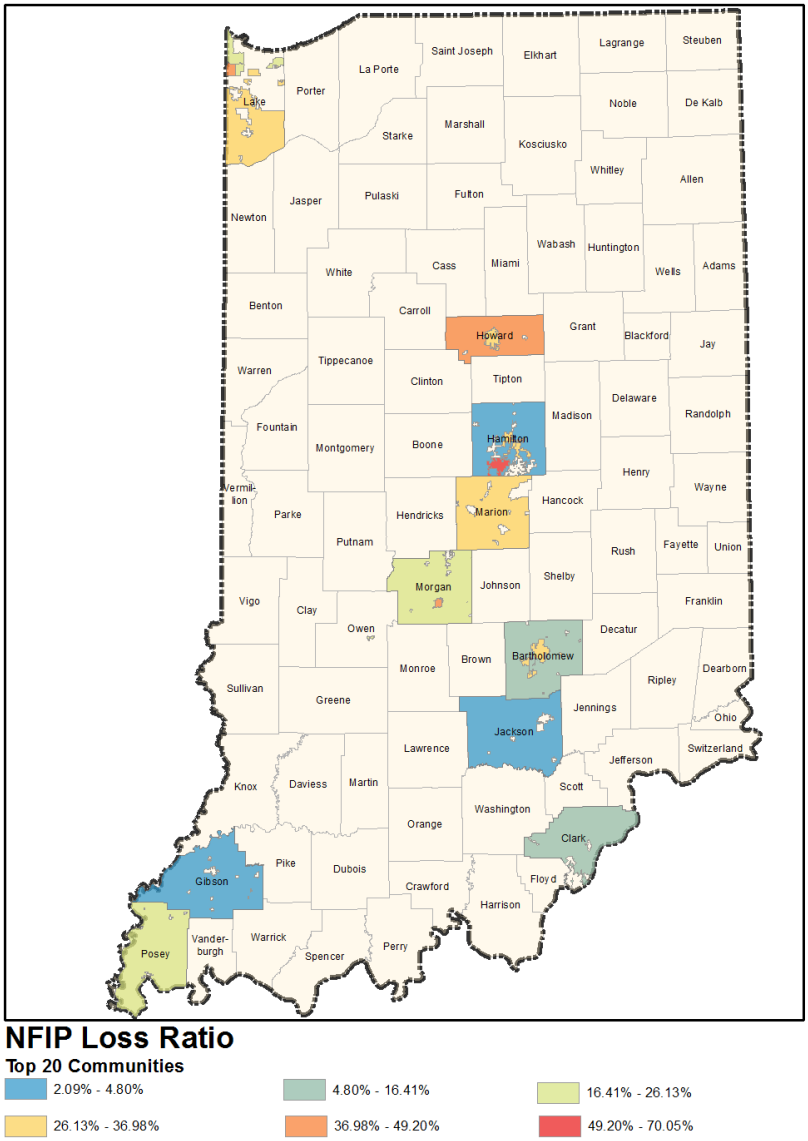
Table 21: NFIP Insurance Coverage and Gaps of Top 20 CAPI Communities

Community	County	# of policies	Insurance Coverage	Exposure of Flood-Prone Buildings	Insurance ratio (Coverage/ Replacement Cost)
Gibson County	Gibson	32	$1,237,900	$59,229,884	2.1%
Hamilton County	Hamilton	88	$13,021,800	$471,098,079	2.8%
Jackson County	Jackson	70	$9,181,500	$191,169,851	4.8%
Clark County	Clark	553	$86,313,400	$583,050,020	14.8%
Bartholomew County	Bartholomew	301	$42,819,900	$260,997,396	16.4%
City of Hammond	Lake	649	$90,785,900	$440,447,990	20.6%
Posey County	Posey	107	$15,289,800	$69,663,319	21.9%
City of Lake Station	Lake	44	$5,915,400	$25,285,926	23.4%
Town of Spencer	Owen	49	$5,081,800	$21,583,094	23.5%
Morgan County	Morgan	148	$32,408,300	$135,234,010	24.0%
Town of Highland	Lake	366	$65,064,500	$249,026,527	26.1%
City of Indianapolis	Marion	1,908	$1,012,137,400	$3,681,650,161	27.5%
Lake County	Lake	272	$39,897,600	$140,464,444	28.4%
City of Columbus	Bartholomew	684	$142,150,300	$443,040,846	32.1%
City of Noblesville	Hamilton	282	$58,944,400	$181,660,373	32.4%
City of Kokomo	Howard	133	$23,023,400	$62,265,056	37.0%
Howard County	Howard	140	$34,687,600	$80,543,363	43.1%
Town of Munster	Lake	441	$97,032,000	$201,521,573	48.1%
City of Martinsville	Morgan	149	$31,954,600	$64,952,850	49.2%
City of Carmel	Hamilton	396	$98,371,200	$140,430,470	70.0%

The City of Indianapolis, City of Columbus, and City of Noblesville had the highest total CAPI scores. This is partially because these cities have significant infrastructure within the floodplain and high costs associated with repetitive loss and severe repetitive loss properties.

Figure 48 maps the insurance ratio of each of the communities. The insurance ratio is calculated by dividing the total insurance of the community by the total replacement cost of the buildings in the 100-year floodplain.

Figure 48: Flood Insurance Ratio of Top 20 CAPI Communities



6.1.3. Probability of Future Occurrences

The probability of future occurrences of flooding—expressed in terms of frequency—is the likelihood that a specific event will happen. The Hazus analyses in this chapter identified the current facilities that are at risk for a 1%-annual-chance flood, based on the NFIP maps and studies that use the 1%-annual-chance floodplain area (area inundated during a 100-year flood). Ongoing work in climate change science, coupled with increased development, will determine if extreme flood events will occur more frequently in the future.

6.1.4. Mitigation Strategies

The planning team identified the following strategies to mitigate flooding. Assuming funding is available, it is the intention that high priority strategies will be implemented within one year of plan adoption, medium priorities will be implemented within two years, and low priorities within three years.

Table 22: Flood Mitigation Strategies

Priority	Goal	Objective	Strategy	Potential Collaborator(s)	Potential Funder(s)
High	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Develop an outreach program to educate communities on green infrastructure and provide opportunities for them to seek additional training	IDHS, IDNR, IUPUI, USGS	NRCS, FEMA, DOE, URC
High	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Ensure better coordination of federal, state, and local mitigation activities.	Engage regularly with Congressional and Legislative officials, and especially Congresswoman Susan Brooks, to provide status of state and local mitigation activities	IDHS External Affiars, Silver Jackets	Existing programs
High	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Identify new partners to collaborate on the state hazard mitigation planning team.	Invite representatives from the social sciences to join the Silver Jackets to better engage local universities to participate in mitigation planning	Silver Jackets, IUPUI, Indiana University, Purdue University, Ball State, Indiana State University	Existing programs
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Collaborate with Silver Jackets to determine a sustainable funding source for continued collection of LiDAR data	Silver Jackets	State funding, lottery, gaming funds
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Develop electronic photo repository of high flood potential areas and post-disaster imagery to help prioritize new projects	IDHS, Indiana Air National Guard	FEMA, NFIP, HSEP, NOAA, USACE
High	Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.	Support compliance with the NFIP.	Use new LiDAR data and ortho products to compile a comprehensive database of building footprints, which will help to promote flood insurance	Silver Jackets, IOT	State funding, local funding, HSEP, FEMA
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Conduct research on the social vulnerabilities associated with these hazards	IUPUI	FEMA, NSF, NIH
High	Minimize the loss of life and injuries caused by disasters	Develop public awareness and outreach programs	Work with local communities, EMA Directors, flood plain administrators and building officials to encourage good flood plain management development and mitigation to reduce flood insurance costs and property losses.	IDHS, IDNR, FEMA, NFIP, OCRA, IHCDA, CEO and APA.	FEMA, DNR, IHCDA, OCRA

Priority	Goal	Objective	Strategy	Potential Collaborator(s)	Potential Funder(s)
High	Minimize the loss of life and injuries caused by disasters	Develop public awareness and outreach programs.	Encourage CEO and EMA to work with interested property owners or reduce risk to or remove repetitive and Severe Repetitive loss properties from areas of high risk, and institute programs to assist non flood plain properties become more flood resistant.	Local Governments, IDHS, DNR, FEMA, OCRA, IHCDA, Building trade Associations	FEMA, CDBG, Private Mortgage companies
High	Minimize the loss of life and injuries caused by disasters	Develop public awareness and outreach programs.	Facilitate development of projects and programs that educate or protect vehicular traffic and emergence responders from driving into flood roads.	NOAA, ISP, EMA, IDHS, IDNR, CEO, Law Enforcement	Existing funding, FEMA, NOAA, FHWA, Local Government
High	Integrate Indiana's mitigation programs to maximize efficiency and leverage funding	Ensure better coordination of federal, state, and local mitigation activities.	Coordinate with IHCDA and OCRA to consider good flood plain management and resiliency programs and ideas when award considering local projects for funding under their programs for economic development.	OCRA, RPCs, Legislative representatives	Existing funding
Medium	Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.	Support compliance with the NFIP.	Develop a program to obtain elevation certificates for low-income neighborhoods to promote mitigation and flood insurance	IDNR, IDHS, USGS	CDBG, FEMA, FMA, River Basins, State funding
Medium	Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.	Evaluate and strengthen communication and transportation emergency services.	Identify and develop database to document major slide locations (particularly in southeast Indiana); conduct a study to predict trigger points for damage, and create a GIS vulnerability layer of hot spots and areas of concern	IDHS, INDOT, IUPUI, IDNR, USGS	FEMA, OCRA
Medium	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Ensure better coordination of federal, state, and local mitigation activities.	Convene a sub-committee of Silver Jackets to develop a good working definition of *resiliency*. Conduct a pilot outreach program to communicate that theme to local communities, focusing on physical risk, socioeconomic risk, and risk to community development	Silver Jackets, Indiana University, Purdue University, FEMA	FEMA, OCRA, IDHS
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Conduct a pilot project using terrestrial LiDAR data to assess slope failure and identify hot spots that may not be visible otherwise	Silver Jackets	FEMA, OCRA
Medium	Lessen the impacts of disasters to new and existing infrastructure, residents and infrastructure.	Encourage the integration of Hazard Mitigation Planning into local Comprehensive Plans	Encourage local communities to construct resilient infrastructure by incorporation of mitigation practices into design and development planning for extending local infrastructure.	OCRA, IHCDA, RPCs, APA, IDHS, IDNR, FEMA, INDOT, REMCs, local building and engineer officials	Existing funding

Priority	Goal	Objective	Strategy	Potential Collaborator(s)	Potential Funder(s)
Medium	Integrate Indiana's mitigation programs to maximize efficiency and leverage funding	Develop a program of affordable housing that is resilient to flooding.	Work with Special Needs agencies and the agencies and organizations that provide affordable housing to incorporate good mitigation strategies into the selection of new housing locations for their clients.	OCRA, FSSA, VA, Habitat for Humanity, VOAD	FEMA, existing funding, CDBG
Low	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Increase use of Silver Jackets social media platforms to reach new audiences and investigate areas of opportunity to provide outreach to special needs populations statewide in areas of risk	Silver Jackets, IUPUI	FEMA, DHS, State funding

6.2. Severe Storm and Tornado

Severe storms and tornadoes can occur during any month of the year and at any time during the day or night. Their unpredictability and potentially deadly impact make them one of Indiana's most dangerous hazards.

Severe thunderstorms include large damaging hail, frequent lightning, and/or strong winds. Tornadoes are defined as violently rotating columns of air (funnel clouds) extending from thunderstorms to the ground. Once the funnel cloud touches the ground, it becomes a tornado.

Tornadoes are classified according to the Enhanced Fujita intensity scale shown in Table 23.

Table 23: Enhanced Fujita Intensity Scale

Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
EF0 Gale	65-85 mph	6-17 yards	0.3-0.9 miles	Light damage, some damage to chimneys, branches broken, shallow-rooted trees blown over.
EF1 Moderate	86-110 mph	18-55 yards	1.0-3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes off foundations, attached garages damaged.
EF2 Significant	111-135 mph	56-175 yards	3.2-9.9 miles	Considerable damage, entire roofs torn from houses, mobile homes demolished, large trees snapped or uprooted.
EF3 Severe	136-165 mph	176-566 yards	10-31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.
EF4 Devastating	166-200 mph	0.3-0.9 miles	32-99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
EF5 Incredible	> 200 mph	1.0-3.1 miles	100-315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

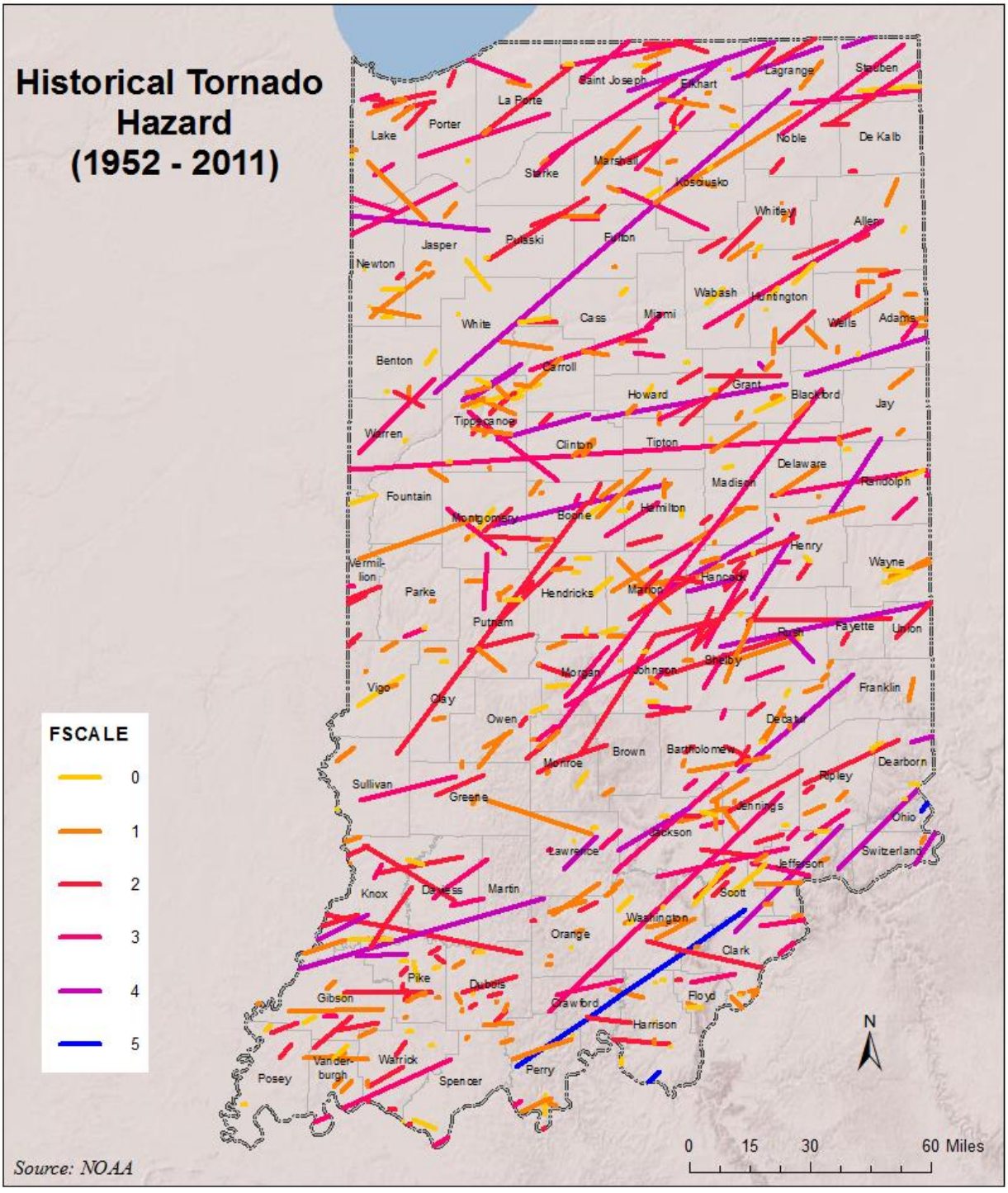
6.2.1. Historical Occurrences

Severe storms are the most common hazard experienced across the state and are often responsible for localized flooding and tornadoes. In the past decade, 13 federal disaster declarations have been designated for events that include severe storms and/or tornadoes. These resulted in $300.7 million in Individual Assistance (IA) approved, $350.4 million in Public Assistance (PA) obligated, and $46.1 million Hazard Mitigation Grant Program (HMGP) assistance for a total combined cost of $687.2 million.

Severe storms and tornadoes are responsible for the most deaths in the state of Indiana. Most people accept that tornadoes are deadly, but understanding of the deadly outcomes of severe storms is less common. Every year, severe storms result in injuries or deaths due to high winds and lightning. Many lives could be saved with relatively inexpensive mitigation practices.

Figure 49 illustrates historical tornado paths from 1952 to 2011 as reported to the National Oceanic and Atmospheric Administration.

Figure 49: Historical Tornado Paths



Since 2008, there have been 4,443 severe thunderstorm reports to NCDC. These events resulted in 15 deaths, 85 injuries, and more than $53.6 million in damages. Table 24 lists the NCDC reports by county and district.

Table 24: NCDC-Reported Thunderstorms (2008-2013)

County	# of Events	Death	Injury	Property Damage	Crop Damage
IDHS DISTRICT #1					
Lake	118	0	0	$404,000	$0
Porter	65	0	3	$120,500	$0
LaPorte	65	0	0	$825,000	$0
Newton	33	0	1	$1,673,000	$0
Jasper	36	0	0	$52,000	$0
District Subtotal	317	0	4	$3,074,500	$0
IDHS DISTRICT #2					
St Joseph		0	0	$2,095,000	$250,000
Elkhart	51	0	0	$55,000	$0
Starke	33	0	0	$0	$0
Marshall	32	0	0	$140,000	$0
Pulaski	28	0	0	$40,000	$0
Fulton	40	0	1	$110,000	$0
Kosciusko	74	0	0	$5,541,000	$0
District Subtotal	258	0	1	$7,981,000	$250,000
IDHS DISTRICT #3					
LaGrange	25	0	0	$60,000	$0
Stuben	41	0	0	$95,000	$0
Noble	23	0	0	$185,000	$0
DeKalb	15	1	0	$0	$0
Whitley	51	0	0	$31,500	$0
Allen	99	1	0	$1,451,000	$25,000
Miami	75	0	0	$320,000	$0
Wabash	32	0	0	$85,000	$0
Huntington	80	0	0	$106,000	$0
Wells	37	0	0	$365,000	$0
Adams	32	0	0	$411,000	$0
District Subtotal	510	2	0	$3,109,500	$25,000
IDHS DISTRICT #4					
Benton	50	0	0	$724,000	$2,000,000
Warren	23	0	0	$122,000	$500
Fountain	27	0	0	$140,000	$0
White	26	0	0	$50,500	$10,000
Cass	47	0	0	$361,000	$5,000
Carroll	48	0	0	$301,500	$1,000
Clinton	48	0	0	$232,500	$1,000

County	# of Events	Death	Injury	Property Damage	Crop Damage
Tippecanoe	109	1	2	$300,000	$0
Montgomery	45	0	1	$92,250	$0
District Subtotal	423	1	3	$2,323,750	$2,017,500
IDHS DISTRICT #5					
Boone	82	0	0	$537,000	$0
Hamilton	105	0	4	$5,260,000	$1,000
Hendricks	50	0	0	$980,000	$0
Marion	275	8	47	$3,710,000	$1,000
Hancock	56	0	0	$306,150	$0
Morgan	82	0	0	$627,000	$0
Johnson	87	3	2	$190,000	$0
Shelby	49	0	0	$473,000	$0
District Subtotal	786	11	53	$12,083,150	$2,000
IDHS DISTRICT #6					
Howard	51	0	0	$130,000	$0
Tipton	18	0	1	$145,250	$0
Grant	66	0	0	$205,000	$0
Madison	68	1	3	$382,000	$0
Blackford	21	0	0	$100,000	$0
Jay	20	0	0	$225,000	$0
Delaware	81	0	2	$650,000	$0
Randolph	22	0	0	$177,250	$300
Henry	41	0	2	$246,000	$0
Wayne	59	0	0	$323,000	$0
Rush	21	0	0	$115,100	$1,000
Fayette	17	0	0	$56,000	$0
Union	15	0	0	$121,000	$0
District Subtotal	500	1	8	$2,875,600	$1,300
IDHS DISTRICT #7					
Vermillion	36	0	1	$131,750	$0
Parke	31	0	0	$51,000	$0
Putnam	55	0	0	$369,000	$0
Vigo	101	0	0	$280,000	$500
Clay	23	0	0	$23,250	$0
Owen	39	0	0	$142,000	$1,500
Sullivan	32	0	0	$68,500	$0
Greene	44	0	0	$620,000	$0
District Subtotal	361	0	1	$1,685,500	$2,000
IDHS DISTRICT #8					
Monroe	68	0	3	$141,500	$0
Brown	20	0	0	$50,000	$0
Bartholomew	49	0	0	$483,000	$0

County	# of Events	Death	Injury	Property Damage	Crop Damage
Lawrence	60	0	0	$290,000	$0
Jackson	44	0	4	$467,000	$0
Orange	38	0	0	$66,000	$0
Washington	30	0	0	$173,000	$0
District Subtotal	309	0	7	$1,670,500	$0
IDHS DISTRICT #9					
Decatur	42	0	0	$544,000	$500
Franklin	22	0	0	$54,000	$0
Jennings	31	0	1	$108,000	$0
Ripley	44	0	0	$181,000	$0
Dearborn	30	0	0	$46,000	$0
Ohio	4	0	0	$27,000	$0
Scott	19	0	0	$27,000	$0
Jefferson	28	0	0	$27,000	$0
Switzerland	14	0	0	$59,000	$0
Clark	53	0	0	$185,000	$0
Floyd	45	0	0	$46,000	$0
Harrison	55	0	0	$57,000	$0
District Subtotal	387	0	1	$1,361,000	$500
IDHS DISTRICT #10					
Knox	93	0	2	$637,000	$0
Daviess	50	0	0	$265,500	$2,000
Martin	19	0	0	$117,250	$0
Gibson	61	0	4	$9,691,000	$1,000
Pike	20	0	0	$491,000	$0
Dubois	58	0	0	$130,000	$0
Crawford	70	0	0	$25,000	$0
Posey	50	0	0	$1,255,000	$10,000
Vanderburgh	60	0	0	$1,459,000	$0
Warrick	45	0	1	$304,000	$0
Spencer	43	0	0	$520,000	$0
Perry	23	0	0	$275,000	$0
District Subtotal	592	0	7	$15,169,750	$13,000
State Grand Total	4,443	15	85	$51,334,250	$2,311,300

Since 2008, there have been 4,443 tornado reports to NCDC. These events resulted in 24 deaths, 47 injuries, and more than $233 million in damages. Table 25 lists the NCDC reports by county and district.

Table 25: NCDC-Reported Tornadoes (2008-2013)

County	# of Events	Death	Injury	Property Damage	Crop Damage
IDHS DISTRICT #1					
Lake	1	0	0	$1,000,000	$0
Porter	3	0	0	$1,550,000	$0
LaPorte	2	0	0	$500,000	$0
Newton	3	0	0	$75,000	$0
Jasper	5	0	0	$105,500,000	$5,000
District Subtotal	14	0	0	$108,625,000	$5,000
IDHS DISTRICT #2					
St Joseph	0	0	0	$0	$0
Elkhart	6	6	0	$945,000	$25,000
Starke	0	0	0	$0	$0
Marshall	0	0	0	$0	$0
Pulaski	1	0	0	$0	$0
Fulton	0	0	0	$0	$0
Kosciusko	2	0	0	$300,000	$0
District Subtotal	9	6	0	$1,245,000	$25,000
IDHS DISTRICT #3					
LaGrange	0	0	0	$0	$0
Stuben	0	0	0	$0	$0
Noble	0	0	0	$0	$0
DeKalb	0	0	0	$0	$0
Whitley	4	0	0	$520,000	$3,000
Allen	2	0	0	$0	$0
Miami	2	0	2	$750	$0
Wabash	3	0	0	$140,000	$0
Huntington	3	0	0	$100,000	$0
Wells	0	0	0	$0	$0
Adams	1	0	0	$500	$0
District Subtotal	15	0	2	$761,250	$3,000
IDHS DISTRICT #4					
Benton	2	0	0	$5,000	$5,000
Warren	1	0	0	$1,000	$2,000
Fountain	3	0	0	$15,000	$0
White	2	0	0	$200,000	$0
Cass	2	0	2	$250,000	$0
Carroll	3	0	2	$460,000	$7,000
Clinton	0	0	0	$0	$0

County	# of Events	Death	Injury	Property Damage	Crop Damage
Tippecanoe	3	0	0	$95,000	$0
Montgomery	2	0	0	$63,000	$0
District Subtotal	18	0	4	$1,089,000	$14,000
IDHS DISTRICT #5					
Boone	4	0	0	$10	$0
Hamilton	0	0	0	$0	$0
Hendricks	1	0	0	$10	$0
Marion	3	0	18	$29,100,000	$0
Hancock	3	0	0	$825,000	$0
Morgan	4	0	2	$180,000	$500
Johnson	3	0	3	$23,022,000	$5,500
Shelby	3	0	2	$290,000	$0
District Subtotal	21	0	25	$53,417,020	$6,000
IDHS DISTRICT #6					
Howard	1	0	0	$80	$0
Tipton	0	0	0	$0	$0
Grant	3	0	0	$100,000	$0
Madison	2	0	0	$120,000	$0
Blackford	0	0	0	$0	$0
Jay	1	0	0	$0	$0
Delaware	1	0	0	$16,000	$0
Randolph	0	0	0	$0	$0
Henry	0	0	0	$0	$0
Wayne	0	0	0	$0	$0
Rush	1	1	8	$1,000,000	$0
Fayette	0	0	0	$0	$0
Union	0	0	0	$0	$0
District Subtotal	9	1	8	$1,236,080	$0
IDHS DISTRICT #7					
Vermillion	1	0	0	$30,000	$0
Parke	3	0	0	$25,000	$0
Putnam	1	0	0	$45,000	$0
Vigo	3	0	0	$3,500	$0
Clay	1	0	0	$3,000	$500
Owen	3	0	0	$20,000	$0
Sullivan	1	0	0	$20,500	$0
Greene	6	0	0	$1,300,000	$0
District Subtotal	19	0	0	$1,447,000	$500
IDHS DISTRICT #8					
Monroe	3	0	0	$200,000	$0
Brown	3	0	0	$200,000	$0
Bartholomew	0	0	0	$0	$0

County	# of Events	Death	Injury	Property Damage	Crop Damage
Lawrence	5	0	2	$760	$0
Jackson	1	0	0	$30,000	$0
Orange	8	0	0	$295,000	$0
Washington	8	5	0	$2,090,000	$50,000
District Subtotal	28	5	2	$2,815,760	$50,000
IDHS DISTRICT #9					
Decatur	1	0	0	$820,000	$0
Franklin	1	0	0	$250,000	$0
Jennings	3	0	0	$65,000	$2,000
Ripley	3	3	5	$320,000	$0
Dearborn	3	0	0	$70,000	$0
Ohio	0	0	0	$0	$0
Scott	4	1	0	$570,000	$0
Jefferson	5	4	0	$790,000	$0
Switzerland	2	0	0	$90,000	$0
Clark	8	2	0	$55,385,000	$0
Floyd	1	0	0	$10,000	$0
Harrison	1	0	0	$0	$0
District Subtotal	32	10	5	$58,370,000	$2,000
IDHS DISTRICT #10					
Knox	2	0	0	$206,000	$0
Daviess	3	0	0	$0	$0
Martin	0	0	0	$0	$0
Gibson	8	0	0	$1,000,000	$0
Pike	9	0	0	$570,000	$0
Dubois	1	0	1	$669,000	$0
Crawford	2	0	0	$0	$0
Posey	5	2	0	$740,000	$0
Vanderburgh	5	0	0	$100,000	$0
Warrick	6	0	0	$420,000	$0
Spencer	4	0	0	$60,000	$3,000
Perry	3	0	0	$200,000	$0
District Subtotal	48	2	1	$3,965,000	$3,000
State Grand Total	213	24	47	$232,971,110	$108,500

6.2.2. Vulnerability Assessment

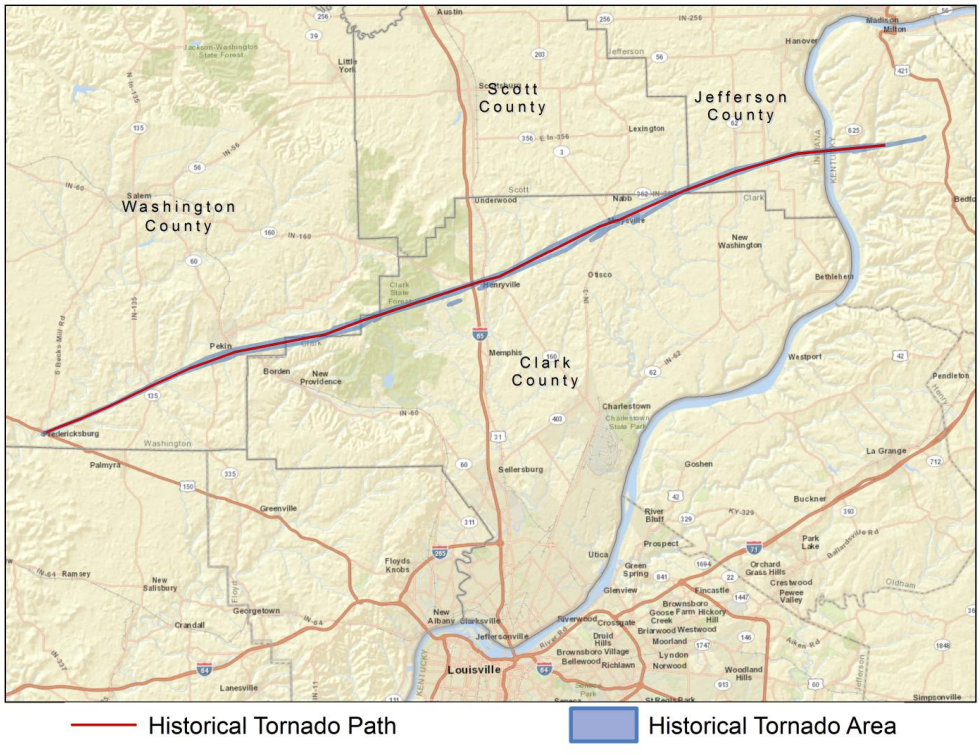
Because the threat of severe thunderstorms is equally distributed across the state, all communities and infrastructure are vulnerable. The types of infrastructure impacted could include roadways, utility lines, railroads, bridges, and more. Physical impacts may include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, impassable bridges and roadways, fires caused by lightning, and lost building functionality.

The vulnerability assessment for tornadoes is similar to that of severe thunderstorms and often results in the same types of physical impacts, though usually more severe. Based on reported damages from tornadoes, urbanized and industrial areas face the greatest vulnerability because of their concentration of buildings, population, and lifeline utilities. Rural communities also face the potential for significant economic impact from loss of crops, livestock, and storage facilities. Because the economy in rural counties is less diversified than in urban areas, the impacts of a tornado may destroy the economic livelihood of a majority of the county's population.

6.2.2.1 GIS Tornado Analysis

The Polis Center modeled the 2012 EF4 tornado that carved a 49-mile path through Indiana's Washington, Clark, and Jefferson counties and into Kentucky. Figure 50 shows the path of the tornado.

Figure 50: Historical 2012 Tornado Path



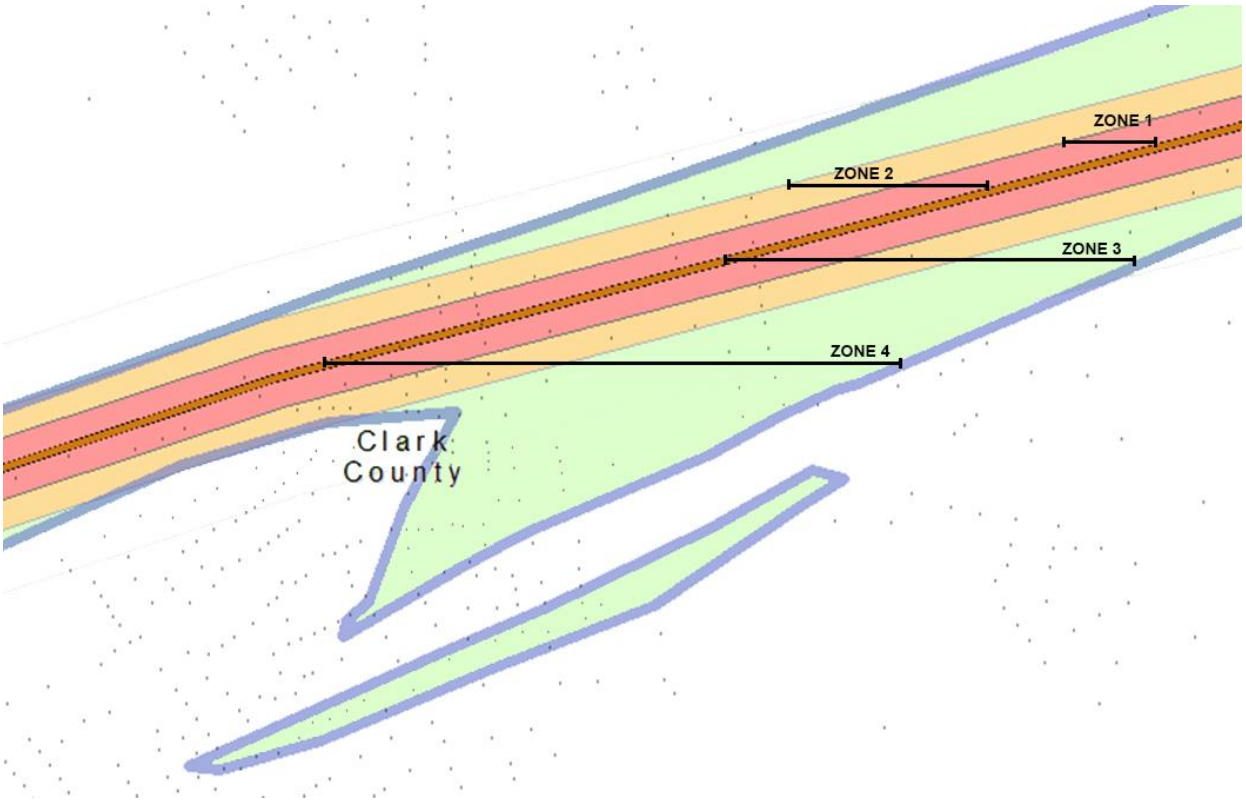
Within any given tornado, there are degrees of damage. The most intense damage occurs within the center of the path with decreasing amounts of damage away from the center. Table 26 describes the damage zones of an EF4 tornado.

Table 26: Tornado Damage Zones

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

Using data provided by the National Weather Service (NWS) for the boundary of the 2012 tornado path, we used the GIS model to predict building inventory losses based on the zones shown in Figure 51.

Figure 51: GIS Analysis Using Tornado Buffers



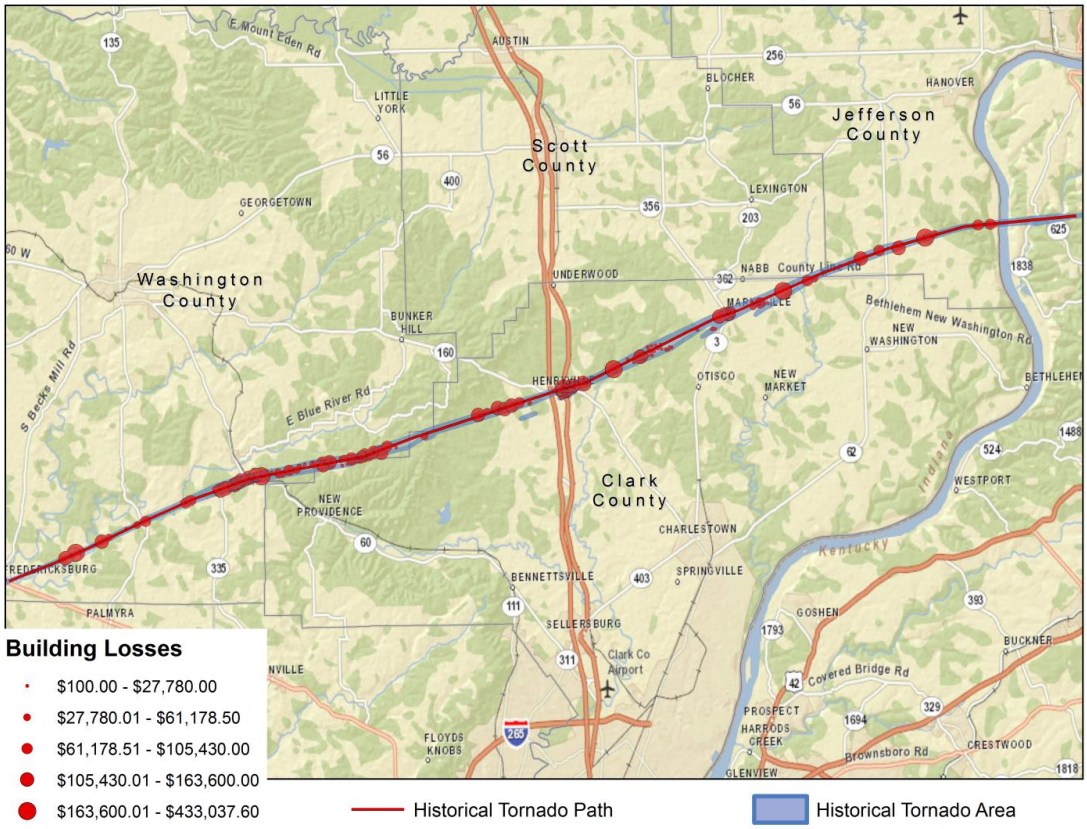
According to the analysis, the tornado damaged 353 buildings at a total replacement cost of $15.5 million. The results by occupancy are listed in Table 27, and Figure 52 shows the building losses by varying degrees of damage.

Note: In 2012, there were two tornadoes that ran through the same relative area of Southern Indiana. The first was an EF4 and the second an EF3. This model predicts estimated damages based on the best available data for the EF4 event. The results may not match those actually incurred in 2012.

Table 27: Historical EF4 Tornado Building Damage

Occupancy Class	Buildings Damaged	Building Losses
Agricultural	70	$ 3,651,736
Commercial	16	$ 779,141
Education	2	$ 101,734
Government	2	$ 314,883
Industrial	1	$ 114,792
Religious	10	$ 1,182,815
Residential	252	$ 9,392,764
Total	353	$ 15,537,865

Figure 52: Historical EF4 Tornado Building Losses



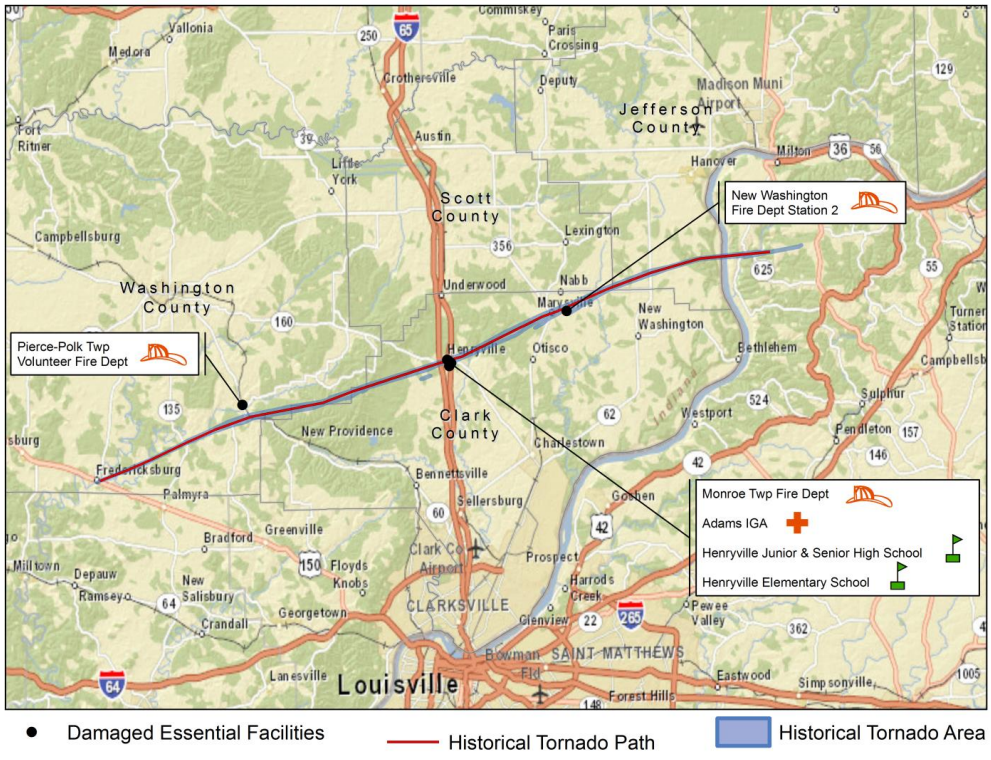
6.2.2.1.1 Analysis of Essential Facilities

The GIS analysis of the historical EF4 tornado reported damage to six essential facilities, listed in Table 28 and shown in the map in Figure 53. This model predicts estimated damages based on the best available data. The results may not match those actually incurred in 2012.

Table 28: Essential Facility Losses

Facility Class	Facility Name	Building Loss	Building Value	Percent Damage
Fire Station	Monroe Twp Fire Dept	$ 61,800	$ 618,000	10%
Fire Station	New Washington Fire Dept Station 2	$ 77,300	$ 773,000	10%
Fire Station	Pierce-Polk Twp Volunteer Fire Dept	$ 77,300	$ 773,000	10%
Medical Facility	Adams IGA	$ 50,000	$ 500,000	10%
School	Henryville Elementary School	$ 412,000	$ 515,000	80%
School	Henryville Junior & Senior High School	$412,000	$ 515,000	80%

Figure 53: Damaged Essential Facilities



6.2.2.1.2 Analysis of State-Owned Facilities

No state-owned properties were within the path of destruction.

6.2.3. Probability of Future Occurences

The probability of future tornadoes will remain high. Due to the unpredictability of this hazard, all buildings and infrastructure in Indiana are at risk of damage including temporary or permanent loss of function. For tornadoes, it is not possible to isolate specific essential or non-essential facilities that would be more or less vulnerable to damages.

Recent construction of new buildings to codes that address tornado strength winds will reduce damage in future events. Continuing efforts to increase public awareness to the dangers of tornadoes should mitigate injury, death and property losses in the future. As the population increases and more areas are developed, the potential damage from such storms will increase.

6.2.4. Mitigation Strategies

The planning team identified the following strategies to mitigate severe storms and tornadoes. Assuming funding is available, it is the intention that high priority strategies will be implemented within one year of plan adoption, medium priorities will be implemented within two years, and low priorities within three years.

Table 29: Severe Storm and Tornado Mitigation Strategies

Priority	Goal	Objective	Strategy	Potential Collaborator(s)	Potential Funder(s)
High	Minimize the loss of life and injuries caused by disasters.	Improve emergency sheltering.	Work to implement safe rooms in any new addition or construction to schools that will accommodate all students and surrounding neighborhood population	IDHS, County EMAs, local schools, DOE	FEMA
High	Minimize the loss of life and injuries caused by disasters.	Improve emergency sheltering.	Work with local communities, EMA Directors, State-wide building trades, and home builders, and architects to design and install saferooms in residential and businesses.	IDHS, DNR, FEMA, NFIP, OCRA, IHCDA, CEO and APA.	FEMA, DNR, IHCDA, OCRA
High	Minimize the loss of life and injuries caused by disasters.	Improve emergency sheltering.	Conduct assessments of schools to ensure they are providing the necessary refuge for students and neighboring population	IDHS, County EMA, local schools	FEMA
High	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Develop public education program in partnership with builders, real estate, and loan producers to provide information on residential saferoom loans as part of a mortgage	IDHS, HUD, local building and real estate agencies	FEMA, HUD
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Work with county highway departments to conduct pipe analyses to improve debris clearing	INDOT, IDHS	FEMA, FHWA
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Conduct research on the social vulnerabilities associated with these hazards	IUPUI	FEMA, NSF, NIH

Priority	Goal	Objective	Strategy	Potential Collaborator(s)	Potential Funder(s)
High	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Work with local and state wide Chambers of Commerce building officials to encourage local contractors to become certified by the National Storm Shelter Association for the construction, manufacture and installation of safe rooms in residential and small businesses.	Building Trades, IDHS Building Commissioner, Home builder association, IDHS, FEMA	FEMA, HSEP
High	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Continue and expand current public awareness programs so they would be compatible with employer/employee educational programs on OSHA safety and extend into what to do at home.	Local Governments, IDHS, IN OSHA, EMA, Local Governments, Unions, and trades.	FEMA, HSEP
Medium	Promote research, education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Improve education and training of emergency personnel and public officials.	Encourage state and local governments to incorporate wind resistant, safe room, severe storms and lightning protection strategies when designing new government buildings and infrastructure.	DOA, INDOT, DNR, FSSA, BMV, ISP, IPSC.	Existing funding
Medium	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Identify new partners to collaborate on the state hazard mitigation planning team.	Work with Special Needs agencies and the agencies and organizations that provide affordable housing to incorporate good mitigation strategies into the selection of new housing options for their clients.	OCRA, FSSA, VA, Habitat for Humanity, VOAD	FEMA, existing funding, CDBG
Medium	Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.	Evaluate and strengthen communication and transportation emergency services.	Invest in burying power lines to help rural electric cooperatives become more resilient	IDHS, REMCs, public power companies	FEMA
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Improve education and training of emergency personnel and public officials.	Conduct a training program for county highway departments to educate on the best, most resourceful ways to prioritize and allocate project funding	INDOT, IDHS	FEMA, FHWA
Low	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Develop mobile applications to communicate risks to the public	IDHS, state universities	FEMA

6.3. Earthquake

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Ninety-five percent of earthquakes occur at the plate boundaries; however, some earthquakes occur in the middle of plates, as is the case for seismic zones in the Midwestern United States. The most seismically active area in the central US is the New Madrid Seismic Zone. Scientists have learned that the New Madrid fault system may not be the only fault system in the central US capable of producing damaging earthquakes. The Wabash Valley Fault System in Indiana shows evidence of large earthquakes in its geologic history, and there may be other currently unidentified faults that could produce strong earthquakes.

The USGS asserts that a large earthquake that will seriously impact southwestern Indiana is inevitable; however, it is currently impossible to predict when such an earthquake will occur. According to the USGS, there is a 25-40% chance of a magnitude 6.0 or greater earthquake in the next 50 years for the central US. There is a 7-10% chance of a repeat of events similar to the New Madrid earthquakes of 1811-12.

Source: Indiana Geological Survey, Seismic Risks in Indiana

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

Earthquake magnitude, which is determined from measurements on seismographs, measures the energy released at the source of the earthquake. Intensity measures the strength of shaking produced by the earthquake at a certain location and is determined from effects of people, human structures, and the natural environment.

INDIANA BEST PRACTICE

After the Mt. Carmel, Illinois earthquake in 2008, there was renewed interested in planning and training in many State departments. In May 2011, IDHS joined thousands of other participants nationwide in National Level Exercise 2011 (NLE 11), which assessed the Nation's ability to respond to a worst-case scenario incident.

Tables 30 and 31 define earthquake magnitudes and their corresponding intensities.

Table 30: Abbreviated Modified Mercalli Intensity Scale

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

Table 31: Earthquake Magnitude vs Modified Mercalli Intensity (MMI) Scale

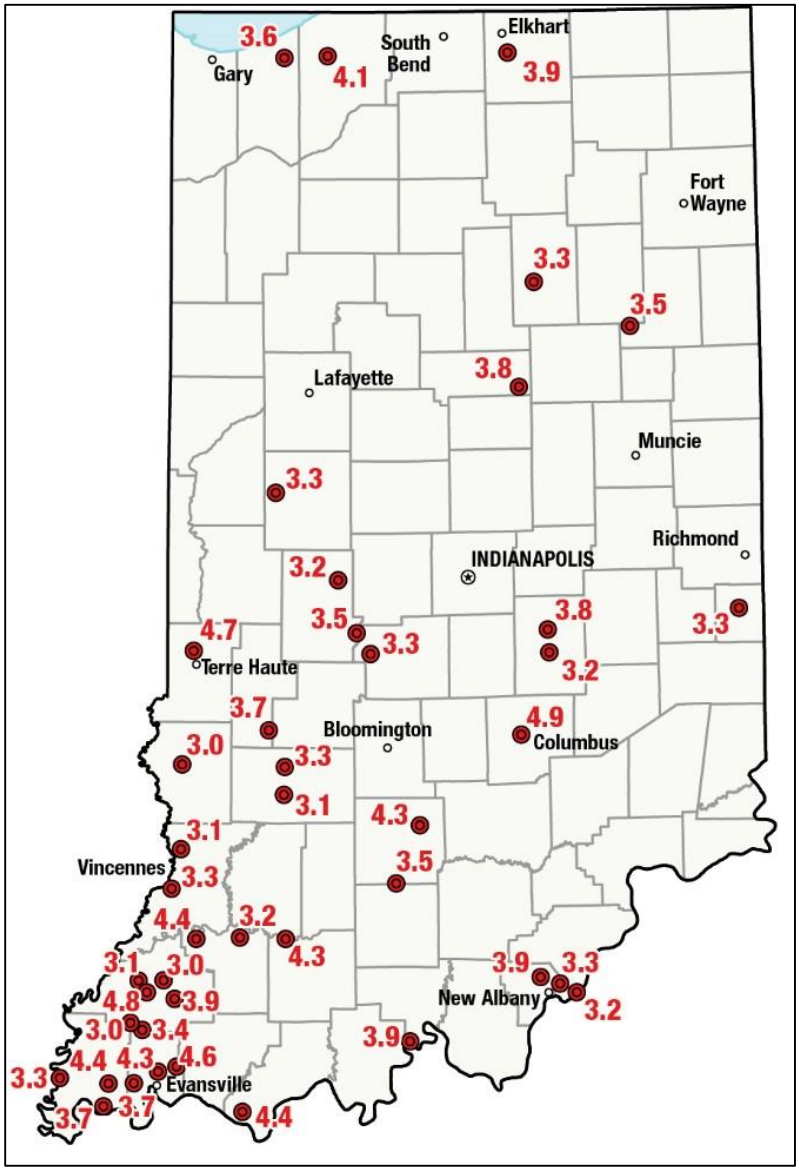
Earthquake Magnitude	Typical Maximum MMI
1.0-3.0	I
3.0-3.9	II-III
4.0-4.9	IV-V
5.0-5.9	VI-VII
6.0-6.9	VII-IX
7.0 and higher	VIII or higher

6.3.1. Historical Occurrences

At least 43 earthquakes, M3.0 or greater, have occurred in Indiana since 1817. The last such event was a M3.1 centered just north of Vincennes on May 10, 2010. A M3.8 earthquake occurred in December later that same year with approximately 10,390 individuals submitting felt reports to the USGS.

The majority of seismic activity in Indiana occurs in the southwestern region of the state. However, an even larger number of earthquakes originate just across the boundary in Illinois and can be felt in Indiana. The M5.2 Mt. Carmel event on April 19, 2008 was felt by residents in Indiana, Kentucky, and many more states across the central US. Figure 54 depicts Indiana's historical earthquake epicenters.

Figure 54: Historical Epicenters in Indiana



6.3.2. Vulnerability Assessment

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

Soils with little clay and high water table may experience liquefaction, a phenomenon caused by increased pore pressures between individual soil particles. This can cause slope failures, lateral spreading, surface subsidence, and sand blows and can cause buildings to tilt or sink into the ground.

6.3.2.1 Hazus-MH Earthquake Analysis

The Indiana Geological Survey (IGS) provided geological information and recommendations for modeling earthquake scenarios. Polis used Hazus and performed three modeling scenarios. The first is a 7.7 magnitude arbitrary scenario with an epicenter in Barlow, Kentucky. This scenario was chosen to simulate a New Madrid earthquake.

The second is a 6.8 magnitude arbitrary scenario with an epicenter in Mt. Carmel, Illinois. This scenario was chosen to simulate a Wabash Valley earthquake. The epicenter is the location of the May 2010 earthquake.

The third scenario is a .2% probabilistic scenario (500-year return period). This scenario is based on ground-shaking parameters derived from USGS's probabilistic seismic hazard curves. The analysis evaluates that average impacts of a multitude of possible earthquake epicenters with a magnitude that would be typical of that expected for a 500-year return (.2% probability).

These analysis options were chosen because they are useful for prioritization of seismic reduction measures and for developing mitigation strategies. Because the majority of seismic activity in Indiana occurs in the southwest part of the state, we estimated losses for IDHS districts 7 and 10 only, as they would incur the most significant physical damage.

The updated modeling scenarios provided by IGS have only recently been incorporated into the local planning effort. These scenarios have changed since the 2011 plan and thus the previous local plan data will be revised.

6.3.2.1.1 6.8 Magnitude Scenario: Mt. Carmel, IL

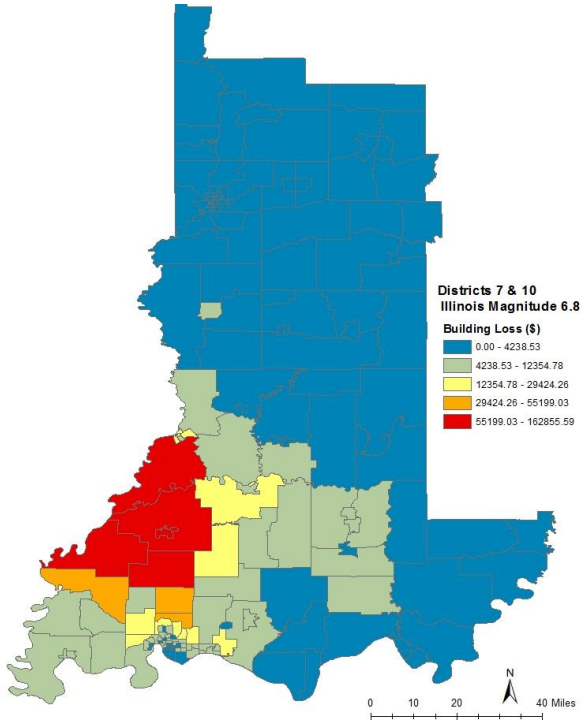
The extent of damages from an earthquake with 6.8 magnitude epicenter in Mt. Carmel, Illinois would encompass all areas of districts 7 and 10. Hazus estimates that 272,000 buildings would be damaged at a replacement cost (excluding contents) of $46.7 million. Residential buildings account for 81% of the number of damaged buildings and 63% of the total building value.

Hazus estimates that 31,811 buildings (12% of total buildings in the region) would be at least moderately damaged, and 2,681 buildings would be damaged beyond repair. Table 32 presents building damages by occupancy and construction type respectively, and Figure 55 highlights the areas in districts 7 and 10 with the greatest losses.

Table 32: Building Damages by Occupancy (6.8M Mt. Carmel)

	NONE	SLIGHT	MODERATE	EXTENSIVE	COMPLETE
Agriculture	23,994	4,571	2,334	841	483
Commercial	7,901	2,125	1,186	381	163
Education	325	104	68	19	7
Government	776	217	137	48	25
Industrial	1,544	469	278	90	38
Other Residential	17,997	3,354	1,525	384	165
Religion	2,544	510	236	64	22
Single Family	141,919	32,213	16,795	4,745	1,779
Total	197,000	43,563	22,559	6,572	2,682

Figure 55: Building Losses for Districts 7 and 10 (6.8M Mt. Carmel)



Essential Facilities Analysis

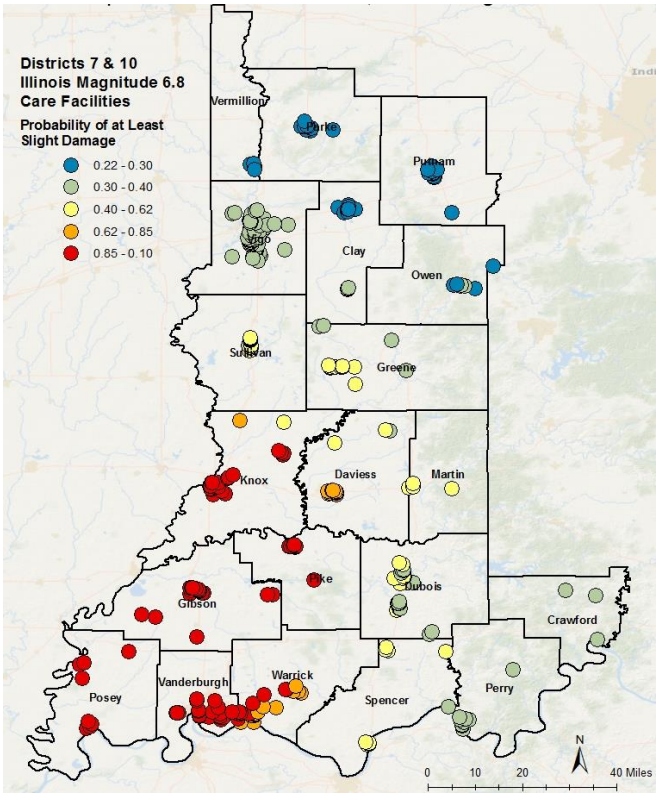
There are 1,097 essential facilities in IDHS districts 7 and 10—329 care facilities, 365 schools, 276 fire stations, 107 police stations, and 20 EOCs. Table 33 lists essential facility damage and functionality. Figures 56 through 60 map the locations of the damaged essential facilities.

Before the earthquake, the region had 21,577 care facility beds available for use. On the day of the earthquake, the model estimates that only 9,190 beds (43%) would be available for use by patients already in the care facility and those injured by the earthquake. After one week, 55% of the beds would be back in service. After 30 days, 74% would be operational.

Table 33: Essential Facilities Damage and Functionality (6.8M Mt. Carmel)

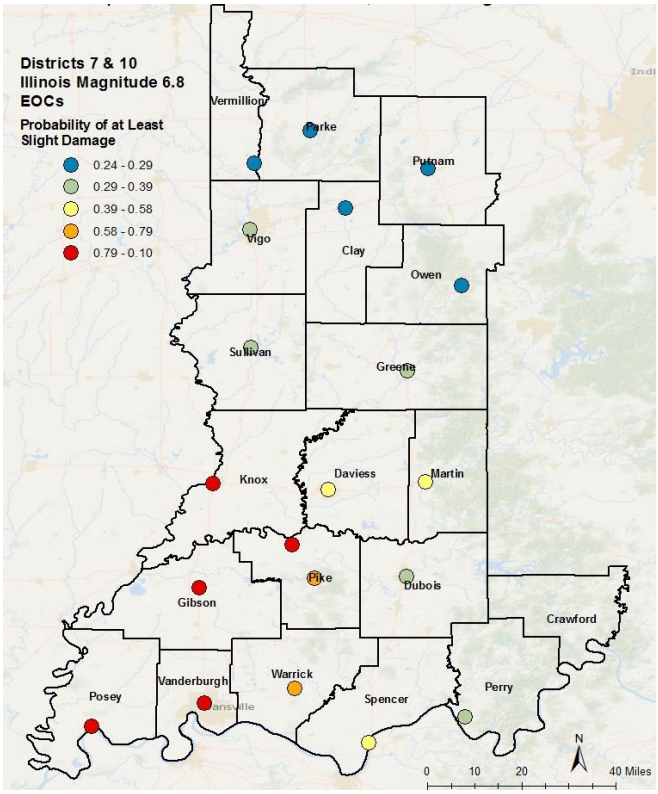
	Total Essential Facilities	Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Care	329	128	19	180
Schools	365	45	7	213
EOCs	20	6	1	12
Police Stations	107	37	10	59
Fire Stations	276	102	18	157

Figure 56: Damage to Care Facilities (6.8M Mt. Carmel)



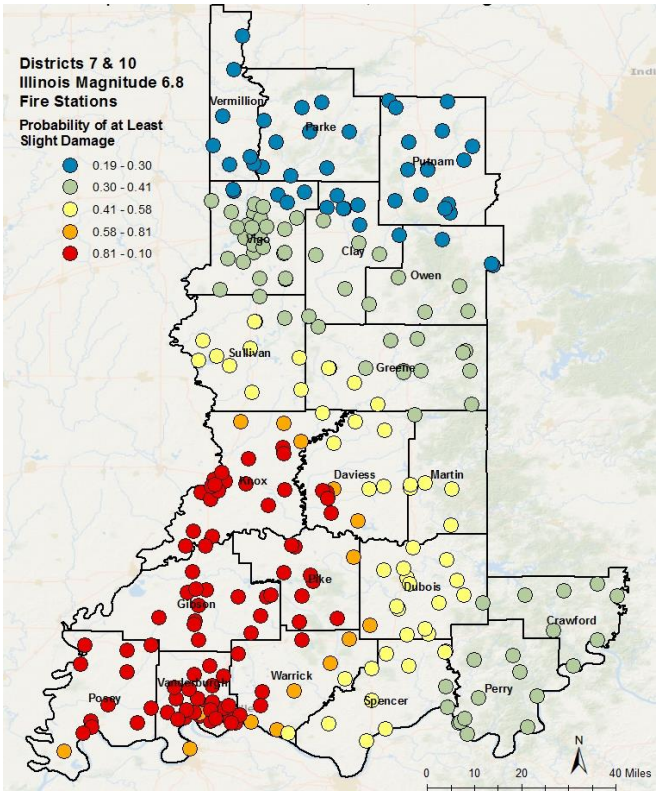
Hazus estimates that 5.8% of the total care facilities damaged would be completely damaged. Care facilities include hospitals, surgery centers, WIC facilities, and nursing homes.

Figure 57: Damage to EOCs (6.8M Mt. Carmel)



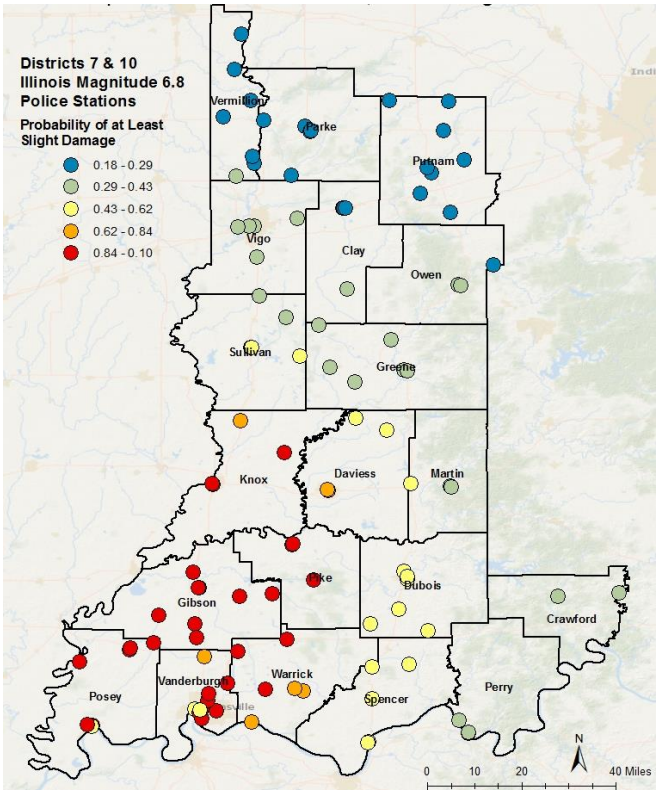
Hazus estimates that 5.0% of the total emergency operations centers damaged would be completely damaged.

Figure 58: Damage to Fire Stations (6.8M Mt. Carmel)



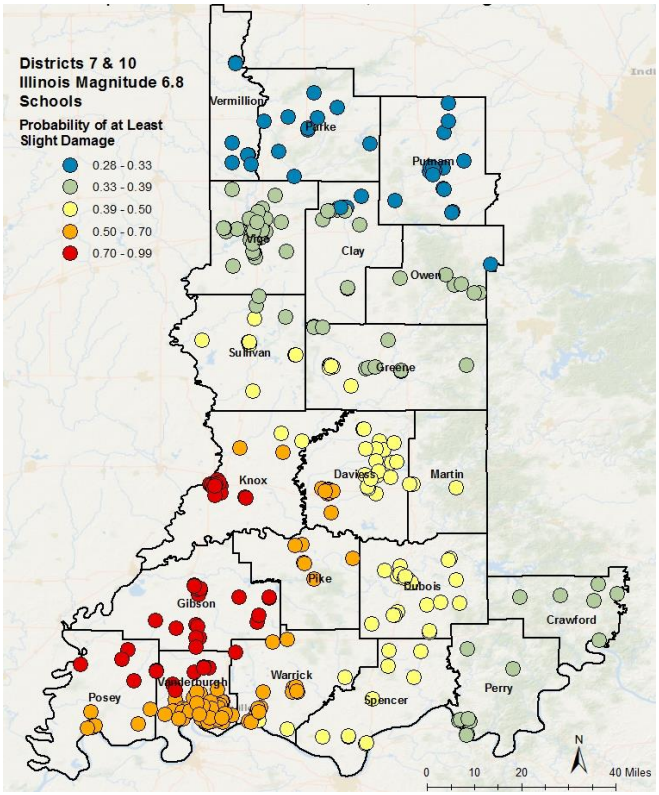
Hazus estimates that 6.5% of the total fire stations damaged would be completely damaged.

Figure 59: Damage to Police Stations (6.8M Mt. Carmel)



Hazus estimates that 9.3% of the total police stations damaged would be completely damaged.

Figure 60: Damage to Schools (6.8M Mt. Carmel)



Hazus estimates that 1.9% of the total schools damaged would be completely damaged.

State-Owned Facilities Analysis

Hazus estimates that 1,828 state-owned facilities would be damaged at a replacement cost of $24,757,000. The loss ratio (building damages divided by building replacement cost) for state-owned facilities is 2%. Figure 61 shows the locations of damaged state-owned facilities.

Figure 61: Damage to State-Owned Facilities (6.8M Mt. Carmel)

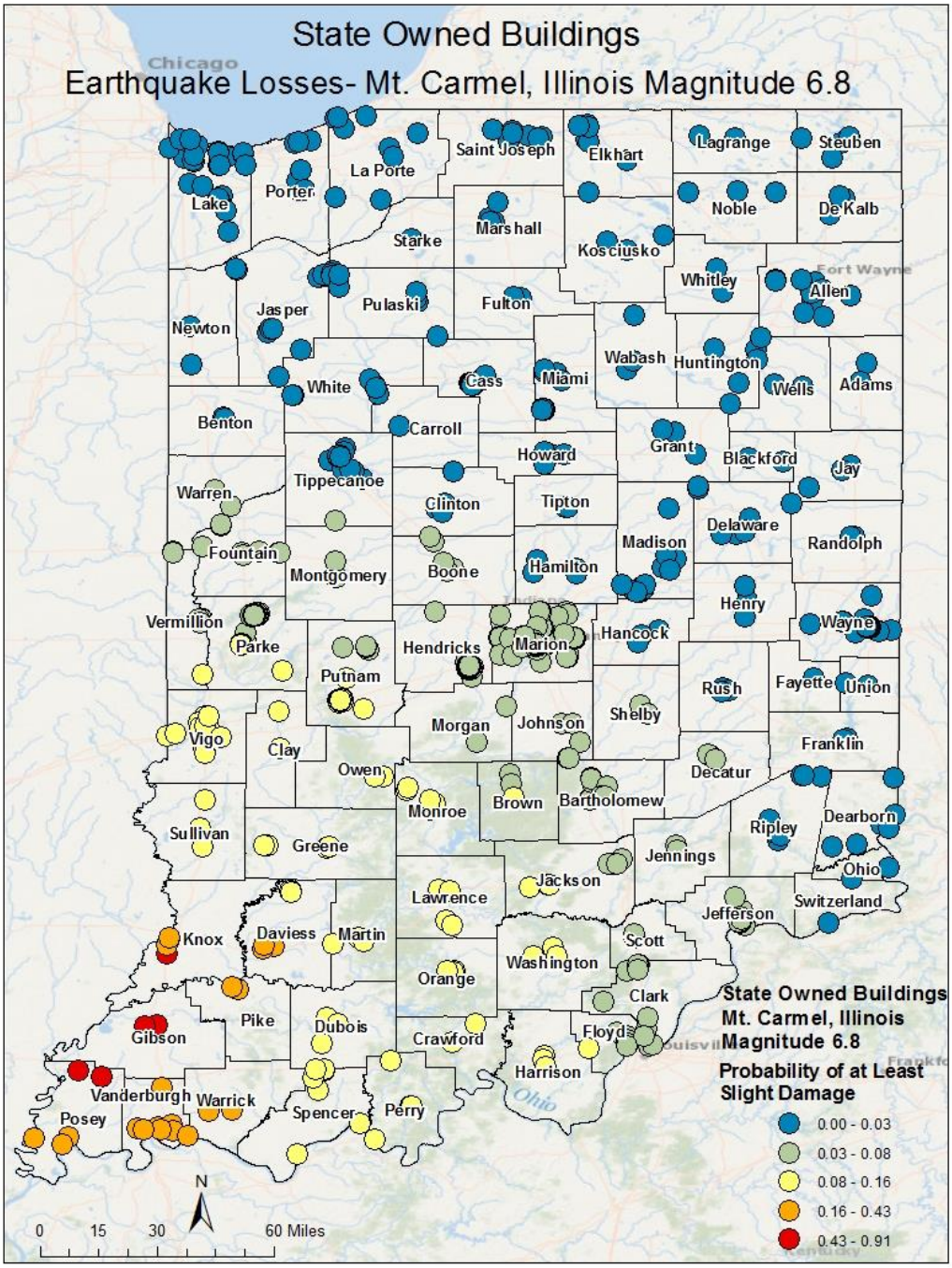


Table 34 identifies the damaged buildings and building losses by county for local jurisdictions. The direct building losses reflect the estimated costs to repair damage caused to the building and its contents. The following results, for all except DeKalb County, were compiled as part of a 2014 IDHS Response and Recovery exercise. The Dekalb County results are included from the local plan update.

Table 34: Hazus-MH Results for Local Communities

County	Num. Buildings	Direct Building Damage (Millions of dollars)
IDHS District 3		
Dekalb	0	$0
IDHS District 5		
Boone	3,613	$33,000,000
Hamilton	8,540	$103,800,000
Hendricks	10,043	$116,980,000
Marion	38,804	$420,110,000
Hancock	3,016	$25,560,000
Morgan	5,011	$48,970,000
Johnson	6,590	$70,590,000
Shelby	4,449	$39,200,000
IDHS District 7		
Vermillion	1,125	$9,280,000
Parke*	467	$2,700,000
Putnam	1,734	$16,140,000
Vigo	1,230	$10,460,000
Clay	2,830	$24,290,000
Owen	1,598	$11,140,000
Sullivan	2,390	$25,960,000
Greene	3,059	$25,540,000
IDHS District 8		
Monroe	4,746	$43,970,000
Brown	452	$2,220,000
Bartholomew	4,855	$63,530,000
Lawrence	1,709	$12,110,000
Jackson	2,499	$21,470,000
Orange	1,304	$12,950,000
Washington	1,044	$6,090,000
IDHS District 10		
Knox	7,324	$294,810,000
Daviess	4,265	$64,460,000
Martin	793	$7,120,000
Gibson	11,554	$829,940,000

County	Num. Buildings	Direct Building Damage (Millions of dollars)
Pike	2,741	$77,340,000
Dubois	4,240	$66,900,000
Posey	6,620	$212,340,000
Vanderburgh	22,221	$550,760,000
Warrick	6,394	$106,120,000
Spencer	2,101	$23,760,000
Perry	1,096	$8,540,000
Crawford	851	$3,340,000

**Parke building inventory incomplete*

6.3.2.1.2 7.7 Magnitude Scenario: Barlow, KY

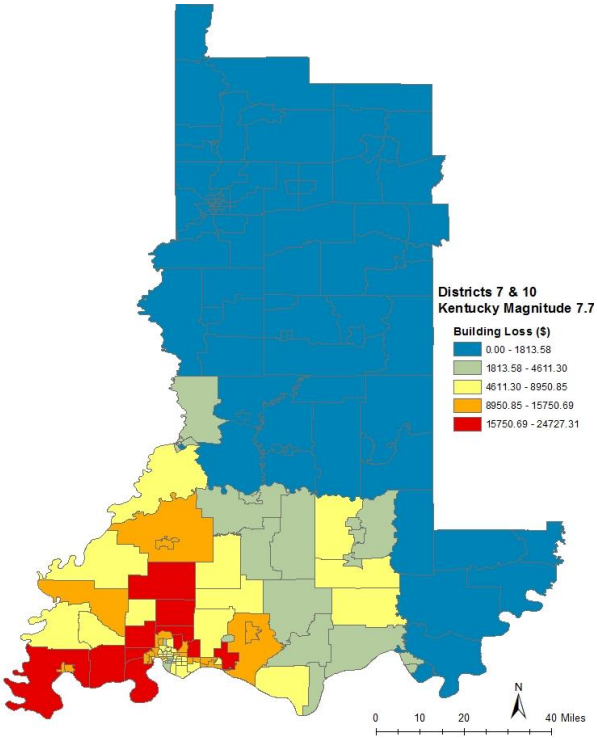
The extent of damages from an earthquake with 7.7 magnitude epicenter in Barlow, Kentucky would encompass all areas of districts 7 and 10. Hazus estimates that 272,000 buildings would be damaged at a replacement cost (excluding contents) of $46.7 million. Residential buildings account for 81% of the number of damaged buildings and 63% of the total building value.

Hazus estimates that 20,119 buildings (7% of total buildings in the region) would be at least moderately damaged, and 1,552 buildings would be damaged beyond repair. Table 35 presents building damages by occupancy and construction type respectively, and Figure 62 highlights the areas in districts 7 and 10 with the greatest losses..

Table 35: Building Damages by Occupancy (7.7M Barlow)

	NONE	SLIGHT	MODERATE	EXTENSIVE	COMPLETE
Agriculture	27,328	3,417	1,210	217	51
Commercial	8,715	1,952	896	151	42
Education	378	88	45	9	3
Government	889	200	93	15	5
Industrial	1,656	454	243	54	12
Other Residential	19,830	3,354	1,525	384	165
Religion	2,862	353	127	28	5
Single Family	158,090	23,529	10,906	3,543	1,383
Total	219,748	32,507	14,407	4,161	1,553

Figure 62: Building Losses for Districts 7 and 10 (7.7M Barlow)



Essential Facilities Analysis

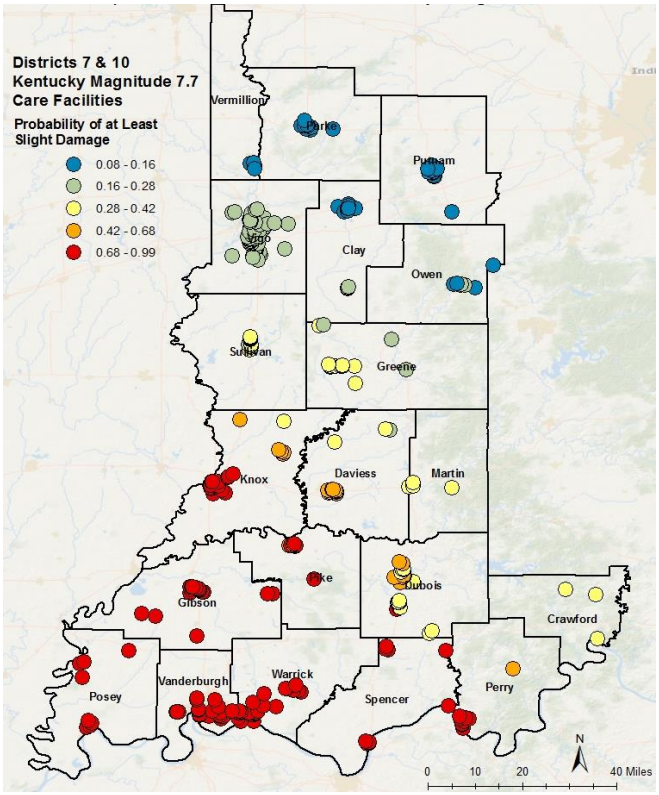
There are 1,097 essential facilities in IDHS districts 7 and 10—329 care facilities, 365 schools, 276 fire stations, 107 police stations, and 20 EOCs. Table 36 lists essential facility damage and functionality. Figures 63 through 67 map the locations of the damaged essential facilities.

Before the earthquake, the region had 21,577 care facility beds available for use. On the day of the earthquake, the model estimates that only 9,679 beds (45%) would be available for use by patients already in the care facility and those injured by the earthquake. After one week, 54% of the beds would be back in service. After 30 days, 68% would be operational.

Table 36: Essential Facilities Damage and Functionality (7.7M Barlow)

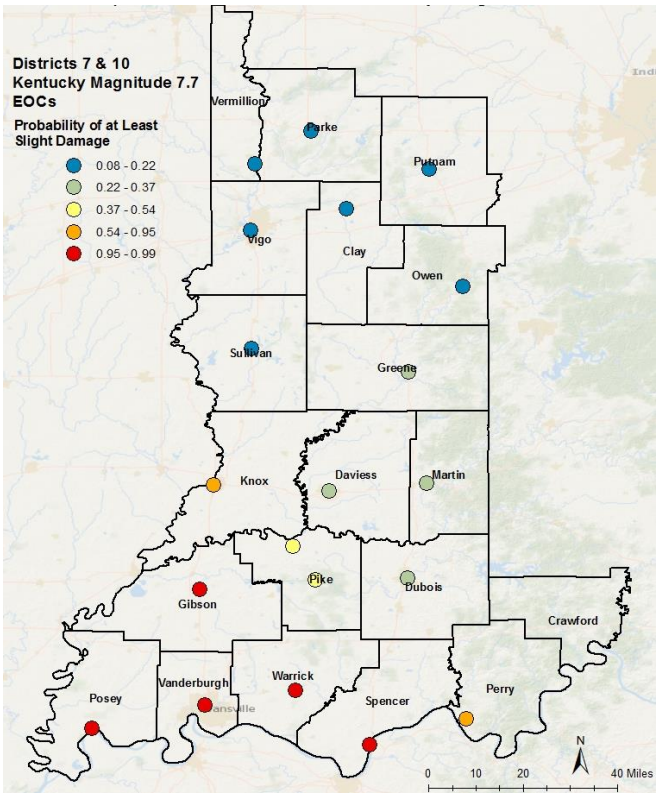
	Total Essential Facilities	Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Care	329	133	43	175
Schools	365	0	0	259
EOCs	20	7	2	12
Police Stations	107	43	13	53
Fire Stations	276	116	39	146

Figure 63: Damage to Care Facilities (7.7M Barlow)



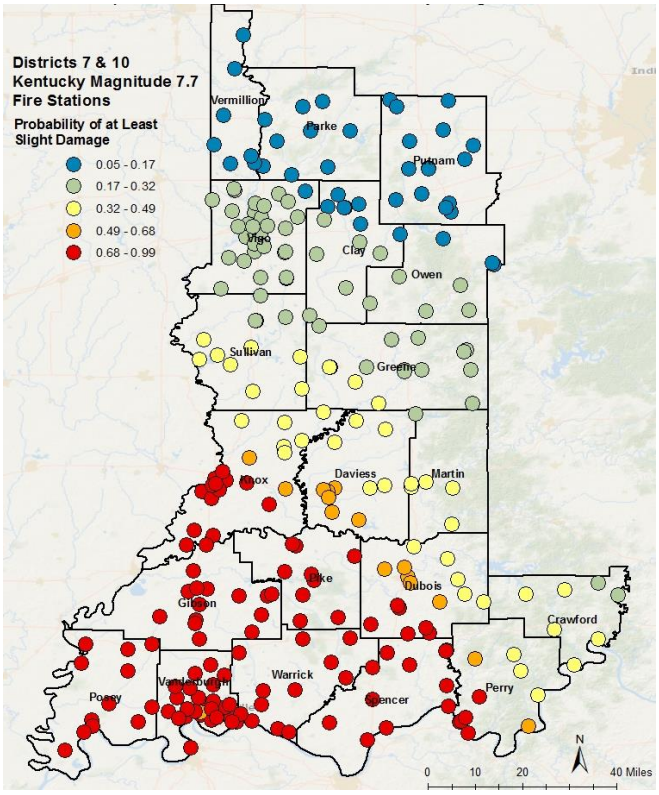
Hazus estimates that 13.1% of the total care facilities damaged would be completely damaged. Care facilities include hospitals, surgery centers, WIC facilities, and nursing homes.

Figure 64: Damage to EOCs (7.7M Barlow)



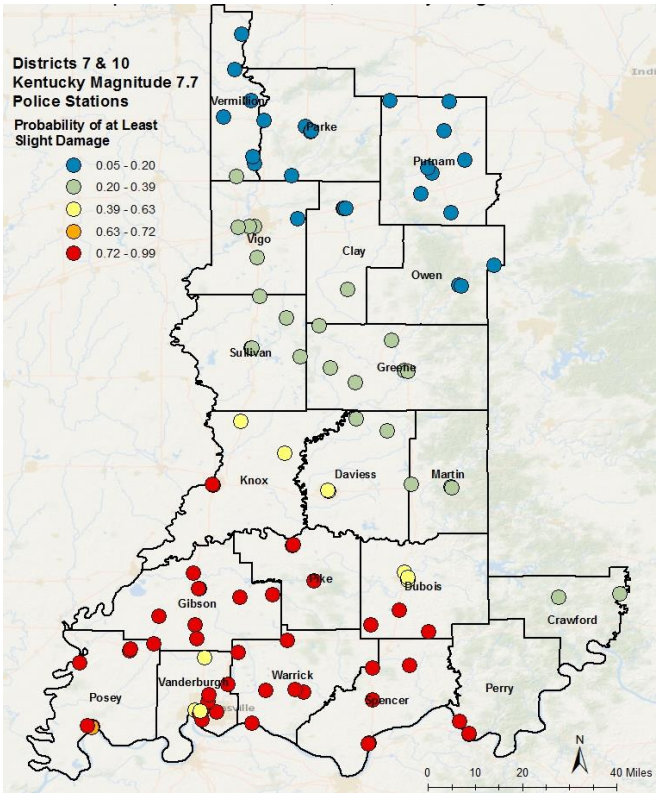
Hazus estimates that 10.0% of the total emergency operations centers damaged would be completely damaged.

Figure 65: Damage to Fire Stations (7.7M Barlow)



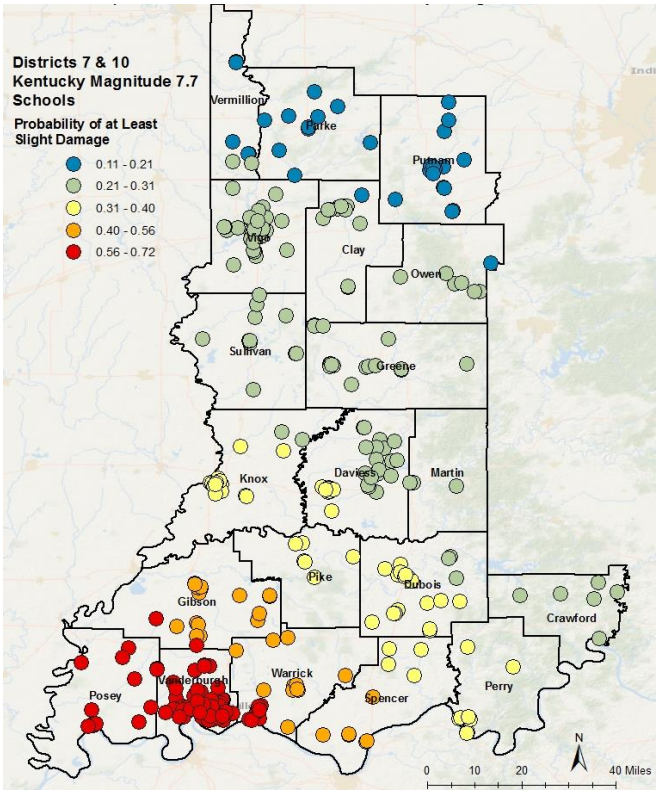
Hazus estimates that 14.1% of the total fire stations damaged would be completely damaged.

Figure 66: Damage to Police Stations (7.7M Barlow)



Hazus estimates that 12.1% of the total police stations damaged would be completely damaged.

Figure 67: Damage to Schools (7.7M Barlow)

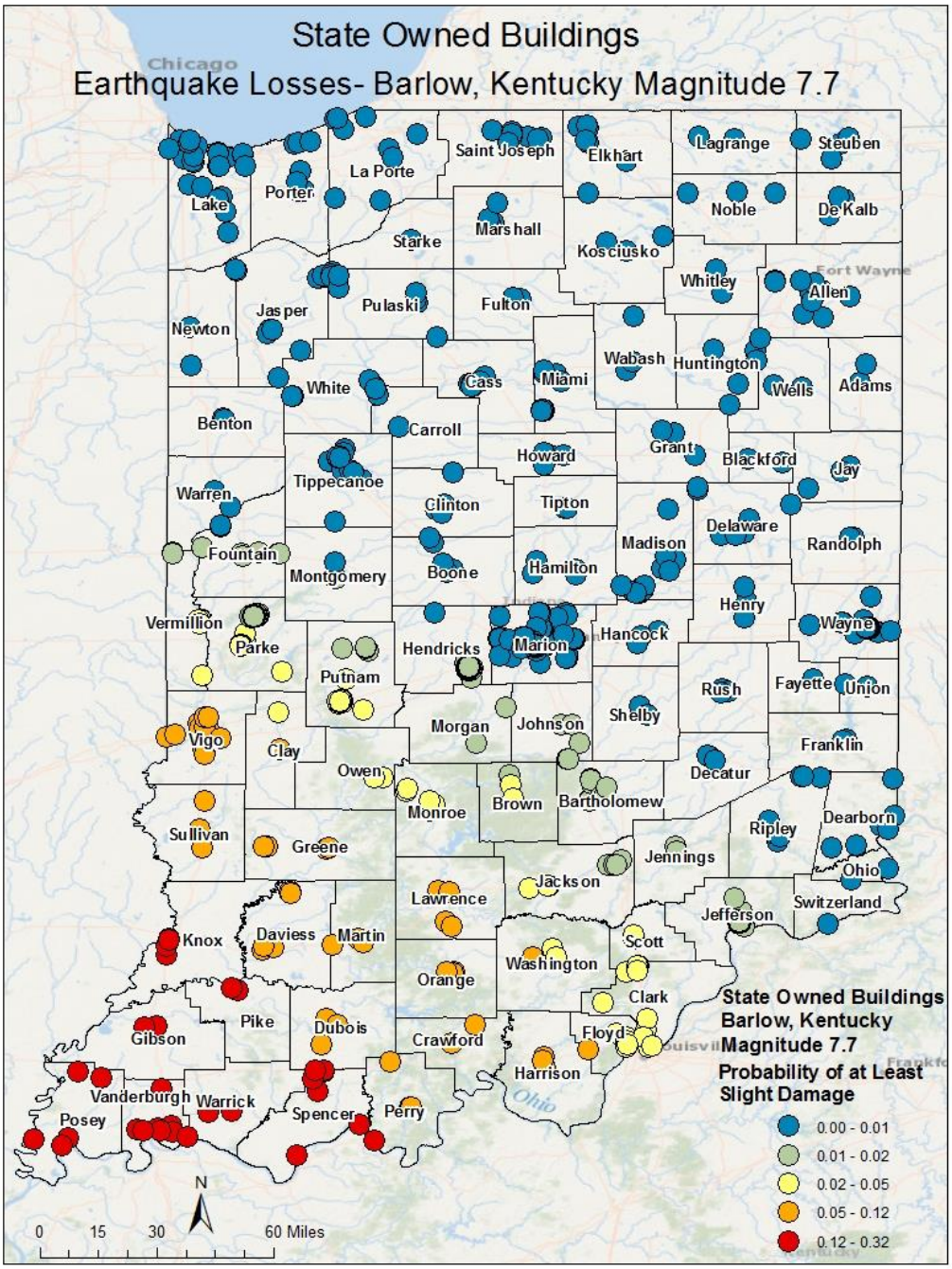


Hazus estimates that no schools would be completely damaged, but there is a probability that some may be slightly damaged.

State-Owned Facilities Analysis

Hazus estimates that 701 state-owned facilities would be damaged at a replacement cost of $5,384,000. The loss ratio (building damages divided by building replacement cost) for state-owned facilities is 1%. Figure 68 shows the locations of damaged buildings.

Figure 68: Damage to State-Owned Facilities (7.7M Barlow)



6.3.2.1.3 500-Year Probabilistic Scenario

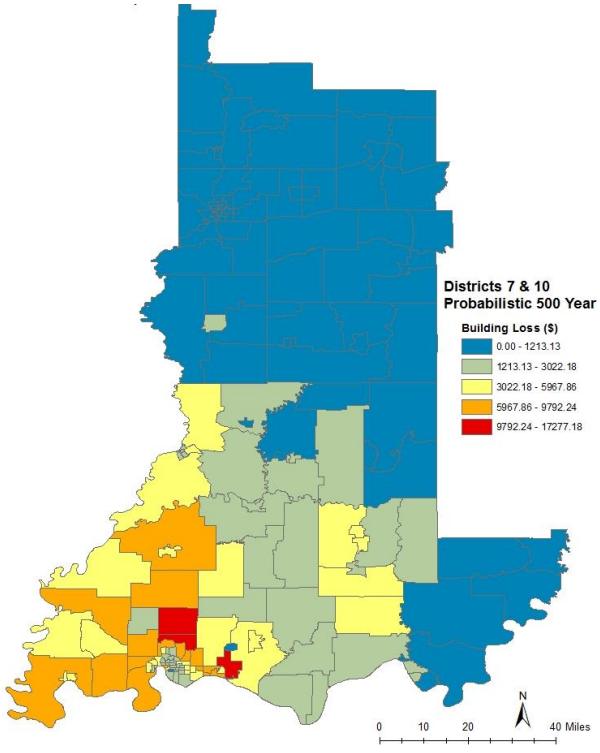
The extent of damages from a 500-year (.2%) probabilistic earthquake would encompass all areas of districts 7 and 10. Hazus estimates that 272,000 buildings would be damaged at a replacement cost (excluding contents) of $46.7 million. Residential buildings account for 81% of the number of damaged buildings and 63% of the total building value.

Hazus estimates that 12,092 buildings (4% of total buildings in the region) would be at least moderately damaged, and 237 buildings would be damaged beyond repair. Table 37 presents building damages by occupancy and construction type respectively, and Figure 69 highlights the areas in districts 7 and 10 with the greatest losses..

Table 37: Building Damages by Occupancy (500-Yr Probabilistic)

	NONE	SLIGHT	MODERATE	EXTENSIVE	COMPLETE
Agriculture	28,520	2,910	691	91	10
Commercial	9,910	1,408	383	49	4
Education	436	65	20	2	0
Government	1,018	143	38	4	0
Industrial	1,992	314	98	15	1
Other Residential	20,721	2,147	513	40	4
Religion	2,919	332	106	16	1
Single Family	165,368	22,079	8,368	1,421	215
Total	230,884	29,399	10,217	1,638	237

Figure 69: Building Losses for Districts 7 and 10 (500-Yr Probabilistic)



Essential Facilities Analysis

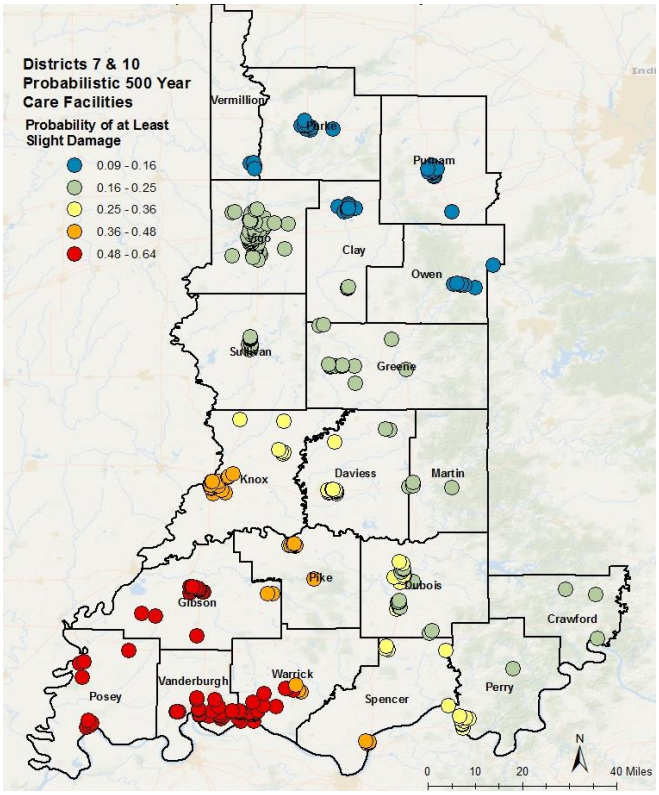
There are 1,097 essential facilities in IDHS districts 7 and 10: 329 care facilities, 365 schools, 276 fire stations, 107 police stations, and 20 EOCs. Table 38 lists essential facility damage and functionality. Figures 70 through 74 map the locations of the damaged essential facilities.

Before the earthquake, the region had 21,577 care facility beds available for use. On the day of the earthquake, the model estimates that only 14,790 beds (69%) would be available for use by patients already in the care facility and those injured by the earthquake. After one week, 81% of the beds would be back in service. After 30 days, 95% would be operational.

Table 38: Essential Facilities Damage and Functionality (500-Yr Probabilistic)

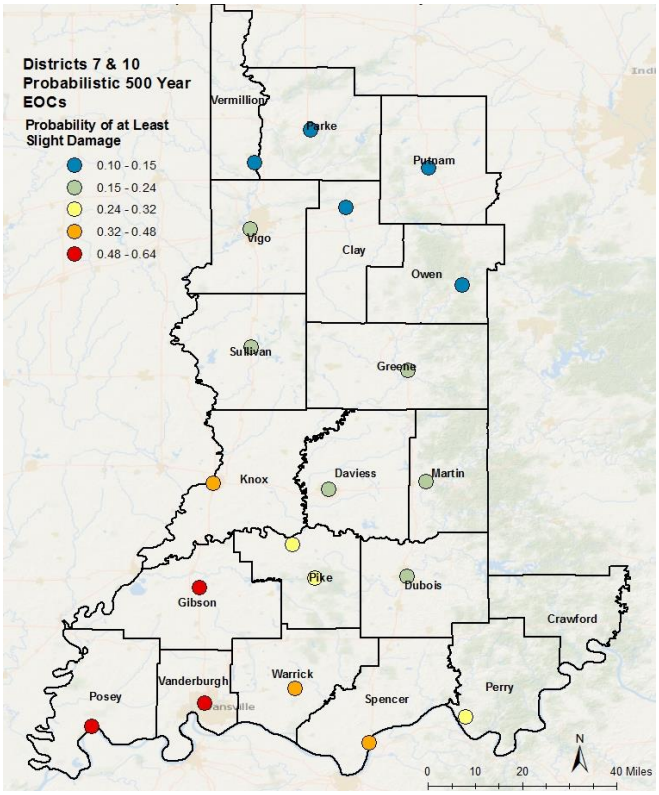
	Total Essential Facilities	Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Care	329	0	0	254
Schools	365	0	0	338
EOC's	20	0	0	17
Police Stations	107	0	0	81
Fire Stations	276	1	0	213

Figure 70: Damage to Care Facilities (500-Yr Probabilistic)



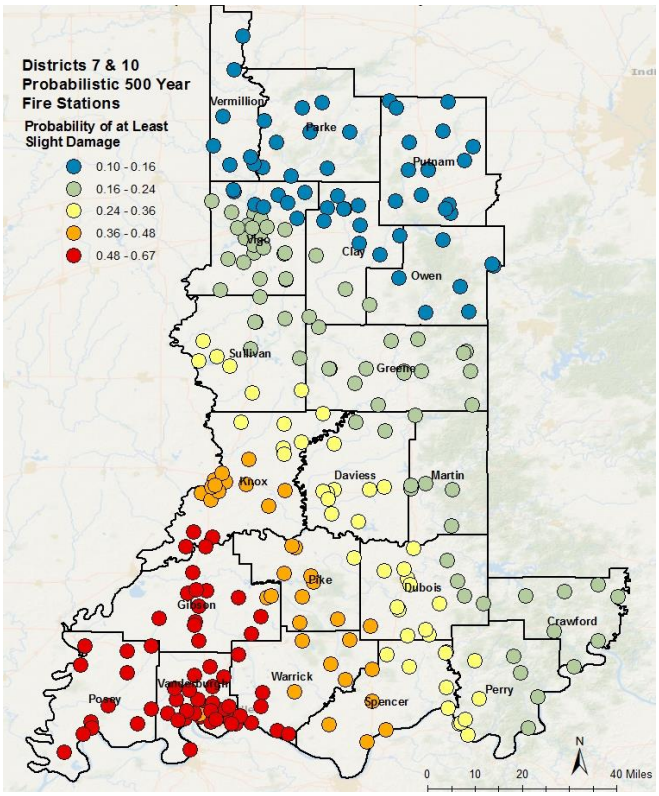
Hazus estimates that no care facilities would be completely damaged, but there is a probability that some may be slightly damaged. Care facilities include hospitals, surgery centers, WIC facilities, and nursing homes.

Figure 71: Damage to EOCs (500-Yr Probabilistic)



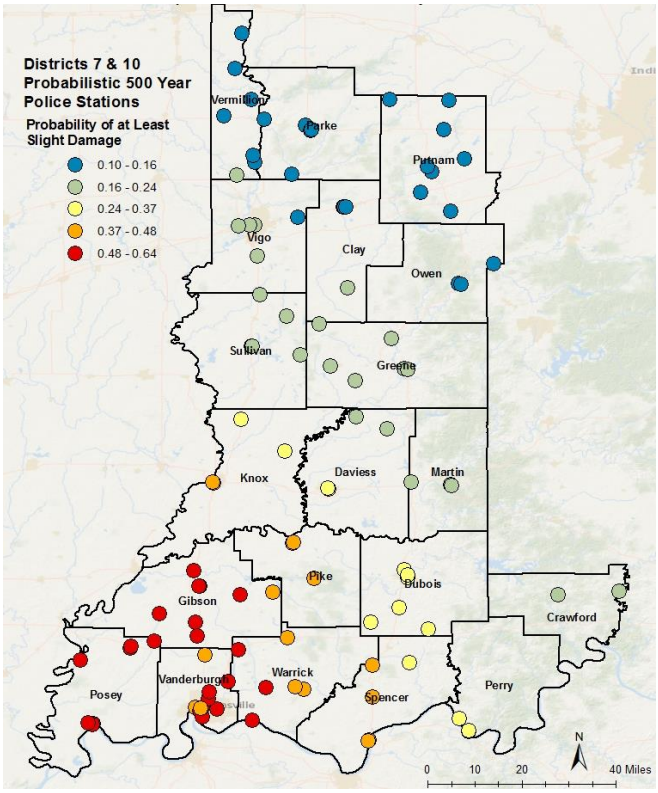
Hazus estimates that no emergency operations centers would be completely damaged, but there is a probability that some may be slightly damaged.

Figure 72: Damage to Fire Stations (500-Yr Probabilistic)



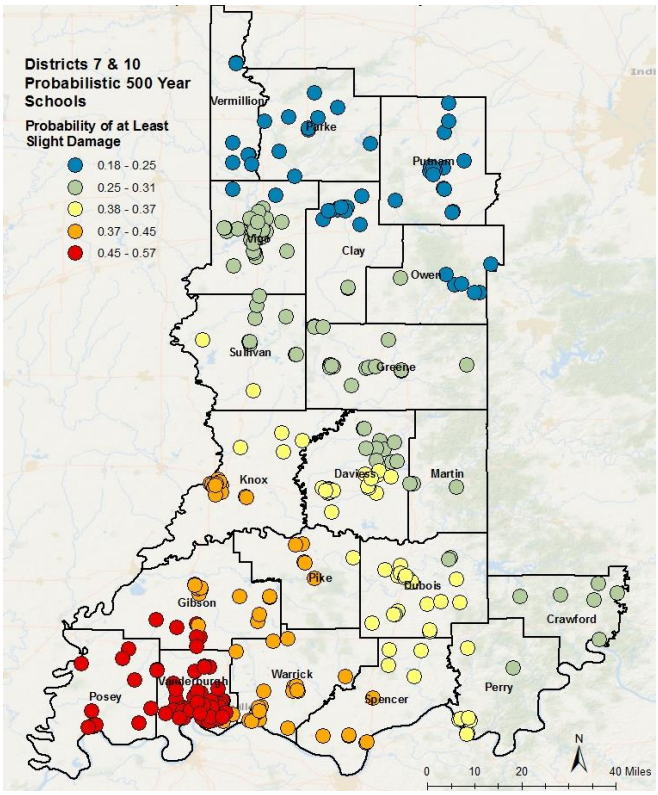
Hazus estimates that no fire stations would be completely damaged, but there is a probability that some may be slightly damaged.

Figure 73: Damage to Police Stations (500-Yr Probabilistic)



Hazus estimates that no police stations would be completely damaged, but there is a probability that some may be slightly damaged.

Figure 74: Damage to Schools (500-Yr Probabilistic)

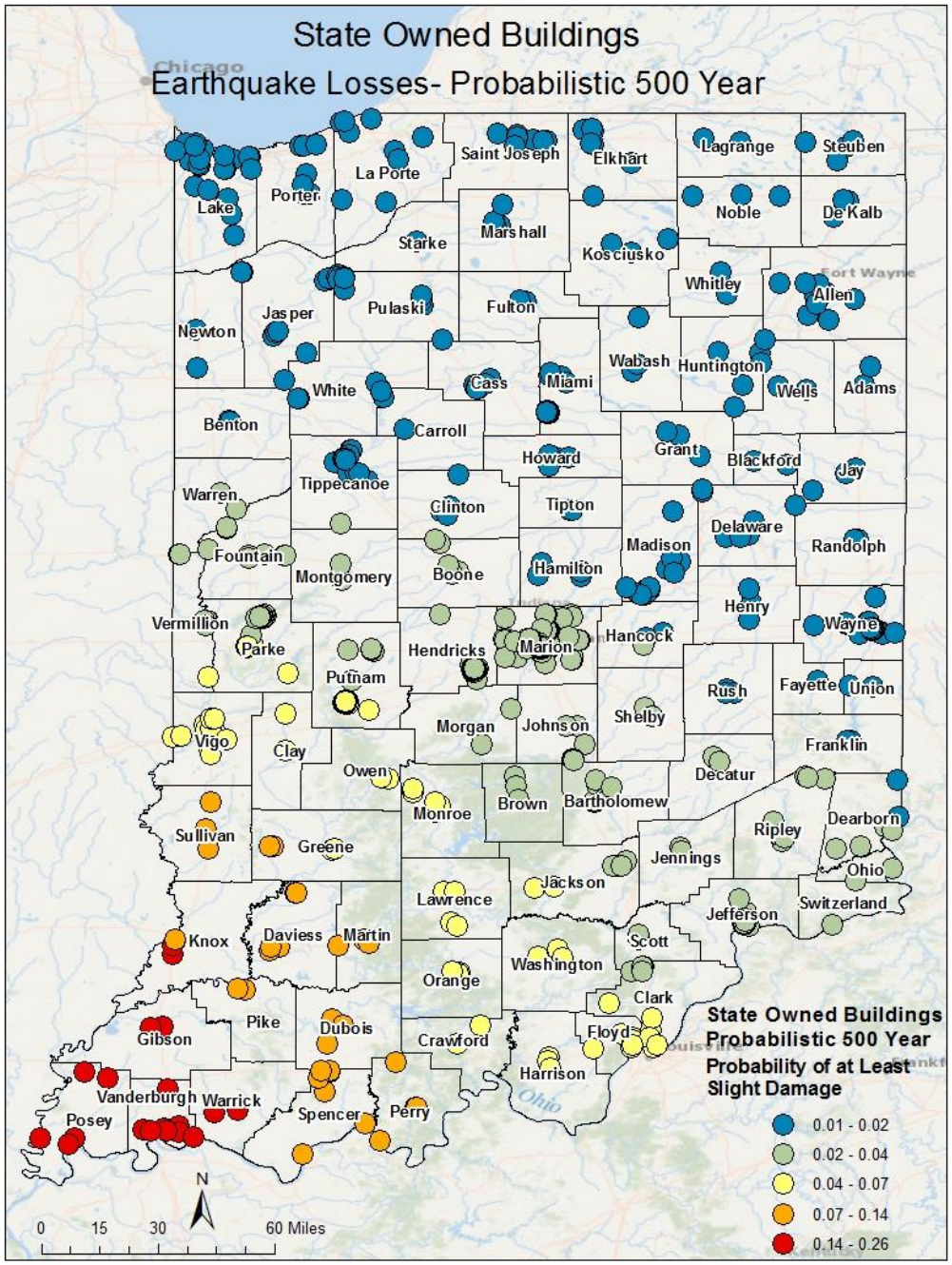


Hazus estimates that no schools would be completely damaged, but there is a probability that some may be slightly damaged.

State-Owned Facilities Analysis

Hazus estimates that 1,261 state-owned facilities would be damaged at a replacement cost of $9,181,000. The loss ratio (building damages divided by building replacement cost) for state-owned facilities is 1%. Figure 75 shows the locations of damaged buildings.

Figure 75: Damage to State-Owned Facilities (500-Yr Probabilistic)



6.3.3. Probability of Future Occurances

The probability of future earthquakes is unknown. The USGS asserts that a large earthquake that will seriously impact southwestern Indiana is inevitable; however, it is currently impossible to predict when such an earthquake will occur. According to the USGS, there is a 25 to 40% chance of a magnitude 6.0 or greater earthquake in the next 50 years for the central US. There is a 7 to 10% chance of a repeat of events similar to the New Madrid earthquakes of 1811-12.

Future earthquake events will affect larger populations, business development, and aged vulnerable infrastructure. Upgraded codes will protect newer construction, but much of the population will remain vulnerable because of low public interest in earthquake safety due to the relative inactivity of the fault systems presents a serious problem.

6.3.4. Mitigation Strategies

The planning team identified the following strategies to mitigate earthquakes. Assuming funding is available, it is the intention that high priority strategies will be implemented within one year of plan adoption, medium priorities will be implemented within two years, and low priorities within three years.

Table 39: Earthquake Mitigation Strategies

Priority	Goal	Objective	Strategy	Potential Collaborator(s)	Potential Funder(s)
High	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Create a program that provides online seismic education for the general public	IDHS, IUPUI	FEMA
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Conduct research on the social vulnerabilities associated with these hazards	IUPUI	FEMA, NSF, NIH
High	Promote research, education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Improve education and training of emergency personnel and public officials.	Work with state and local officials to adopt relevant sections of the IBC/IRC for earthquake resistant construction.	IDHS, NEHRP, IGS, PU, Building trades Local Building Officials	FEMA, State Funding
High	Promote research, education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Improve education and training of emergency personnel and public officials.	Work with local officials and EMA to develop mitigation programs that educate local residents on the need for non structural retrofits of furniture, HVAC and other utility and mechanical systems to make them earthquake resistant.	Building Trades, IDHS Building Commissioner, Home builder association, IDHS, FEMA	FEMA, HSEP
High	Promote research, education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Improve education and training of emergency personnel and public officials.	Train EMA, State employees in nonstructural retrofit techniques to encourage good mitigation practices in their communities and their places of employment.	Local Governments, IDHS, IN OSHA, EMA, Local Governments, Unions, and trades.	FEMA, HSEP
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Develop a statewide earthquake analysis and plan based on the most likely possible scenario – include mitigation strategies and secondary impacts that more northern areas of the state may experience	IDHS, IUPUI	IDHS, FEMA
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Improve education and training of emergency personnel and public officials.	Convene a Seismic Council (sub-committee of Silver Jackets) to meet regularly and discuss issues, concerns, and opportunities	IDHS, NRCS, USGS, IGS	Existing programs

Priority	Goal	Objective	Strategy	Potential Collaborator(s)	Potential Funder(s)
Medium	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Ensure better coordination of federal, state, and local mitigation activities.	Work with CUSEC to further Indiana's Earthquake Mitigation Goals and National objectives for funding through NEHRP.	FEMA, CUSEC, IGS, PU, IDHS, INDOT	FEMA, NEHRP
Low	Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.	Retrofit critical and essential facilities and structures to withstand disasters.	Coordinate with local jurisdictions to require appropriate seismic design and construction for new government-owned buildings	IDHS, IGS	FEMA

Section 7 Other Hazards Vulnerability and Mitigation

7.1 Natural Hazards

Natural hazards are threats that are naturally occurring and have a negative effect of people, infrastructure, and/or the environment. For the natural hazards discussed in this section, vulnerability is determined based on historical incidents and potential impacts. A combined list of mitigation strategies is included in Section 7.1.7.

IDHS and The Polis Center are currently developing vulnerability analyses for wildfire, disease outbreak, and fluvial erosion hazard. These analyses will be incorporated into the 2017 version of the SHMP.

7.1.1 Winter Storm

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

Indiana can experience snowfall during most years from Novermber through March, especially in the lake effect snow belt in the northern part of the state. Snow has occurred as early as September and as late as May, although these events are rare. The first measurable snowfall of the season usually occurs by the start of November in northern Indiana and by mid-November in southern Indiana.

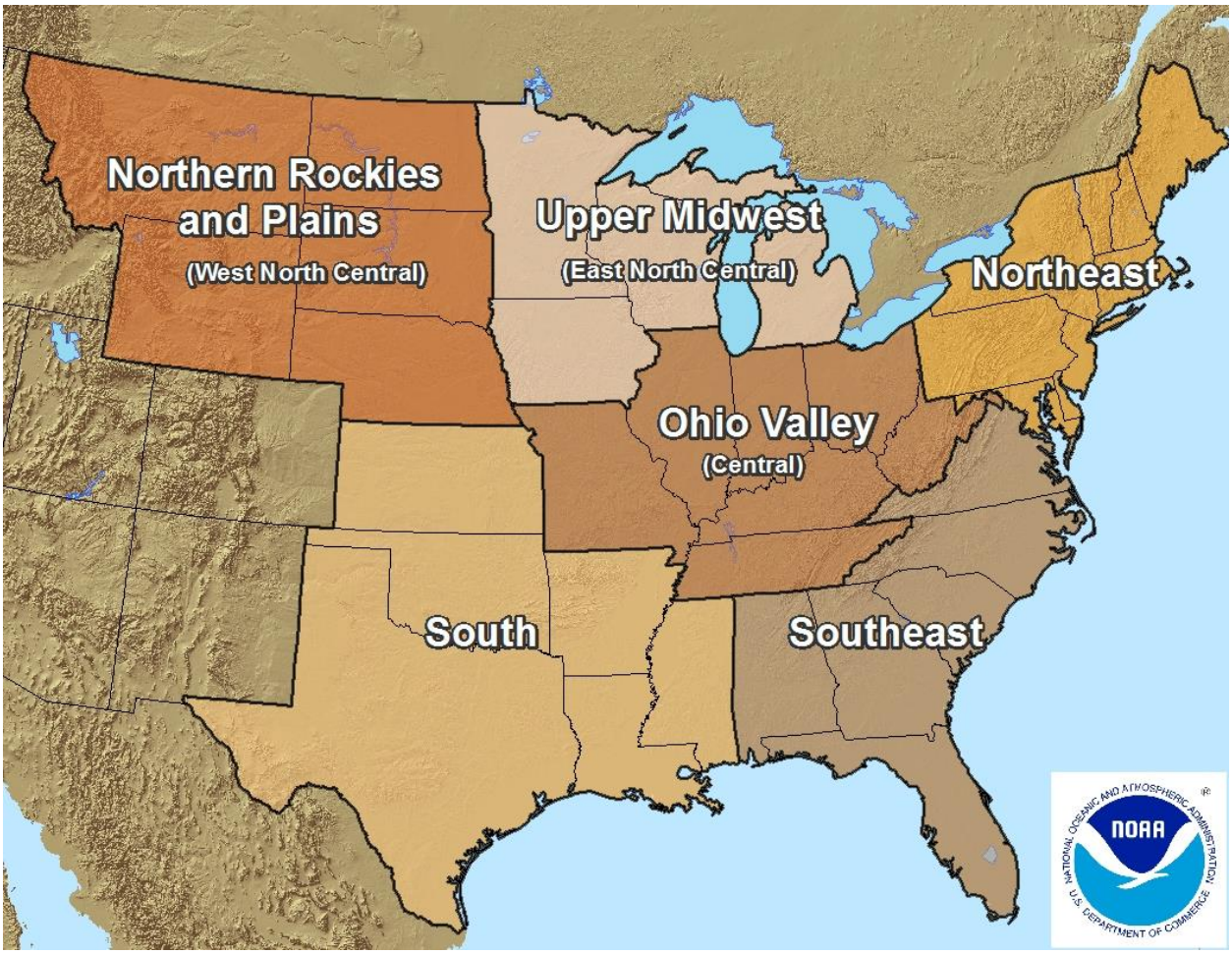
NOAA's National Climatic Data Center produced a Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the US. The RSI (Table 40) ranks snowstorm impacts on a scale from 1 to 5, similar to the Enhanced Fujita scale for tornadoes.

Table 40: Regional Snowfall Index

Category	RSI Value	Description
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18+	Extreme

The RSI is based on the spatial extent of the storm and the amount of snowfall and considers how these elements interact with an area's population. It is produced for each of the six NCDC climate regions (Figure 76).

Figure 76: NCDC Climate Regions



In the past 50 years, NCDC reported 113 snowstorms in the Ohio Valley. The most recent severe storm was the Groundhog Day Blizzard, which occurred from January 31, 2011 to February 3, 2011 and was ranked as an RSI Category 5 storm for the Ohio Valley Region and a Category 3 storm for the South and the Southeast. More than 5.8 million people were exposed to snowfall in excess of 18 inches, and the storm caused over $1 billion in damage.

NOTE: The winter of 2014 produced record-breaking snowfall in Indiana in excess of 52 inches. This exceeded the snowiest winters in 1981-82 and 1977-78. Complete data are not yet available for the 2014 winter impacts.

7.1.1.1 Vulnerability Assessment

The hazard extent of a winter storm is statewide, but it is typically most severe in northern Indiana. Heavy snow causes many problems for the public. Snowfall rates can exceed an inch per hour. As these systems intensify, wind speeds can approach hurricane force (74 mph). The blowing and drifting snow that results can paralyze a region. Automobiles are stranded on highways and peoples' lives are at risk in the absence of adequate shelter. With roads impassable, travel may be restricted for significant periods.

To further compound risks, cold air moving south behind the retreating low pressure area can cause temperatures to plummet. As the arctic high pressure area behind the low builds into the region temperatures can fall to 20 to 30 degrees below normal. A cold air mass can stay over the region for up to a week, until the next weather system moves in. These conditions can tax utility systems that are already working at peak output.

The weight of the snow itself can also be a problem, especially if the snow has a high water content. Tremendous weight of snow from significant storms can cause structures to collapse. Tree branches, especially on fully-leaved trees, can easily break under the weight of heavy snow. For example, if a snow cover of 12 inches has a water equivalent of 1.0 inch of water it would weigh 5.2 pounds per square foot. Additional snowfall would continue to increase this weight and structures could eventually become stressed. Flat roofs are especially susceptible to this problem but sloping roofs, especially if the structural components are weak, can also be damaged.

Population Exposure - Historical information indicates that the entire state is at risk to winter storms. Winter storms affect mostly humans, particularly special needs populations, and animals due to lack of mobility or isolation from supplies. They are more reliant upon the roads and vehicular travel for access to needed supplies. Lack of communication due to downed phone and power lines, will further isolate and make obtaining assistance more difficult if needed.

Human Services - The loss of usual means of transportation to provide emergency services and the dependence upon back up power systems will be the first of many impacts upon the Human Service Agencies. The lack of reliable communications and personnel to staff and provide services paired with increased demand for services they provide may overwhelm smaller agencies and tax many larger agencies to near exhaustion.

Transportation Exposure - The transportation network will be the first impacted. Snow and ice accumulations will make travel along these systems difficult or impossible. These types of storms do not usually destroy this type of infrastructure, but rather result in temporary effects. The problem is normally debris related. The freeze thaw of winter and its related damage to roads is normal and planned for throughout the state. Transportation is more likely to be affected by cascading events, such as debris from ice storms or flooding from excessive snowmelt.

Other Infrastructure Exposure - A community's infrastructure is likely to experience the most physical damage. Power and communication equipment is vulnerable to winds, but the addition of ice on the lines quickly renders the community without power or communication. The loss of power may mean that communities and individuals may not have water, since it takes electricity to convey it to the customer. Towns and cities depend upon electricity to pump, treat and deliver water to their citizens.

Economic Exposure - Economically, industry and agriculture can suffer the effects of a winter storm. Both are dependent on transportation. The collapse of structures due to snow loading, loss of man-hours and inability to ship goods, receive material or to receive orders for goods and services will impact the economic community. Historically, Indiana has suffered agriculturally from loss of livestock or crops due to winter storms and cascading events such as flooding.

The loss potential to above-ground infrastructure could be devastating. The lack of past history of frequent severe storms does not provide a large sample of information upon which to base loss estimates. The 1991 storm that brought a declaration for 21 counties in Indiana was by far the largest disaster in recent history. Winter storms in Indiana normally are not long-term recovery programs. These events typically only require emergency snow and debris removal. They can also be deadly due to exposure, fire, carbon monoxide poisoning, and transportation accidents.

The lack of public awareness, preparedness, and mitigation will result in increased losses as the population and the dependence upon technology continues. The recovery time to power and communication infrastructure can be improved by the requirement that electric and communications service lines be buried. The lack of heat in residences and the exposure to cold is the greatest threat to people. Public education on the dangers of alternative heating systems, and what to do if caught outside during a storm would reduce the risk to the population. These programs can prevent the state's exposure to loss from these storms from increasing as the population increases.

7.1.1.2 Probability of Future Occurrences

The probability of future winter storms will remain high. Due to the unpredictability of this hazard, all buildings and infrastructure in Indiana are at risk of damage including temporary or permanent loss of function. Global climate change may have an impact on the probability of future events; however, it is unclear as to the extent of this impact.

7.1.2 Drought

Droughts are created by below normal rainfall; however, excessive heat can lead to increased evaporation, which will enhance drought conditions. A drought can occur in any month and is the consequence of a reduction in the amount of precipitation over an undetermined length of time (usually a growing season or more). The severity of a drought depends on location, duration, and geographical extent. Additionally, drought severity depends on the water supply, usage demands made by human activities, vegetation, and agricultural operations.

Indiana is increasingly vulnerable to drought hazards due to growth and shifts in population; land use changes, which can result in water shortage and degrade water quality; and climate change, which increases the frequency, severity, and duration of drought events.

The US Drought Monitor categorizes droughts on a scale from D0 to D4 as outlined in Figure 77.

Figure 77: US Drought Monitor – Categories of Drought Severity

		Ranges					
Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
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	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2

Since 2008, there have been 93 drought events reported to NCDC. There were no reports of deaths, injuries, or crop damage in NCDC records.

Indiana's most recent significant drought occurred in 2012. From July through December more than half of the state was under a moderate drought (D1) or worse. In July, 51% of the state experienced a severe drought, and in August, 7% of the state was in an exceptional drought.

Source: US Drought Monitor

7.1.2.1 Vulnerability Assessment

The hazard extent for a drought is statewide. Communities are often reactive in their approach to drought planning. Instead of developing detailed and comprehensive mitigation strategies for future droughts, they respond to imminent droughts by implementing strategies (e.g., burn bans and water restrictions) that do little to minimize the costs of response and recovery. The Polis Center is beginning to research the less understood social vulnerabilities associated with drought. Future versions of the SHMP will explore this further.

Indiana's most recent significant drought occurred in 2012. The month of March was characterized by record-breaking warmth, which resulted in an early start to the growing season. This combined with lack of precipitation from the 2011-2012 winter led to abnormally dry conditions across the state in April.

From July through December more than half of the state was under a moderate drought (D1) or worse. In July, 51% of the state experienced a severe drought, and in August, 7% of the state was in an exceptional drought. Lack of rainfall and extreme temperatures devastated crops and impaired livestock feed and water supplies across Indiana.

Source: US Drought Monitor, National Weather Service

The impacts of the 2012 drought were statewide and severe. Figure 78 shows the distribution of impact reports from the National Drought Mitigation Center's Drought Impact Reporter, and Table 41 lists the types of impacts reported between July and August of 2012.

Figure 78: Drought Impact Reports (Jul-Aug 2012)

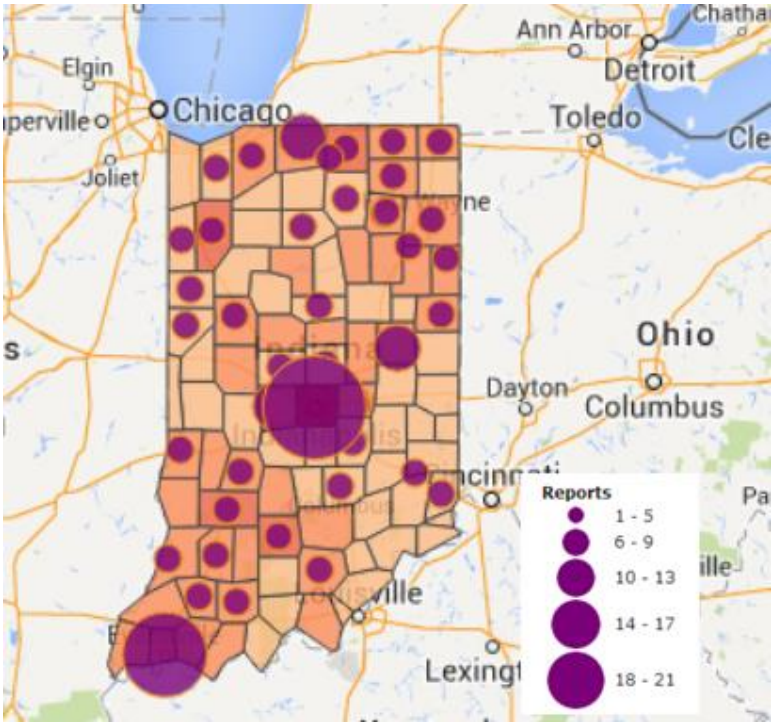
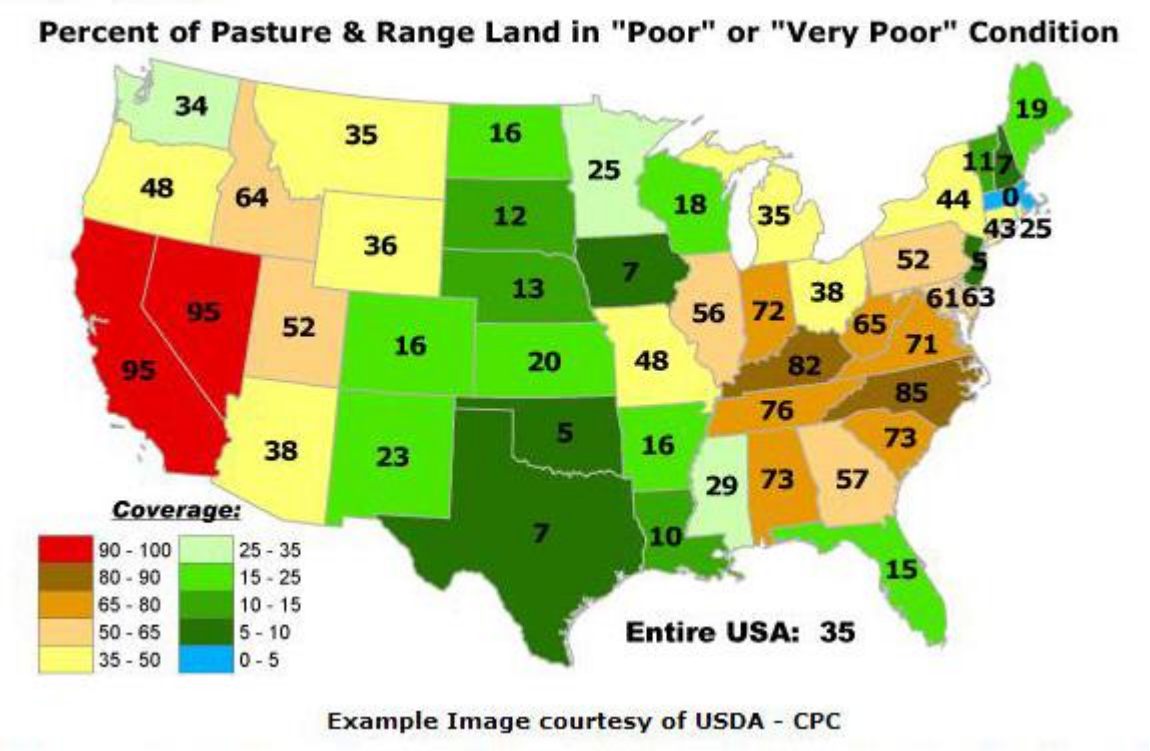


Table 41: Reported Impacts of the 2012 Drought (Jul-Aug)

Impact Category	Number of Reports
Agriculture	90
Energy	1
Plants and Wildlife	32
Society and Public Health	26
Water Supply and Quality	29
Business and Industry	18
Fire	10
Relief, Response, and Restrictions	35
Tourism and Recreation	5

As Table 33 shows, the most significant impacts of drought in Indiana are related to agriculture. The USDA determined that in 2012, between 65 and 80 percent of the state's pasture and range land was in poor or very poor condition (Figure 79).

Figure 79: Agricultural Impacts of the 2012 Drought



Drought impacts on corn and soybeans crops can be assessed using NCDC's Crop Moisture Stress Index (CMSI), which is calculated through the use of a drought index (Palmer Z Index) and annual average crop productivity values within each US climate division. Moisture stress, either a lack or an abundance of, can critically affect crop growth and development.

Figures 80 and 81 show the corn and soybean moisture stress index for the US from 1900 to 2013.

Figure 80: Corn Moisture Stress Index

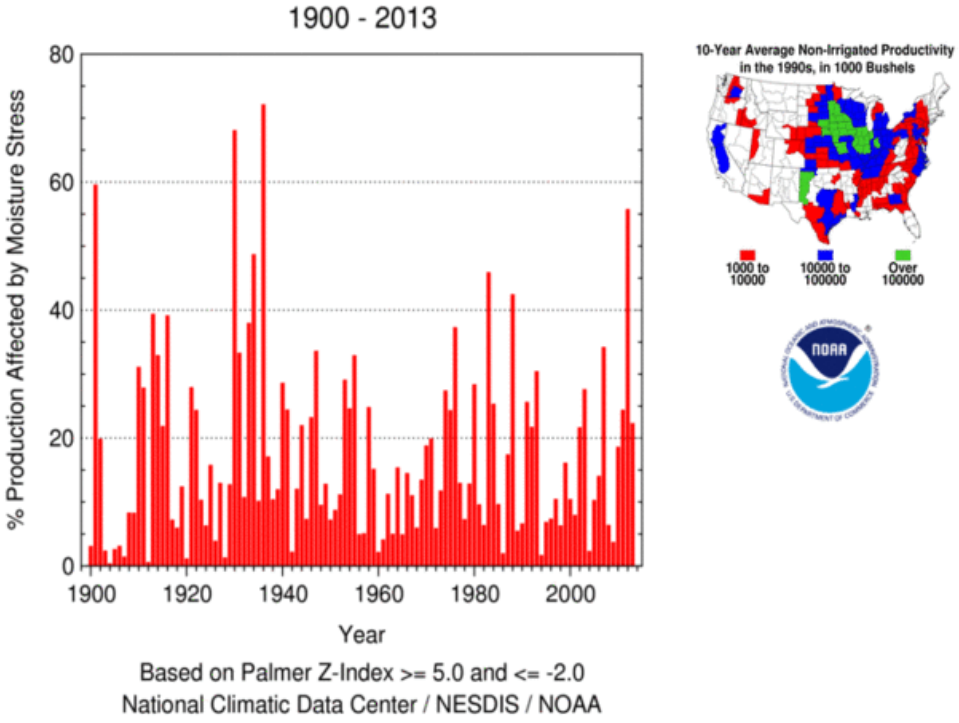
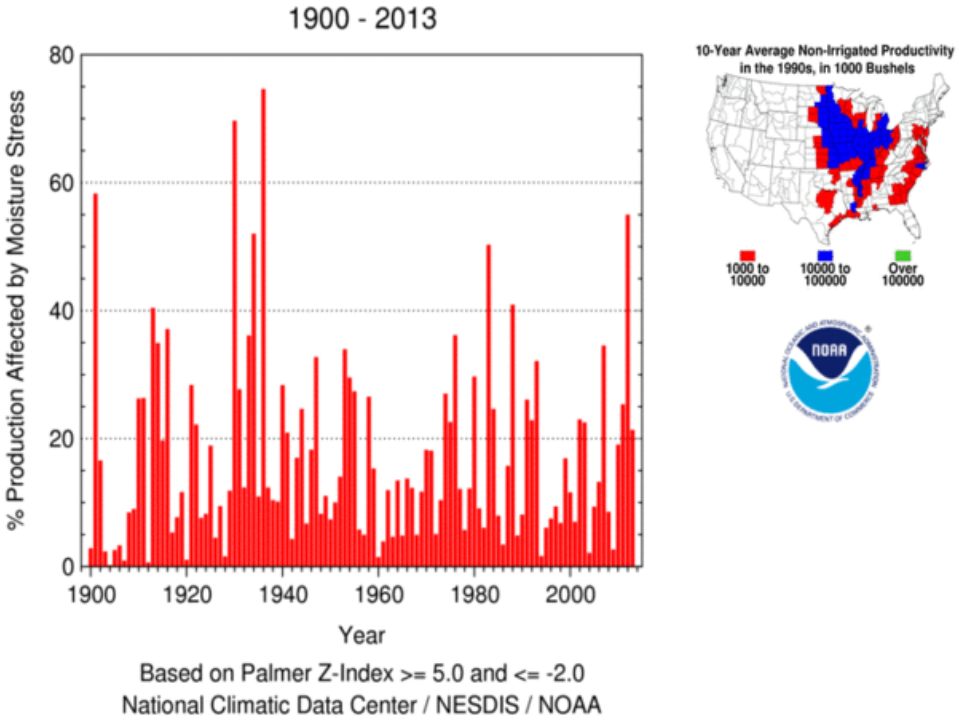


Figure 81: Soybean Moisture Stress Index



7.1.2.2 Probability of Future Occurrences

Since the last plan update in 2008, the state has experienced significant droughts, but the probability of future droughts is unknown. Due to the unpredictability of this hazard, both rural and urban areas in Indiana are at risk. Global climate change may have an impact on the probability of future events; however, it is unclear as to the extent of this impact.

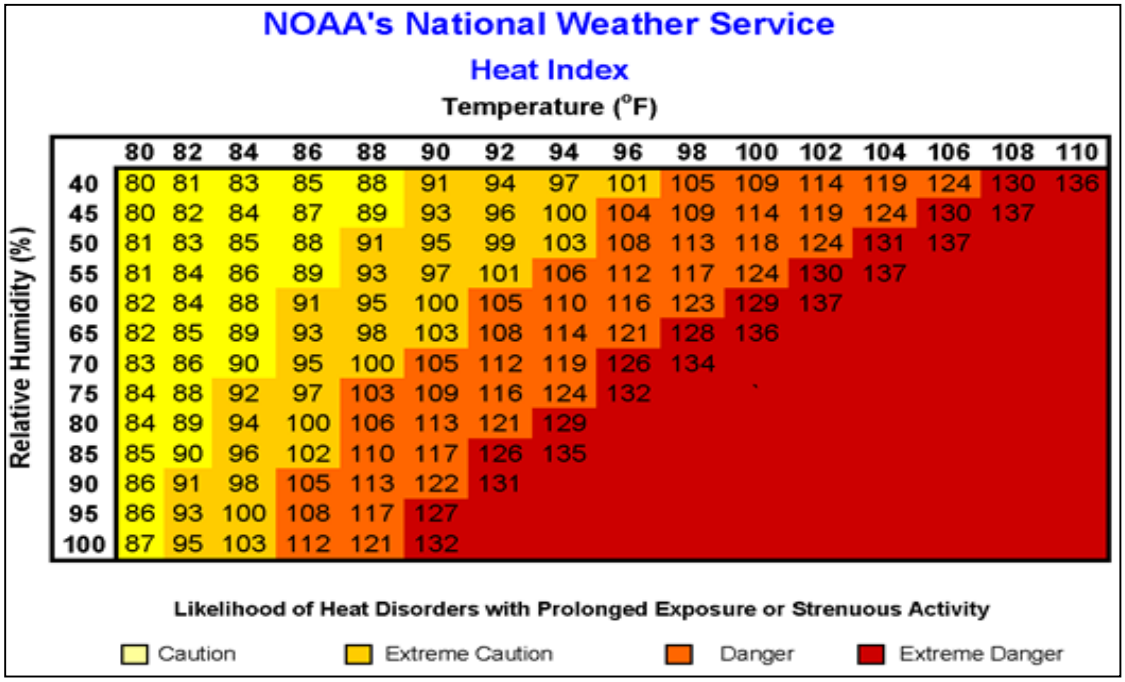
7.1.3 Extreme Temperatures

Extreme temperatures—both hot and cold—can have significant impact on human health and safety, commercial businesses, agriculture, and primary and secondary effects on infrastructure (e.g. burst pipes, power failures, etc.). Weather conditions described as extreme heat or cold vary across different areas of the state, based on the range of average temperatures within the region.

An Extreme Heat Event (EHE) is characterized by temperatures that hover 10 degrees Fahrenheit or more above the average high temperature for a region and last for several weeks. An extended period of extreme heat of three or more consecutive days is typically referred to as a heat wave.

Heat alert procedures are based primarily on Heat Index Values. The Heat Index—given in degrees Fahrenheit—is often referred to as the apparent temperature and is a measure of how hot it really feels when the relative humidity is factored with the actual air temperature. The National Weather Service Heat Index Chart can be seen below in Figure 82.

Figure 82: National Weather Service Heat Index Chart

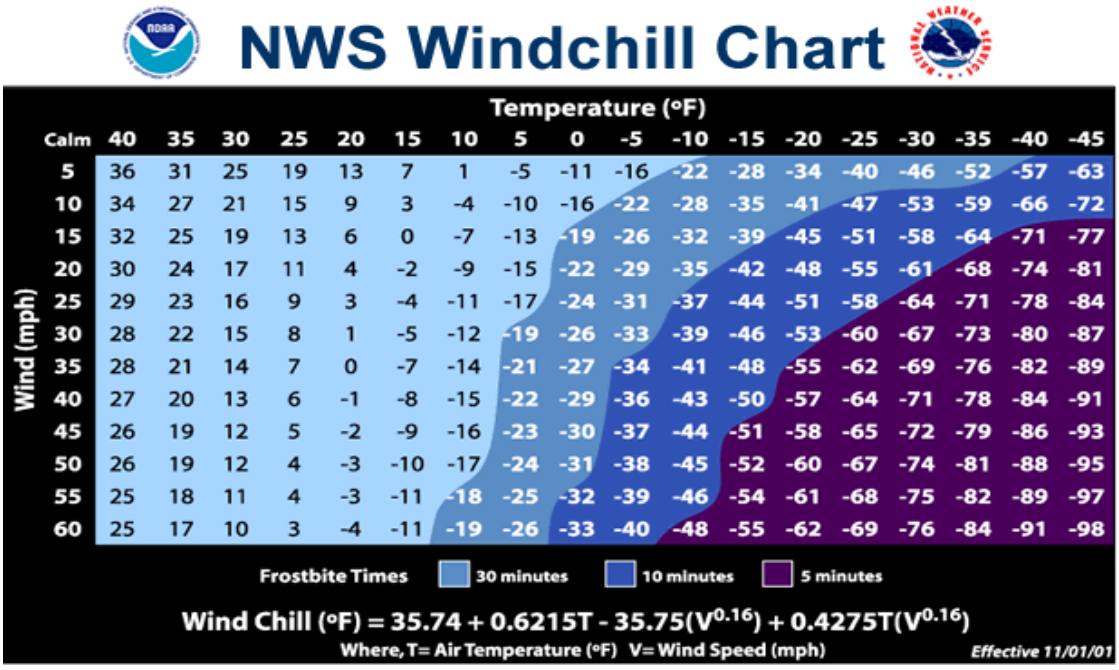


What constitutes an extreme cold event, and its impacts, varies across the United States. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Extreme cold temperatures are typically characterized by the ambient air temperature dropping to approximately 0 degrees Fahrenheit or below.

The magnitude of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. Wind Chill Temperature is the temperature that is felt when outside and is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop.

The index, shown in Figure 83, includes a frostbite indicator, showing points where temperature, wind speed, and exposure time will produce frostbite in humans.

Figure 83: National Weather Windchill Chart



7.1.3.1 Vulnerability Assessment

The hazard extent of extreme temperatures is statewide. The NCDC database identified five occurrences of extreme temperature in the past decade: four excessive heat events and one extreme cold event. In August 2010, extreme heat in Vanderburgh County resulted in ten reported injuries, while the summer heat of 2012 caused three deaths. NCDC records report a single event of extreme cold from December of 2008 through the middle of January 2009.

One of the cascading events of extreme cold temperatures over a long period of time is the formation of ice dams that result in damage to bridges and other infrastructure. In extreme events, ice will damage residential and commercial structure foundations, but the typical result in Indiana is flash flooding. The flooding may be further exacerbated if the ice dam "self destructs" or officials are forced to intervene to open the channel.

Extreme temperature events often lead to severe short and long term health conditions, or even death, particularly for special needs populations and the elderly. Urban populations are particularly vulnerable because of elevated temperatures in cities—known as the "urban heat island effect—caused by lack of tree cover and the magnifying effect of heat on paved surfaces. However, extreme temperatures can occur within any area in the state; therefore, the entire state population and all buildings are vulnerable to extreme temperature hazards.

Extreme heat is the number one cause of weather-related fatalities in the United States, with hundreds occurring each year. On average, extreme heat claims more than 1,500 lives annually—more than floods, lightning, tornados, and hurricanes combined.

7.1.3.2 Probability of Future Occurrences

Since the last plan update in 2008, the state has experienced a significant heat event in 2012 and a record 2013-2014 extreme cold event, but the probability of future extreme temperatures is unknown. Global climate change may have an impact on the probability of future events; however, it is unclear as to the extent of this impact.

7.1.4 Wildfire

The hazard extent of wildfires is greatest in the heavily forested areas of southern Indiana. The IDNR Division of Forestry assumes responsibility for approximately 7.3 million acres of forest and associated wild lands, including state and privately-owned lands. Indiana's wildfire seasons occur primarily in the spring—when the leaf litter on the ground dries out and before young herbaceous plants start to grow and cover the ground (green up)—and in the fall—after the leaves come down and before they are wetted down by the first heavy snow. During these times, especially when weather conditions are warm, windy, and with low humidity, cured vegetation is particularly susceptible to burning. When combined, fuel, weather, and topography, present an unpredictable danger to unwary civilians and firefighters in the path of a wildfire. Human action can not only intervene to stop the spread of wildfires, but can also mitigate their onset and effects. Forest and grassland areas can be cleared of dry fuel to prevent fires from starting and can be burned proactively to prevent uncontrolled burning.

7.1.4.1 Probability of Future Occurrences

The probability of future wildfires is directly related to the extreme heat and drought vulnerabilities. Since the last plan update in 2008, the state has experienced a significant heat event in 2012 and droughts in both 2012 and 2013. Global climate change may have an impact on the probability of future events; however, it is unclear as to the extent of this impact.

7.1.5 Disease Outbreak

The Centers for Disease Control and Prevention (CDC) characterizes a disease outbreak as a sharp increase in the number of incidences of a disease in the population. When the expected or routine amount of incidences of a disease rapidly grows into a public health threat, public health and emergency management officials and medical care professionals must act swiftly to limit morbidity and mortality. The CDC requires state and local health departments to report 77 different types of infectious diseases. Transmission of infectious diseases may occur through a variety of pathways, including airborne inhalation, food, liquids, bodily fluids, contaminated objects, ingestion, or vector-borne spread. Disease outbreaks pose a particular risk to urban and suburban communities due to the close environments in which people interact.

7.1.5.1 Probability of Future Occurrences

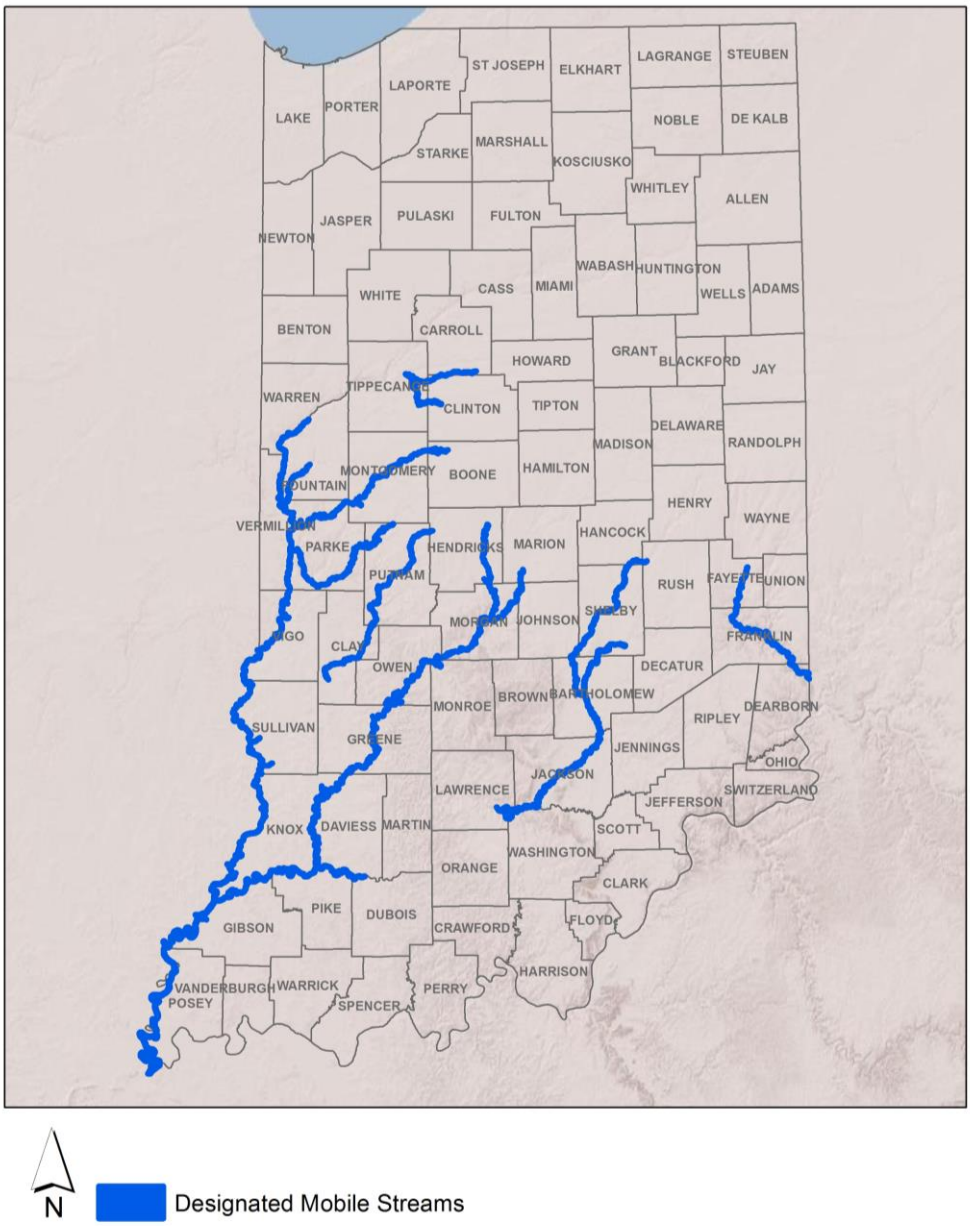
The probability of future disease epidemics is unknown. Global climate change may have an impact on the probability of future events; however, it is unclear as to the extent of this impact.

7.1.6 Fluvial Erosion Hazard (FEH)

Fluvial erosion is defined as the erosion caused by streams, rivers, creeks, and other flowing bodies of water. It has become a prevalent hazard throughout the state, primarily as a result of the numerous floods and bankfull episode along the rivers. In the past, FEH was only an issue for a few homes constructed along the streams and rivers. However, beginning in 2005, increased development caused large portions of soil to erode to the point of imminent collapse. In the flood of June 2008, at the confluence of the Wabash and Ohio, the Wabash cut through a section of land creating a 2,500 acre island. And in recent years, even areas along the White River have begun to encroach on local and statewide infrastructure. Fluvial erosion near Centerton south of Indianapolis on the White River has migrated 55 feet since 2005. This area happens to be near the Indianapolis Power and Light generating plant.

Increased population density has also heightened people's exposure and vulnerability to FEH. Simultaneously the state's citizens have demonstrated a significant increased interest in protecting their communities from the devastating consequences of unmitigated natural hazards. Removing homes or restricting property development in the floodway or floodway fringe, thereby creating in perpetuity, green spaces, parks, golf courses and other unobstructed land are prime examples of the state's current mitigation efforts to combat the pressures of rampant development. Figure 84 shows the streams in Indiana that are highly mobile.

Figure 84: Highly Mobile Streams



7.1.6.1 Probability of Future Occurrences

The probability and extent of future occurrences of FEH are currently being studied at Indiana University-Purdue University Indianapolis (IUPUI). FEH damage to infrastructure represents the largest dollar expenditure with extreme flood events. Ongoing work in climate change science, coupled with increased development, will determine if extreme flood events and FEH will occur more frequently in the future.

7.1.7 Other Natural Hazards Mitigation Strategies

The following mitigation strategies apply to natural hazards in Indiana. Assuming funding is available, it is the intention that high priority strategies will be implemented within one year of plan adoption, medium priorities will be implemented within two years, and low priorities within three years.

Table 42: Other Natural Hazards Mitigation Strategies

Priority	Goal	Objective	Strategy	Hazard	Potential Collaborator(s)	Potential Funder(s)
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Conduct research on the social vulnerabilities associated with these hazards	Winter Storm, Drought, Extreme Temps, Wildfire, Disease Outbreak, Fluvial Erosion Hazard	IUPUI	FEMA, NSF, NIH
High	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Develop and distribute information on severe winter storm mitigation	Winter Storm	IDHS	FEMA
High	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Ensure better coordination of state and local mitigation activities.	Provide state employees with NOAA weather radios	Extreme Temps	IDHS	FEMA
High	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Develop guidance for communities to minimize water usage and fuel reduction strategies	Extreme Temps, Drought	IDNR, USDA, OCRA, USGS, NRCS	OCRA, FEMA, DNR Forestry, USDA
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Develop water resource plan to coordinate local and state efforts to minimize drought impacts on water infrastructure and resources. Impacts include water quantity and quality of new developments	Extreme Temps, Drought	USGS, NRCS, OCRA, IDNR, IWRC, IDHS	HSEP, OCRA, IWRC
High	Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.	Retrofit critical and essential faciltiies and structures to withstand disasters.	Retrofit state facilities to provide adequate capabilities in the event of disasters. Include green infrastructure to reduce unnecessary strain on water resources	Winter Storm, Drought, Extreme Temps, Wildfire, Disease Outbreak, Fluvial Erosion Hazard	INDOT, URC, NRCS, INDOT, IOT, IDOC, IDHS	FEMA, HSEP, existing state and federal funding

Priority	Goal	Objective	Strategy	Hazard	Potential Collaborator(s)	Potential Funder(s)
Medium	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Create a media campaign that outlines the dangers of extreme temperatures, populations at risk, and actions to minimize exposure	Extreme Temps	ISDH, IDHS, FEMA, OFBCI, local universities	EMPG, HSEP, FEMA
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Convene a Drought Council (subcommittee of Silver Jackets) to meet regularly and discuss issues, concerns, and opportunities in design, training, and exercising to reduce risk to responders and built environment	Drought	INDOT, NRCS, USGS, IDHS, IGS, local universities	Existing programs
Medium	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Ensure better coordination of state and local mitigation activities.	Invite representatives from IDHS planning departments and local universities to participate as subcommittee of the Mitigation Council	Winter Storm, Drought, Extreme Temps, Wildfire, Disease Outbreak, Fluvial Erosion Hazard	IWRC, ISDH, local universities	FEMA, DHS, ICC, DHHS
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Increase outreach to elderly and disabled populations during extreme weather	Winter Storm, Drought, Extreme Temps	IDHS, ISDH	FEMA, DHHS
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Enhance statewide weather monitoring to better predict and communicate severe winter weather	Winter Storm	IDHS, Silver Jackets	FEMA
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Develop ordinances to prioritize controlled water use	Drought	Silver Jackets	OCRA, USDA
Low	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Develop drought contingency plans to include residential and agricultural water delivery	Drought	Silver Jackets	OCRA, USDA
Low	Minimize the loss of life and injuries caused by disasters.	Improve emergency sheltering.	Provide heating/cooling shelters with backup generators	Extreme Temps	IDHS	FEMA

Priority	Goal	Objective	Strategy	Hazard	Potential Collaborator(s)	Potential Funder(s)
Low	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Address wildfire vulnerability reduction in local zoning ordinances and land use plans	Wildfire	IDHS, IDNR, NRCS	USDA, NRCS
Low	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Improve education and training of emergency personnel and public officials.	Provide enhanced public awareness of open burn bans	Wildfire	IDHS, IDNR, NRCS	USDA, NRCS

7.2 Technological Hazards

Most technological hazards in Indiana are events that stem from breakdowns or weaknesses in industrial and construction processes. IDHS and The Polis Center are currently developing vulnerability analyses for technological hazards. These analyses will be incorporated into the 2017 version of the SHMP.

7.2.1 Dam and Levee Failure

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

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

In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. Many structures across the US have been under-funded or otherwise neglected, leading to the recognition that certain structures are unsafe or, rarely, can lead to actual failure. The threat of dam or levee failure may require substantial commitment of time, personnel, and resources. Since dams and levees deteriorate with age, minor issues become larger compounding problems, and the risk of failure increases.

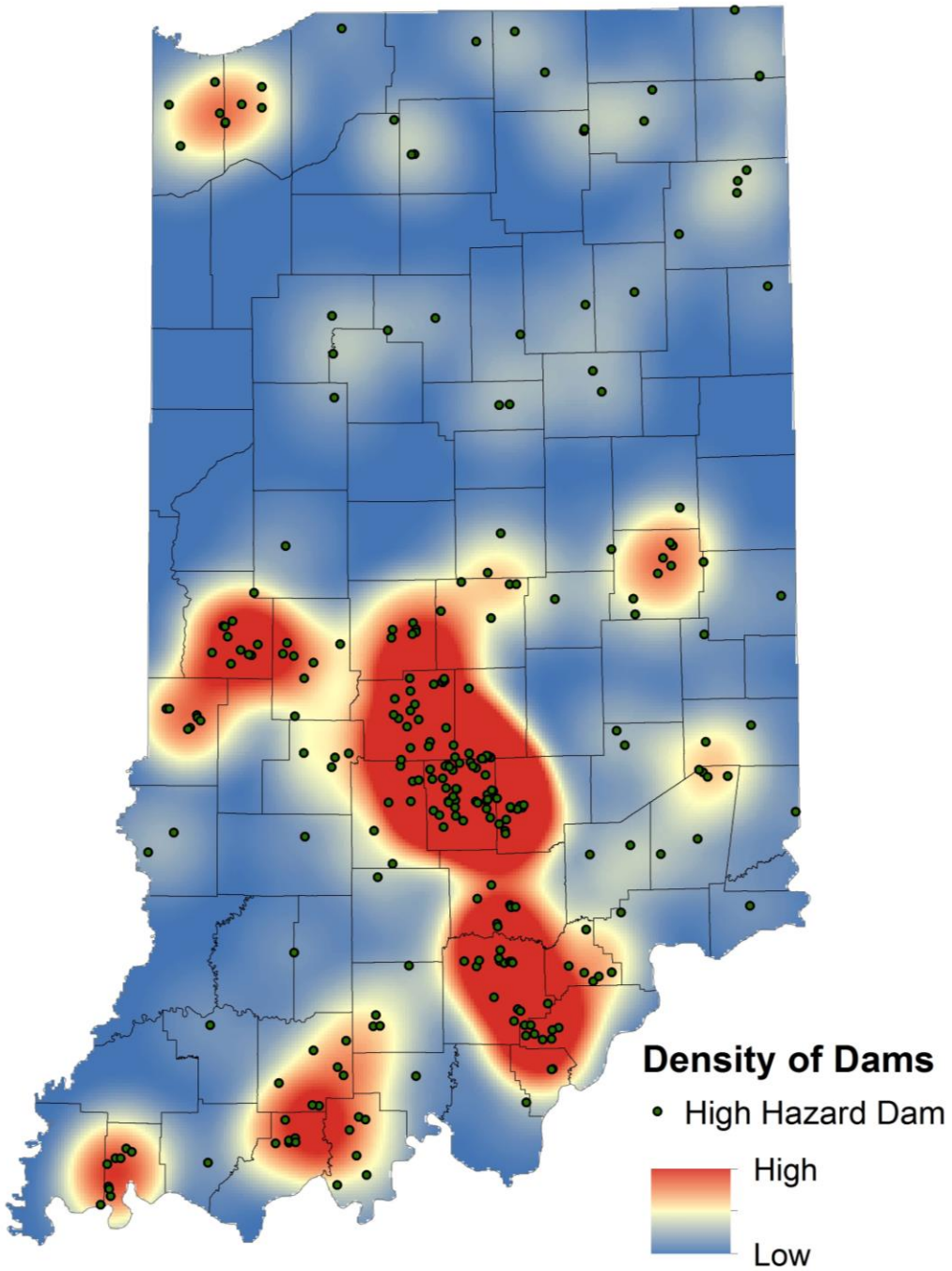
The IDNR Division of Water assigns the hazard potential for dams and levees based on the federal classification system. Table 43 below describes each hazard classification.

Table 43: EAP Hazard Classification

Federal Classification	Description
High	Probable loss of life, serious hazard to health, serious damage to homes, businesses, and industrial structures, infrastructure, and public utilities
Significant	Damage to low value, non-residential structures, local agricultural crops, and livestock
Low	Losses restricted mainly to the dam

Both population and infrastructure located downstream are at risk in the event of dam or levee failure. Developing an Incident and Emergency Action Plan (IEAP) and updated inundation maps is the first step toward highlighting the areas of greatest vulnerability in each community. Figure 85 shows the locations and density of high hazard dams in Indiana.

Figure 85: High Hazard Dams



7.2.2 Hazardous Materials Release

Hazardous materials are any solid, liquid, or gas that can pose a threat to human health and/or the environment due to being radioactive, flammable, explosive, toxic, corrosive, a biohazard, an oxidizer, an asphyxiant, or capable of causing severe allergic reactions. Hazardous materials are most often released as a result of accidents during transportation or at fixed facilities

The transportation of chemicals and substances along interstate routes and railroads is commonplace in Indiana. The rural areas of Indiana have considerable agricultural commerce, creating a demand for fertilizers, herbicides, and pesticides to be transported along rural roads. Also, Indiana is bordered by the Ohio River to the south. Barges transport chemicals and substances along these waterways daily. These factors increase the chance of hazardous material releases and spills throughout the State of Indiana.

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

7.2.3 Structural Fire

Structural fires are uncontrolled fires in populated areas that threaten life and property. Structural fires have many causes, including smoking, arson, industrial accidents, electrical malfunctions, damage to utility lines, laboratory accidents, lightning, and explosive or combustible materials.

Structural fires occur in virtually every community and are the most common hazard facing most communities in Indiana and across the country.

Each year in the United States, fires result in approximately 5,000 deaths and 25,000 injuries requiring medical treatment. According to the Federal Emergency Management Agency's National Fire Data Center, residential fires represent 78% of all structural fires and cause 80% of all fire fatalities. Tragically, over 40% of residential fires and 60% of residential fatalities occur in homes with no smoke alarms.

Table 44: 2010 State Fire Death Rates and Relative Risk by State

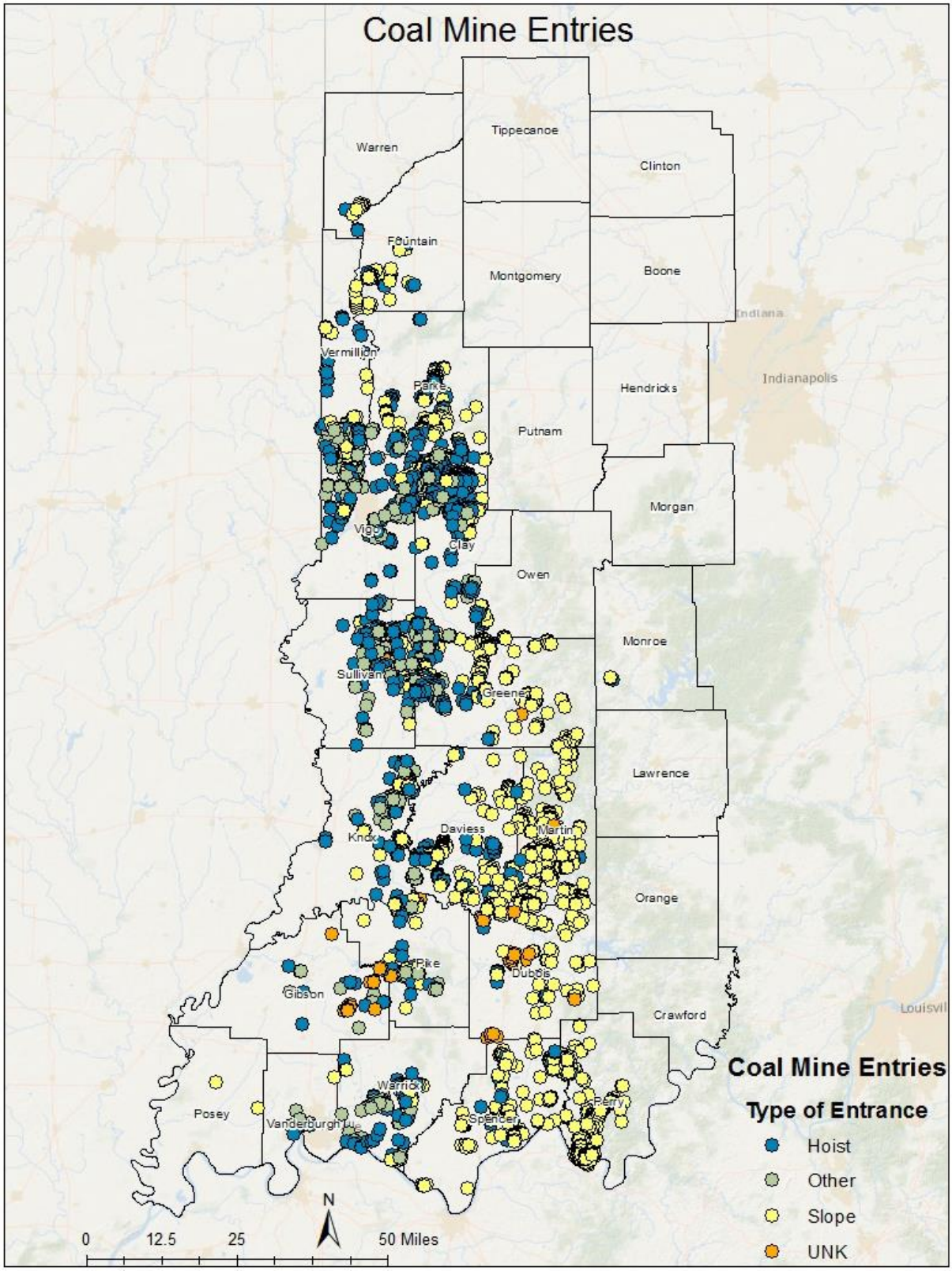
STATE	FIRE DEATH RATE
Alabama	28.2
Alaska	15.4
Arizona	5.5
Arkansas	13.3
California	6.3
Colorado	7.1
Connecticut	7
Delaware	15.6
District of Columbia	41.3
Florida	7.6
Georgia	16.9
Idaho	12.1
Illinois	8.5
Indiana	14.6
Iowa	10.8
Kansas	14
Kentucky	17.5
Louisiana	19.8
Maryland	12.3
Massachusetts	5.6
Michigan	13.3
Minnesota	8.1
Mississippi	25.3
Missouri	18.2
Montana	10.1
Nebraska	9.8
Nevada	6.7
New Hampshire	9.1
New Jersey	7.3
New Mexico	10.6
New York	7.9
North Carolina	12.6
Ohio	13.9
Oklahoma	22.3
Oregon	5.7
Pennsylvania	13.5
Rhode Island	12.4
South Carolina	12.5
South Dakota	12.2
Tennessee	21.7
Texas	10.3
Utah	6.8
Virginia	10.3
Washington	10.7
West Virginia	37.2
Wisconsin	8.1
United States	**11.1**

Source: http://www.usfa.fema.gov/statistics/estimates/states.shtm

7.2.4 Ground Failure (Subsidence)

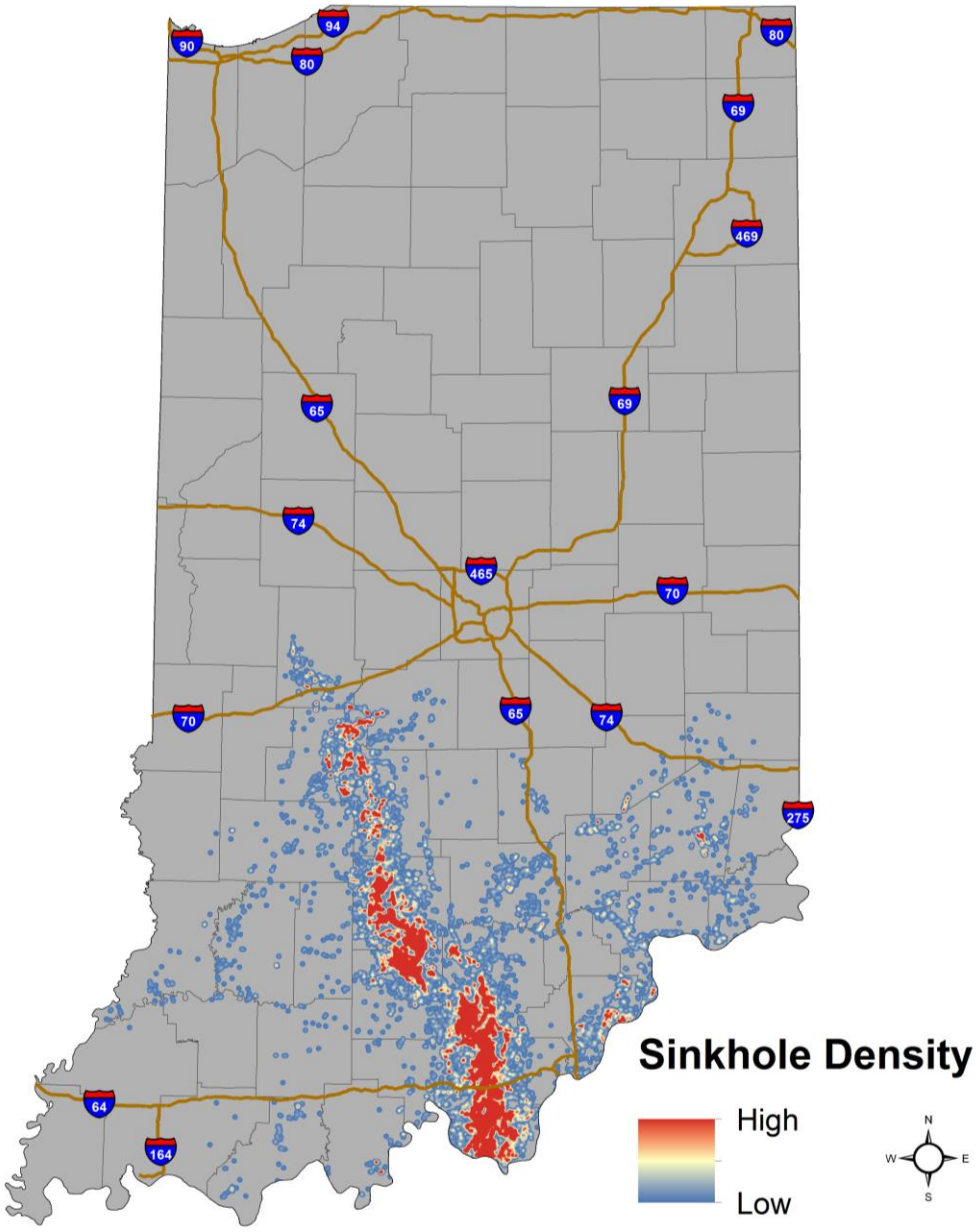
Indiana has networks of underground coal mines scattered throughout southern Indiana. Mine subsidence is a vertical ground movement caused by man-made underground mines. These coal mines can fail and create ground failures damaging anything on the overlying surfaces. Mine entrances may be classified as slopes (horizontal entrance) or hoists (vertical entrance). Most mine openings have been permanently sealed and present no danger. However, many openings were sealed improperly and present the risk of sudden collapse or deterioration of the fill material. Currently there is no way to know when or where mine subsidence will occur. Figure 86 maps known coal mine locations by type of entrance.

Figure 86: Indiana Underground Coal Mines



Southern Indiana has a network of underground caves formed by what is known as karst landscape. According to the Indiana Geological Survey (IGS), karst landscapes usually occur where carbonate rocks (limestone and dolostone) underlie the surface. Freely circulating slightly acidic water in the soil slowly dissolves the bedrock, causing karst formations. These karst formations have the potential to collapse under the weight of the ground above them creating a sinkhole. Ground failure of this nature is known as land subsidence. Any structures built above a karst formation could potentially be subject to land subsidence and collapse into a resulting sinkhole. Figure 87 shows the density of karst sinkholes in Indiana.

Figure 87: Indiana Sinkhole Density



7.2.5 Communications System Failure

Communications failure can include telecommunications failure, radio communications failure, and information technology (IT) failure.

Telecommunications assets consist of any electronic device—operated by a privately- or publicly-owned entity—used for the purposes of message delivery.

Telecommunications failure may have a significant impact on a community since nearly every aspect of modern life is dependent on digital infrastructure. Economic and national security, as well as emergency response and recovery, relies on the assets and operations of telecommunications infrastructure. Disruption to telecommunications systems, whether as a result of terrorist or other malicious attacks, natural disasters, or human failure to adhere to best practices, can lead to technological and financial losses, or even loss of life.

Radio communication failure is the severe interruption or loss of private and/or public radio communications systems. The disruption may be caused by equipment failure, deliberate or unintentional human acts, or as a result of a natural, technological, or human-induced disaster. The most common associated problems can range from minor, for example, brief public inconvenience, to severe losses of production and revenues for businesses and institutions and command and control at the government level.

Information technology (IT) infrastructure consists of all state government computers and servers, as well as Ethernet and Internet connectivity. The Indiana Office of Technology (IOT) manages IT operations for all state facilities, providing tools and services to support the regulatory, administrative, and daily operations of the state, including high-speed network with wireless access, central web hosting, free and low-cost software for individual use, tools and support for instruction and research, and supercomputers for data analysis and visualization.

An IT infrastructure failure may consist of a localized, statewide, or nationwide disruption of the hardware, programs, Ethernet, and/or Internet. Failure of any one of these elements can impact the entire IT system. Failure can result from the following exposures:

- Physical- consists of possible physical damage to server equipment and critical hardware caused by either natural hazards or intentional destruction
- Capacity- consists of possible overload of available resources resulting in services slowing or shutting down
- External- consists of an attack of the university network from either an external IP address or a computer with direct network access. External attacks undermine the confidentiality, integrity, and/or availability of hardware and the information on it.

7.2.6 Public Utility Failure

Public utility failure refers to short- or long-term disruptions to electrical power, water, and/or gas. There are two types of electrical failures: brownouts and blackouts. Brownouts occur when there is a brief drop in voltage due to excessive demand for power (e.g. during heat waves). Brownouts may last for a few minutes or few hours and cause lights to dim, appliance motors to slow, equipment to reset, and less heat/air to be generated. Blackouts occur when there is widespread loss of power as a result of a natural hazard, equipment failure, sabotage, or accident.

In the event of an electrical failure, numerous community functions may be affected, including information technology, communication, and emergency services. Additionally, public buildings could lose climate control, posing health risks during extreme heat or cold.

Water failure occurring from water pipe breaks can result in flood damage to buildings and infrastructure. Additionally, the loss of water usage may occur due to contamination of the water supply. Prolonged water failure can prevent or hinder daily operations and could affect the health and safety of the population.

Gas failure occurs as a result of a broken valve or ruptured pipeline and typically results in the release of natural gas into the environment or structure. The release of natural gas can ignite a fire or explosion, and prolonged exposure can lead to serious health risks, including loss of consciousness or death.

7.2.7 Air Transportation Incidents

Air transportation is used to carry human passengers, as well as thousands of tons of cargo. Aircraft accidents can occur for a variety of reasons, including mechanical failure, poor weather conditions, human error, and intentional causes. The majority of aircraft accidents takes place during take-off or landing and may affect unpopulated, residential, or metropolitan areas. Incidents involving military, commercial, or private aircraft can also occur while the aircraft is on the ground. Aircraft accidents can lead to incidents of significant property damage, environmental damage, fire, explosion, hazardous material release, serious injuries, and death.

7.2.8 Explosion

Accidental explosions may result from a variety of incidents, including but not limited to: fire, hazardous materials release, and failure of or damage to public utility lines. Accidental explosions can lead to property damage, short and long term health effects, serious injuries, and event death. Emergency response to incidents involving accidental explosions may require fire, safety/law enforcement, search and rescue, and hazardous materials units.

On October 10, 1933, a Boeing 247 Propliner, operated by United Airlines and registered as NC13304, crashed near Chesterton, Indiana. The transcontinental flight, carrying three crew and four passengers, originated in Newark, New Jersey with a final destination in Oakland, California. It exploded en route between stops in Cleveland, Ohio and Chicago, Illinois. All aboard died in the crash, which was proven to have been deliberately caused by an on-board explosive device. This was the first known intentional downing of a domestic airliner in the US.

7.2.9 Technological Hazards Mitigation Strategies

The following mitigation strategies apply to technological hazards in Indiana. Assuming funding is available, it is the intention that high priority strategies will be implemented within one year of plan adoption, medium priorities will be implemented within two years, and low priorities within three years.

Table 45: Technological Hazards Mitigation Strategies

Priority	Goal	Objective	Strategy	Hazard	Potential Collaborator(s)	Potential Funder(s)
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Conduct research on the social vulnerabilities associated with these hazards	Communications System Failure, Public Utility Failure, Air Transportation, Explosion	IUPUI, Silver Jackets	FEMA, NSF, NIH
High	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Develop guidance for communities to use to develop response plans to dam failures and identify evacuation routes. Local EMAs should provide opportunities for downstream residents to view inundation maps and provide information on risk and mitigation	Dam/Levee Failure	IDHS, IDNR, OCRA, USGS, USACE, NRCS, IEMA	OCRA, FEMA, NRCS, USACE
High	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Continue to work with Realtors, EMAs, dam owners to communicate risk of dam failures, responsibilities of owners for maintenance, and expand efforts to develop Incident and Emergency Action Plans (IEAPs)	Dam Failure	USGS, NRCS, OCRA, IDNR, IWRC, IDHS, USACE	HSEP, OCRA, IWRC, FEMA, IDNR
High	Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.	Retrofit critical and essential facilities and structures to withstand disasters.	Retrofit state facilities to provide adequate capabilities in the event of disasters. Include green infrastructure to reduce unnecessary strain on resources. Reduce power losses to state facilities by inclusion of dual fuel generators or burying of utilities	Communications System Failure, Public Utility Failure	INDOT, URC, NRCS, IDOA, IOT, IDOC, IDHS	FEMA, HSEP, existing state and federal funding
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Research historical occurrences and develop example case studies for training purposes	Communications System Failure, Public Utility Failure, Air Transportation, Explosion	IUPUI, Silver Jackets	FEMA, NSF, NIH

Priority	Goal	Objective	Strategy	Hazard	Potential Collaborator(s)	Potential Funder(s)
Medium	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Work with schools, university planners, and community organizations to facilitate the development of communities that are vulnerable to utility and communication failures. Develop plans to circumvent communications failures using existing lines of communication	Communications System Failure	IDHS, FEMA, URC, local universities, community organizations, local media	EMPG, HSEP, FEMA
Medium	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Ensure existing communications networks and information networks are resistant to compromise from outside sources through education of users, plans for continuity of operations, and secure systems to protect data	Communications System Failure	IOT, URC, IPSC, local universities	HSEP, DHS, DHHS, existing state and federal funding
Medium	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Ensure better coordination of federal, state, and local mitigation activities.	Invite representatives from local universities, federal partners, and the planning, technical, and preparedness department of IDHS to participate as a subcommittee of the Mitigation Council	Dam/Levee Failure, Ground Failure, Structural Fire, Hazmat, Communications System Failure, Public Utility Failure, Air Transportation, Explosion	IDHS, ISDH, local universities	FEMA, DHS, DHHS
Low	Promote research education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Conduct new studies/research to profile hazards and promote mitigation.	Add additional technological hazards to the SHMP	NA	IDHS	Existing programs

7.3 Human Hazards

The SHMP has a stronger focus on the risk assessment and mitigation of natural hazards for many reasons, but primarily because there is better understanding of the return period for most natural hazards. The frequency and potential severity of human hazards is far less predictable. The State is beginning to conduct more research into understanding the social vulnerabilities of such disasters, and the 2017 version of the SHMP will begin to address these in more detail. Other planning efforts, including the Indiana Threat/Hazard Identification and Risk Assessment (THIRA) addresses the preparedness and response activities related to human hazards.

7.3.1 Cyber Attack

Cyber attacks are intentional attempts to illegally access or harm part or all of an IT infrastructure system. Unlike physical attacks which can be immediately responded to, cyber attacks are often difficult to identify and address. Cyber attacks can be in the form of viruses which alter or erase programs and systems, accessing and/or altering restricted files or systems, and accessing the computer or device of another person to attack others or steal confidential information. Cyber attacks can have wide-ranging effects on the individual, organizational, community, and national level.

These risks include:

- Organized cybercrime, state-sponsored hackers, and cyber espionage can pose national security risks.
- Transportation, power, and other services may be disrupted by large-scale cyber incidents.
- Vulnerability to data breach and loss increases if an organization's network is compromised. Information about a company, its employees, and its customers can be at risk.
- Individually-owned devices such as computers, tablets, mobile phones, and gaming systems that connect to the Internet are vulnerable to intrusion. Personal information may be at risk without proper security[2].

7.3.2 Active Shooter

An active shooter is a person who appears to be actively engaged in killing or attempting to kill people in a populated area — typically employing the use of firearms. In some cases, active shooters use other weapons and/or improvised explosive devices (IED) to cause additional victimization and act as an impediment to law enforcement and emergency services responders. There may be no pattern or method to their selection of victims.

These situations are dynamic and evolve rapidly, demanding immediate deployment of law enforcement resources to stop the shooting and mitigate harm to innocent victims. The average active shooter incident lasts approximately 12 minutes, while 37 percent last less than five minutes. In 57 percent of active shooter incidents, police arrive while the shooting is still underway[3].

[2] Source: http://www.ready.gov/cyber-attack

7.3.3 Arson

Arson is any willful or malicious burning, or attempt to burn—with or without intent to defraud—a dwelling, public building, motor vehicle or aircraft, and/or the personal property of another individual or entity. The FBI reports that in 2011, there were 18.2 arson offenses from every 100,000 inhabitants nationwide. Nearly 46 percent of all arson offenses involved structures (e.g., residential, storage, public, etc.) Mobile property was involved in 23.9 percent of arsons, and other types of property (such as crops, timber, fences, etc.) accounted for 30.2 percent of reported arsons.

7.3.4 CBRNE Attack

CBRNE refers to chemical, biological, radiological, nuclear, or explosive attacks. There is a growing threat of terrorism incidents employing biological, chemical, and radiological agents. A biological agent is a naturally occurring substance that can cause harm to living organisms and can be adapted for use as a weapon (i.e., anthrax, cholera, and tularemia.) It is estimated that there are over 1,200 biological agents that can be found or modified into liquid droplets, aerosols, or dry powders. Chemical agents are primarily produced with the purpose to incapacitate or kill. Chemical agents can be found in liquid, gas, or solid form and are disseminated by using heat to evaporate the agent, exploding munitions, or a mechanical spray device. Radiological agents can be naturally occurring or manmade and may be weaponized using an explosive device. Exposure to radiological agents can cause changes in cell growth and functioning, resulting in significant health issues, or death.

7.3.5 Hostage Situation

Hostage situations involve an individual or group being forcefully held by another individual or group as security against an implied threat, or in order to assure that specified terms are met in a conflict. Barricade situations involve an individual or group that have taken position in a physical location, most often a structure or vehicle, and does not allow immediate police access and refuses police orders to exit. Subjects of barricade situations may be known to be armed, thought to be armed, have access to weapons in the location, or be in an unknown weapon status. Hostage and barricade situations may be the result of individual criminal activity, public disturbances, or terrorism.

7.3.6 Riot

Riots and civil unrest occur when groups or individuals disrupt a community to the degree that intervention is required to protect public safety. They typically occur in more urban areas or where there are dense populations. Common triggers of such events include racial tension, religious conflict, unemployment, and unpopular political actions. In extreme cases, riots and civil unrest can result in injuries, deaths, and property damage. The most common activities associated with this hazard include looting, vandalism, and arson.

7.3.7 Terrorism

There is no universally accepted definition of terrorism, even among US government agencies. The Code of Federal Regulations (CFR) defines terrorism as "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives (28 C.F.R. Section 0.85). Acts of terrorism can occur in many forms, depending on technological means available to the terrorist, the motivation behind the act, the points of weakness of the target, and the terrorist's ingenuity.

Sabotage is the destruction of property or an obstruction of normal operations in order to defeat, hinder, or subvert a cause or endeavor. Acts of sabotage may be carried out by an individual or group, for the purpose of terrorism or in the course of a public disturbance. Sabotage can take many forms, including: bombings; organized extortion; use of biological, chemical, and radiological agents; pre-meditated plans of attack on institutions of public assembly; information technology disruptions; ethnic/religious/gender intimidation; and disruption of legitimate scientific research or resource-related activities.

7.3.8 Human Hazards Mitigation Strategies

The following mitigation strategies apply to human hazards in Indiana. Assuming funding is available, it is the intention that high priority strategies will be implemented within one year of plan adoption, medium priorities will be implemented within two years, and low priorities within three years.

Table 46: Human Hazards Mitigation Strategies

Priority	Goal	Objective	Strategy	Hazard	Potential Collaborator(s)	Potential Funder(s)
High	Promote research, education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Review and update existing, or create new, community plans, maps, and ordinances.	Work with state agencies to complete the state recovery plan, continuity of government, and continuity of operations plans for all state agencies	Cyber Attack, Active Shooter, Arson, CBRNE Attack, Hostage Situation, Riot, Terrorism	State Personnel Department, IDOC, IDHS, Governor	HSEP, IDHS, existing state funding
High	Lessen the impacts of disasters to new and existing infrastructure, residents, and responders.	Retrofit critical and essential facilities and structures to withstand disasters.	Examine mitigation and prevention design in the restoration or construction of state facilities	Cyber Attack, Active Shooter, Arson, CBRNE Attack, Hostage Situation, Riot, Terrorism	INDOT, URC, IDOA, IOT, IDOC, IDHS	FEMA, HSEP, existing state and federal funding
Medium	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Expand the "see something, say something" campaign to include specific threats found on social media and in workplace, schools, and at home	Cyber Attack, Active Shooter, Arson, CBRNE Attack, Hostage Situation, Riot, Terrorism	IDOE, ISP, IDHS, community organizations	DOJ, HSEP, FEMA
Medium	Minimize the loss of life and injuries caused by disasters.	Develop public awareness and outreach programs.	Provide additional training for private industry and other businesses on human hazards	Cyber Attack, Active Shooter, Arson, CBRNE Attack, Hostage Situation, Riot, Terrorism	ISP, IDHS, IDOE	DOJ, DHS, HSEP
Medium	Promote research, education, and outreach to expand Indiana's knowledge about disasters and their impacts.	Improve education and training of emergency personnel and public officials.	Develop training program on impacts of human hazards on infrastructure and residents in Indiana. Continue exercise program development and mitigation opportunities for human hazards	Cyber Attack, Active Shooter, Arson, CBRNE Attack, Hostage Situation, Riot, Terrorism	IDHS, ISDH, IDOC, INDOT, IDOA	Existing programs
Medium	Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.	Ensure better coordination of federal, state, and local mitigation activities.	Collaborate to ensure that prevention programs also include mitigation actions where possible	Cyber Attack, Active Shooter, Arson, CBRNE Attack, Hostage Situation, Riot, Terrorism	IDHS, ISDH	FEMA, DHS, DOJ, DHHS

Section 8 Local Capabilities to Mitigate Hazards

8.1 Local Funding and Technical Assistance

IDHS supports the development of local mitigation plans through funding, technical assistance, and domain expertise, primarily through its role within the Indiana Silver Jackets. Additionally, IDHS relies on ongoing partnerships with nonprofit and private contractors and academic institutions that work with local jurisdictions to support education, outreach, and planning.

Local capabilities continue to vary widely throughout the state. Some are proactive where there is a significant risk. The 2011 plan identified the efforts in the southwestern part of the state where Evansville (Vanderburgh County) and surrounding counties have actively pursued changes in local and state building codes to assure tighter seismic control on buildings. In addition they have retrofitted fire stations, hospitals, and nursing homes and developed outreach programs to educate the public on how to make their residences earthquake-safe.

Another example of strong local capability is within the City of Columbus in Bartholomew County. The Columbus Flood Risk Management Plan was completed in June of 2013 and addresses all aspects of the flooding risk in the community. The plan assesses the threat from local streams, provides the background information for the Flood Response & Evacuation Plan, evaluates opportunities to mitigate flooding risks for specific streets and neighborhoods, and identifies regulatory actions that could prevent the flooding risk from become worse. The Columbus Flood Risk Management Plan was recognized with the 2013 Excellence in Floodplain Management award from the Indiana Association for Floodplain and Stormwater Management (INAFSM). The plan is available online at http://www.columbus.in.gov/planning/flood.

INDIANA BEST PRACTICE (City of Columbus Flood Response)

June of 2008 -- Although the City had what could be described as a normal rain event, the entire watershed had heavy rain over the weekend. The city which is at the bottom of the watershed suffered flooding to critical and essential facilities. Damaging their major employer and the Regional Hospital to the point the hospital was out of service for well over six months. The City leveraged local funding with a planning grant from the Indiana Housing and Community Development Authority (IHCDA) to develop not only a flood response plan, but a ***comprehensive*** Flood Risk Reduction Plan.

A final example of strong local capability is demonstrated by the Town of Spencer and the City of Indianapolis, which both have developed flood response plans that leverage the USGS flood libraries.

One measure of the improved local capabilities is the status of the local planning effort and the ongoing activity to update the plans. In the past five years, all 92 of Indiana's counties have completed a multi-hazard mitigation plan (MHMP) and most are in the process of completing their first five-year update. For 72 of these counties, IDHS partnered with The Polis Center at IUPUI to include Hazus level 2 analyses in their MHMP risk assessments. The level 2 analysis uses the county's local data to best estimate the potential physical, social, and economic losses of a disaster. These results better inform mitigation and planning strategies.

Local capabilities are enhanced by the Indiana Association of Regional Councils, a statewide association of regional planning organizations that promotes regional strategies and solutions to address local issues and also supports grant writing. In the past five years, IARC has actively supported the long-term recovery efforts in local jurisdictions for damages caused by federal declarations DR-1740, DR-1766, and DR-1795.

IARC Regions (Figure 88):

1. Economic Development Coalition of Southwest Indiana
2. East Central Indiana Regional Planning District
3. Indiana 15 Regional Planning Commission
4. Kankakee-Iroquois Regional Planning Commission
5. Madison County Council of Governments
6. Michiana Area Council of Governments
7. Northeastern Indiana Regional Coordinating Council
8. Northwestern Indiana Regional Planning Commission
9. Region III-A Economic Development District & Regional Planning Commision
10. River Hills Economic Development District & Regional Planning Commission
11. Southeastern Indiana Regional Planning Commission
12. Southern Indiana Development Commission
13. West Central Indiana Economic Development District

Figure 88: IARC Regions

8.2 Local Plan Integration

The current process of integrating local data and mitigation strategies into statewide planning efforts has been completed on an as-needed basis and as existing resources allow. IDHS will work with The Polis Center between 2014 and 2017 to develop a new process that will streamline the review of local MHMPs and improve integration with the SHMP to capture disaster information (descriptions, losses, and claims) and status of mitigation projects and activities in the most efficient and timely way. These data will be used to generate an annual report for the Indiana Silver Jackets.

8.3 Process of Prioritizing Local Mitigation

When prioritizing local mitigation activities, IDHS considers federal priorities for funding, priorities of the governor and legislature, and the cost-benefit of each proposed activity to ensure the greatest benefit for the funds expended. To this end, the state initially focused on the development of MHMPs in communities where population and growth were fueling rapid development. In response, many of these communities have developed strong, coordinated ordinances to discourage development in the floodplains. This has been relatively easy as these communities typically have large, open areas for residential and commercial growth.

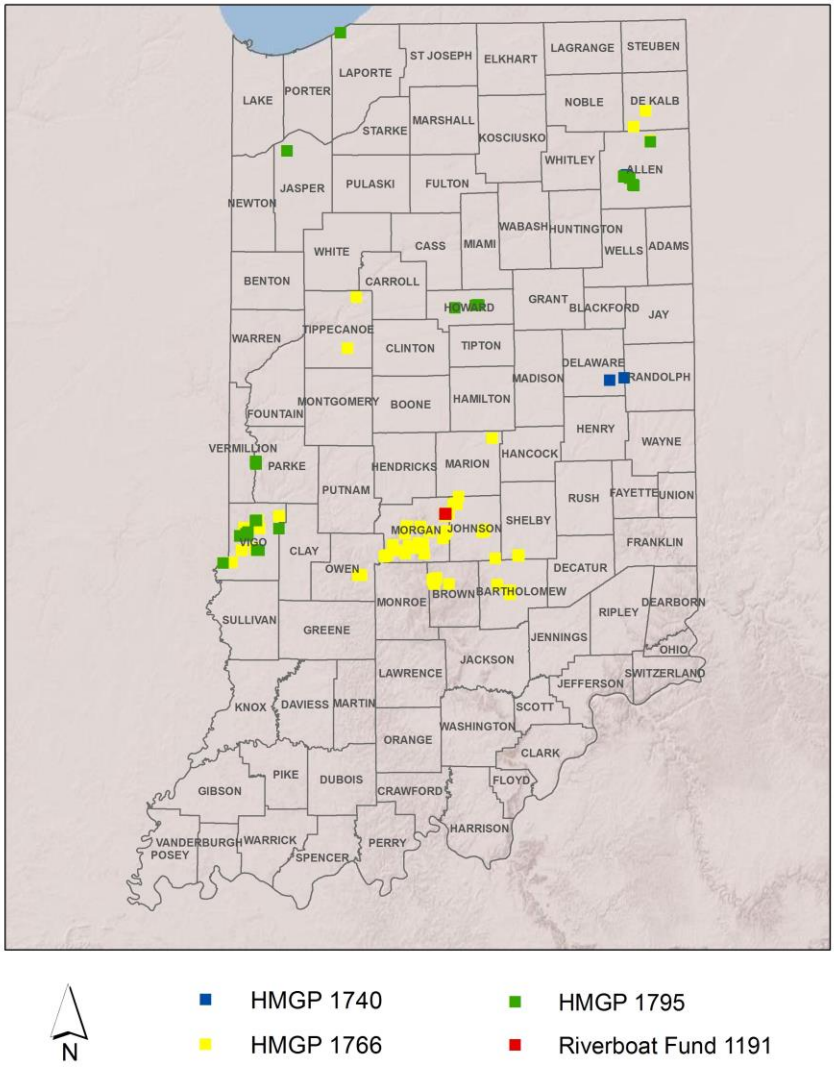
The State has focused on these communities' legacy areas where development had taken place prior to the delineation of floodplain and flood risk. It will continue to be necessary to focus as much funding as possible to assist these communities in reducing existing risk by providing technical assistance and working to integrate risk reduction into their comprehensive planning efforts.

In the future, the state's problems will be in areas that were populated and saw growth in the earlier decades and centuries and are beginning to see renewed growth. These are the larger, older urban areas where the new generations are moving back to the metropolitan areas. These communities—such as Indianapolis, Evansville, and Fort Wayne—have a smaller inventory of undeveloped or underdeveloped land and seem more likely to make the same mistakes for the same reasons they made when the area was first developed.

These areas also have the most repetitive and severe repetitive loss properties in the state, which positions them as areas of highest vulnerability. In past years, prioritization was based primarily on availability of funding, financial status of the community (small and impoverished communities had priority), repetitive loss status, and federal mandates. Communities with the greatest number of repetitive loss and severe repetitive loss (SRL) properties were the focus of the state's planning and mitigation activities in recent years. As a result, Indiana has made significant strides in buying out these repetitive loss properties. Since 2008, the State has acquired more than 750 properties.

Figure 89 shows the location of acquisitions by program over the past five years.

Figure 89: Acquisitions by Program Since 2008



In 2013, IDHS updated its process of prioritization to include FEMA Region V's Community Action Potential Index (CAPI), which uses multiple risk indicators to rank Indiana's communities and determine which have the highest overall risks, as well as the capacity and inclination to take actions to mitigate these risks.

CAPI identified 20 communities as Tier 1, the highest priority group to begin taking mitigation actions in programs like Risk MAP, Pre-Disaster Mitigation (PDM) program, Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP), etc. This section lists mitigation strategies for these communities as identified in their multi-hazard mitigation plans, or in Risk MAP's Action Tracker, a tool that collected mitigation strategies as part of the Resiliency Meeting.

8.4 Communities at Greatest Risk

Table 47 lists the top 20 CAPI communities and describes one of their most significant risk factors respectively.

Table 47: Risk Factors of Top 20 CAPI Communities

Community Name	CAPI Score	CAPI Risk Factors
City of Indianapolis	92.24	More than $6.5 million in repetitive losses
City of Columbus	83.20	More than 20% of the community within SFHA
City of Noblesville	79.43	Nearly 20% of the community within the SFHA
Morgan County	77.30	Nearly 20% of the community within the SFHA
Bartholomew County	72.29	More than 20% of the community within SFHA
Clark County	69.34	More than 25 repetitive loss occurrences
City of Martinsville	67.46	Has experienced more than $29.40 per capita ratio in Individual Assistance
Town of Munster	67.11	More than $25 million in insurance claims
City of Kokomo	66.68	30 repetitive loss occurrences
Lake County	66.03	Contains 6 of the 20 Tier 1 communities
Hamilton County	65.82	Nearly 10% of the community within the SFHA
City of Hammond	65.10	Nearly $1.5 million in insurance claims
Town of Highland	64.45	More than $9.2 million in insurance claims
City of Carmel	62.87	Has levees and high-risk dams
Jackson County	61.93	More than 25% of the community within the SFHA
Gibson County	61.83	More than 30% of the community within the SFHA
City of Lake Station	61.47	More than $1 million in repetitive losses
Howard County	61.11	More than $1.7 million in insurance payments
Town of Spencer	60.31	More than $2.1 million in insurance payments
Posey County	59.93	Nearly 40% of the community within the SFHA

8.5 Status of Multi-Hazard Mitigation Plans

Table 48 lists the status of each of the top 20 CAPI plans. Most communities are included in the larger county mitigation plan.

Table 48: Status of Local MHMPs

Community Name	MHMP Title	MHMP Status
City of Indianapolis	Marion County Multi-Hazard Mitigation Plan	Update approved in 2013
City of Columbus	Bartholomew County Multi-Hazard Mitigation Plan	Adopted 2009; to be udpated
City of Noblesville	Hamilton County Multi-Hazard Mitigation Plan	Adoptions for 2013 update in progress
Morgan County	Morgan County Multi-Hazard Mitigation Plan	Funding approved for update
Bartholomew County	Bartholomew County Multi-Hazard Mitigation Plan	Funding approved for update
Clark County	Clark County Multi-Hazard Mitigation Plan	Funding approved for update
City of Martinsville	Morgan County Multi-Hazard Mitigation Plan	Funding approved for update
Town of Munster	Lake County Multi-Hazard Mitigation Plan	Adopted 2010; scheduled for 2014 update
City of Kokomo	Howard County Multi-Hazard Mitigation Plan	Adopted 2010; scheduled for 2014 update
Lake County	Lake County Multi-Hazard Mitigation Plan	Adopted 2010; scheduled for 2014 update
Hamilton County	Hamilton County Multi-Hazard Mitigation Plan	Adoptions for 2013 update in progress
City of Hammond	Lake County Multi-Hazard Mitigation Plan	Adopted 2010; scheduled for 2014 update
Town of Highland	Lake County Multi-Hazard Mitigation Plan	Adopted 2010; scheduled for 2014 update
City of Carmel	Hamilton County Multi-Hazard Mitigation Plan	Adoptions for 2013 update in progress
Jackson County	Jackson County Multi-Hazard Mitigation Plan	Funding approved for update
Gibson County	Gibson County Multi-Hazard Mitigation Plan	Funding approved for update
City of Lake Station	Lake County Multi-Hazard Mitigation Plan	Adopted 2010; scheduled for 2014 update
Howard County	Howard County Multi-Hazard Mitigation Plan	Update in progress
Town of Spencer	Owen County Multi-Hazard Mitigation Plan	Adopted 2010; scheduled for 2014 update
Posey County	Posey County Multi-Hazard Mitigation Plan	Funding approved for update

8.6 Mitigation Strategies and Actions

The 2011 SHMP included a list of select mitigation strategies from 72 local MHMPs. Table 49 has been updated to reflect changes and additions to the list of top mitigation strategies for each county, as well as MHMP status and status of mitigation strategy when data was available. The State will continue to monitor the mitigation progress and successes of local jurisdictions.

Table 49: Local MHMP Mitigation Strategies

County	Hazard	Mitigation Strategy	Status of MHMP
Adams	Multiple	Establish water conservation ordinances and contingency plans	5-year update complete
	Hazmat Spills	Evaluate impact of chemicals being transported through Adams County	
Allen	Flood	Prepare enhancements for the City of Fort Wayne and Allen County to advance into a higher Class rating	5-year update complete
	Drought	Establish and adopt the State of Indiana (or local) water conservation ordinance	
Bartholomew	Flood	Conduct and implement flood protection studies	Plan approved; pending 5-year update
	Multiple	Encourage watershed based solutions to resolve flooding problems	
Benton	Flood	Develop retention ponds or equivalent to mitigate runoff from tiles in rural farm areas	5-year update complete
	Winter Storms	Purchase generators or transfer switch to provide back-up power to shelters, including churches	
	Thunderstorms	Purchase and install new warning sirens within the county	
Blackford	Winter Storms	Implement new plans for public education including distribution of literature regarding family safety measures	5-year update complete
	Hazmat Spills	Develop an evacuation plan for hazardous materials spills	
	Tornados	Upgrade existing and install new warning sirens	
Boone	Tornados	Harden fire and police stations; electric, water, and sewer plants, and government buildings	Plan approved
	Hazmat Spills	Establish a first response Hazmat Spills team, conduct appropriate training, and procure equipment	
	Flood	Institute a voluntary buy-out plan for the following areas: SR 47 and Stillcock, Old Mill SRA, Creek Road and Fall Road	
Brown	Multiple	Establish safe rooms in vulnerable locations	Plan approved; pending 5-year update/funded
	Flood, Dam/Levee Failure	Require an Emergency Action Plan for high hazard dams	
Carroll	Flood	Continue to buy-out or flood-proof houses, farms, and mobile homes	Plan approved
	Winter Storms	Acquire backup generators to run the wastewater treatment plant and the local shelter in the event of a disaster or extended power outage due to power lines downed by ice	
	Thunderstorms	Institute a mass notification system, e.g. Reverse 911, to cover all communities within the county	
Cass	Fire	Develop a public education program to inform residents of potential hazards and emergency plans	Plan approved
	Flood	Institute a buy-out plan for the Goose Creek area (approx 12-18 homes)	
	Multiple	Procure back-up generators or transfer switches for all essential facilities	

County	Hazard	Mitigation Strategy	Status of MHMP
Clark	Flood, Dam/Levee Failure	1 Drainage improvements; including channel widening, and monitoring and analysis of dams 2 Inform the community on action plans for flooding	Plan approved; pending 5-year update/funded
	Tornados	Siren and warning signal Installations countywide	
	Winter Storms	Provide for contracting private snow removal	
Clay	Winter Storms	Improve winter road clearing abilities	Plan approved; pending 5-year update
	Multiple	Acquire back-up generators for public facilities, shelters, utilities, EMS, firehouses	
	Flood	Address erosion along creeks and streams	
Clinton	Flood	Continue to enforce and update the county's floodplain ordinance	Plan approved
	Thunderstorms	Implement new plans for public education including distribution of first aid kits and weather radios and pamphlets that address the importance of retrofitting infrastructure	
	Winter Storms, Fires	Work with the State to organize a District 4 meeting to address protocol for shared equipment within the district and training efforts	
Crawford	Tornados	Upgrade/install sirens	Plan approved; pending 5-year update/funded
	Thunderstorms	Improve floodplain zoning	
	Earthquake	Harden structures	
Daviess	Flood	Conduct a study to determine the impact of upgraded drainage in Elnora	Plan approved
		Conduct a study to confirm that well heads located within floodplains are flood proofed	
	Winter Storms	Purchase additional snow removal equipment	
Dearborn	Multiple	Install Reverse 911 system to serve entire county	5 year update in progress
	Thunderstorms	Improve storm management enforcement	
	Winter Storms	Purchase special track tires for emergency vehicles	
Decatur	Winter Storms	Coordinate with neighboring counties for severe weather alerts	Plan approved
	Tornados	Install outdoor warning sirens, countywide	
	Thunderstorms	Improve storm water management	
	Hazmat Spills	Increased training and public awareness for hazardous materials spills	
Dekalb	Flood	Assess vulnerability of individual structures in the SFHA	5 year update in progress
	Hazmat Spills	Ensure that all SARA Title III facilities have current response plans and facility maps on file with local EMAs and Fire Departments	
Delaware	Thunderstorms	Improve outdoor warning siren coverage	5 year update in progress
	Flood	Separate storm and sanitary sewers	
Dubois	Flood	1 Construct a berm around the sewage treatment facility 2 Institute a buyout plan for repetitive loss properties within the county	Plan approved
	Hazmat Spills	Implement NOAA's radio system for hazmat spill alerts	
	Fire	Develop a public education program to present at public events	
Elkhart	Multiple	Inventory and evaluate existing outdoor warning systems;	Plan approved; pending 5-year update/funded
	Winter Storms	Develop tiered winter advisory levels;	
Fayette	Flood	Purchase/acquire repetitive loss properties	Plan approved
	Winter Storms	Bury power and telephone lines	
	Multiple	Add shelter capacity	

County	Hazard	Mitigation Strategy	Status of MHMP
Floyd	Earthquake	Install inertial shutoff valves on gas lines in critical facilities	Plan approved; pending 5-year update/funded
	Tornados	New construction of a comprehensive EMA facility and shelter to allow intergovernmental communications and relief efforts	
	Floods, Thunderstorms	Review and adjust storm water maintenance and management procedures	
Fountain	Flood	Install permanent signage to warn residents of flash flood area on Jackson Street, Main Street, Mill Street, and Washington Street	Plan approved
	Multiple	Develop emergency plans for procurement of food and water for existing shelters	
	Winter Storms	Create a natural snow fence to mitigate damage from Winter Storms hazards	
Franklin	Flood	Conduct a technical engineering study on the possibilities to reduce flooding along creeks and streams	Plan approved; pending 5-year update
	Multiple	Purchase weather radios for all public buildings if possible – radios currently do not work due to hilly terrain.	
	Tornados	Install new sirens in communities where they do not currently exist.	
Fulton	Winter Storms	Purchase pre-treatment supplies to provide management of ice/snow covered intersections that are elevated	Plan approved
	Tornados	Harden existing shelters	
	Dam/levee Failure	Conduct a hydrology study to determine where to replace or install culverts/ditches	
Gibson	Tornados	Create new tornado/severe thunderstorm shelters within Gibson County.	5 year update in progress
	Flood	Continue to enforce and update the county's floodplain ordinance	
	Earthquake	Harden the Emergency Operations Center and set the facility up as a shelter.	
Grant	Flood	Repair levee at Johnstown	Plan approved
	Tornados	Enforce codes requiring mobile homes to have tie-downs	
	Multiple	Purchase new generators for county buildings	
Greene	Flood	Permanent road gates at Long Tree and Highway 157	Plan approved; pending 5-year update
	Hazardous Materials	Emergency response team	
	Multiple	Back up power to utilities, fire stations and EMS	
Hamilton	Multiple	Provide multi-lingual hazard preparedness literature at public facilities and websites	Plan approved; pending 5-year update
	Flood	Train GIS staff in Hazus-MH to quanitfy estimate losses	
Hancock	Flood	Prohibit construction of critical facilities in known hazard areas	Plan approved; pending 5-year update
	Multiple	Use GIS to map areas of previous occurances and damage	
	Dam/Levee Failure	Restrict unauthorized access to dams	
Harrison	Flood	Develop plans for watershed and storm water management	Plan approved; pending 5-year update
	Tornados	Examine the feasibility of purchasing a reverse 911 system for alerting Harrison County's residence during a tornado or severe thunderstorm event.	
	Multiple	Construction of public shelters	
Hendricks	Flood	Maintain channels and regulate drains	Plan approved; pending 5-year update
	Hazardous Materials	Establish and maintain HazMat Response Team	
Henry	Flood	Provide the community with information on how to protect themselves in a flood	Plan approved
	Tornados	Increase the range of sirens in Henry County, and install new sirens in areas where they do not currently exist	

County	Hazard	Mitigation Strategy	Status of MHMP
Howard	Flood	Acquire property of repetitive flooding along Wildact Creek	5 year update complete
Huntington	Tornados	Harden, relocate, or reconstruct critical facilities—especially fire stations and schools—and shelters and trailer parks throughout the county	Plan approved
	Flood	Institute a buy-out plan for homes along the Wabash River and Little Wabash River	
	Thunderstorms	Improve storm water management	
	Hazmat Spills	Conduct a commodity flow study for safety concerns	
Jackson	Multiple	Purchase weather radios for public buildings and mobile homes	Plan approved; pending 5-year update/funded
	Tornados	Increase the range of sirens in Jackson County, and install new sirens in communities where they do not currently exist	
	Thunderstorms	Build shelters in large gathering areas such as ball fields, fair grounds, and parks, and in areas with less-stable housing.	
Jasper	Flood	Buy out 8 homes on Austin Street that are located in a flood-prone area	Plan approved; pending 5-year update
	Multiple	Provide safe housing for victims of disasters	
	Thunderstorms, Tornados	Implement the requirement of tie-downs for all manufactured housing	
Jay	Multiple	Procure generators or transfer switches for all essential facilities	Plan approved
	Thunderstorms, Tornados	Upgrade existing and install new warning sirens	
	Flood	Develop zoning plans to help communities participate in the National Flood Insurance Program	
Jefferson	Flood	Channelization to reduce flooding	Plan approved; pending 5-year update
	Multiple	Implement warning system to serve entire county	
	Thunderstorms	Emergency power for water distribution	
Jennings	Multiple	1 Construct storm shelters to be placed in strategic locations 2 Construct a hardened EOC	Plan approved; pending 5-year update
	Tornados	Apply for Homeland Security or other grant funding opportunities for tie-downs for mobile homes.	
	Dam/levee Failure	Encourage dam-improved maintenance, particularly the Country Square Lakes Dam.	
Johnson	Flood	Work with DNR on a plan to re-channel Young Creek and clear log jams	5 year update in progress
	Multiple	Establish an emergency team utilizing resources from Franklin Armory and Camp Atterbury	
	Tornados	Install new warning sirens within the county	
Knox	Flood	Certification of levees	Plan approved; pending 5-year update
	Multiple	Reverse 911	
Kosciusko	Multiple	Harden fire stations	Plan approved
	Thunderstorm, tornados	Procure new sirens	
	Winter Storms	Procure emergency generators or transfer switches for schools, fire stations, community centers, and shelters	
Lagrange	Winter Storms	Procure emergency generators for schools, fire stations, community centers, and shelters; also portable generators for lift stations	Plan approved
	Tornados	Upgrade existing and install new warning sirens, especially in unincorporated areas	
	Multiple	Establish a new hardened shelter	

County	Hazard	Mitigation Strategy	Status of MHMP
Lake	Flood	Develop an EAP for Lake George and complete any necessary repairs to reduce chances of overtopping in Hobart	Plan approved
	Multiple	Distribute weather radios to residents in mobile homes, nursing homes, and major businesses in Dyer	
	Winter Storms, Thunderstorms	Trim trees to minimize the amount/duration of power outages in Griffith	
LaPorte	Dam/Levee Failure	Use bio-engineered bank stabelization techniques	Plan approved; pending 5-year update/funded
	Thunderstorm, Flood	Perform routine debris clearance along banks	
Lawrence	Flood	Better signage, cross bars, and locked gates at certain roads to limit traffic.cross bars, and locked gates at certain roads to limit traffic	Plan approved; pending 5-year update
Madison	Flood	Maintain channels and regulated drains to control flooding	5 year update in progress
	Multiple	Utilize outdoor warning sirens to alert the public of adverse weather conditions	
Marion	Flood	Reduce flood insurance premiums through increased participation in the NFIP's CRS program	5 year update in progress
	Multiple	Provide hazard preparedness literature at public facilities and on website	
		Establish procedures to alert and evacuate the population in known hazard areas	
Marshall	Multiple	Establish new shelters throughout the county	Plan approved
	Winter Storms	Purchase generators to provide back-up power to schools and shelters	
	Tornados	Purchase and install new warning sirens within the county	
Martin	Flood	Elevate the following roads: Highway 450 – Dover Hill/Trinity and the Houghton Bridge Road	Plan approved; pending 5-year update
	Tornados	Initiate the process to institute Reverse 911	
	Multiple	Have weather radios passed out to citizens	
Miami	Flood	Conduct a study to determine potential buy-out properties	Plan approved
	Tornados	Purchase generators for all shelters within the county	
	Thunderstorms	Institute Reverse 911	
Monroe	Thunderstorms	Conduct a countywide stormwater study and create a stormwater utility	Plan approved
	Tornados	Harden fire stations	
	Hazmat Spills	Conduct a commodity flow study	
Montgomery	Flood, Dam Failure	Implement sediment and erosion control	Plan approved; pending 5-year update/funded
	Multiple	Maintain stream gages and monitor water levels in during rain event	
Morgan	Flood	Institute buyout program for flood prone land areas and relocate critical facilities as nesessary	Plan approved; pending 5-year update
	Tornados	Install weather alert radios for all critical facilities	
	Winter Storms	Establish shelters throughout the county, especially near mobile home areas	
Newton	Flood, Dam/Levee Failure	Complete work on the Sumava levee on the Kankakee River	Plan approved
	Winter Storms	Develop partnerships with power companies and neighboring counties to address downed power lines	
	Hazmat Spills	Identify a back-up water supply at the intersection of Hwy 14 and I-65 in case of a fire	
Noble		Develop a warning siren fund	Plan approved; pending 5-year update
	Flood	Remove log jams to prevent localized flooding	

County	Hazard	Mitigation Strategy	Status of MHMP
Ohio	Tornados	Construction of hardened shelter at fairgrounds	Plan approved; pending 5-year update
	Multiple	Countywide coverage for emergency sirens	
	Hazmat Spills, Floods	Identify all problem roadway areas and install improved signage	
Orange	Flood	Watershed maintenance	Plan approved; pending 5-year update
	Multiple	Procure radios	
	Dam/Levee Failure	Stream, creek, river maintenance	
	Earthquake	Establish earthquake building codes - update local ordinances	
Owen	Tornados	Harden critical facilities, especially fire stations and schools	Plan approved
	Flood	Reduce the risk of flooding in vulnerable areas	
	Multiple	Construct a new Emergency Operation Center	
Parke	Flood, Dam/Levee Failure	Signage, both permanent and temporary	Plan approved
	Multiple	1 Back-up generators for public facilities/ shelters, utilities	
		2 Provide key structures with weather radios to warn of impending hazards.	
Perry	Flood	Flood wall study	Plan approved; pending 5-year update/funded
	Thunderstorms	Minimize damages from excessive storm water	
	Multiple	Develop emergency phone notification system	
Pike	Tornados	Procure and install new warning sirens at every fire department, in Velpen, Stendal, Otwell, and Union (unincorporated) and in Spurgeon	Plan approved
	Dam/Levee Failure	Protect the community from dam failuresand flooding	
	Flood	Institute potential buy-out for homes near River Road and Dodge City	
Porter	Multiple	1 Work with a corps of engineers to redesign levees 2 Monitor water levels throughout the county to minimize damage to future development	Plan approved
	Winter Storms	Procure generators or transfer situations for all essential facilities	
	Hazmat Spills	Implement NOAA's radio system for hazmat spill alerts	
Posey	Tornados	Increase the range of sirens in Posey County, and install new sirens in communities where they do not currently exist.	Plan approved; pending 5-year update
	Flood	Stabilize the Wabash riverbank north of New Harmony.	
	Multiple	Build shelters in large gathering areas such as ball fields, fair grounds, and parks, and in areas with less-stable housing.	
Pulaski	Tornados	Purchase additional sirens (approximately 48) and cameras throughout the county as an early warning system	Plan approved
	Winter Storms	Upgrade the EOC at the Sheriff's Office to include back-up power supply so that the facility can remain open in emergency events	
	Multiple	Institute Reverse 911	
Putnam	Flood	Road washouts prevention and notification ordinance/enforcement.	Plan approved; pending 5-year update
	Tornados	Examine existing weather alert sirens within the county, ensure there are sirens in state/local parks, and reallocate use of sirens to heavily populated areas	
	Thunderstorms	Back-up generators for public facilities/shelters, utilities, EMS, firehouses	
Randolph	Flood	Reduce the risk of flooding in vulnerable areas in Randolph County	Plan approved; pending 5-year update
	Fire	Mitigate against known fire risks in Randolph County	
	Multiple	Protect infrastructure in those areas most vulnerable to a natural disaster	

County	Hazard	Mitigation Strategy	Status of MHMP
Ripley	Flood	Road washout prevention 2 Purchase repetitive loss properties	Plan approved
	Multiple	Ensure that police stations, fire stations, and schools have emergency generators	
		Purchase weather radios for all public buildings and mobile homes through joint funding.	
Rush	Thunderstorms	Conduct new training for storm spotters or volunteer firemen	Plan approved, pending adoption
	Winter Storms	1 Purchase additional snow removal equipment and road markers to guide snow plows	
		2 Implement a tree-trimming service	
Scott	Multiple	Elevate county roads	Plan approved; pending 5-year update/funded
	Flood, Thunderstorms	Stucker Ditch silt removal	
Shelby	Tornados	Harden critical facilities, including volunteer fire stations and local radio station	Plan approved; pending 5-year update
	Flood	Update zoning ordinances in Shelby County	
	Multiple	Outfit the EMA and GIS Staff with portable printers to provide maps for first responders in case of a power outage	
Spencer	Flood, Dam Failure	Address flooding concerns	5 year update Complete
	Tornados	Warning siren improvements throughout the county	
	Multiple	New EOC (centrally located and hardened)	
	Thunderstorms	Develop county-wide stormwater drainage plans to guide surface waters through the proper channels	
St Joseph	Winter Storms	Establish warming centers for special needs populations	Plan approved
	Tornados	Establish siren maintenance and replacement program	
	Hazmat Spills	Switch from ton cylinders of chlorine gas disinfectants	
Starke	Tornados	Institute Reverse 911	Plan approved
	Multiple	Procure generators for back-up power in certain public buildings and community centers: Civic Center, Water Treatment center, police and fire departments, highway departments	
	Hazmat Spills	Develop a public education program to discuss the county's hazards, explain the meanings of emergency sirens, and point out shelter locations	
Steuben	Multiple	Require safe rooms in all critical facilities	5 year update in progress
	Dam/Levee Failure	Encourage dam owners to develop EAP/ERP	
Sullivan	Tornados	Retrofit windows in county courthouse to be high-wind resistant; protect historic dome of the building	Plan approved
	Multiple	Procure back-up generators for EOC and community wastewater/water systems	
	Flood	Continue to implement current floodplain ordinance to 1) remain in compliance with the NFIP, 2) restrict construction within the 100-year floodplain	
Switzerland	Flood, Thunderstorms	1 Protect the community from storms and excess water. 2 Back-up generators for water plant in Vevay	Plan approved; pending 5-year update
	Tornados	Hardening of 4H Fairgrounds shelter	
	Multiple	Install "Reverse 911" system to serve entire county	
Tippecanoe	Flood, Thunderstorms	Acquire stream gages on Wea, Indian, and Burnetts Creeks	Plan approved; pending 5-year update/funded
	Multiple	Install outdoor warning sirens near county schools	
Tipton	Multiple	Procure emergency generators or transfer switches for schools, community centers, County Highway, County Courthouse and shelters, especially the 4-H Fairgrounds	Plan approved

County	Hazard	Mitigation Strategy	Status of MHMP
Union	Multiple	Investigate critical care facilities to determine which need hardening	Plan approved
	Flood	Reduce and eliminate chronic flooding hazards	
Vanderburgh	Earthquake	Explore partnerships to provide retrofitting classes for homeowners, renters, building professionals, and contractors.	5 year update complete
	Flood	Purchase and install stream gages and water table gages to provide flood warning capabilities	
Vermillion	Flood, Thunderstorms	Debris cleanup in streams	Plan approved; pending 5-year update
	Tornados	Reinforce public infrastructure – schools, jails, firehouses	
	Multiple	Provide key structures with weather radios to warn of impending hazards.	
Vigo	Flood	Maintain drainage ditches along state/local roads	Plan approved; pending 5-year update/funded
	Tornados	Local ordinance requiring mobile parks (new) to install warning sirens – shelters @ private sector expense.	
	Multiple	Back-up generators for public facilities/shelters, utilities, EMS, firehouses	
Wabash	Tornados	1 Install new warning sirens	Plan approved; pending 5-year update
		2 Establish shelters in recreational and mobile home parks	
	Multiple	Establish a public education program to explain the county's hazards and meanings of warning sirens and to point out shelter locations	
Warren	Tornados	Install additional warning sirens: 11 in Warren County; 2 in Williamsport; 1 in West Lebanon	Plan approved
	Flood	Upgrade watershed/storm drainage by increasing the capacity of the system or instituting retention ponds	
	Winter Storms	Institute a program to bury power lines and trim trees in Williamsport	
Warrick	Multiple	Ensure that police stations, fire stations, and schools have emergency generators.	Plan approved
	Flood	Purchase repetitive loss properties along Handler Whitaker Ditch, as well as other water tributaries within the county.	
	Earthquake	For all public facilities and key industry buildings in the county which have gas lines, add inertial shut-off valves.	
Washington	Flood	Implement road improvement projects in flood prone areas	Plan approved; pending 5-year update
	Multiple	Develop materials to educate the public on preparedness and survival	
Wayne	Thunderstorms	Develop a public outreach campaign to encourage residents to develop a family disaster plan	Plan approved; pending 5-year update
	Winter Storms	Procure back up communications in the event of an outage	
	Fires	Develop mutual agreements between surrounding fire departments	
	Multiple	Equip critical facilities with back-up generators in the event of a power outage	
Wells	Flood	Buyouts in downtown area	Plan approved; pending 5-year update/funded
	Multiple	Upgrade, improve and elevate the hospitals	
White	Multiple	Procure back-up generators for shelters and critical facilities	Plan approved; pending 5-year update
	Flood	Require manufactured homes to be moved from the floodplain area along Little Monon Creek	
	Fires	Procure new equipment and conduct increased training for first responders	
Whitley	Multiple	Purchase generators for critical facilities throughout the county and Churubusco and South Whitley Town Halls	Plan approved
		Install stream gauges throughout the county	
		Improve storm water management	
		Install new warning sirens	

Section 9 State Capabilities to Mitigate Hazards

This section describes the State's pre- and post-disaster hazard mitigation policies, programs, and capabilities to mitigate Indiana hazards. It also includes an evaluation of the state laws, regulations, policies, and programs related to hazard mitigation and development in hazard-prone areas. Specific capabilities are also described within the context of mitigation goals and objectives and proposed mitigation strategies in Sections 6 and 7 of this plan.

In addition to adhering to laws, regulations, and programs, the State has recently placed a stronger emphasis on research to mitigate hazards. Examples of projects with a strong research component include the Flood Inundation Mapping Library, Non-Levee Embankment Identification, and Comprehensive Wildlife Strategy projects, which are explained in more detail in Section 5.1.

9.1 Laws and Regulations

IDHS utilized a revised version of FEMA form 386-3 (part of the mitigation planning series) to help determine specific mitigation capabilities of Indiana's departments and agencies and identify the regulations and programs that support the mitigation process.

9.1.1 Office of the Governor

Under Indiana Law, the governor is responsible for the coordination of all of Indiana's emergency/disaster management system including mitigation programs. The Office of the Governor's activities include the following.

Disaster Assistance Appropriations (Post-Disaster): The Governor can request appropriations from the General Assembly for disaster assistance whenever he/she deems it is necessary for the protection of all citizens. The Authority of an Executive Order can establish and require that the state, its agencies and departments, and local communities adopt mitigation.

Executive Order for the Adoption of Mitigation Strategies (Pre- and Post-Disaster: The Authority of an Executive Order can establish and require that the state, its agencies and departments and local communities adopt mitigation strategies, and principles as part of their governing or regulatory functions.

9.1.2 Indiana Department of Homeland Security (IDHS) Agency

IDHS serves as administrator and coordinator of the State's mitigation projects that have been funded by the Federal government through FEMA under the Robert T. Stafford Act, Public Law 93-288. IDHS coordinates all situation and damage assessment operations in a disaster area. The agency routinely cooperates with federal, state and local governments to maintain and develop disaster preparedness, response, recovery and mitigation Plans. IDHS establishes and maintains an EOC to provide coordination and public information during emergencies and disasters.

IDHS's activities include the following.

Manages the State Hazard Mitigation Program (Pre- and Post-Disaster): The mitigation staff's purpose is to promote mitigation statewide and to manage the FEMA mitigation Programs for Indiana.

Hazard Mitigation Grant Program (HMGP) (Post-Disaster): IDHS administers this program, which is available after a Presidential Disaster Declaration. HMGP funds hazard mitigation plans and cost-effective projects that reduce or eliminate the effects of hazards and/or vulnerability to future disaster damage.

Pre-Disaster Mitigation (PDM) Grant Program (Pre-Disaster): IDHS administers funds from this annual, national competitive program. PDM funds hazard mitigation plans and cost-effective projects that reduce or eliminate the effects of hazards and /or vulnerability to future disaster damage.

Flood Mitigation Assistance (FMA) Program (Pre- and Post-Disaster): IDHS administers this program, which funds flood mitigation plans, provides technical assistance and funds construction projects that reduce flood risk to insured, repetitive loss properties.

Encourages and promotes jurisdiction participation in NFIP (Pre-and Post-Disaster): IDHS requires good standing in the NFIP as a prerequisite to mitigation funding.

Education and Outreach (Pre- and Post-Disaster): Mitigation Staff promotes pre- and post-disaster mitigation techniques, including retrofitting, NFIP, flood proofing, and construction of saferooms, is imperative for prevention of damage from future events.

9.1.3 Indiana Department of Transportation (INDOT)

INDOT's mission is to provide the best transportation system that enhances mobility, stimulates economic growth, and integrates safety, efficiency and environmental sensitivity. Construction and Maintenance of the major state and federal highways and interstates and related infrastructures within the State is the primary focus. INDOT's activities include:

Engineering and Design Practices (Pre- and Post-Disaster): Provides technical assistance for relocation of critical facilities, relocation of bridges and upgrading of culverts.

Disaster Recovery and Repair (Post-Disaster): Clears and repairs roadways interrupted by flooding, tornados and landslides. Promotes and utilizes mitigation measures throughout engineering and design process to prevent future damage.

Education and Outreach (Pre-and Post-Disaster): The INDOT provides information to citizens on safety and prevention techniques and promotes severe weather awareness.

9.1.4 Indiana Department of Natural Resources (IDNR)

The IDNR regulates the state's rivers, streams, dams and levees, reservoirs, lakes and floodplains and administers and enforces the National Flood Insurance Program regulations and state floodplain regulations. The department also advises local communities regarding enforcement of their floodplain ordinances. Its activities include:

Floodplain Management Program (in accordance with IC 14-28-1 Flood Control Act and IC 14-28-3 Floodplain Management Act) (Pre- and Post-Disaster): IDNR, Division of Water coordinates with the NFIP; monitors compliance with state and local floodplain management standards; provides assistance in mitigation planning and identifies flood hazards.

Indiana Dam Safety Program (IC 14-27-7 Dams, Dikes and Levees Regulation Act) (Pre- and Post-Disaster): Inspection, enforcement and permitting programs for dam and levees, classifies hazards and develops standards for dams and levees.

Conducts Hydrological Studies (Pre-Disaster): Maintains records of lake, stream and river levels necessary for proper identification of flooding hazards. Cooperates in USGS data-collection programs. Currently, more than 80 percent of the continuous hydrologic data-collection activity is maintained through efforts cooperatively funded by the IDNR and the USGS.

Protects Threatened or Endangered Species (Pre- and Post-Disaster): Coordination early in project development determines potential effects on threatened or endangered species. Also coordinates with US Fish and Wildlife.

Indiana Historic Preservation Office (in accordance with Section 106 of the National Historic Preservation Act) (Pre- and Post-Disaster): FEMA, in coordination with the State Historic Preservation Officer, ensures that the effects a proposed project may have on any district, site, building, structure or object that is included in or eligible for inclusion in the National Register of Historic Places are not adverse. If there are adverse effects, FEMA enters into consultation with the SHPO to avoid or mitigate effects to cultural resources and develop a project-specific agreement to identify the measures to mitigate the effects.

9.1.5 Indiana Geological Survey

The Indiana Geological Survey provides services to the State of Indiana that contributes to the wise stewardship of its citizenry through the gathering and interpretation of relevant geological information. Indiana Geological Survey is a member of the Association of Central United States Earthquake Consortium. Its activities include the following.

Consultation on geologic features and soil types, subsidence and slope stability. (Pre- and Post-Disaster): Carried out through a combination of the following activities: geologic sample and data collection and storage, information dissemination (in the form of published maps, reports and databases), educational outreach programs, focused research initiatives and cooperative investigations with governmental agencies, industries and educational organizations.

9.1.6 Indiana Department of Environmental Management (IDEM)

The Indiana Department of Environmental Management utilizes Federal Environmental Protection Agency funding for the construction and upgrading of water and waste treatment facilities and protection of environmental resources. Its activities include the following.

Consultation (Pre- and Post-Disaster): Identifies disaster and environmental concerns and issues surrounding mitigation projects.

Technical Assistance (Pre- and Post-Disaster): Provides technical assistance concerning Superfund sites. Incorporates mitigation objectives whenever possible.

9.1.7 Indiana State Department of Health

The Indiana State Department of Health serves to promote, protect, and provide for the public health of people in Indiana. Its activities include the following:

Identifies and monitors issues that may affect the public health within the area of a disaster, i.e. well contamination, disease and vector control. (Pre- and Post-Disaster): Promote integration of public health and health care policy; strengthen partnerships with local health departments, collaborate with hospitals, providers, governmental agencies, businesses, insurance, industry, and other health care entities; and support locally-based responsibility for the health of the community.

9.1.8 Indiana Department of Commerce

The State of Indiana helps communities improve by providing savings plans, tax credits, and a variety of programs to assist with public infrastructure. Community Development Division helps cities, towns, and counties continue to improve by providing grants to assist with public infrastructure or childcare accessibility, matching savings accounts for low-income Hoosiers, and offering tax credits that support non-profit organizations. Its activities include the following.

Provides funding under the Community Development Block Grant Program and Economic Development Program for infrastructure construction/improvement and commercial property acquisition/relocation in designated mitigation projects. (Pre- and Post-Disaster): Can supply matching funds to communities for acquisition/elevation projects under the Community Development Block Grant (CDBG) program. Provides technical assistance to communities through EDA programs.

9.1.9 Indiana Office of Community and Rural Affairs (OCRA)

OCRA administers financial vehicles and incentives to create affordable housing for rent or purchase as well as supportive facilities. Its activities include the following.

Funding for construction of housing through its low to moderate income housing, senior citizen housing, etc. (Pre-and Post-Disaster): Provides funding for relocation of floodplain residents through purchase of new housing.

9.2 Programs

Indiana has a history of successfully implementing hazard mitigation through program development and project implementation. As previously stated, the agencies involved are active participants in the Silver Jackets and also the Indiana Indiana Association for Floodplain and Stormwater Management (INAFSM). INAFSM was founded in 1996 by professionals interested in and responsible for floodplain and stormwater management in the state of Indiana. Its members include federal, state, and local agency staff, engineers, consultants, planners, elected officials, members of academia, students, and floodplain residents.

Several state agencies promote programs that encompass pre- and post-disaster mitigation activities including the following.

Flood Control Revolving Fund--DNR, Division of Water, Project Development

The Flood Control Revolving Fund, I.C. 14-28-5 was created to provide local entities loans with low interest to pursue a relevant flood control program. Loans are subject to approval by the Natural Resources Commission. Program includes:

- Removal of obstructions and accumulated debris
- Clearing and straightening channels
- Channel widening
- Building or repairing levees or flood protective works
- Construction of bank protection works

This fund is also available to a conservancy district to pay for the costs of establishing a district and costs associated with preparing the district plan for any of the purposes for which a district can be established.

Flood Control Revolving Fund-- Natural Resources Commission

- Loans may not exceed $300,000 to any one local entity
- Loan term = 10 years; 3% interest rate
- Fund monies do not revert to the state general fund.
- Fund monies are awarded on a prioritized basis

Indiana Rural Development-- Indiana Office of Community and Rural Affairs

Over 40 loan, loan guarantee, and grant programs to finance housing, businesses, economic development, and community facilities and infrastructure

- Business: growth and establishment of local businesses and cooperatives
- Community Facilities: programs and technical assistance for schools, health clinics and emergency response facilities
- Utilities: assisting rural communities to improve water, energy, telecommunications and broadband services, electric services
- Housing: homeownership, home repair and modification, and development and rehab of affordable rental housing

USDA Rural Development Community Programs

Community Programs finance drinking water treatment systems and wastewater treatment systems in rural communities. Community Programs also funds essential community facilities like hospitals, day cares, emergency response and assisted living.

Indiana State Disaster Relief Fund

The fund is established to provide financial assistance to eligible entities for the costs of repairing, replacing, or restoring public facilities or individual residential real or personal property damaged or destroyed by a disaster and to assist eligible entities in paying for the response costs incurred by an eligible entity during a disaster. Eligible categories of work include:

- Debris Removal - deposited within the public right-of-way and equipment costs.
- Publicly Owned Transportation Systems -roads, streets, highways, bridges, and other public ways and their necessary appurtenances.
- Publicly Owned Buildings and Structures.
- Publicly Owned Water Control Facilities - dams, levees, dikes, ditches, and other drainage or flood control, or both, devices.
- Publicly Owned Recreation Facilities - parks, and recreation facilities.
- Publicly Owned Utilities: sanitary sewer systems, storm sewers, lift stations, or wastewater treatment facilities; and water treatment, water storage, or water distribution facilities.
- Other Infrastructure owned by or operated by or on behalf of an eligible applicant.

Policies Regulating Development

Regulation of development in hazard-prone areas is imperative. There are several policies that perform this function in an effort to prevent future damage or reduce the risk of damage in already developed areas. Indiana is designated as a "home rule" state (IC 36-1). Counties, municipalities, and townships are granted all the powers they need for the effective governing of local affairs. This results in a lack of uniformity from one jurisdiction to the next. Home Rule gives municipal jurisdictions the power to govern themselves in local municipal matters independent of state laws. When a state law and a local ordinance govern the same activity, the ordinance yields to state law. Table 50 describes policies that regulate development in hazard-prone areas.

Table 50: Policies that Regulate Development in Hazard-Prone Areas

Policy Area	Description/Applicability	Effectiveness
Floodplain Management	IDNR, Division of Water coordinates with the NFIP; monitors compliance with state and local floodplain management standards; provides assistance in mitigation planning and techniques; identifies flood hazards. Pre- and -post disaster, local jurisdictions must comply with floodplain requirements regarding development in hazard-prone areas. The requirements include provisions for building and rebuilding (regardless of the nature of damage) in floodplains.	The Program outlines strict policies for new development in high-risk, hazard-prone areas. Structures must be elevated two (2) feet above the Base Flood Elevation of the floodplain. The local floodplain managers have reduced the number of damaged structures in hazard events through permitting and promotion of mitigation alternatives.
Coastal Erosion Management	The purpose of the Indiana Lake Michigan Coastal Program is to enhance the state's role in planning for and managing natural and cultural resources in the coastal region and to support partnerships between federal, state and local agencies and organizations. The Indiana Lake Michigan Coastal Program relies upon existing laws and programs as the basis for achieving its purpose. There are 3 coastal counties in Indiana.	Coastal grant programs are available to local jurisdictions. The NFIP has not mapped flood areas along coastlines, but it has been estimated that 25 percent of homes and other structures within 500 feet of the U.S. coastline and the shorelines of the Great Lakes will fall victim to the effects of erosion within the next 60 years.

Policy Area	Description/Applicability	Effectiveness
Zoning	Zoning is a locally enacted law that regulates and controls the development and land use of private property. It prevents development in inappropriate places (e.g., flood plains, steep ravines, lands with underground caves, etc…) and by regulating the use of land to protect flood prone areas.	The State continues to promote the importance of zoning as an effective method to minimize damage and encourages local jurisdictions to adopt zoning ordinances. Zoning is still a voluntary program, and continues to meet resistance in smaller, rural communities.
Land-Use Planning	The land use plan lays out land development goals and priorities. The plan details how specific parcels of property will be used, allowing safe and coordinated development. Land use plans take into consideration the hazards associated with any give area in a jurisdiction.	Some Indiana Residents consider land use planning an encroachment on their personal property, but the process allows jurisdictions to identify site-specific hazards and avoid development that places people or property in harms way. Still found mostly in larger cities and to some extent as economic development plans in smaller communities.

Section 10 Plan Maintenance, Monitoring, and Evaluation

10.1 Plan Maintenance

The State Hazard Mitigation Officer (SHMO) and the Indiana State Hazard Mitigation Council (ISHMC) will monitor the plan with each declared disaster for the continued relevancy of its goals and objectives. They will also determine whether funded projects have been effective in achieving these goals, and whether the strategies and measures have been effective in reducing losses caused by hazards.

In the past decade, Indiana has experienced several significant disasters that have allowed IDHS to adjust its focus on mitigation with the cooperation of local jurisdictions, other state agencies, and federal agencies. To prioritize mitigation funding for each disaster, FEMA and the IDHS mitigation divisions incorporate issues identified by the state partners and Silver Jackets since the last disaster. However, with disaster declarations becoming less frequent and a longer period for the update of the state plan from three years to five years, a more formal review will be put in place to examine the progress and success of the projects and programs since the last update.

In 2013, flooding in the central and northeastern parts of the state—where the State focused significant mitigation funding during the late 1990s and from 2002 to 2007—resulted in significantly less damages than would have occurred before the mitigation projects were implemented. Flooding of this magnitude would have resulted in hundreds of homes and businesses being damaged in the past. Most communities had some smaller pockets of damaged homes, but the event did not result in a disaster declaration. In recent disasters, a year, or even three, is not a significant amount of time to judge climatological events.

In collaboration with The Polis Center, the SHMO will annually update the projects outlined in this SHMP by modifying objectives, if needed, and reporting on the status. Additionally, IDHS will work with The Polis Center to provide annual reports to the Indiana Silver Jackets to more directly integrate the team into the planning process.

10.2 Plan Monitoring and Evaluation

The monitoring of projects and the closeout of grant processes are covered at length in the Indiana Administrative Plan. Indiana's Administrative Plan is meant to be a multi-grant program administration and grants management document. It is the means by which the IDHS's Mitigation Section operates (Standard Operation Plan). Additionally, all mitigation grants awarded require that the local jurisdictions sign a state and local agreement that outlines the reporting requirements, both fiscal and narrative, of project progress and closeout requirements. It includes maintenance and post closeout requirements for the local jurisdiction.

The State will review the progress of the projects on a quarterly basis. Projects which entail elevation or acquisition will be surveyed at start of construction or demolition and the completion of the project. Currently, every sub-grantee must provide supporting documentation for all transactions at the earliest possible opportunity, but no later than the next quarterly report. This is both during the grant period and post grant (Indiana Mitigation Administrative Plan). The mitigation section, through the cooperation of the local EMA directors, State Field Coordinators, and Department of Natural Resources monitors the status of project areas and programs. The staff of the agencies visits the counties on a regular basis and report the status of project sites and their maintenance.

An important time for plan monitoring is post-event. The purpose of monitoring the plan that time is to review and evaluate how well the overall strategies work to achieve the goals of the State and local mitigation plans. At the first scheduled meeting of the Indiana Silver Jackets Task Force after an incident, the SHMO and ISJ (or its designated subcommittee) will monitor the plan with each declared disaster for the continued relevancy of its goals and objectives. (NOTE: The IDHS Executive Director may call a meeting as required, but usually a meeting occurs within 30 days of the disaster declaration). The SHMO and the ISJ (or its designated subcommittee) will evaluate whether the designated projects have been effective in reducing losses due to the natural or man-made hazards they were designated to mitigate or prevent and whether they have reduced losses from other hazards. This will be accomplished by:

- Identifying mitigation projects within the declared areas.
- Reviewing quarterly reports to confirm what projects are completed under each goal.
- Evaluating whether mitigation projects are relevant to the declaration. If projects are relevant to the hazard which precipitated the declaration, the following evaluative steps will be taken:
    - Use CAPI, recent disaster data, and other analyses to capture the savings realized by completed projects or savings which may be realized by the mitigation activity.
    - Review the goals and projects to determine their relevance to changing situations in the state.
    - Review the Risk Assessment as necessary such as upon receipt of new HAZUS-MH modeling, or critical facility information.
    - Identify implementation problems (technical, political, legal, and financial) based upon quarterly progress reports, and input from the local jurisdictions and sub-grantees, and state agencies.
- Updating the Plan to reflect the successes and other findings of the monitoring and evaluating process.

When there are no declared disasters, the SHMO will update and expand the SHMP annually to include other natural and man-made hazards that threaten the citizens of Indiana and modify, add, or delete mitigation goals and projects. IDHS plans to work with The Polis Center to expand the existing standard SHMP to an enhanced SHMP for the 2017 update.

Since the 2011 SHMP, there have been no major changes to the system of tracking mitigation activities and goals. The process is documented through the use of tracking tools to monitor progress and, when necessary, follow up with mitigation. These tracking spreadsheets are maintained on a common drive for all of the mitigation section staff to access. The State has implemented, with the help of contract staff and additional IDHS personnel, a regularly scheduled site inspection process to monitor the progress of projects in the field and ensure that they are being completed within scope and budget. This new process allows the State to expedite the closeout process of grants and projects.

The State of Indiana has continued to maintain a focus on the acquisition of owner-occupied flood-prone homes as funding and local matching funds permit. The March 2012 Henryville Tornado increased awareness and local interest in hardening and protecting structures from high wind events. Over the last three years, the State has also implemented the Indiana Code 25-23.7-8-6, which requires the installation of weather radios in each manufactured home in a mobile home community built after June 30, 2007. The following table lists the status of grant mitigation projects within the state.

Table 51: Status of Indiana Mitigation Activities

				Status		
Community	Description	Date Awarded	Federal Award	Completed	Ongoing	Awaiting Funding
HMGP Funded						
Ft Wayne	Acquisition & demolition	1/23/2004	$124,562	x		
IU	Earthquake Video	3/10/2004	$37,500	x		
Bluffton	Acquisition & demolition	5/3/2004	$684,926	x		
Wells County	Planning	5/3/2004	$15,000	x		
Vanderburgh County	Planning	3/9/2004	$50,000	x		
Statewide	Outdoor Warning Sirens	6/24/2004	$73,223	x		
Rensselaer	Acquisition & demolition	5/21/2004	$531,514	x		
Decatur	Acquisition	5/3/2004	$749,657	x		
Ft. Wayne	Acquisition	7/7/2004	$734,049	x		
Anderson	Elevation	4/7/2004	$7,040	x		
Kokomo	Planning	12/22/2004	$443,173	x		
Delaware Co	Acquisition	3/24/2005	$258,411	x		
Alexandria	Acquisition	1/21/2005	$243,792	x		
Noblesville	Acquisition	5/3/2005	$499,596	x		
Muncie	Acquisition	3/24/2005	$165,679	x		
Montpelier	Siren	7/21/2006	$3,150	x		
Jackson Co	Planning	3/28/2006	$14,530	x		
Decatur	Acquisition & demolition	2/22/2006	$2,046,974	x		
State of IN	Outreach	7/18/2006	$101,150	x		

				Status		
Community	Description	Date Awarded	Federal Award	Completed	Ongoing	Awaiting Funding
Sullivan Co	Planning	11/13/2006	$25,575	x		
Delaware Co	Planning	11/2/2006	$32,250	x		
Tippecanoe Co	Acquisition & demolition	1/9/2007	$229,069	x		
Vanderburgh Co	Mobile Home Tie Down	10/5/2007	$312,215	x		
Ft Wayne	Mungovan Acquisition	11/19/2008	$180,600	x		
Morgan Co	Plan	7/21/2008	$32,250	x		
Vera Cruz	Acquisition	7/15/2008	$457,509	x		
State	Public Outreach Flood	12/3/2008	$95,575	x		
Anderson	Riverside Dr Acquisition	11/24/2008	$741,207	x		
Dubois Co	Plan	12/23/2008	$43,552	x		
State	Project Management 1662	5/20/2009	$60,143	x		
DeKalb Co	Holiday Lakes Acquisition	5/21/2009	$494,235	x		
Allen Co	River Haven Acquisition	6/15/2009	$30,900	x		
Dyer	Acquisition	9/16/2009	$274,875	x		
Washington Co	Plan	9/9/2009	$44,888	x		
State	Mangement Costs 1732	6/30/2010	$42,247	x		
Delaware Co	Sizemore Acquisition	10/19/2009	$143,083	x		
Ft Wayne	Junk Ditch A Acquisition	11/5/2009	$749,513	x		
Ft Wayne	Junk Ditch B Acqisition	11/9/2009	$745,880	x		
Benton Co	Plan	10/21/2009	$44,888	x		
Daviess Co	Plan	10/27/2009	$44,888	x		
State	Mangement Costs 1740	6/9/2010	$92,863		x	
Franklin	Acquisition	9/21/2009	$4,920,291		x	
Morgan Co	Acquisition	12/11/2009	$3,029,006		x	
Martinsville	Acquisition	9/18/2009	$2,983,200		x	
Columbus	Acquisition	12/9/2009	$4,364,174		x	
Brown Co	#1 Acquisition	8/19/2010	$1,871,267		x	
Bartholomew Co	Acquisition	8/13/2010	$270,143		x	
Johnson Co	Acquisition	8/19/2010	$3,448,022		x	
Morgan Co	Waverly Henderson	8/16/2010	$182,624		x	
Brown Co	#2 Acquisition	8/16/2010	$258,368		x	
Indianapolis	Acquisition	8/13/2010	$153,254		x	
Spencer	Acquisition	9/29/2010	$1,061,132		x	
Auburn	NATMUS flood proof	4/18/2011	$86,936	x		
Shelby Co	Acquisition	12/14/2010	$528,857	x		
Vigo Co	Vigo North	4/15/2011	$544,367		x	x

				Status		
Community	Description	Date Awarded	Federal Award	Completed	Ongoing	Awaiting Funding
Vigo Co	Vigo South					x
Morgan Co	Old Town Waverly	2/28/2011	$1,298,243		x	
Tippecanoe Co	Acquisition	12/8/2010	$171,976	x		
State	State Management 1766	10/28/2011	$1,248,510		x	
Ft Wayne	Junk Ditch St Mary's	12/3/2010	$560,325		x	
State	Management Costs	5/27/2010	$425,312		x	
Montezuma	Acquisition	5/6/2011	$951,013		x	
Howard Co	Acquisition	2/28/2011	$1,341,436		x	
DeMotte	Acquisition	1/5/2011	$206,948		x	
Auburn	Acquisition	9/27/2010	$52,733		x	
State	IU Disaster Resistant University	6/29/2011	$195,238		x	
State	outreach -shake house	10/13/2011	$261,116			
Elnora	White River Fight Plan	proposed				
Orange Co	Floodwarning EAP	in process				
Vanderburgh Co	Plan Update	6/27/2011	$62,954	x	x	
Vigo Co	Dresser-Brock-Gard	10/6/2011	$329,300		x	x
Vigo Co	Dresser - Price-Wier	7/8/2011	$184,168			x
Vigo Co	Dresser - Mcculloch	withdraw				x
LaCrosse	Community Shelter	proposed				x
Vigo Co	Toadhop Hovey	proposed				x
State	Project Management 1795	6/9/2010	$425,312		x	
Morgan Co	Morgan Co 2010	2/1/2012	$640,334		x	
Plymouth	Plum St	10/9/2011	$409,024		x	
Plymouth	Garro St	11/9/2011	$289,073		x	
Remington	Acquisition	4/29/2011	$318,545		x	
Portage	Acquisition	4/2/2013	$130,731			x
Hamilton Co	Mitigation Plan Update	5/23/2011	$60,276		x	
State HMGP 1828	State Management Costs	1/9/2012	$81,980		x	
Fayette Co	Public Warning	3/29/2012	$18,000		x	
Morgan Co	Acquisition	5/24/2012	$179,334		x	
State	Five Points Hardening	9/20/2012	$18,750		x	
State	State Management Costs 1832	1/9/2012	$81,980		x	
Town of Dyer	Mitigation Plan Development	6/2/2008	$30,000	x		
City of Hammond	Mitigation Plan Development	6/2/2008	$37,500	x		
Hancock County	Mitigation Plan Development	6/2/2008	$30,000	x		

				Status		
Community	Description	Date Awarded	Federal Award	Completed	Ongoing	Awaiting Funding
DeKalb County	Mitigation Plan Development	6/2/2008	$30,000	x		
Noble County	Mitigation Plan Development	6/2/2008	$30,000	x		
Steuben County	Mitigation Plan Development	6/2/2008	$30,000	x		
Boundary Rivers	Mitigation Plan Development	9/6/2005	$1,821,750	x		
Madison County	Mitigation Plan Development	9/20/2006	$37,050	x		
State	Technical Assistance	5/10/2006	$200,925	x		
Ft. Wayne	Acquisition	9/20/2006	$180,000	x		
Jasper County	Mitigation Plan Development	8/20/2007	$43,390	x		
Bartholomew County	Mitigation Plan Development	9/14/2006	$36,000	x		
Hendricks County County	Mitigation Plan Development	9/14/2006	$36,000	x		
State	Technical Assistance	3/8/2007	$7,200	x		
Ft Wayne	Acquisition	9/25/2007	$55,059	x		
State	Technical Assistance	6/3/2008	$147,723	x		
State	Technical Assistance	9/18/2008	$8,599	x		
Howard County	Acquisition	9/18/2008	$171,975	x		
City of Plymouth	Acquisition	9/22/2008	$200,000	x		
Adams County	Mitigation Plan Update	9/22/2009	$68,607	x		
Allen County	Mitigation Plan Update	9/22/2009	$69,615	x		
City of Auburn	Acquisition	6/11/2010	$86,600	x		
Jasper County	Sirens	4/26/2010	$215,000	x		
State	Technical Assistance	7/9/2010	$10,366	x		
City of Auburn	Acquisition	9/23/2010	$96,750	x		
1913 Flood Anniversary	Outreach and Education	3/5/2013	$91,010		x	
City of Brazil Phase I	Acquisition	4/16/2013	$569,642		x	
City of Brazil Phase ll	Acquisition	4/17/2013	$460,844		x	
City of Evansville	Acquisition	3/5/2013	$136,099		x	
Vanderburgh Co	Acquisition	3/6/2013	$148,598		x	
Dekalb Retrofit Study		7/26/2013	$11,250		x	
Dekalb	Mitigation Plan Update	5/20/2013	$25,001		x	
Stueben	Mitigation Plan Update	5/21/2013	$25,001		x	
Howard County	Mitigation Plan Update	2/27/2013	$35,000		x	
Marion County	Mitigation Plan Update	2/26/2012	$54,454	x		
3 County Plan	Mitigation Plan Update	2/17/2013	$55,508		x	
Chandler	Siren	12/9/2013	$10,649		x	

				Status		
Community	Description	Date Awarded	Federal Award	Completed	Ongoing	Awaiting Funding
Bartholomew County	Siren	12/10/2013	$14,370		x	
Fulton County	Siren	12/11/2013	$19,304		x	
Morgan Co	Acq	2/19/2014	$285,253		x	
Tipton County	Acq	12/5/2013	$672,221			
State HMPG 4058	State Management Cost	11/4/2013	$51,702		x	
Howard Co 08	Acquisition		$171,975			
City of Auburn 09	Acquisition	5/5/2010	$86,600			
PDMC						
IN Central Farmlands 08	Mitigation Plan Development	4/15/2008	$848,813	x		
IN Northern Prairie 08	Mitigation Plan Development	4/15/2008	$628,425	x		
Dyer	Pump Station	2/23/2012	$522,562		x	
Adams County 09	Mitigation Plan update	5/13/2010	$70,965	x		
Allen County 09	Mitigation Plan update	5/14/2010	$69,615	x		
Messenger Corp 10	Retrofit	9/17/2010	$96,750	x		
State 12	Mitigation Plan 2013	10/30/2013	$297,000		x	
State 12	Local Mitigation Plan update	10/30/2013	$248,325		x	
State 12	Management		$54,532		x	
Other Funding Sources						
State	Floodwarning EAP	Multiple year funding	funded by DNR and OCRA		x	
State	Digitizing DFIRMS	Multiple year funding	funded by DNR		x	
State	Fluvial Erosion Hazard	ongoing	funded by OCRA supp funds		x	
State	Orange Co. Flood Risk study	ongoing	funded by OCRA and USACE		x	
HMGP Disasters 1740-1795	Local 25% match	ongoing	funded by OCRA		x	
4 County	Mitigation plan update	ongoing	Homeland Security Grant Program		x	