2024 State of Indiana
Standard Multi-Hazard Mitigation Plan

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A renowned Indiana landmark, a covered bridge, looms above a swollen stream. The spring of 2009 witnessed a substantial rainfall event in northern Indiana, leading to a major flooding incident that jeopardized local communities and agriculture. Flooding, a recurrent hazard in Indiana, results in tens of thousands of dollars in annual damages and is one of two hazards for which the state has received federal disaster funding.

Photograph courtesy of the Indiana Department of Homeland Security, captured by state employees during their assessment of the flood damage.

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 https://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 2024 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, and the many other federal, state, local, and non-profit organizations that contributed to this plan.

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Acronyms

ACS	American Community Survey
AGI	Adjusted Gross Income
ASDSO	Association of State Dam Safety Officials
BFE	Base Flood Elevation
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosives
CCIA	Climate Change Impacts Assessment
CDBG	Community Development Block Grant
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CICERO	Center for International Climate Research
CMSI	Crop Moisture Stress Index
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DOH	Department of Health
DRU	Disaster-Resistant University
EMA	Emergency Management Agency
ENSO	El Niño-Southern Oscillation
EOC	Emergency Operations Center
FBI	Federal Bureau of Investigation
FEH	Fluvial Erosion Hazard
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Studies
FMA	Flood Mitigation Assistance
GDP	Gross Domestic Product
GIO	Geographic Information Office
GIS	Geographic Information Systems
HA	Housing Assistance
HAV	Hepatitis A Virus
HMGP	Hazard Mitigation Grant Program
HUC	Hydrologic Unit Code
IA	Individual Assistance
IAC	Indiana Administrative Code
IARC	Indiana Association of Regional Councils
IC	Indiana Code
IDEM	Indiana Department of Environmental Management
IDHS	Indiana Department of Homeland Security
IDLGF	Indiana Department of Local Government and Finance
IDNR	Indiana Department of Natural Resources
IDOA	Indiana Department of Administration

IDOH	Indiana Department of Health
IEAP	Incident and Emergency Action Plan
IED	Improvised Explosive Device
IGS	Indiana Geological Survey
IHCDA	Indiana Housing and Community Development Authority
IHP	Individuals & Household Program
IMPD	Indianapolis Metropolitan Police Department
IN	Indiana
INAFSM	Indiana Association for Floodplain and Stormwater Management
INDOT	Indiana Department of Transportation
INFIP	Indiana Floodplain Information Portal
IN-ISAC	Indiana Information Sharing and Analysis Center
IOT	Indiana Office of Technology
IP	Internet Protocol
ISDH	Indiana State Department of Health
ISHMC	Indiana State Hazard Mitigation Council
ISJ	Indiana Silver Jackets
IT	Information Technology
IU	Indiana University
IUPUI	Indiana University-Purdue University Indianapolis
KY	Kentucky
MHMP	Multi-Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
MSA	Metropolitan Statistical Area
NCDC	National Climatic Data Center
NFIF	National Flood Insurance Fund
NFIP	National Flood Insurance Program
NLE	Non-Levee Embankment
NOAA	National Oceanic and Atmospheric Administration
NSSL	National Severe Storms Laboratory
NTSB	National Transportation Safety Board
NWS	National Weather Service
OCRA	Office of Community and Rural Affairs
ONA	Other Needs Assistance
PA	Public Assistance
PDM	Pre-Disaster Mitigation
PDSI	Palmer Drought Severity Index
PGA	Peak Ground Acceleration
RCP	Representative Concentration Pathway
REP	Radiological Emergency Preparedness
RFC	Repetitive Flood Claims
Risk MAP	Risk Mapping, Assessment, and Planning

RL	Repetitive Loss
RSI	Regional Snowfall Index
SBA	Small Business Administration
SDRF	State Disaster Relief Fund
SFHA	Special Flood Hazard Area
SHMO	State Hazard Mitigation Officer
SHMP	Standard Hazard Mitigation Plan
SHPO	State Historic Preservation Officer
SRL	Severe Repetitive Loss
THIRA	Threat and Hazard Identification Risk Assessment
US	United States
USACE	United States Army Corps of Engineers
USD	United States Dollar
USDA	United States Department of Agriculture
USGCRP	US Global Change Research Program
USGS	United States Geological Survey
WCT	Wind Chill Temperature

Executive Summary

The Indiana Multi-Hazard Mitigation Plan was developed in collaboration with government, academic, and other private partners for the purpose of preventing, protecting against, responding to, and recovering from natural disasters that may threaten the State's citizens, infrastructure, and economy.

The federal Disaster Mitigation Act of 2000 provides the legal basis for FEMA mitigation planning requirements for State, local, and tribal governments as a condition of federal grant assistance. Indiana must have a FEMA approved State Multi-Hazard Mitigation Plan to remain eligible to receive federal assistance through the following programs:

- Public Assistance (Categories C-G)
- Hazard Mitigation Grant Program (HMGP)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance Grant Program (FMA)
- Fire Management Assistance Grants (FMAG)

Since 2008, Indiana has received almost $50,000,000 in Mitigation grant funding through these programs.

The 2024 Indiana Multi-Hazard Mitigation Plan lays the framework for accomplishing one of the Indiana Department of Homeland Security's top 2019-2020 strategic priorities of expanding mitigation and resiliency in the State of Indiana. This includes expanding statewide collaboration and planning, promoting safety, implementing a statewide mitigation strategy, and strengthening partnerships that impact resiliency.

Throughout this plan, there are boxes highlighting some of Indiana's best practices in Mitigation. These best practices include projects for the acquisition and demolition of flood prone properties, the construction of residential and community safe rooms to protect citizens during severe weather, collaboration between multiple federal, state, and local agencies and other partners to develop solutions to natural hazard issues and planning efforts across the State to assess natural hazard risks, identify mitigation opportunities, and help build the resiliency of communities, and the State.

There have been some significant changes to this plan since the last version was adopted back in 2019. Some of these changes include:

- Future climate trends in Indiana are discussed in the State Profile section. Projections are indicating that the State could see an increase in precipitation (6-8%) by mid-century. This will increase the flooding risk in communities throughout the State. There is also projected to be an increase in extreme temperature events (hot and cold). New research is indicating that the most frequent area of tornado activity nationwide (Tornado Alley) is starting to shift eastward due to these precipitation and temperature changes. This shift would bring more frequent severe storms and/or tornadoes to the State.
- Vulnerable communities – Recent studies have shown that certain individuals or groups of people are disproportionately impacted by disasters. Building upon the identification of vulnerable populations outlined in the 2019 plan, this 2024 update expands deeper into how hazards affect communities at risk.

- New Mitigation Strategies – In collaboration with 37 subject matter experts, seven State agencies, State universities, and other national partners, 49 strategies to help mitigate the risk from natural hazards and build the resiliency of the State have been identified in this plan update. These strategies are all described in section 8 of the plan.
- All data and analyses in the plan were updated for 2024 using the most recent version of FEMA's Hazus-MH Risk Assessment software, along with other GIS analyses, and updated information from all 92 counties.

The Indiana Multi-Hazard Mitigation Plan and the Indiana Department of Homeland Security's planning process comply with all applicable Federal statutes and regulations, and the State will amend the plan as necessary to reflect changes in State and Federal laws and statutes as required in 44 CFR 201.1 -7.

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.

Since 2000, Indiana has received 21 federal disaster declarations, with all 92 counties being impacted by a FEMA declared disaster during that time (Figure 1). The most recent disaster (DR-4704) was declared on April 15, 2023, after a series of severe storms, straight-line winds, and tornadoes swept across Indiana. The declaration includes 13 counties across Indiana: Allen, Grant, Howard, Lake, Brown, Benton, Clinton, Johnson, Monroe, Morgan, Owen, Sullivan, and White. A total of 23 tornadoes are counted as touching down during the outbreak.

The following is a list of federal disaster declarations since 2012:

- **DR-4704:** A string of severe storms, straight-line winds and tornadoes tore through 13 Indiana Counties across the State.
- **DR-4515:** The COVID-19 pandemic.
- **DR-4363:** Severe storms and flooding causing extensive and record flooding along the Yellow, Kankakee, and Iroquois Rivers.
- **DR-4173:** Severe winter storm and snowstorm with the second highest calendar day snowfall for Indianapolis, 11.4” since records began.
- **DR-4058:** severe storms, straight-line winds, and tornadoes

THE GOALS OF THE SHMP INCLUDE:

- 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 hazards of interest and other 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.

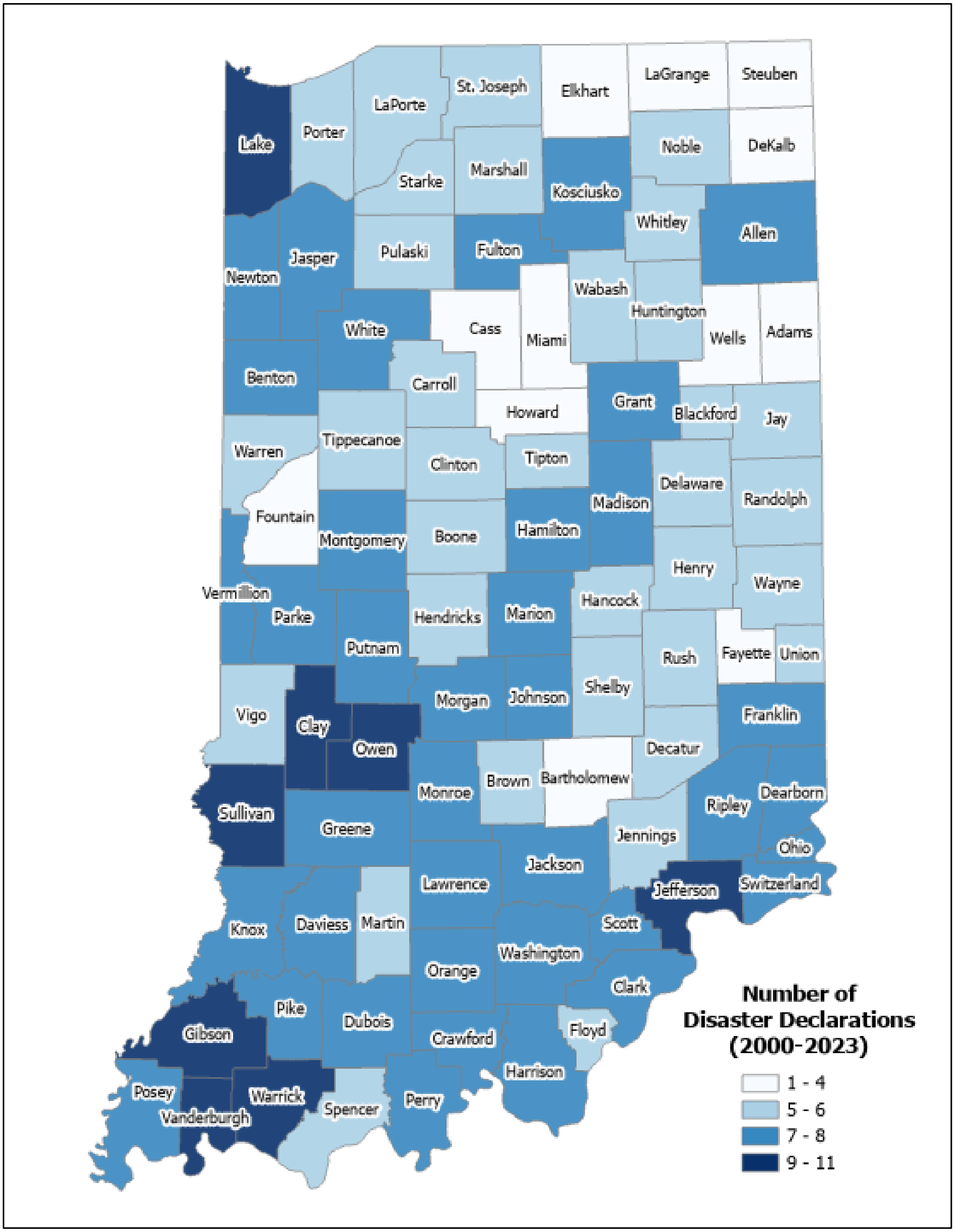


Figure 1. Federal Disaster Declarations (2000-2023)

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), Hazard Mitigation Assistance (HMGP).

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

- **Individuals & Households 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.
  - **Section 406 – Public Assistance Program:** Provides discretionary authority to fund mitigation measures in conjunction with the repair of disaster-damaged facilities.
- **Community Development Block Grants:** Provides grants to help cities, counties, parishes, and states to recover from presidentially declared disasters, especially in low- and moderate-income areas.
- **Assistance for Farmers and Ranchers:** Provides financial assistance to eligible producers affected by natural disasters.
- **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 Indiana State Disaster Relief Fund (SDRF) is a state disaster recovery fund for events that have seriously impacted communities, but that do not rise to the level of a federal declaration. Although established in 2003 to provide infrastructure damage assistance, the Indiana SDRF was not funded until 2007. This funding is very limited as it is tied to the public safety fund and is dependent on the state's fireworks sale. In 2007, the SDRF was expanded to provide Individual Assistance for homeowners and renters whose primary residence was damaged/destroyed. Table 1 summarizes Federal and SDRF declared disasters since the last plan.

Table 1. Summary of Federal and State Disasters

Disaster Number	Disaster Type	Disaster Description	Date Declared	Total IA	Total PA	Total HMGP	Total
Federal							
4363	Federal	Storms, winds, and tornadoes	5/4/2018	$3,883,630.08	$14,326,676.95	$2,558,898.30	$20,769,205.33
4515	Federal	Indiana COVID-19	4/3/2020	$73,869,521.52	$130,268,027.70	$348,482.77	$204,486,031.99
4704	Federal	Storms, winds, and tornadoes	4/15/2023	$2,485,361.41	$1,244,144.17	--	$3,729,505.58
State							
15986	State	Storms, winds, and tornadoes	5/27/2019	$26,579.44	--	--	$26,579.44
16020	State	Storms and tornadoes	6/15/2019-6/17/2019	$12,414.00	--	--	$12,414.00
16575	State	Rainfall and flooding	6/27/2020	$77,066.00	--	--	$77,066.00
17027	State	Storms and flooding	6/18/2021-6/19/2021	$156,009.00	--	--	$156,009.00
17505	State	Derecho	6/13/2022-6/14/2022	$50,921.79	--	--	$50,921.79
17583	State	Storms and flooding	7/23/2022-7/25/2022	$86,228.83	--	--	$86,228.83

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. SBA disaster loans can be available for federally and non-federally declared disaster events.

Table 2 lists the most recent FEMA declarations, except the COVID-19 pandemic declaration (DR-4515). The declaration for the COVID-19 pandemic is excluded due to the nature of the declaration. Traditionally, FEMA has not declared a disaster for health or social-related hazards. The COVID-19 declaration was vast to provide funding in an unprecedented time of need.

As federal disaster declarations are not common, the federal disaster declaration includes the 2023 number even though most other analysis or summaries in this plan are through 2022.

Table 2. Federal Disaster Declarations (2019-2023)

	DR-4363	**DR-4704** (as of 7/17/23)
Event Date	Feb 14, 2018 - Mar 4, 2018	Mar 31, 2023 - Apr 1, 2023
Event Description	Severe Storms and Flooding	Severe Storms, Straight-line winds, and Tornadoes
Eligible IHP Applications	1,165	263
IHP Dollars Approved	$3,883,630.08	$2,305,270.58

	DR-4363	**DR-4704** (as of 7/17/23)
Associated SBA	SBA 15512	SBA 17881 (17955 PA*)
SBA Loan Approved	242	148
SBA Loan Amount Approved	$5,867,000	$12,314,900.00

Table 3 lists the most recent SBA loans with SDRF declarations. All SDRF awards listed in Table 3 are IA assistance.

Table 3. SBA Loans with SDRF Declarations (2019-2022)

	Event Date	Event Description	SBA # of Loans	SBA Loan Amount	SDRF # of Awards	SDRF Award Amount
2019						
15986	May 27	Tornadoes, high winds, and severe storms	22	$26,579.44	5	$26,579.44
16020	June 15-17	Severe weather and tornadoes	12	$722,800.00	2	$12,414.00
2020						
16575	June 27	Heavy rainfall and flooding	22	$1,056,400.00	11	$77,066.00
2021						
17027	June 18-19	Severe storms and flooding	33	$1,624,700.00	27	$156,009.00
2022						
17505	June 13-14	Derecho windstorm	45	$1,660,000.00	7	$50,921.79
17583	July 23-25	Severe storms and flooding	7	$520,300.00	12	$86,228.83

Table 4 lists the primary and contiguous counties associated with declarations outlined in Table 3.

Table 4. Primary and Contiguous Counties Declared with SBA Loans in Indiana (2019-2022)

	Primary Counties	Contiguous Counties
15986	Madison	Delaware, Grant, Hamilton, Hancock, Henry, Tipton
16020	Monroe	Brown, Greene, Jackson, Lawrence, Morgan, Owen
16575	Newton	Benton, Jasper, Lake
17027	Jefferson, Monroe	Brown, Clark, Greene, Jackson, Jennings, Lawrence, Morgan, Owen, Ripley, Scott, Switzerland
17505	Allen	Adams, DeKalb, Huntington, Noble, Wells, Whitley
17583	Daviess	Dubois, Greene, Knox, Martin, Pike

Preventively, FEMA provides grants to states, local communities, tribes, and territories to plan for and prevent effects of disasters and natural hazards. Providing funding for planning efforts reduces reliance on federal funding from future disasters. There are three grants that could provide these preventative funds: Flood Mitigation Assistance (FMA) Grant Program, Building Resilient Infrastructure and Communities (BRIC) Grant, and the Hazard Mitigation Grant Program (HMGP).

One example of how an Indiana community used these grant funds was to build a tornado shelter in a middle and high school. Salem Middle and High Schools in the Town of Salem in Washington County received a total of $7 million from IDHS and built a multi-purpose tornado shelter that can hold up to a total of 2,440 persons in the event of a tornado. In total, IDHS released $295,312.00 in BRIC grants, $21,802,575.19 in PDM grants, and $3,512,138.30 in HGMP grants toward mitigation and disaster planning activities.

2 State Profile

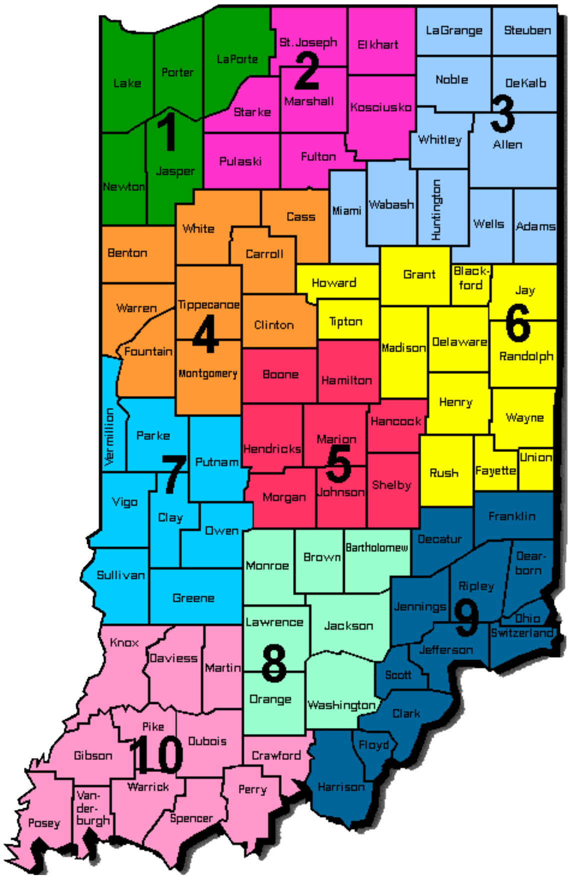


Figure 2. IDHS Districts

Located in the Great Lakes region of the United States, Indiana is the 17th most populous state 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 2) to coordinate disaster activities more effectively such as response, damage assessment, preparedness, and outreach and education.

2.1 Geography and Topography

In terms of land area, Indiana is one of the smallest states west of the Appalachian Mountains, but its topography varies significantly from the northern portion of the state to the southern portion. The northern two-thirds are 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 asparagus, 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, vegetables, 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 3 illustrates Indiana's physiographic landscape. Figure 4 shows the state's perennial streams while Figure 5 shows the Hydrologic Unit Code (HUC) 8 basins.

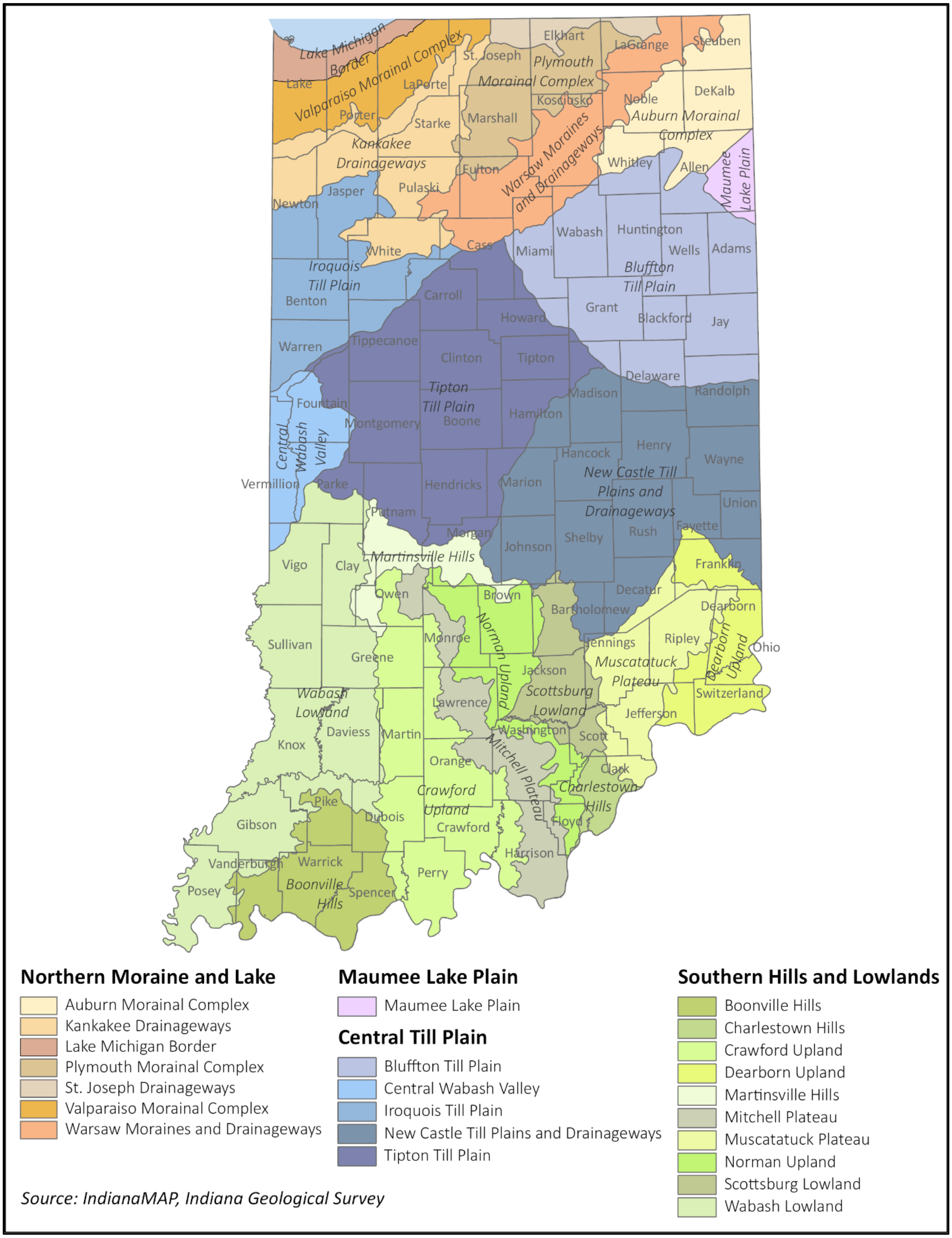


Figure 3. Indiana Physiography

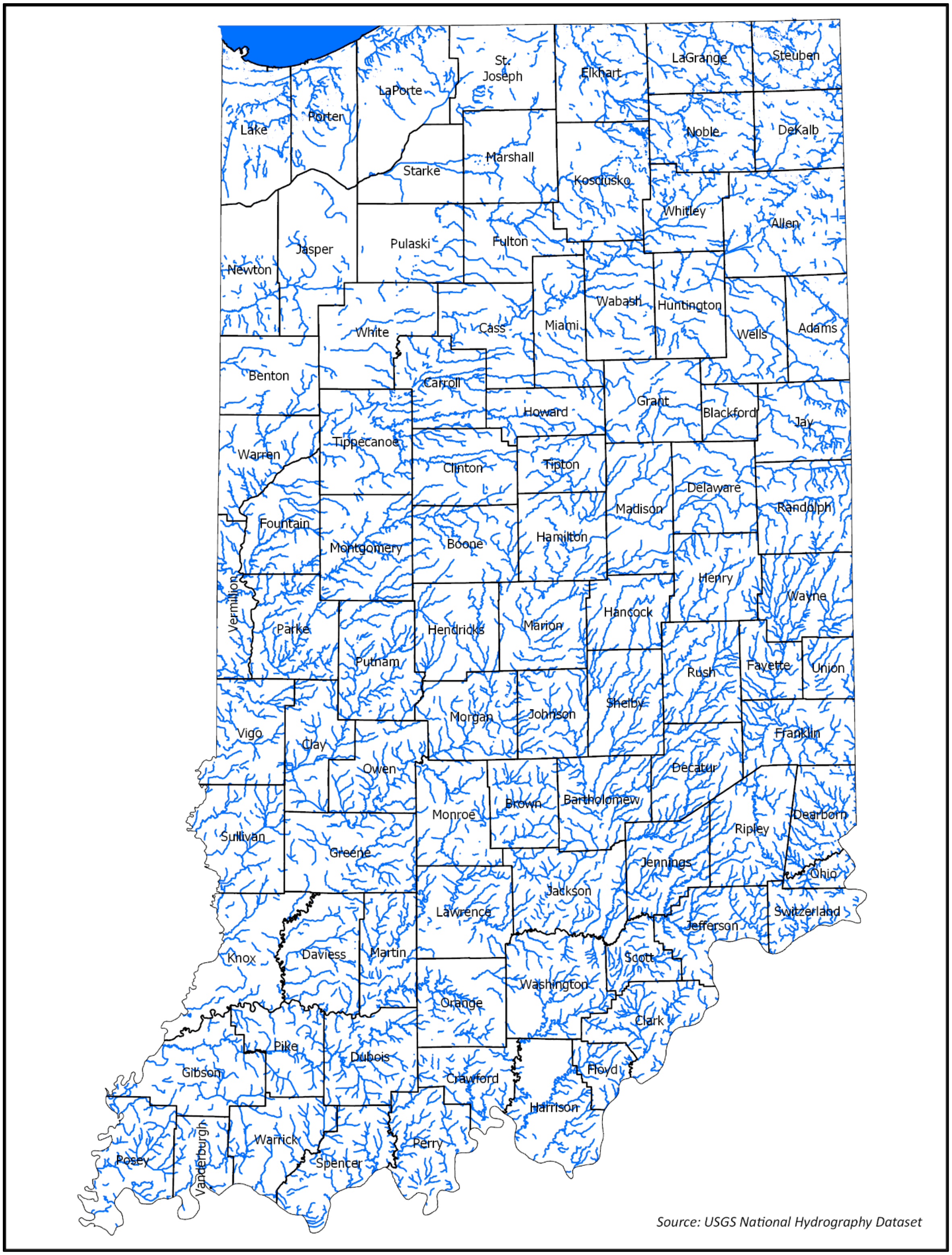


Figure 4. Perennial Streams

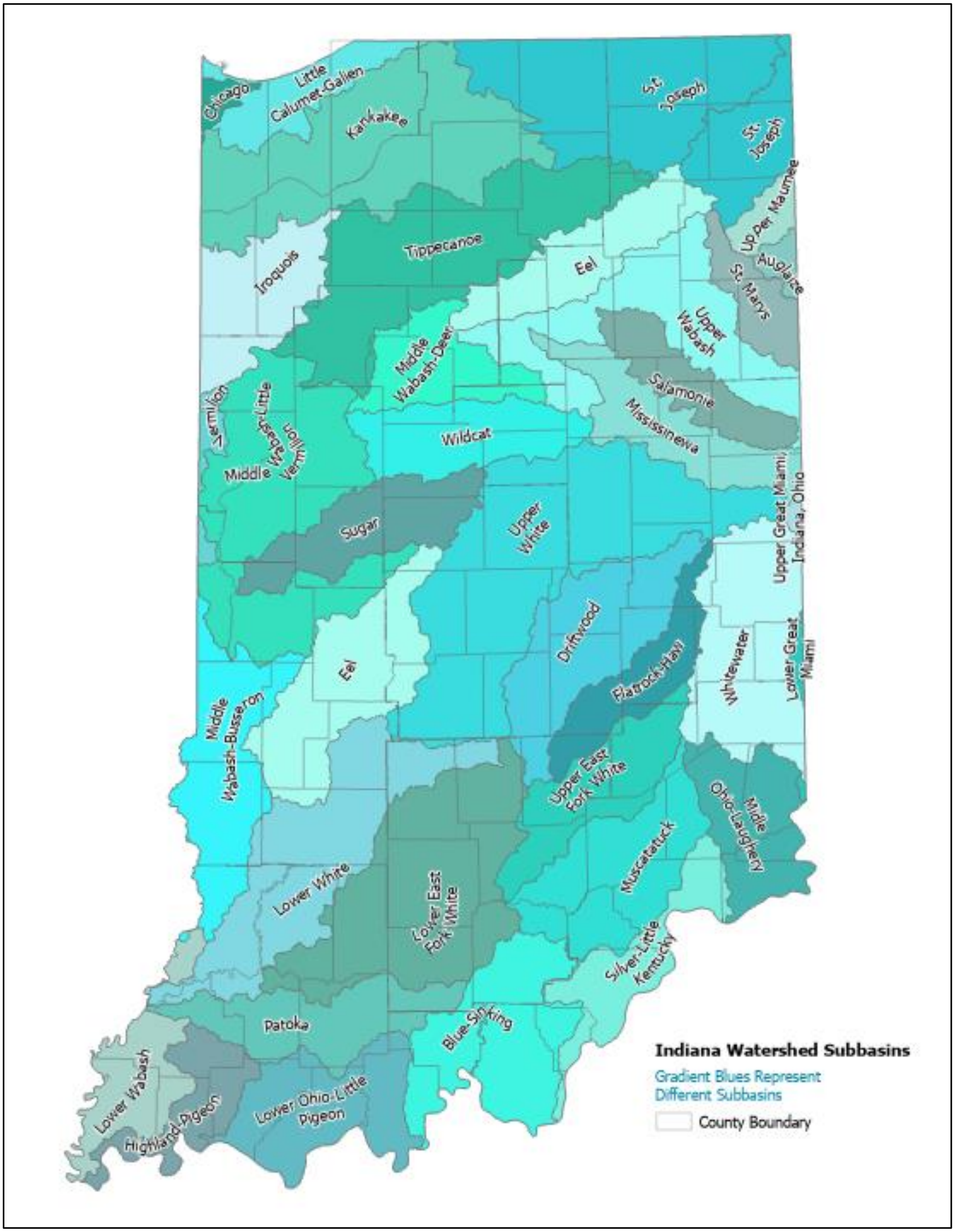


Figure 5. Basins (HUC 8)

2.2 Climate

Indiana is in the hot-summer humid continental climate zone, with large seasonal temperature differences. The state has four distinct seasons with cold winters and hot and humid summers. Due to latitude differences, northern Indiana tends to be cooler than southern Indiana. Precipitation typically averages 40 inches per year, increasing from north to south. Both the Gulf of Mexico and the Great Lakes affect Indiana's climate, with warm and humid air, and the jet stream, which brings polar air from Canada. The state is subject to extreme weather such as thunderstorms and tornadoes, especially in the spring. Spring is the wettest season, bringing with it floods, while fall tends to be drier.

In Indiana, climate change is predicted to affect extreme temperatures, precipitation extremes, and annual peak flows (Widhalm, 2018).

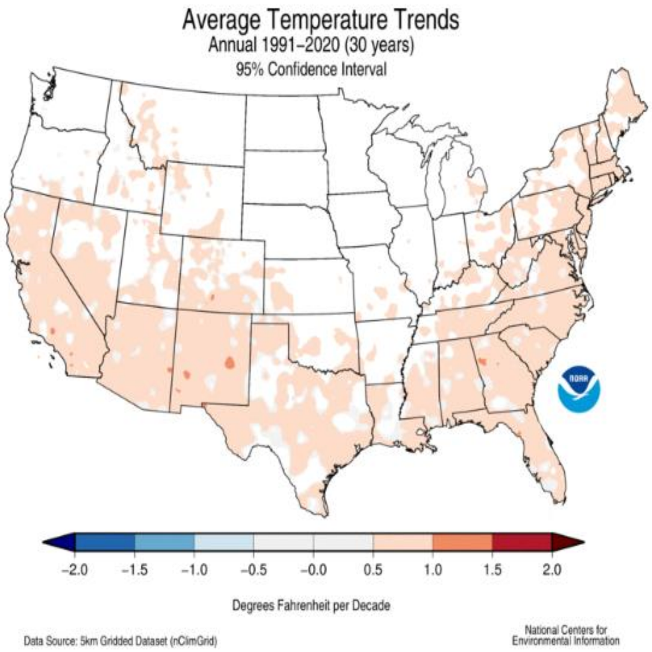
Teleconnections

Weather patterns in other parts of the world have varying levels of influence on Indiana's weather and climate. One well known and commonly discussed teleconnection is the El Niño-Southern Oscillation (ENSO). ENSO is a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean. ENSO has two phases: El Niño and La Niña. During El Niño events, warmer-than-average sea surface temperatures develop in the central and eastern tropical Pacific Ocean. This warming can disrupt normal atmospheric circulation patterns, leading to various weather anomalies worldwide, such as increased rainfall and flooding in some regions and droughts in others. La Niña is the opposite phase, characterized by cooler-than-average sea surface temperatures in the same tropical Pacific region. La Niña tends to have its own set of global weather impacts, which can include increased hurricane activity in the Atlantic, droughts in certain areas, and cooler and wetter conditions in others. Indiana winters during El Niño tend to milder and wetter than normal while La Niña winters tend drier and colder than normal winter.

Other teleconnections that can have short-term impacts on Indiana's weather include the Arctic Oscillation and the North Atlantic Oscillation. Indiana's weather is dependent on whether the oscillation is positive or negative. For example, the negative phase of the Artic Oscillation means frigid Arctic air masses can more easily spill southward toward Indiana. This can result in colder and snowier winters in the region, with an increased likelihood of extreme cold spells and heavy snowfall events.

2.2.1 Past and Current Climate

Climate trends in the United States from 1991-2020 and 1895-2020 as displayed in Figure 6. When comparing weather data from 1991 to 2020 over a 30-year period (left image), we typically expect some warming, with more significant warming in the southern regions and less in the north. However, when we examine temperature trends over a longer period, from 1895 to 2020 (right image), we observe unexpected warming in the northern and central parts of the United States. In the context of these two images, Indiana appears to have experienced relatively minor temperature increases in the past.



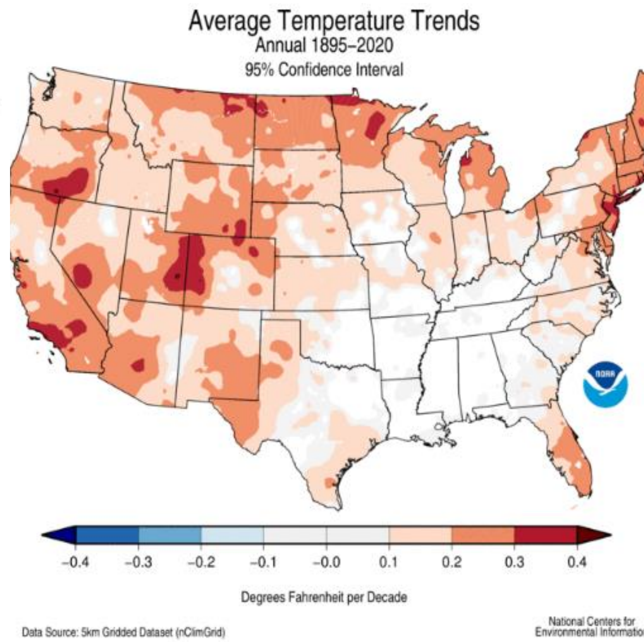


Figure 6. Climate trends in the US

Figure 7 through Figure 12 shows the average temperatures and precipitation per month in three Indiana cities. South Bend is in St. Joseph County in northern Indiana near the Michigan border, Evansville is in Vanderburgh County in the southwestern tip of the state, while Indianapolis is centrally located in Marion County.

Average high temperatures in January range from the low 30s in the northern part of the state to the low 40s in the southern part. July highs range from the low 80s to the upper 80s. January is the coldest month of the year while July is the warmest.

South Bend—Northern Indiana

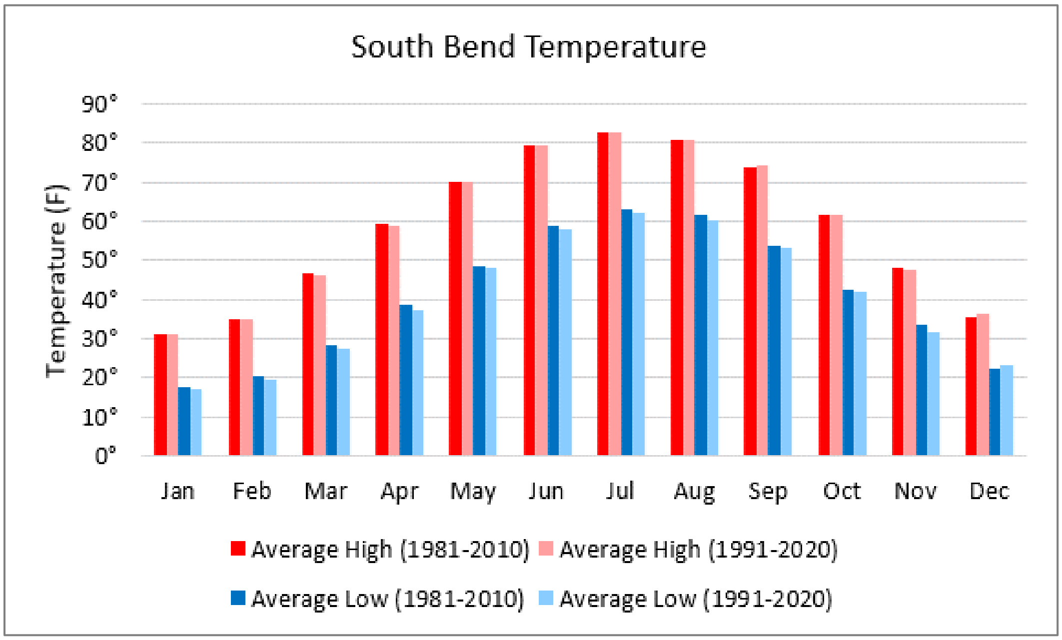


Figure 7. South Bend Temperature Climographs (NOAA, 2023)

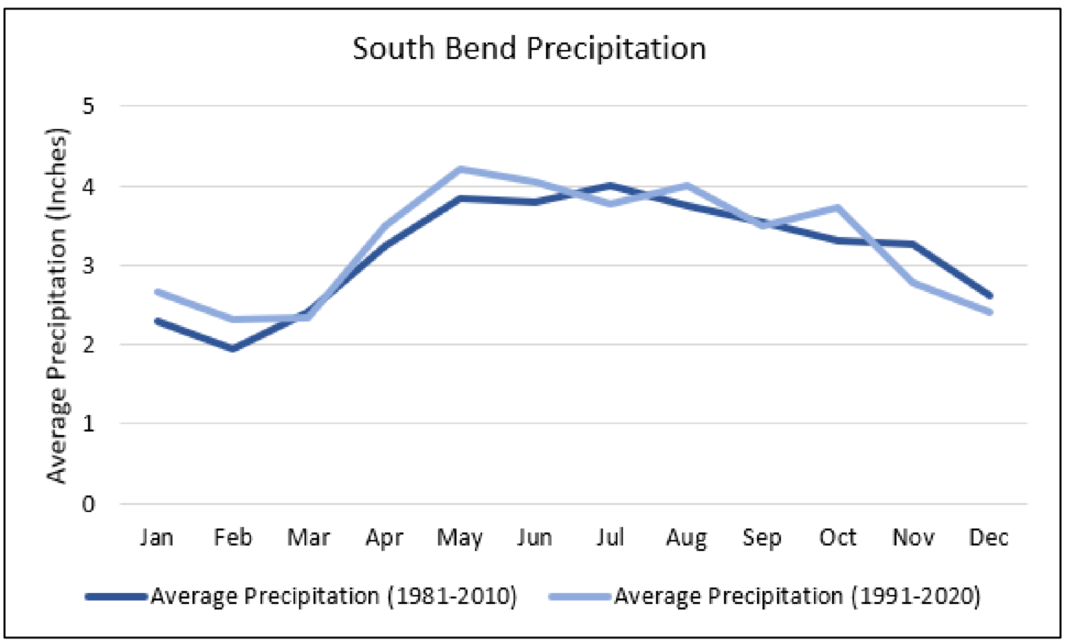


Figure 8. South Bend Precipitation Climographs (NOAA, 2023)

Indianapolis—Central Indiana

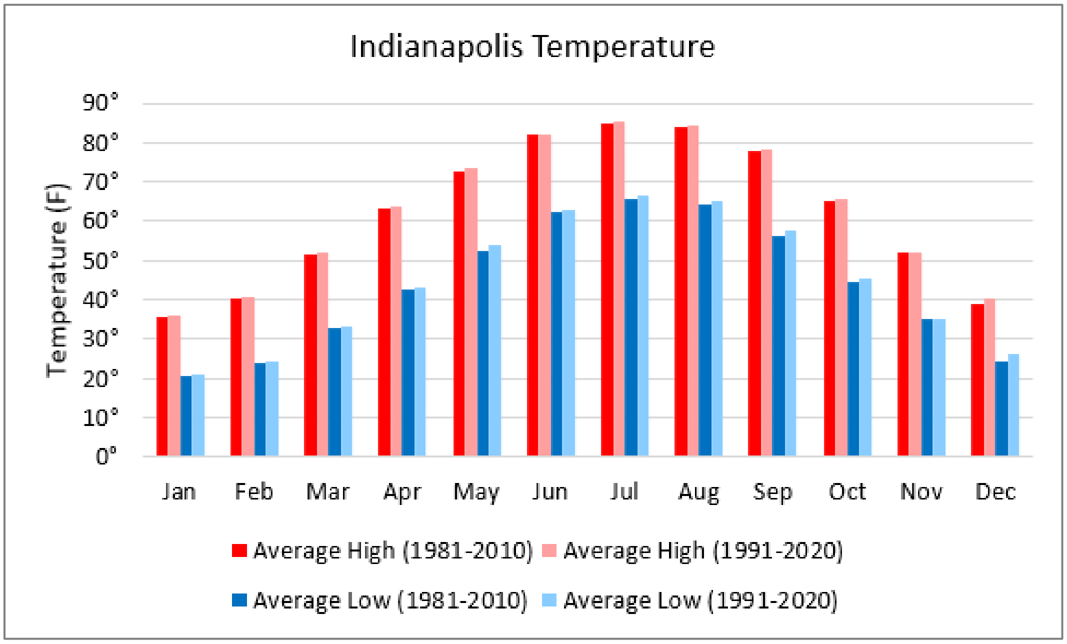


Figure 9. Indianapolis Temperature Climographs (NOAA, 2023)

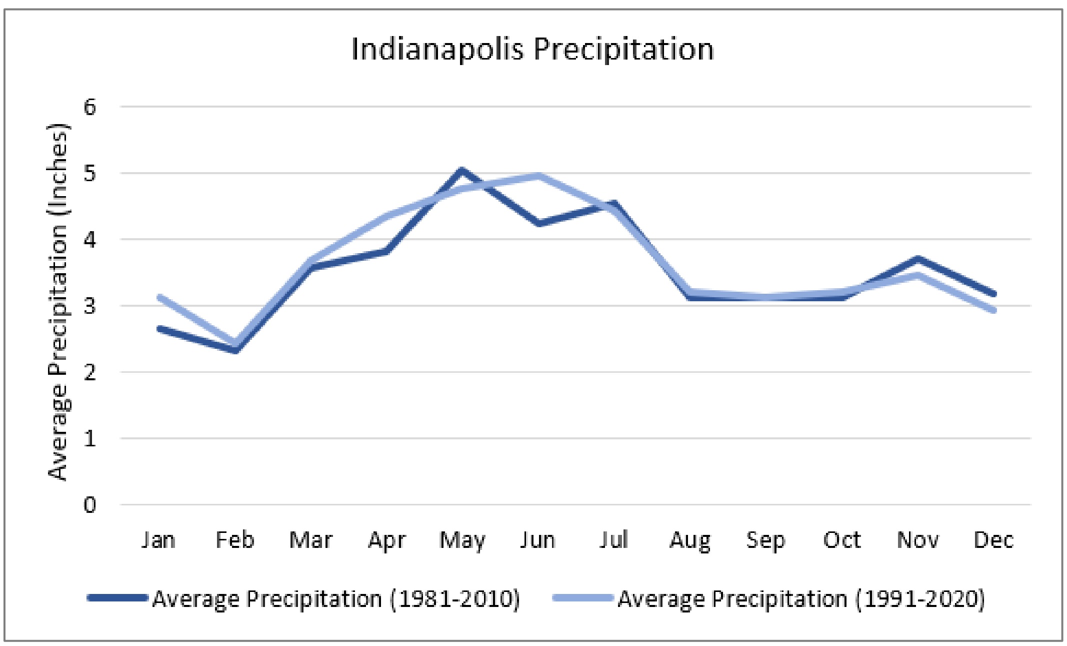


Figure 10. Indianapolis Temperature Climographs (NOAA, 2023)

Evansville—Southern Indiana

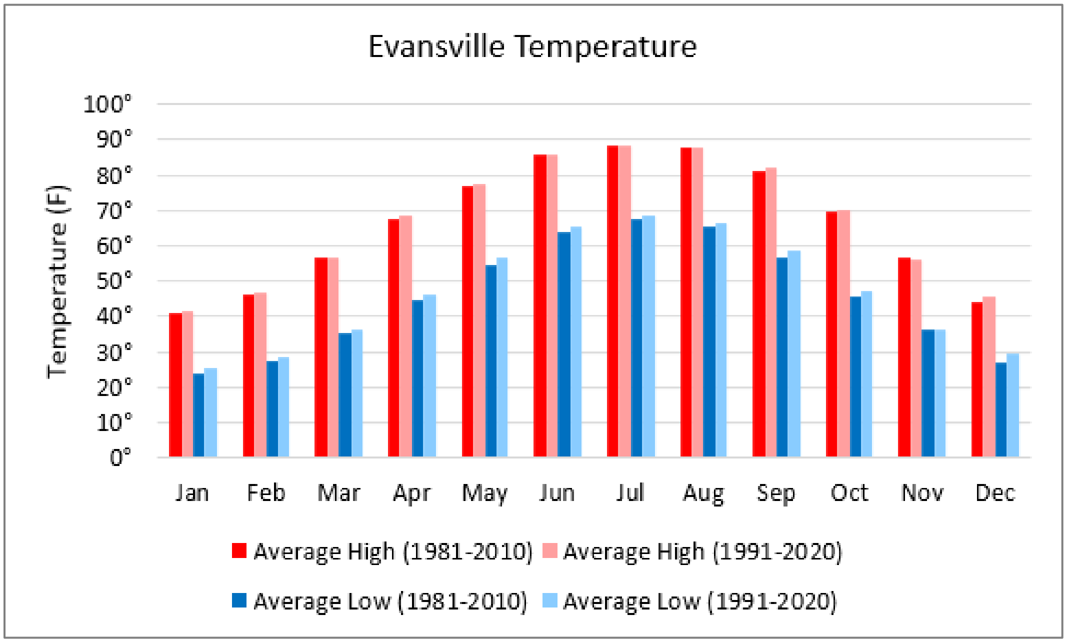


Figure 11. Evansville Temperature Climographs (NOAA, 2023)

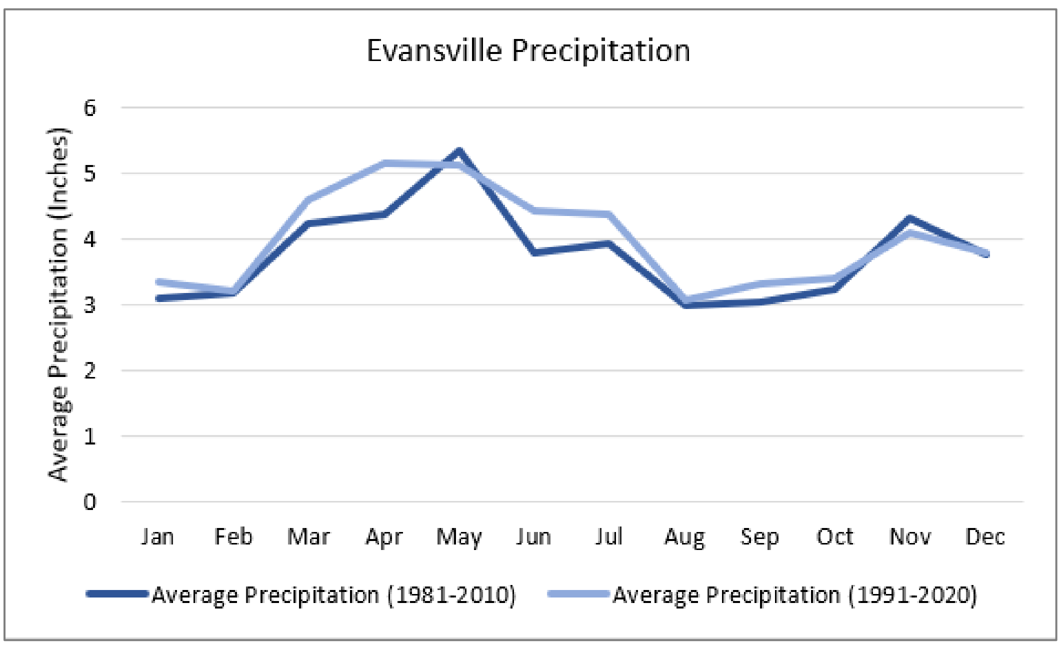


Figure 12. Evansville Precipitation Climographs (NOAA, 2023)

Average annual precipitation ranges from 40 inches in South Bend to 48 inches in Evansville. Traditionally, May was the wettest month of the year with the months of greatest flood frequency in Indiana being January through June; however, data shows increased flooding event in the beginning months of the year. As displayed in Figure 13, increased winter temperatures have caused non-traditional flooding events during winter months from snow melt and rain-like weather (Byun, 2019). It is projected that by 2080s, significant increase in precipitation during the winter and spring may result in Indiana rivers experiencing increased 100-year flood events (Byun et al., 2019). Flash floods continue to be most frequent from May to July (see Figure 14).

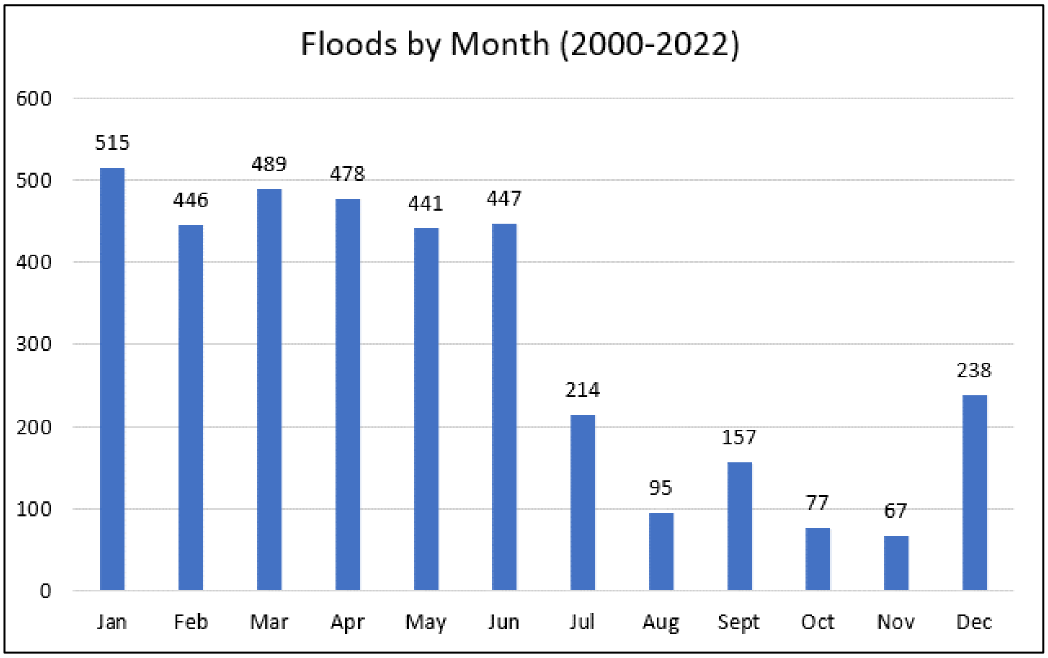


Figure 13. Indiana Floods by Month (National Centers for Environmental Information, 2018)

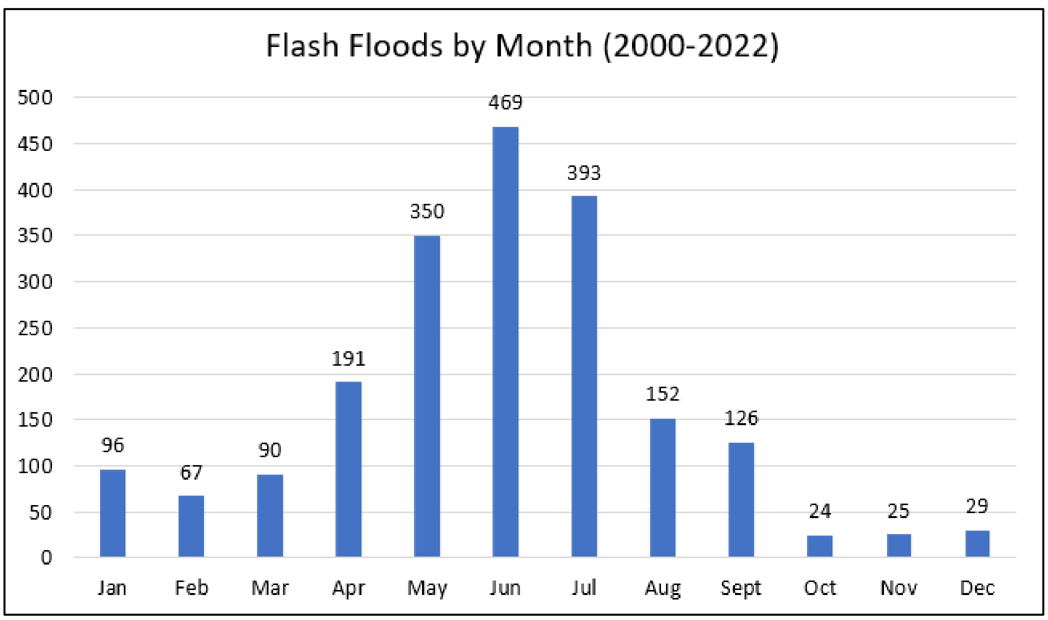


Figure 14. Indiana Flash Floods by Month (National Centers for Environmental Information, 2018)

Tornadoes are a common occurrence in Indiana. According to the National Centers for Environmental Information (NCEI), over 1,800 tornadoes have been reported in the state from 1950 to 2022. Figure 15 displays tornado occurrences by year from 1970 to 2022. Historically, tornado activity in Indiana occurred during the months of April to June. This is projected to persist; however, research is showing the number of EF-1 and greater tornadoes is decreasing in the Spring and Summer and increasing in the Fall and Winter. Figure 16 illustrates this trend.

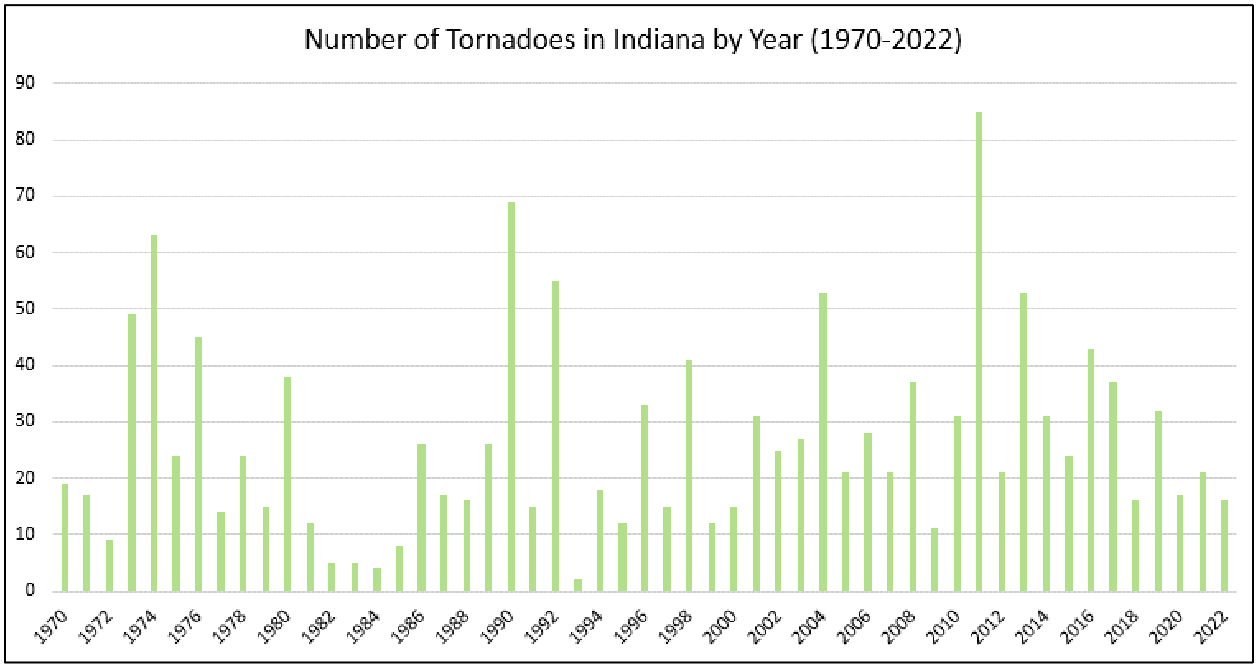


Figure 15. Indiana Tornadoes by Year from 1950-1999 and 2000-2022 (National Centers for Environmental Information, 2018)

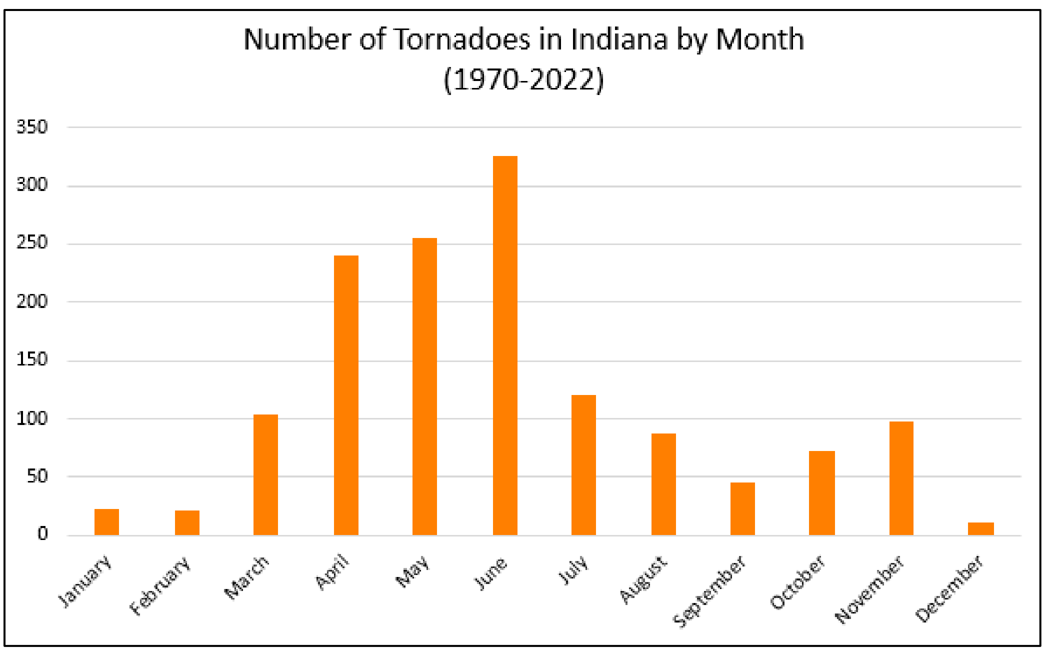


Figure 16. Number of Tornadoes by Month Between 1970 and 2022 (National Centers for Environmental Information, 2018).

Indiana is subject to other storm events besides flooding and tornadoes. Table 5 lists the top 10 event types that occurred in Indiana from 2002-2022 according to NCEI.

Table 5. Top 10 Storm Events Between 2002 and 2022

	Event Type	Occurrences 2002-2022
1	Thunderstorm Wind	10,010
2	Hail	5113
3	Flood	3,005
4	Flash Flood	1,753
5	Winter Weather	1,703
6	Winter Storm	1,534
7	Heavy Snow	905
8	Tornado	696
9	High Wind	683
10	Dense Fog	379

Drought is a period of unusually dry weather that persists long enough to result in negative impacts such as crop damage, decreasing water supply, and/or the ignition of wildfires. It is a normal, recurrent feature of climate that occurs in all climate zones (National Oceanic and Atmospheric Administration, 2018). Drought is unique from other hazards, which can make it more challenging to manage and plan for effectively. It is unique because it often develops gradually, can last for months or years, and the spatial extent varies depending on the drought. There are cases, though, when drought develops quickly and lasts a very short period of time, exacerbated by extreme heat and/or wind (i.e., flash drought).

Even though recent decades have trended towards wetter conditions in Indiana, drought has been a prominent hazard known to cause impacts (Figure 17). The drought of record for the state was in the early 1930s, while the most recent drought to impact Indiana was a flash drought in 2012. Even though the drought in 2012 pales in comparison to the droughts in the early 1900s, there were still significant negative impacts to Indiana in 2012. Indiana's agriculture saw a significant impact, with poor corn and soybean conditions, decreased crop yields (lowest corn yield in the last 75 years), issues with aflatoxin in corn, and Indiana's crop insurance payouts topped $1 billion for drought impacts on corn, soybeans, and wheat. In addition, water restrictions were implemented in major metropolitan areas such as Indianapolis, and burn bans were in effect in 84 of Indiana's 92 counties by July 2012 (National Drought Resilience Partnership, 2018).

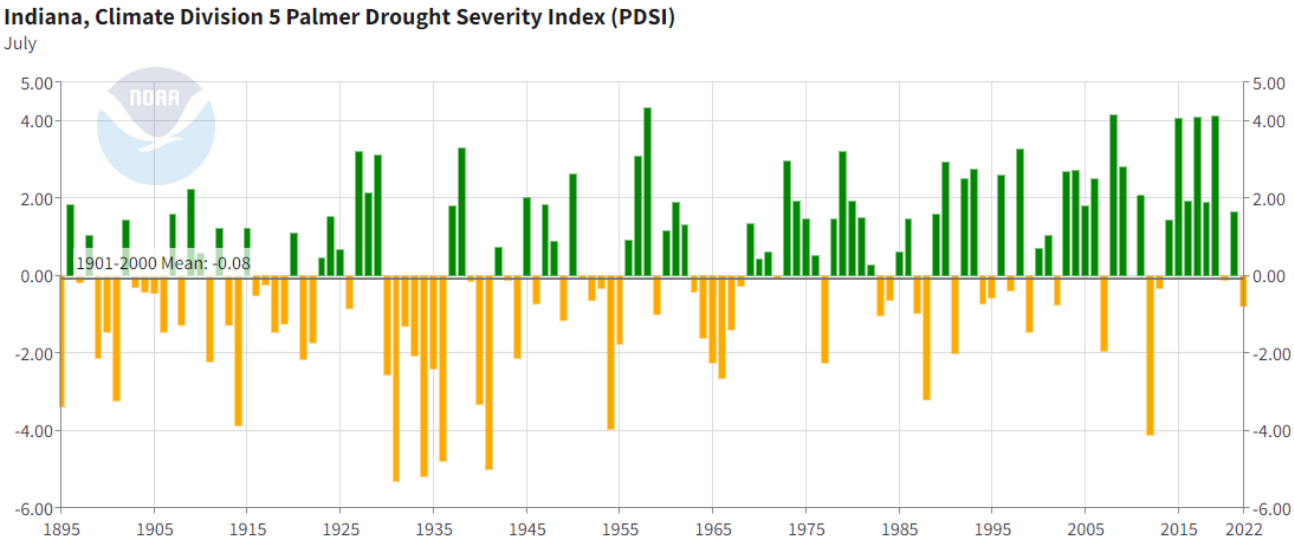


Figure 17. Values for the Palmer Drought Severity Index for July in Indiana, 1895 – 2023 (NOAA, 2023)

Palmer Drought Severity Index (PDSI)

The PDSI is the most prominent index of meteorological drought used in the United States for long-term drought monitoring and research. It uses readily available temperature and precipitation data to estimate relative dryness. It is a standardized index that spans -10 (dry – yellow bars) to +10 (wet – green bars). PDSI calculations are based on precipitation and temperature data as well as the local available water content of the soil.

Future model projections for precipitation changes are less certain than those for temperature, but in general, average annual precipitation is likely to increase and the frequency and intensity of extreme precipitation (i.e., heavy precipitation and stretches of dry weather) are expected across the Midwest. These projected increases in wet conditions are expected to reduce the frequency of extreme droughts in Indiana in the future (Cherkauer et al., 2023). Some regional climate models project increased spring precipitation, but decreased summer precipitation, particularly in the southern portions of the Midwest. The average number of days without precipitation is expected to increase in the future, which could lead to agricultural drought and suppressed crop yields (Cherkauer, 2023).

2.2.2 Future Climate Trends

Scenarios are used to explore how much humans are likely to contribute to future climate change given uncertainties in factors such as population growth, economic development, and development of new technologies. To calculate how human activities could affect the climate system, scientists insert greenhouse gas concentrations, pollution, and changes in land cover to their models. These factors influence the Earth's climate. How much emissions and land use change scientists should incorporate into their models depends on future social and economic development. This information is provided by scenarios produced by integrated assessment models (CICERO, 2018).

It is important to note that climate projections should be interpreted as scenarios rather than certainties. They provide a range of possible future climate outcomes based on current data and modeling techniques, but they do not definitively predict what will happen. The climate system is complex and subject to various natural and anthropogenic influences, leading to inherent uncertainties in projections.

Four emissions pathways are commonly used in future climate modeling, ranging from significantly reduced emissions levels to continuing the current-day high emissions trajectory. While all these scenarios are considered possible, the lowest emissions scenario is highly unlikely.

Table 6 shows statewide projected temperatures and precipitation changes according to the Indiana Climate Change Impacts Assessment. These changes are in comparison to historic values recorded between 1971 and 2000 (Cherkauer et al., 2023).

Table 6. Projected Changes in Indiana Statewide Average Temperature and Precipitation based on the Indiana Climate Change Impacts Assessment (2023).

Scenario	Time Period	Average Annual Change in Temperature (°F)	Average Annual Change in Precipitation (%)
Medium Emissions	**2041 - 2070**	5.1	6%
	2071 - 2100	5.8	5%
High Emissions	**2041 - 2070**	6.2	8%
	2071 - 2100	9.4	10%

Continuing to outline northern, central, and southern sections of the state, Figure 18 through Figure 20 displays the average annual precipitation for St. Joseph County (northern Indiana), Marion County (central Indiana), and Vanderburgh County (southern Indiana) through the end of the century according to NOAA Climate Explorer (NOAA, 2023). The projected minimum and maximum average daily temperatures are included in Table 7 through Table 9. These predictions assume the presence of higher emission values contemporary with current trends.

St. Joseph County—Northern Indiana

Table 7. St. Joseph County Average Projected Temperatures and Precipitation

Decade	Average Daily Temperature		Average Annual Precipitation (inches)
	Minimum (°F)	Maximum (°F)	
2020s	43.2	62.2	40.06
2050s	46.3	65.5	40.87
2090s	51.2	70.6	43.23

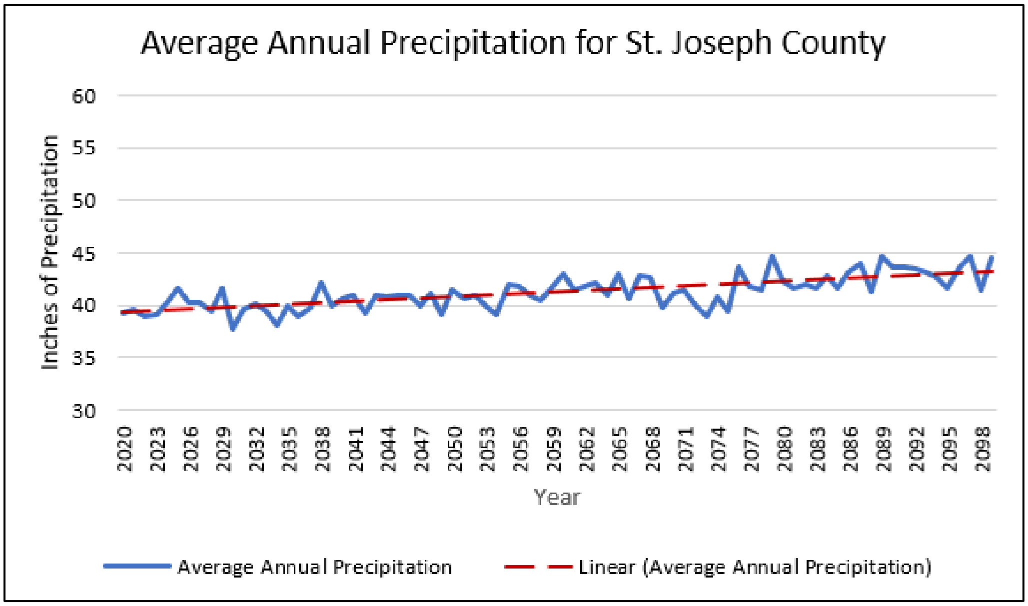


Figure 18. Average Projected Annual Precipitation in inches between 2020-2099 for St. Joseph County

Marion County—Central Indiana

Table 8. Marion County Average Projected Temperatures and Precipitation

Decade	Average Daily Temperature		Average Annual Precipitation (inches)
	Minimum (°F)	Maximum (°F)	
2020s	45.0	65.1	42.72
2050s	47.9	68.3	43.45
2090s	52.6	73.1	44.79

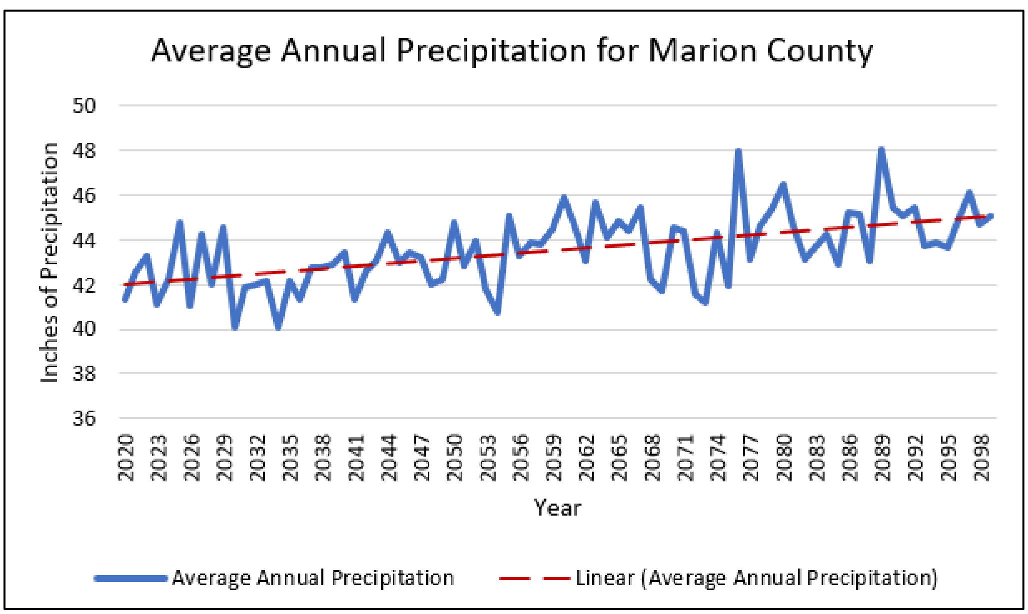


Figure 19. Average Projected Annual Precipitation in inches between 2020-2099 for Marion County

Vanderburgh County—Southern Indiana

Table 9. Vanderburgh County Average Projected Temperatures and Precipitation

Decade	Average Daily Temperature Minimum (°F)	Average Daily Temperature Maximum (°F)	Average Annual Precipitation (inches)
2020s	49.2	69.8	46.31
2050s	51.9	72.9	47.70
2090s	56.4	77.5	48.26

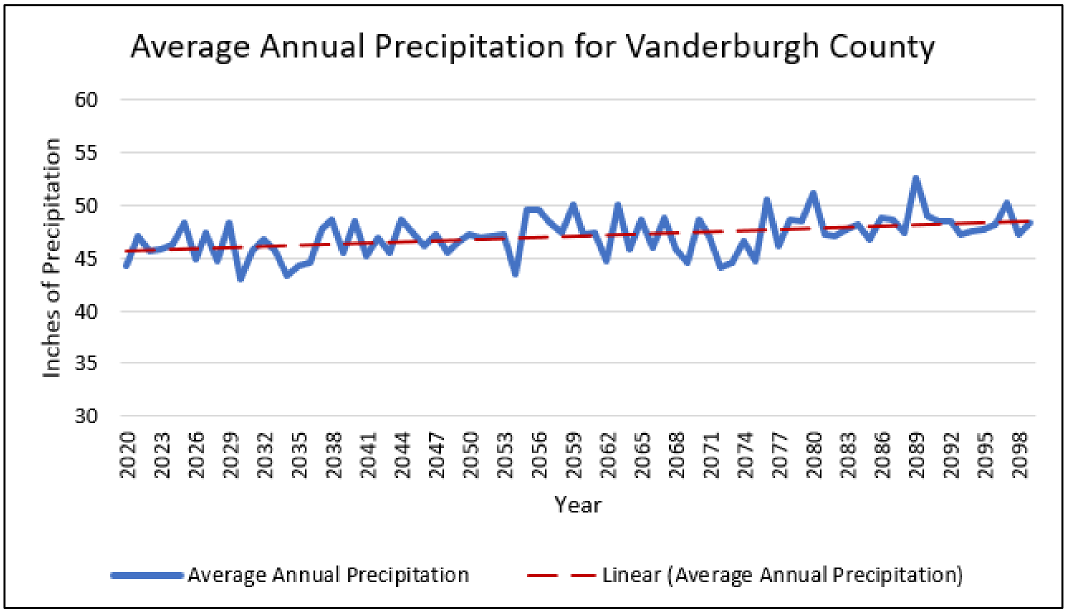


Figure 20. Average Projected Annual Precipitation in inches between 2020-2099 for Vanderburgh County

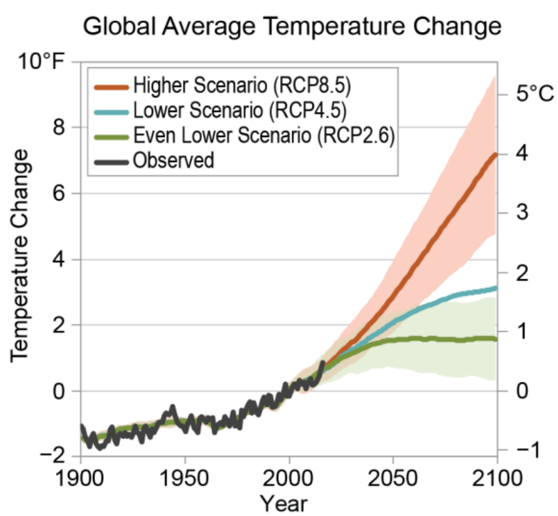


Figure 21. Projected Global Temperatures (UGSCRP, 2018).

Figure 20 shows a multimodel simulated time series from 1900 to 2100 for the change in global annual mean surface temperature relative to 1986-2015 for a range of the Representative Concentration Pathways (RCPs). These scenarios account for the uncertainty in future emissions from human activities, as analyzed with the 20+ models from around the world used in the most recent international assessment. The mean (solid lines) and associated uncertainties (shading, showing ±2 standard deviations across the distribution of individual models based on the average over 2081-2100) are given for all of the RCP scenarios as colored vertical bars. The numbers of models used to calculate the multimodel means are indicated.

According to the Indiana Climate Change Impacts Assessment (IN CCIA) from 2018 (Widhalm, 2018), Indiana weather is predicted to change this century. The main findings are listed below:

- Temperatures are projected to rise about 5-6°F by 2050.
- The number of extremely hot days will rise.
- Extreme cold events will decline.
- The frost-free season will lengthen.

2.2.2.1 Temperatures

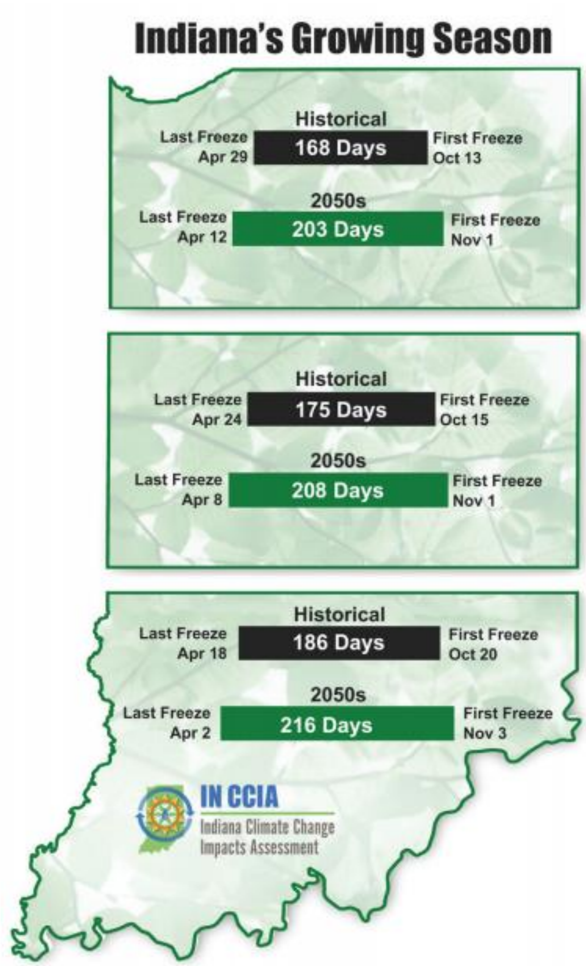


Figure 22. Indiana's Growing Season (Widhalm, et al., 2018)

The CCIA indicates that Indiana has warmed 1.2°F since 1895 and temperatures will rise by about 5°F to 6°F by mid-century. Compared to Table 6, a 5°F to 6°F increase will happen by late century, if not earlier. This has multiple impacts for Indiana, including changes to the timing and length of the frost-free season, and the occurrence of temperature extremes. These shifts will impact air quality, extend the growing season and the allergy season, and create more favorable conditions for some pests and invasive species.

Indiana's growing season is expected to increase by 35 days for the northern part of the state, 33 days for the central part of the state, and 30 days for the southern part of the state (see Figure 22).

Warming temperatures in the winter months will affect the types of plants and pests that can thrive in Indiana and alter the amount of energy needed to heat and cool homes and businesses.

2.2.2.2 Precipitation

Since 1895, average annual precipitation in Indiana has increased by about 15%, or about 4.5 inches, based on a linear trend. This trend is projected to continue, though the type of precipitation and when it falls are changing and will continue to do so.

The southeastern region of the state has observed the largest increases in precipitation, while the east-central and northeast regions observed the smallest. Spring and fall increases were smallest in the north and largest in the south. The opposite was true in summer when increases were larger in the north and west.

Annual precipitation is projected to continue to increase. It is estimated that by mid-century, Indiana will see about 6 to 8 percent more rainfall than in the recent past. However, this increase will not be spread evenly throughout the year. Winter and spring are expected to see substantial increases in precipitation (13 to 20 percent), and more falling as rain instead of snow due to warming temperatures. There is high agreement among climate models for the winter and spring seasons. Increased precipitation will create challenges for flood control and storm water management. Summer and fall precipitation projections are less confident across models, with the average projection showing modest declines. Declining warm season rainfall coupled with higher temperatures is expected to increase water stress and lead to possible water shortages for crops, drinking water and wildlife.

With increasing temperatures, it is expected that rain will replace snow in the cold season. Fewer snow days would save municipality and state funding for plowing and salting roadways. However, wetter winters and springs will increase the risk of flooding and combined sewer system overflows, resulting in decreased water quality.

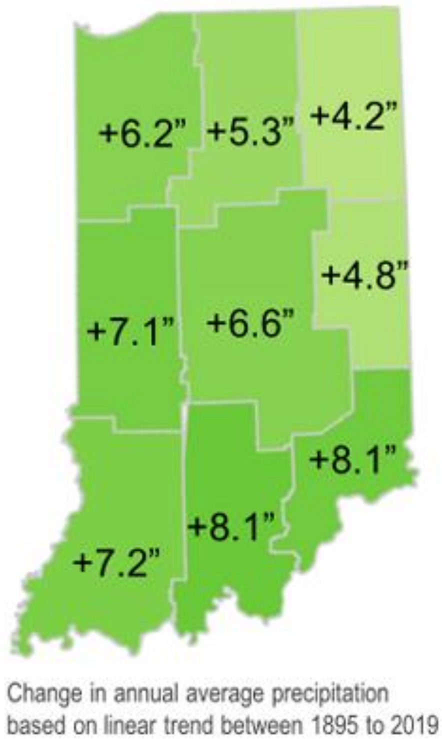


Figure 23. Average Precipitation Increase (Cherkauer, 2023)

2.3 Demography

According to the 2021 Census, Indiana is the 17th most populous state in the nation with 6,852,542 people and a population density of 181 people per square mile. The most populous city is the capital of Indianapolis. Table 10 lists the ten counties with the highest total population.

Table 10. Indiana's Most Populous Counties

County	Total Population	Percent of State Population
Marion	969,542	14.4%
Lake	495,925	7.3%
Allen	381,839	5.7%
Hamilton	341,616	5.1%
St. Joseph	272,049	4.0%
Elkhart	206,314	3.1%
Tippecanoe	185,961	2.8%
Vanderburgh	179,695	2.7%
Porter	172,353	2.6%
Hendricks	172,100	2.5%

Figure 24 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 50 to 59 and 60-64 years represents the tail end of the 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. As a significant portion of Indiana's population ages, demand for specialized healthcare may also increase, leading to further shortages of essential goods and services within that community.

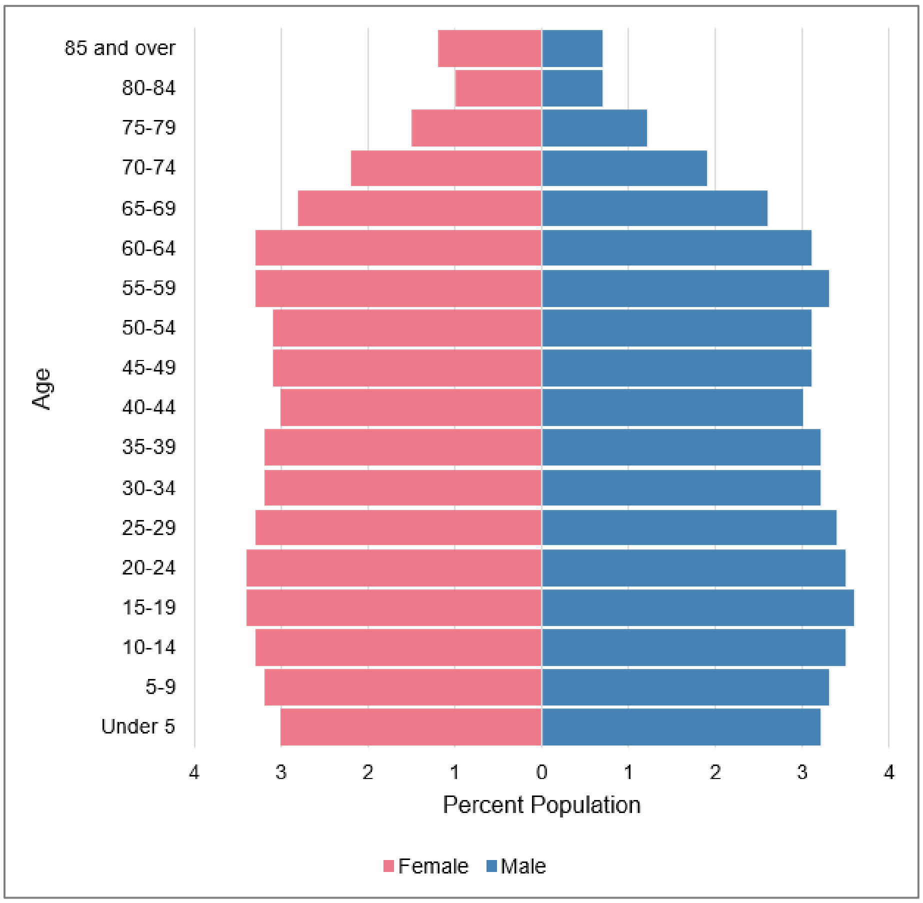


Figure 24. Indiana Population Pyramid (2021 ACS 5-Year Estimate)

Most of Indiana's counties exhibit a population distribution similar to the state's; however, there are some areas with atypical distributions, indicating the presence of populations that may require special consideration in terms of disaster mitigation. For example, the City of West Lafayette spike in population aged 20 to 24 is due to the significant student population at Purdue University and accounts for more than 30% of the city's total population (Figure 25). The age distribution for the Town of Westville is dominantly male population aged 20 to 39. This surpasses the female population in the same age group because the town is home to the state-operated Westville Correctional Facility, a prison for adult males.

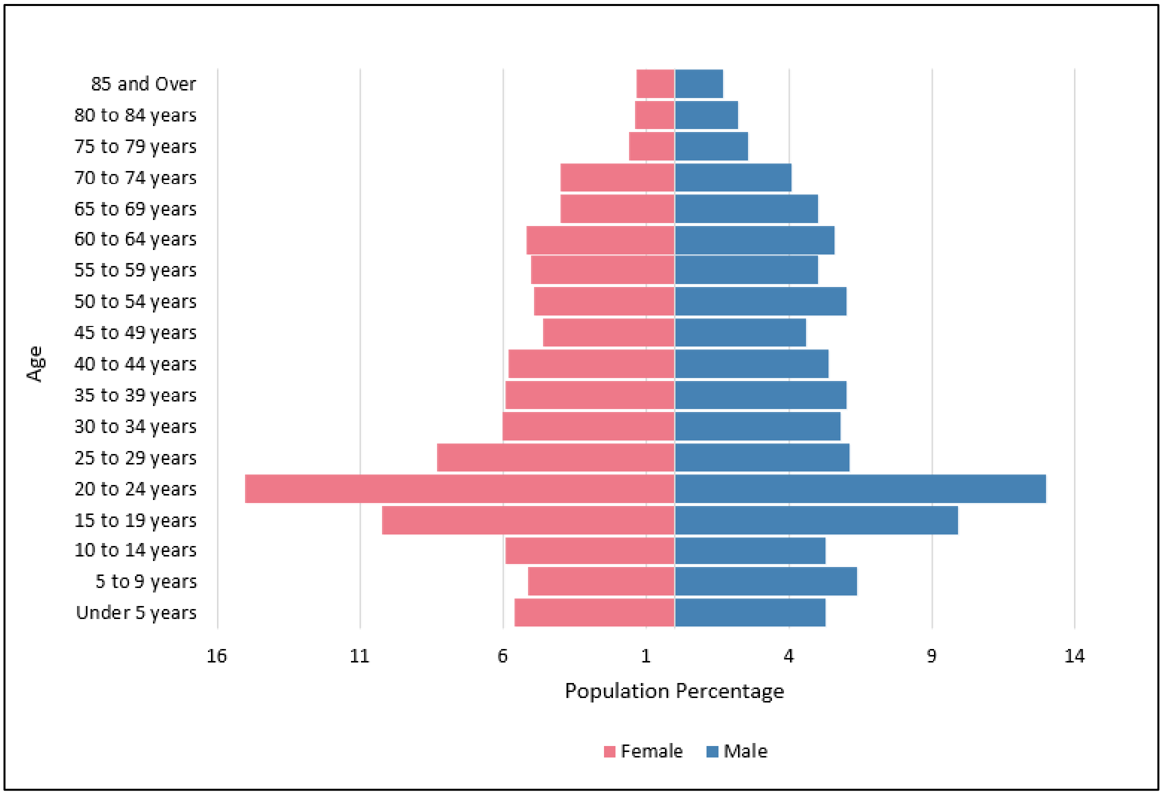


Figure 25. City of West Lafayette Population Pyramid

Diversity and culture are important to consider in mitigation planning. Figure 26 shows the state's racial composition as estimated in the 2020 census.

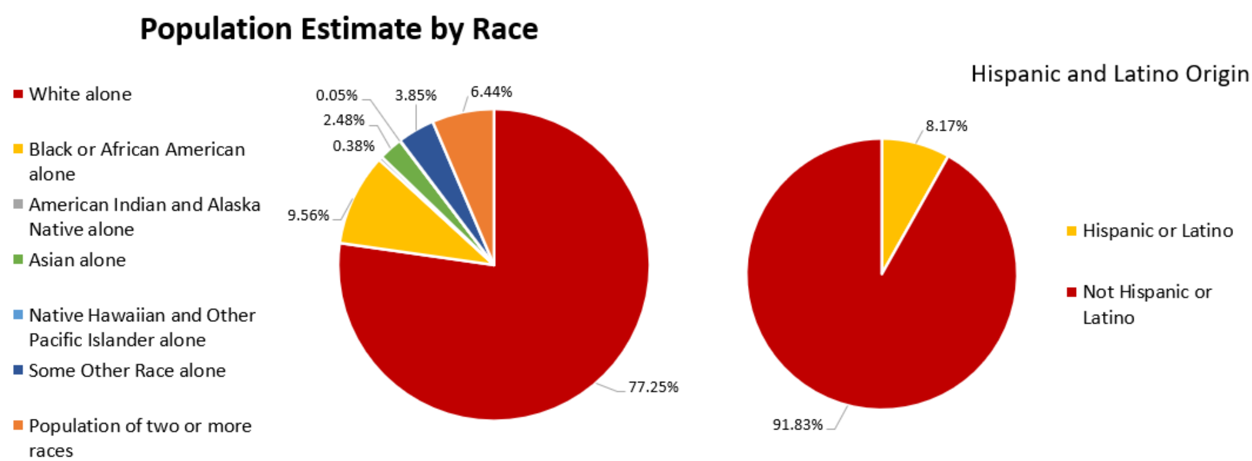


Figure 26. Indiana's Racial and Ethnic Composition

2.4 Native Lands

Indiana, like many other US states, has a complex history when it comes to Native American lands. Before European colonization, the region now known as Indiana was inhabited by several indigenous groups, primarily from the Algonquian and Miami-Illinois language families. These native peoples had their own distinct cultures, societies, and territories.

The indigenous peoples of Indiana included the Miami, Potawatomi, Delaware (Lenape), Kickapoo, Shawnee, and various bands of the Wea and Piankashaw tribes. These tribes had lived in the region for generations before the arrival of European settlers.

Through a series of treaties, agreements, and land purchases, the US government acquired most of the native lands in Indiana, pushing indigenous communities westward or onto reservations. Despite the historical dispossession of their lands, there are still indigenous communities in Indiana today. These communities continue to maintain their cultural heritage and contribute to the state's cultural diversity. The Miami Nation of Indiana and the Pokagon Band of Potawatomi Indians are two federally recognized tribes with a presence in the state.

The Miami, also known as the Miami-Illinois, are an Algonquian-speaking people who originally inhabited the Great Lakes region, including present-day Indiana, Illinois, Ohio, and Michigan. Despite the loss of their lands, some members of the Miami Nation continued to live in Indiana. Over time, they reorganized and worked to maintain their cultural identity and connections to their ancestral homeland. In 1990, the Miami Nation of Indiana achieved federal recognition as a sovereign tribal nation. This recognition provided them with certain rights and benefits, including eligibility for federal programs and services, tribal self-governance, and opportunities for economic development.

The Pokagon Band of Potawatomi reservation is located in southern Michigan: Allegan, Van Buren, Berrien, and Cass Counties. The tribe has service area in northern Indiana, including land in Elkhart, Kosciusko, Laporte, Marshall, Starke, and St. Joseph Counties. Figure 28 shows the Indiana service areas. Table 11 summarizes tribal acreage in Michigan and Indiana. A native land service area refers to native land in which native individuals may not reside within the county, but the tribe holds ownership and responsibilities for specific aspects within these counties. Notably, Laporte County holds the Blue Chip Casino in Michigan City.

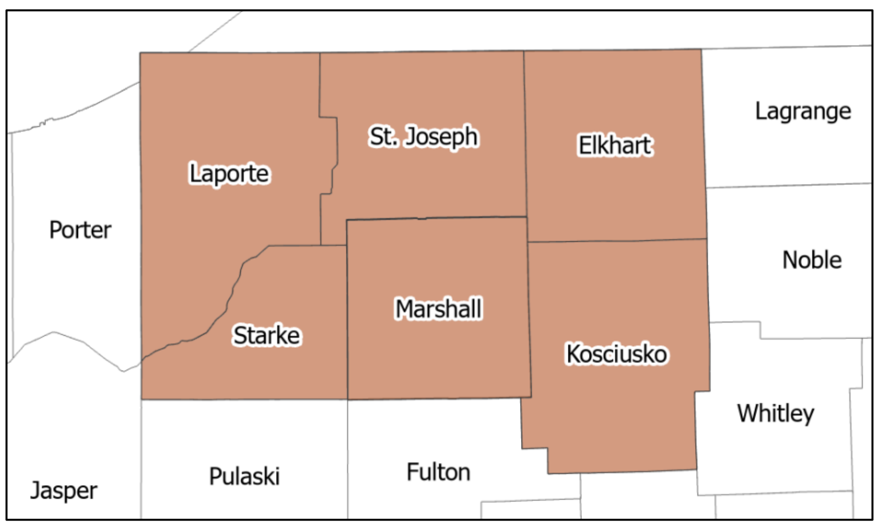


Figure 27. Pokagon Band of Potawatomi Indiana Service Area

Table 11. Tribal Acreage of the Pokagon Band of Potawatomi

Area	Total (acres)	Commercial (acres)	Land Preserve (acres)	Non-Commercial (acres)
Dowagiac	2,423.3	750.5	355.9	1,316.9
Hartford	1,627.3	531.6	152.1	943.6
New Buffalo	740.6	272.8	0.0	467.8
Niles	8.4		6.4	2.0
MI Total	**4,799.6**	**1,554.9**	**514.4**	**2,730.3**
Elkhart	173.2	173.2	0.0	0.0
Goshen	6.2	0.0	3.9	2.3
North Liberty	1,460.4	226.8	0.0	1,233.6
South Bend	207.0	91.6	0.0	115.4
IN Total	**1,846.8**	**491.6**	**3.9**	**1,351.3**
Grand Total	**6,646.4**	**2,046.5**	**518.3**	**4,081.6**

2.5 Population Change

According to the US Census Bureau's Estimates of the Components of Resident Population Change (2010-2022), Indiana's population grew by more than 342,482 or 3.9%. Hamilton County had the most significant increase (24.8%), and Union County had the most significant decrease (-8.1%) in population. Figure 28 illustrates population change from 2010 to 2022 for each county. Significant population change can impact socially vulnerable communities by decreasing the amount of employment opportunities and causing a higher demand of existing resources.

Populations grow or decline through migration and natural increase, and often these two components offset each other. Because international migration data was not as reliable as domestic migration data, this plan only references net domestic trends. From 2010 to 2020, 72 of 92 counties registered a positive natural increase, and only 41 counties added population through net in-migration.

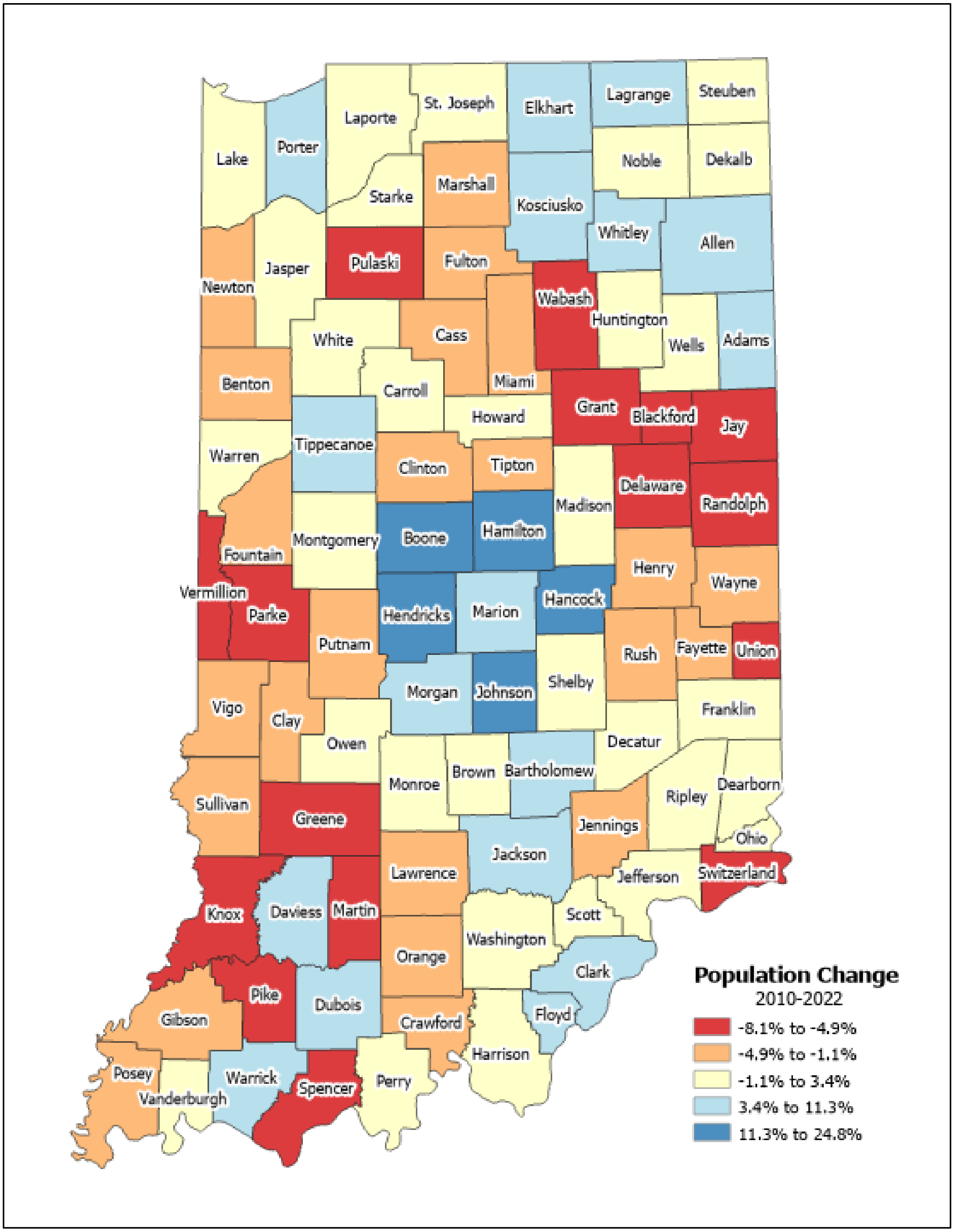


Figure 28. Indiana Population Change by County (2010 - 2022)

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.

Table 12 shows the top 5 states with migration to Indiana and the top 5 states with migration from Indiana since 2019.

Table 12. Indiana Migration

State	In Migration	State	Out Migration
Illinois	38,255	**Florida**	-13,893
New York	5,685	**Tennessee**	-5,789
California	4,148	**Michigan**	-3,929
Ohio	3,902	**Arizona**	-3,749
Pennsylvania	3,829	**Missouri**	-3,235

2.6 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 2022 gross domestic product (GDP) of $352 billion according to the US Bureau of Economic Analysis, the 20th highest in the nation. Manufacturing represents the largest portion of its GDB.

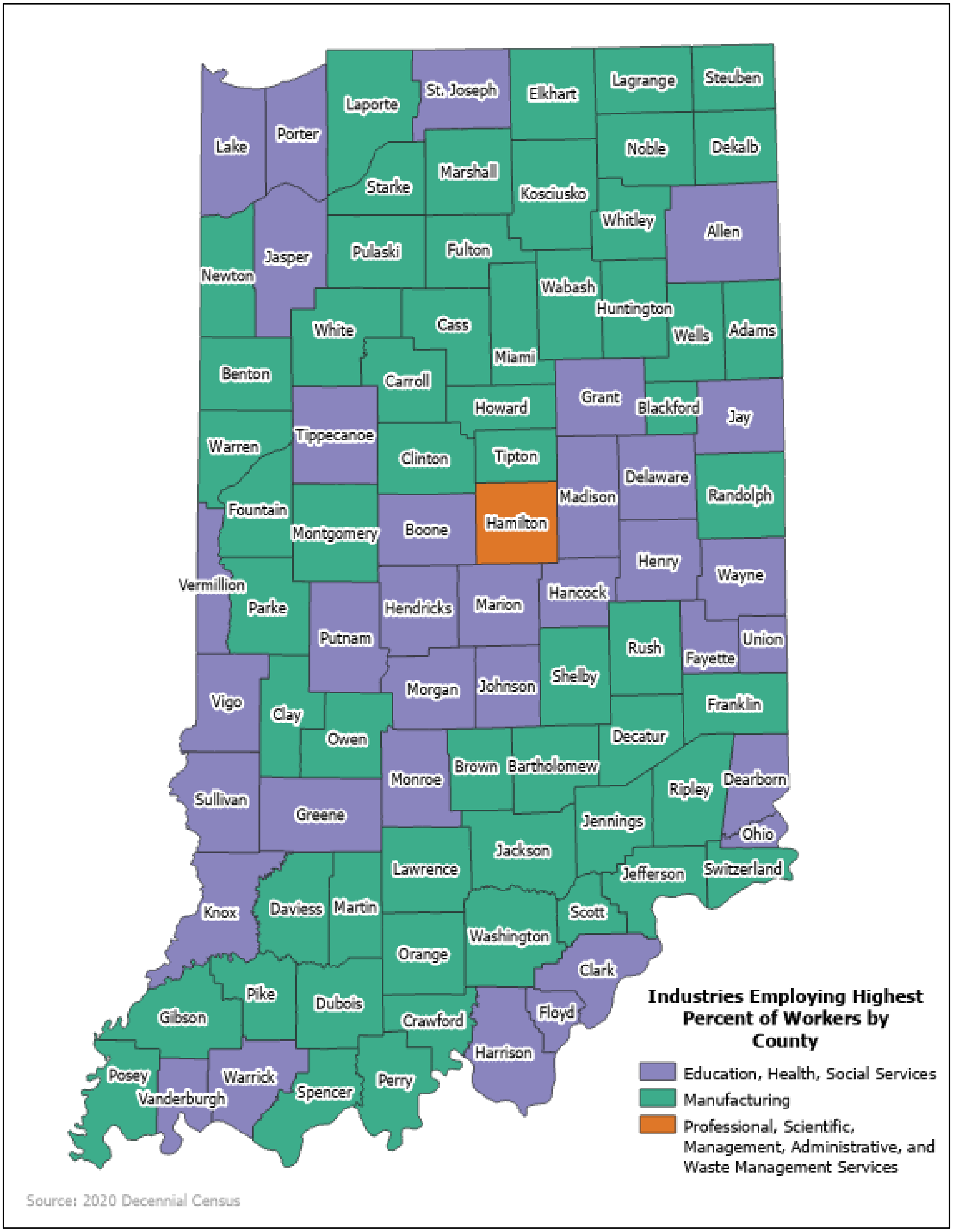


Figure 29. Industries Employing Highest Percentage of Workers by County

2.7 Disadvantaged Communities and Disasters

Certain populations require specific attention in mitigation planning to mitigate the severe impacts of disasters on them. It is crucial to identify these populations and formulate mitigation strategies to enhance their resilience to disasters.

Indiana Volunteer Organizations Active in Disasters (INVOAD) is grassroots, faith-based organization with a focus on Indiana, providing efficient services to all disaster victims and aiming to eliminate service duplications. More information about their mission and actions can be accessed on their website: https://www.nvoad.org/.

Although there are numerous types of vulnerable populations, IDHS chose six vulnerable populations to profile based on advice from INVOAD and available data. They are low-income citizens, older adults, non-English-speaking people, people with disabilities, people without high school diplomas, and households without a vehicle. Figure 30 through Figure 35 shows percentages of vulnerable populations by county.

Table 13 lists the top 5 counties for each census vulnerable population category listed above. It is important to note that Indiana has a significant Amish population, especially in LaGrange, Elkhart, and Daviess counties. The Amish typically end formal education in the 8th grade and report speaking German, Pennsylvania German, or Dutch at home.

Table 13. Counties with Highest Percentage of Vulnerable Populations

% Non-English Primary Language	% in Poverty	% with Disability	% Aged 65+	% without High School Diploma	% Households Without a Vehicle
LaGrange (49.1%)	Monroe (21.8%)	Scott (24.0%)	Brown (24.5%)	LaGrange (32.7%)	LaGrange (27.2%)
Daviess (22.1%)	Switzerland (20.6%)	Grant (21.0%)	Ohio (21.8%)	Daviess (14.3%)	Daviess (15.7%)
Elkhart (21.4%)	Delaware (20.6%)	Orange (20.7%)	Blackford (21.2%)	Adams (9.6%)	Adams (12.7%)
Adams (17.4%)	Vigo (19.8%)	Switzerland (20.6%)	Tipton (20.9%)	Noble (9.4%)	Blackford (10.2%)
Cass (17.4%)	Crawford (19.2%)	Blackford (20.5%)	Warren (20.7%)	Elkhart (8.4%)	Jay (9.1%)

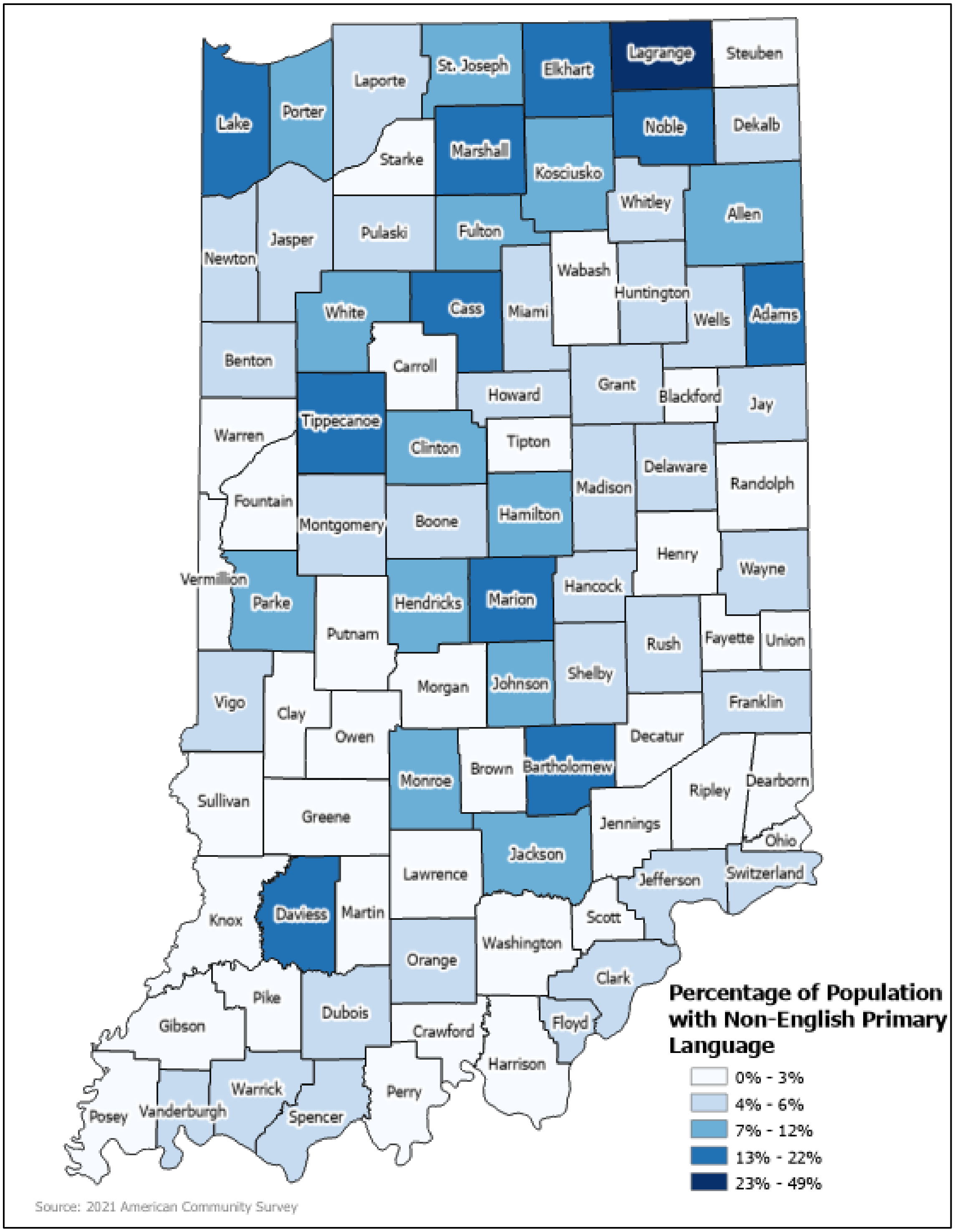


Figure 30. Percent Population with Non-English as Primary Language

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.

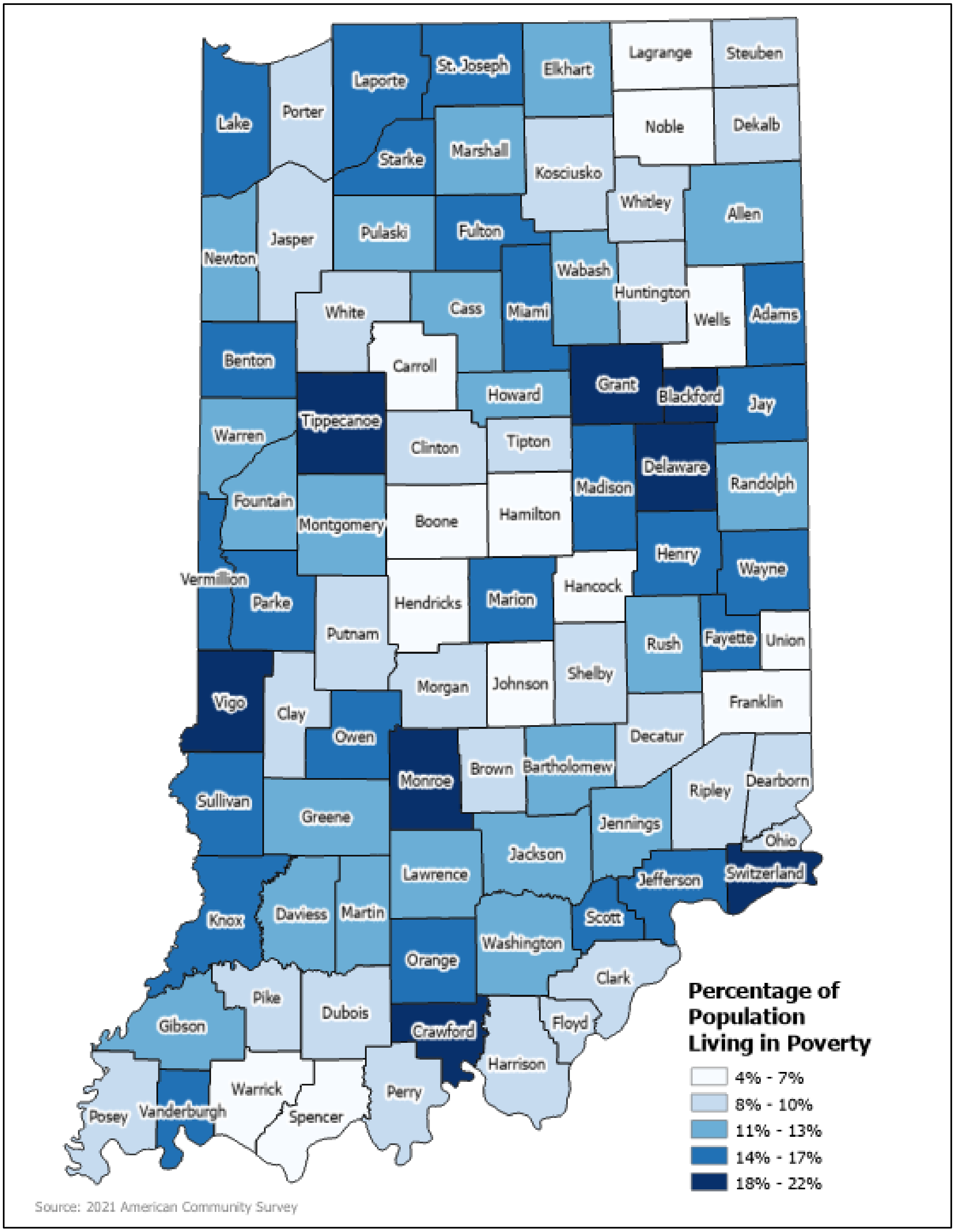


Figure 31. Percent Population Living in Poverty

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 this figure shows, poverty in Indiana persists in both urban and rural areas.

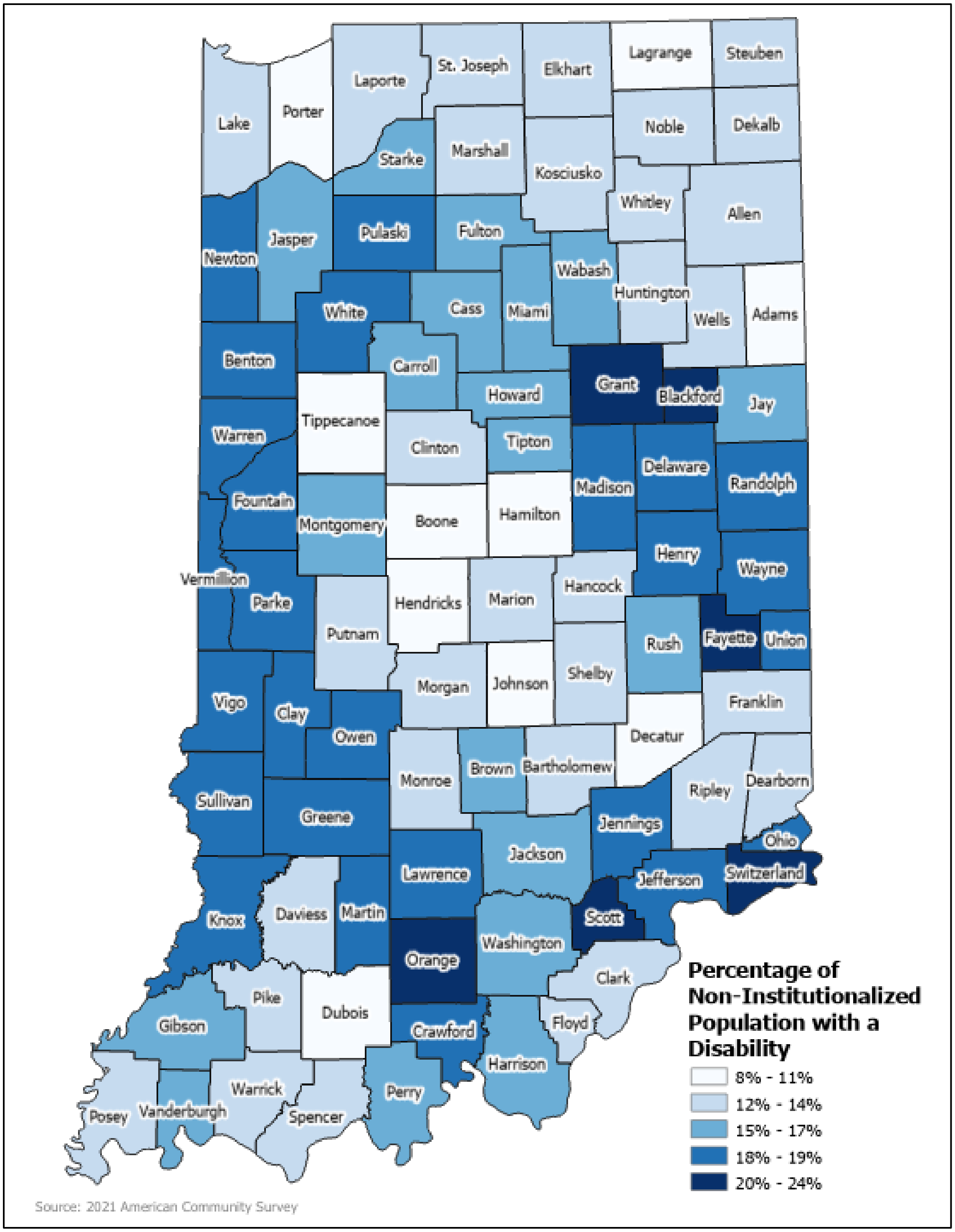


Figure 32. Percent Population with a Disability

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.

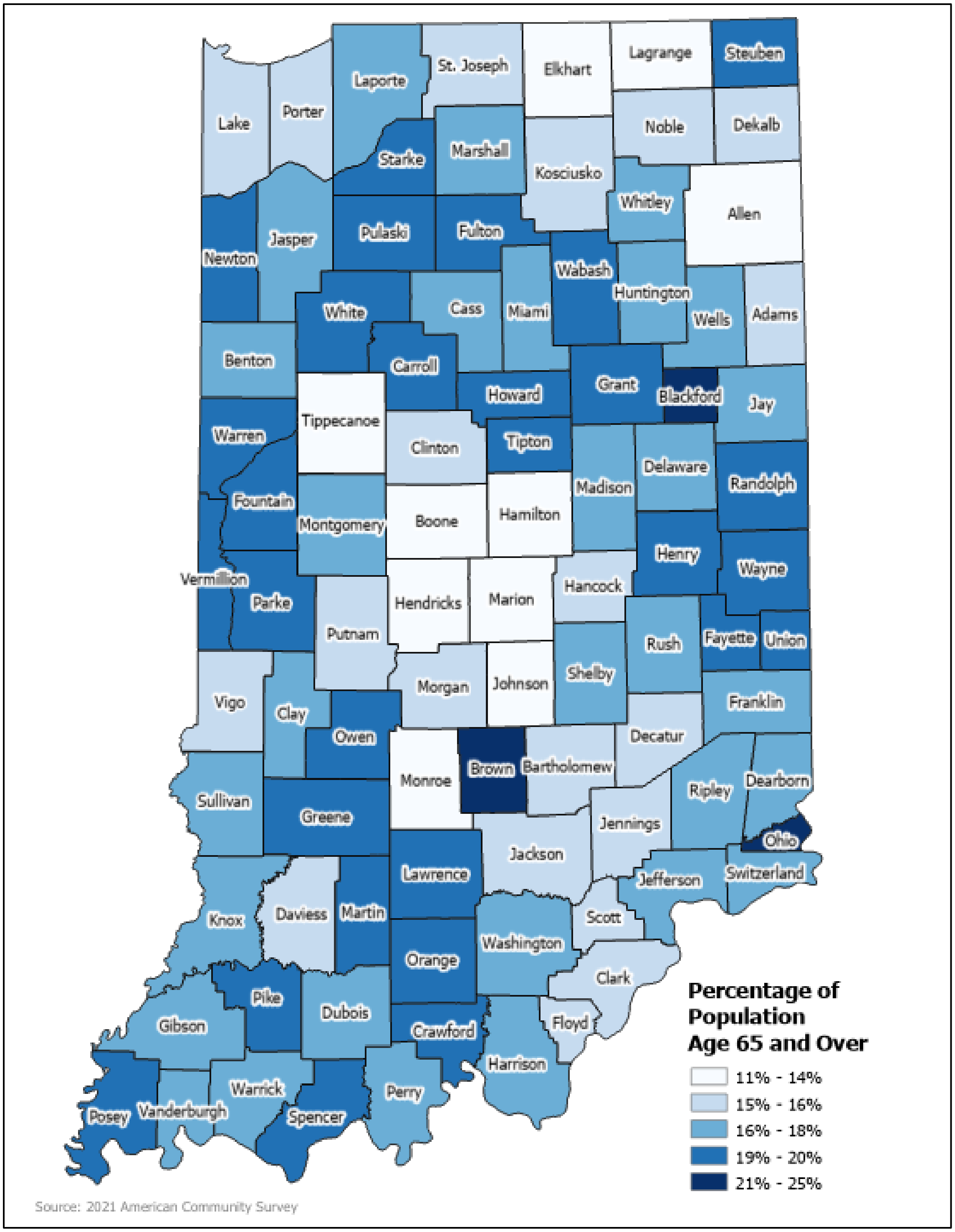


Figure 33. Percent with Population Age 65 and Over

As the baby boomer generation continues to age, the percent elderly population will 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.

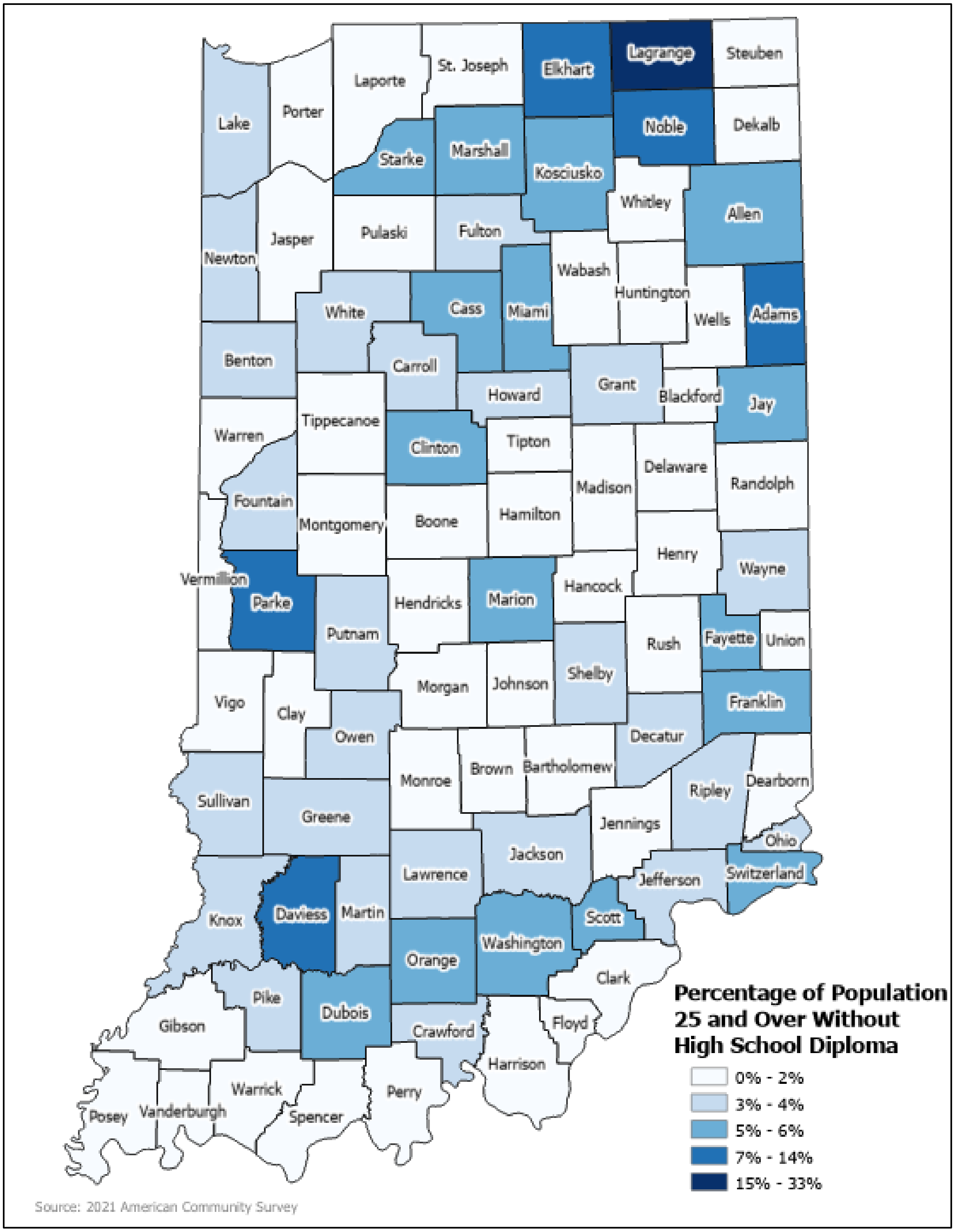


Figure 34. Percent Population without High School Diploma

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.

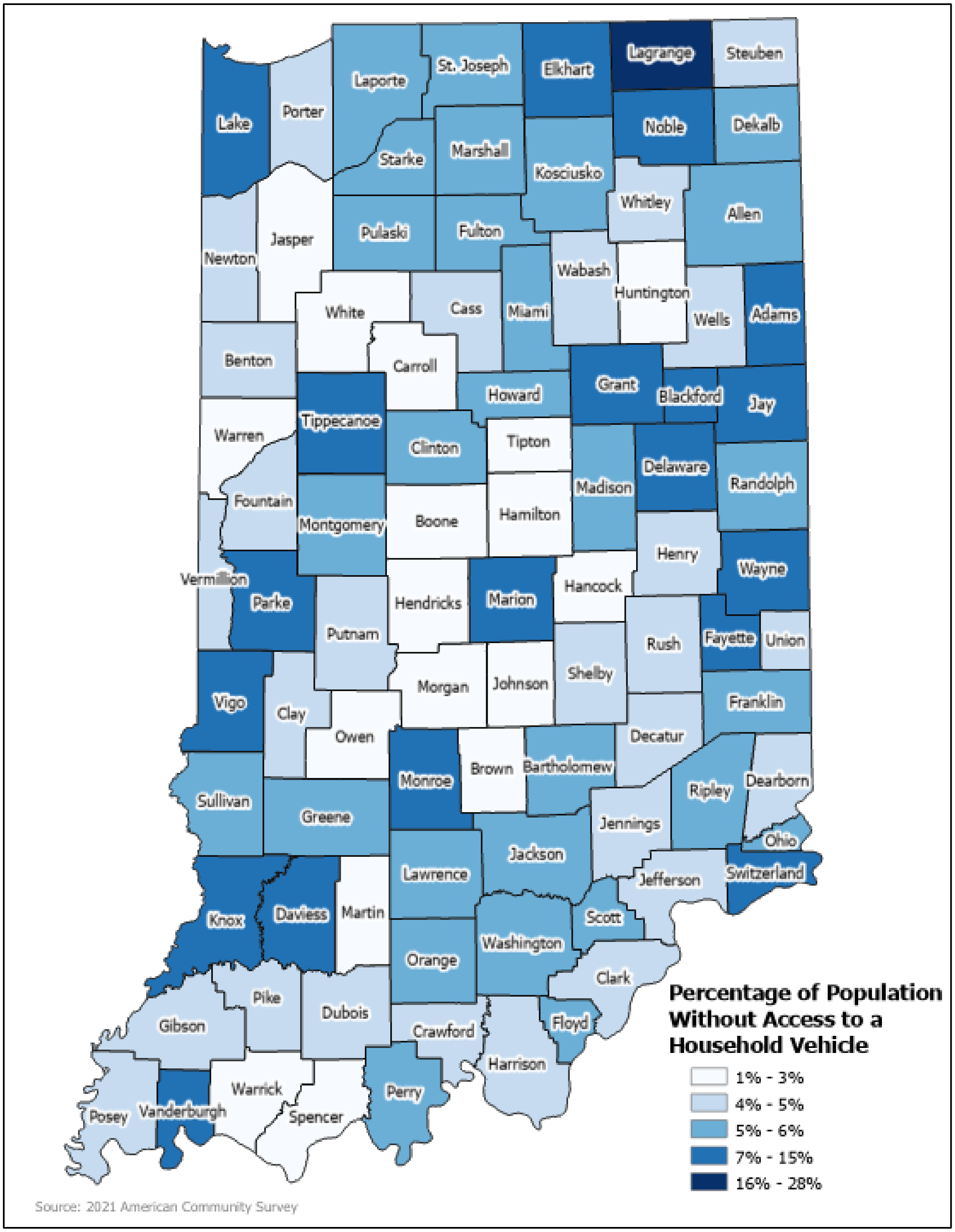


Figure 35. Percentage of Population Without Access to a Household Vehicle

Lack of access to a vehicle heightens the vulnerability of individuals during a natural disaster, as transportation becomes a crucial factor in determining survival. Having reliable transportation is imperative for a variety of reasons, encompassing safe evacuation, obtaining essential supplies, and seeking shelter, as well as accessing vital medical services.

2.8 Land Use and New or Improved Development

Land use refers to how land is utilized or developed for various purposes, such as residential, commercial, industrial, agricultural, recreational, or conservation purposes. New or improved land refers to land that has been modified or developed to serve a specific purpose or to enhance its functionality. This could include activities like urban development, agriculture, reforestation, or other changes that improve the land for a particular use. Indiana land use and changes in land use patterns have significantly impacted the state over the years. Indiana has seen substantial urbanization and development over the years, particularly in areas such as Indianapolis and its metropolitan region. Figure 36 shows project population growth by county in Indiana. Fourteen counties are projected to continue to have population growth.

Urban growth has resulted in the conversion of agricultural and natural lands into residential, commercial, and industrial areas. According to the IDLGF, 182,668 of Indiana's parcels have experienced some sort of construction since 2019. Recent or proposed development must be carefully evaluated to ensure that no adverse impacts occur as a result. Development, small or large, can result in large amounts of fill and other material being deposited in flood storage areas or other vulnerable locations.

In general, the vulnerability of state assets was not affected by development. State construction and development are closely reviewed to avoid disrupting or putting state assets at risk. For example, if a new regional office building is planned, the state would collaborate with local entities to ensure that emergency personnel are trained and capable of handling the increased number of citizens during the day.

As the state's population shifts and develops, the residential and urban areas may extend further into unincorporated county, placing more pressure on existing transportation and utility infrastructure while increasing the rate of farmland conversion.

Table 14 below summarizes the changes in deeded acres by property class.

Table 14. Land Use Change from 2018 to 2022 for Indiana

Property Class	Deeded Acres in 2018	Deeded Acres in 2022	Percentage Change from 2018 to 2022
Agricultural	18,107,709	17,969,643	-0.76%
Mineral	394,222	406,969	3.23%
Industrial	267,838	292,498	9.21%
Commercial	356,017	375,459	5.46%
Residential	2,096,751	2,133,014	1.73%
Exempt	1,175,755	1,237,742	5.27%
Utility	71,313	76,983	7.95%

Agriculture has historically been a dominant land use in Indiana, with the state being a major producer of corn, soybeans, poultry, and other crops. The expansion and intensification of agricultural activities have transformed landscapes, often leading to changes in land cover and environmental impacts. 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.

Land use changes can have environmental consequences, such as habitat loss, fragmentation, soil degradation, water pollution, and altered hydrology. Urbanization and industrial development can contribute to increased impervious surfaces, disrupting natural water systems, and leading to issues like flooding and reduced groundwater recharge. 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 demonstrated 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.

The development of transportation networks, including highways and railways, has influenced land use patterns. Transportation corridors often stimulate development along their routes, altering land use and creating urban sprawl. 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. In total, INDOT maintains 11,200 centerline miles of the state's 97,553 roadway miles, and over 5,600 bridges (Indiana Department of Transportation, 2022).

Indiana has seen efforts to redevelop brownfield sites, which are abandoned or underutilized industrial or commercial properties with potential contamination. These redevelopment projects aim to revitalize these areas for new purposes, often focusing on sustainable and efficient land use. The Indiana Brownfields Program is a partnership with the US EPA and other Indiana agencies to assist communities in making productive use of their brownfield properties. More information on current brownfield sites can be found here:
https://gisdata.in.gov/portal/apps/storymaps/stories/1dd14a1bb6aa403fa83cd2b068448eb0.

Like many jurisdictions across the US, the Indiana state and local governments have implemented land use policies and regulations to guide development, zoning, and conservation efforts. These regulations help manage growth, protect natural resources, and ensure responsible land use practices.

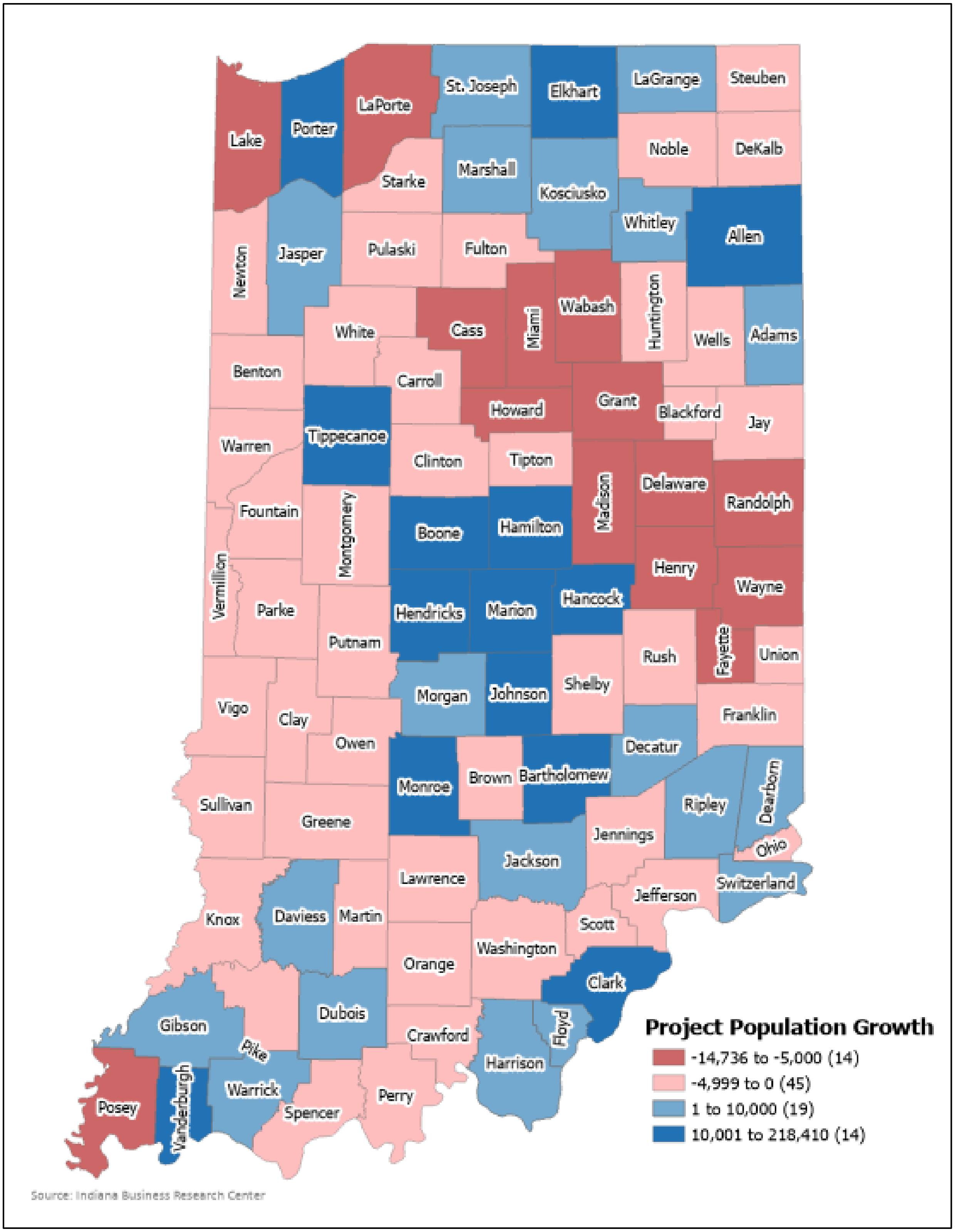


Figure 36. Future Population Growth (2015-2050)

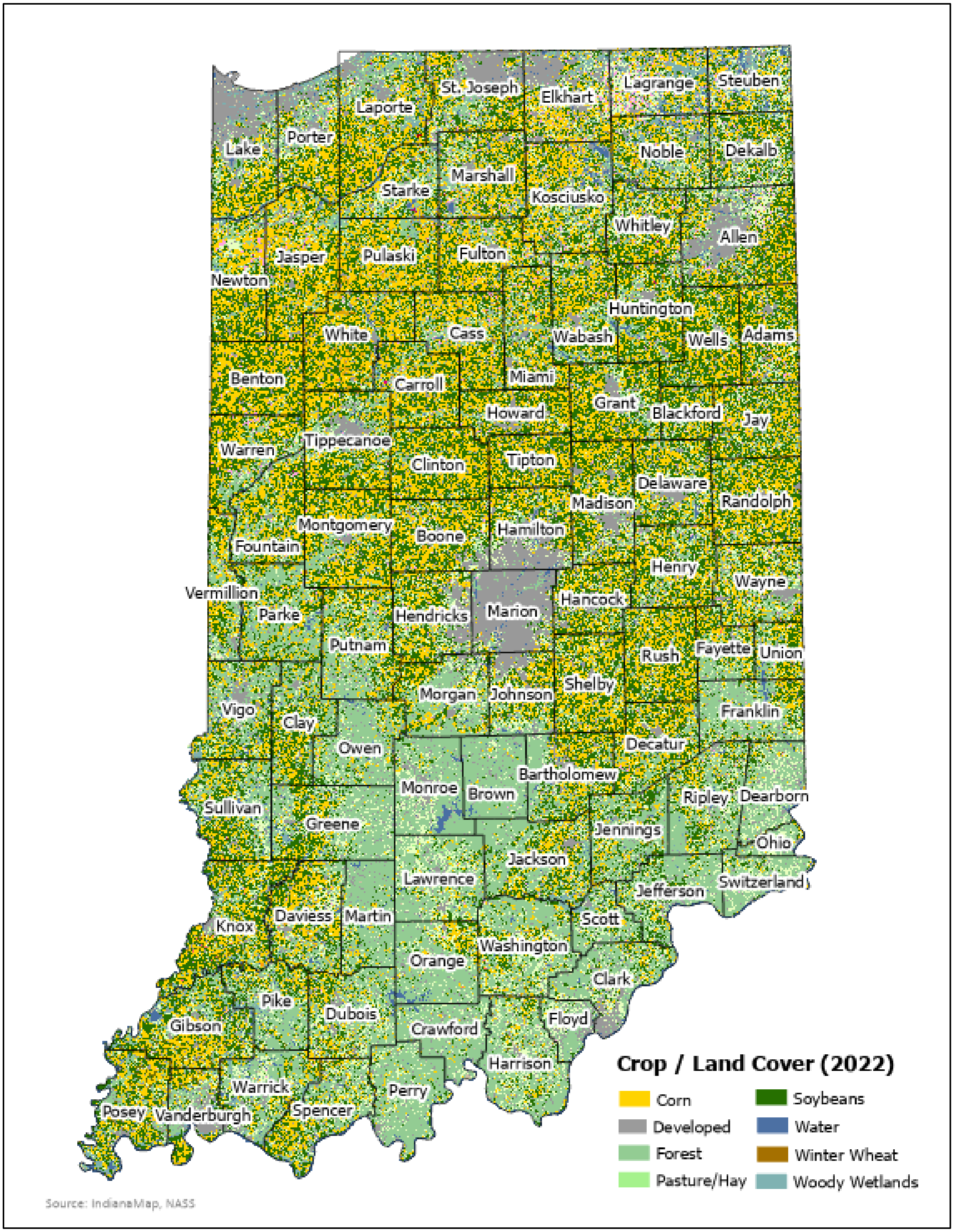


Figure 37. Indiana Crop and Land Cover

2.9 Building Codes

Indiana does not have hazard-resistant building codes, as shown in Figure 38, although one of the most effective ways to help reduce the impacts of natural disasters is the updating and enforcing of better building codes. Studies show that by increasing the standards for building codes, the overall negative impact of natural disasters can be reduced.

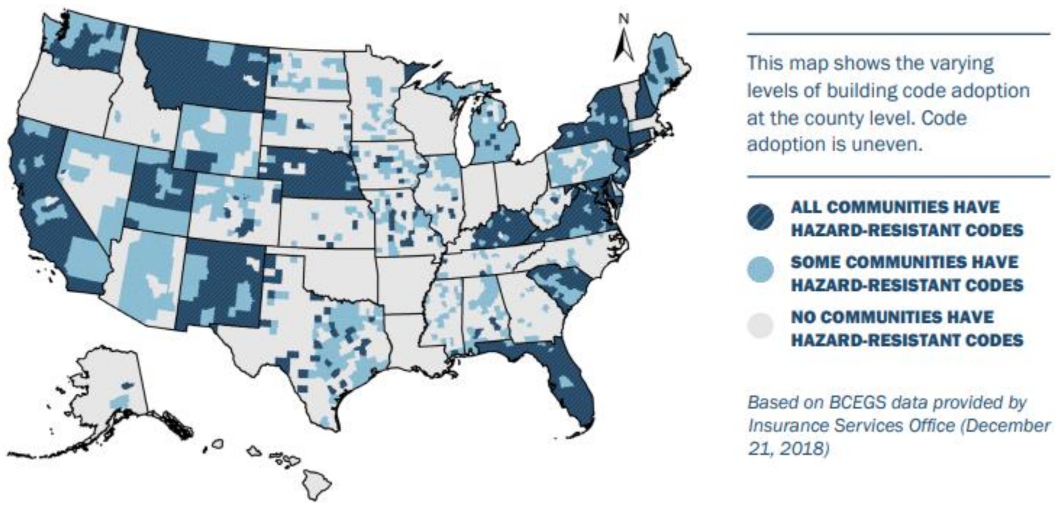


Figure 38. Nationwide Building Code Adoption (Source: FEMA, 2020)

The National Building Code Adoption Tracking Portal by Stantec lists the building codes for each incorporated community in the country. The latest Indiana state building code is based on an outdated 2012 edition of the International Building Code (IBC) and the 2018 International Residential Code (IRC) and is mandated statewide. Indiana weakens flood and seismic resilience by removing or exempting multiple codes under each hazard. The Fire Prevention and Building Safety Commission updated the Residential Code in 2020. Indiana was in the process of updating building codes, but the 2023 Indiana General Assembly passed HEA 1575 that greatly modified the Commission's structure and process to updating codes. This law states only three codes can be updated per year and local building codes cannot exceed the State's codes. The Planning Team attempted to contact the IDHS Building Plan Review Section to discuss this Plan update, but unfortunately did not receive a response. Indiana cannot achieve an Enhanced State status without a building code update completed.

3 Planning Process

3.1 Plan Update Procedure

The IDHS Mitigation Section 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), multiple state agencies, the Indiana Silver Jackets Risk Reduction Task Force, and the Indiana Voluntary Organizations Active in Disaster (INVOAD).

The Polis Center has worked with IDHS since 2003 to develop and update Multi-Hazard Mitigation Plans (MHMP) for 77 of Indiana's 92 counties. Polis also has been involved in Indiana's Risk MAP activities in conjunction with IDNR. Risk MAP projects are described in more detail in Section 6.1 of this plan.

The Indiana Silver Jackets is a multi-agency charter that includes representatives from federal, state, local agencies, higher educational facilities, and regional professional organizations 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 2007, 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 between IDHS, Polis, and the Indiana Silver Jackets has resulted in a contributing planning team of agencies and subject matter experts as listed in Table 1. 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 15. Planning Team Members

Name	Title	Agency
Mary Moran	Director of Emergency Management and Preparedness	Indiana Department of Homeland Security
Carmen Goodman	Recovery Branch Director	Indiana Department of Homeland Security
Ashley Steeb	State Hazard Mitigation Officer	Indiana Department of Homeland Security
Ben Biberdorf	Mitigation Program Specialist	Indiana Department of Homeland Security
Vincent Grahovac	Individual Assistance Program Manager	Indiana Department of Homeland Security
Sarah Owen	Mitigation Plan Reviewer	Indiana Department of Homeland Security
Ariana Gurrola	Mitigation Program Specialist	Indiana Department of Homeland Security
Danielle Lafever	GIS Program Manager	The Polis Center at IUPUI
Jordan Zimmerman	GIS Analyst	The Polis Center at IUPUI
Ted Deitz	Graduate Student Intern	The Polis Center at IUPUI
S M Asger Ali	GIS Analyst	The Polis Center at IUPUI

Name	Title	Agency
Jane Crady	Coordinator	Catholic Charities Disaster Preparedness & Response
Manuela Johnson	Resources Planner	Christopher B. Burke Engineering, LLC
Caleb Slocum	Family & Social Service Administrator	Indiana Department of Administration
Myra McShane	Section Chief for Emergency Response	Indiana Department of Environmental Management
Derek Sebold	Planning & Preparedness Manager	Indiana Department of Health
Bob Davis	Chief Data Officer	Indiana Department of Health
Eric Hawkins	State Epidemiologist	Indiana Department of Health
Allison Curry	Natural Hazard Planner	Indiana Department of Homeland Security
Courtney Eckstein	Radiation Program Director	Indiana Department of Homeland Security
Mike White	CBRNE Assistant Section Chief	Indiana Department of Homeland Security
Anita Nance	Floodplain Management Section Manager	Indiana Department of Natural Resources
Darren Pearson	State NFIP Coordinator	Indiana Department of Natural Resources
Doug Wagner	Water Planner 2	Indiana Department of Natural Resources
Rob Chan	Hydrologic Engineer	Indiana Department of Natural Resources
Greg Waltz	Engineer and Geologist	Indiana Department of Natural Resources
Mark Huter	Assistant State Fire Coordinator	Indiana Department of Natural Resources
Matthew Jaworowski	Chief of Staff	Indiana Economic Development Corporation
Victoria Leffel	Research Geologist	Indiana Geological & Water Survey
Jacob Carrico	Electricity Program Manager	Indiana Office of Energy Development
Elizabeth Sherrill	Graduate Research Assistant	Indiana University - Bloomington
Dr. Michael Hamburger	Professor of Geophysics	Indiana University - Bloomington
M. Anna Nowicki Jessee	Lecturer	Indiana University-Purdue University Indianapolis
Carter Dills	Undergraduate Research Assistant	IU Bloomington
Sam Lashley	Senior Meteorologist	National Weather Service
Angelia Ramos	Emergency Manager	Pokagon Band of Potawatomi Tribal Police
Melissa Widhalm	Operations Manager	Purdue Climate Change Research Center
Beth Hall	Indiana State Climatologist	Purdue University
Brandon Brummett	Outreach Coordinator	United State Army Corp of Engineers
Jeremy Weber	Physical Scientist	United States Geological Survey

IDHS coordinated with other agencies in a series of meetings during this planning process. The core team of IDHS and Polis staff, met on a weekly basis from April 2023 through September 2023. Subject matter experts and state department affiliates were provided a draft to review and provide feedback. Meeting minutes of subject matter areas can be found in Appendix E. The following meetings included additional staff focused on specific needs:

- Earthquake Meeting (June 6, 2023): IDHS and Polis staff met with IU and IUPUI professors and research assistants to discuss datasets and information related to earthquakes in Indiana.
- Indiana Volunteers Organizations Active in Disaster (June 8, 2023): Polis and IDHS attended an in-person monthly meeting with INVOAD, which is a volunteer organization that seeks to mitigate and alleviate the impact of disasters and specifically focuses on vulnerable populations. We discussed the marginalized effects hazards have vulnerable populations, access to food,

water, and shelter lifelines after a hazard, and barriers to aiding these populations when working outside a state or federal agency.

- Indiana Department of Health (June 15, 2023): Subject matter experts provided great updates to the health section that allowed IDHS and Polis to better elaborate on the section.
- Hazardous Material Release and Radiation (June 29, 2023): IDHS and Polis met with other IDHS individuals that work with radiological, CBRNE, and hazardous material release. There is significant overlap between the departments with mitigation efforts to avoid hazardous situations.
- State Facilities and State Asset Land Use Development (June 30, 2023 and February 8, 2024): IDHS and Polis met with Indiana Department of Administration (IDOA) to discuss data available regarding state-owned facilities. IDOA provided a service URL to inform this plan update. In addition, IDOA provided data on state asset land use development.
- Wildfire (July 5, 2023): Polis met with USDA Forest Service and IDNR to discuss updates to the wildfire section.
- Pokagon Band of Potawatomi Indians (July 11, 2023): For the first time in a State Plan, IDHS and Polis met with the EMA director of the Pokagon Potawatomi Emergency Services to discuss how to incorporate native lands in the State Plan update.
- Public Utility (August 3, 2023): IDHS and Polis met with the Indiana Office of Energy Development (OED) and gained information on how public utility has changed since the last plan and how to incorporate OED efforts in the 2024 plan.
- Climate Discussion Meeting (August 9, 2023): IDHS and Polis staff met with a number of climate specialists from the National Oceanic and Atmospheric Administration (NOAA), the National Weather Service (NWS), and Purdue University to discuss information related to climate and, in particular, to climate change.
- Flooding (August 14, 2023): IDHS and Polis staff met with experts from IDNR regarding flooding. IDNR provided insight to areas that needed more attention since the last plan.
- Dams and Levee Failure (August 16, 2023): IDHS and Polis staff met with subject matter experts from IDNR regarding dam and levee failure and how to appropriately update the plan.
- Indiana Department of Environmental Management (September 6, 2023): discussed the relation to hazards from an environmental management perspective and received feedback that was incorporated in the plan.
- Ground Failure (September 6, 2023): IDHS and Polis met with Indiana Geological and Water Survey and Indiana University to discuss ground failure. As ground failure can be a primary and secondary hazard, it was important to discuss how ground failure should be included in the plan update.
- Stream Gages (September 28, 2023): IDHS and Polis met with the US Army Corp of Engineers to discuss a potential stream gage project that is to include Indiana. Notes from the meeting are included in the mitigation action items (see Section 8).
- Economic Development (February 13, 2024): IDHS and Polis met with the Indiana Economic Development Corporation to discuss the goals of economic development in Indiana and current popular industries interested in Indiana. During the meeting, IEDC provided popular sectors looking to build/move into Indiana and counties that have had significant economic development built or planned in the past two years.

On Friday, September 29, 2023 IDHS issued a press release informing the public that a draft version of the plan would be posted on IDHS's website and two public meeting would be held at IUPUI on Wednesday, October 11, 2023 and Monday, October 16, 2023. This information was also sent through its GovDelivery Communications Cloud, an email-based communications tool used to distribute notices and press releases. Press releases are distributed to a compiled list of 387 reporters and news outlets throughout the state of Indiana, as well as to another 203 individuals that have requested to receive updates from the office of Public Affairs. IDHS's Public Information Office posted to notice to social media, too.

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 strategies in the state administered by the Indiana Department of Homeland Security Mitigation Section.

The SHMO will implement the SHMP through the coordinated efforts of IDHS and various state, federal, and local agencies. In addition, the SHMO will work with ISJ to guide efforts. Few states have a Silver Jackets chapter as engaged and active as Indiana's chapter is. The group meets monthly to discuss recent and current mitigation projects and share resources to undertake new activities. The initial focus of the ISJ was addressing statewide flooding concerns. As the ISJ team has evolved and risk exposure has changed, it has begun to take an all-hazards approach to risk reduction, focusing on all natural hazards.

3.3 Integration with Other Planning Efforts

The 2024 State Hazard Mitigation Plan integrates with all of the state's mitigation planning efforts and informs many of the local planning efforts. IDHS Mitigation coordinated with the IDHS Planning Division to understand the breadth of their plan library, how their plans are developed according to existing risks and how the SHMP will be used to integrate all planning activities going forward. The process also considered the planning efforts of a number of other state agencies including: the Indiana Department of Natural Resources' Incident Emergency Action Plans for High Hazard Dams in Indiana, Indiana Department of Energy's Indiana Energy Sector Risk Profile, Indiana Office of Technology's 2021 Indiana Cybersecurity Strategic Plan, Indiana Department of Health's Special Pathogens Plan and Infectious Disease Response Plan, and the Office of Community and Rural Affairs Flood Response Plans.

The State of Indiana's various departments produce policies, updates, and reports annually, and relevant information from the SHMP is thoughtfully integrated into these materials. While it's challenging to track how many plans have incorporated SHMP data due to the amount, the SMHO is actively engaged in collaborating with contacts across different state departments to ensure the seamless integration of SHMP information as required. Furthermore, the SMHO's responsibilities extend beyond state departments, encompassing federal, local, non-profit, grassroots organizations, and private sector contractors, with the goal of coordinating their efforts within the SHMP framework.

Additionally, the 2024 SHMP integrates with FEMA's Risk MAP program. Since 2010, IDHS, IDNR, Polis Center and FEMA contractors have partnered with local governments to complete 19 Discovery projects. For each Risk MAP initiative, IDHS reviews with participating counties their local mitigation plans and assists them in updating existing strategies and/or offering technical support to develop additional mitigation strategies. This collaborative effort helps local governments take a more holistic approach to planning.

In 2016, IDHS completed a statewide hazard/treat identification and risk assessment. This assessment utilized a modified version of the Calculated Priority Risk Index (CPRI). The HIRA lists the following natural hazards as High or Moderate risk:

- High hazard dam
- Flash flood
- Tornado
- Severe thunderstorm
- Earthquake
- Major levee failure
- Major flood
- Wildfire
- Ice storms
- Drought
- Extreme temperatures

For this update, each hazard was evaluated by a team of subject matter experts who reviewed historical occurrences, mitigation efforts, and known vulnerabilities. Each county Emergency Management Agency was strongly encouraged to complete a county-based HIRA using the WebEOC HIRA calculator. Please see Appendix D for additional details.

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 conform to federal and state laws/statutes that apply when considering intentional, criminal, or unintentional technological and human incidents.

IDHS 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 2019 State Hazard Mitigation Plan was adopted by the State of Indiana under the executive powers of the governor and approved by FEMA's Mitigation Division on April 18, 2024.

4 2019 Strategies Progress

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 (Sections 5 through 7) and should be an ongoing process, adapting over time to accommodate a community's needs.

The 2019 SHMP included mitigation strategies in the section of the plan where the hazard was analyzed. All of these strategies have been summarized in a single table below, along with their status. The 2024 SHMP mitigation strategies are located in Section 8. The associated 2024 mitigation strategy is listed by item number in the table below. Some strategies may have been revised to be more accurate for the 2024 update.

Table 16. 2019 Mitigation Strategies

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
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.	Flood	IDHS and IDNR are in constant contact with elected officials in normal business operations and during emergency events.	Ongoing	#23
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.	Flood	IDHS continues to invite partners to join the ISJ Risk Reduction task force. Since the last plan, several agencies have joined the ISJ including but not limited to IHCDA, Purdue Climate Center and the Center for Earth and Environmental Science. The goal for 2019 is to add Department of Energy and the Environmental Protection Agency representatives.	Ongoing	#24
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	Flood	IDNR continues to work with their funding sources. Mapping progress continues and the goal is to have the state completely mapped by 2020.	Complete	#1
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	Flood	INDR continues to work on updating flood maps with new LiDAR data through both the RiskMap efforts and the State Best Available data project.	Removed	#44

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
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	Flood	IUPUI continues to update and share SAVI data on social vulnerabilities. IDHS is partnering with IUPUI to share this information with all aspects of IDHS activities.	Ongoing	#22
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.	Flood	DNR and IDHS continue to partner on the biannual "Stay Afloat" conference to educate jurisdictions and elected officials on good flood plain management best practices. IDHS Mitigation has also reached out to begin partnering with the Indiana Department of Insurance.	Ongoing	#27
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.	Flood	IDHS and IDNR use social media and press releases to advise drivers to 'Turn Around Don't Drown" during rain and flooding events. IDHS GIS section has also worked with local jurisdictions to create an interactive map detailing flooded road conditions.	Ongoing	#28

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
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.	Flood	IDHS continues to partner with OCRA and will be joining them in their 2019 resilience outreach to Indiana communities.	Complete	#2
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	Flood	IUPUI continues to partner with ISJ in updating and sharing SAVI data on social vulnerabilities. IDHS continues to utilize and share this social vulnerability data with internal and external partners.	Ongoing. Merged as Item #32 & #24 in 2024 updates	#32 & #24
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	Severe Storm and Tornado	IDHS has partnered with locals to build storm shelter areas in one school and is beginning construction at a Scout Camp. IDHS has applied to FEMA to install 2 more in schools and a second scout camp.	Complete	#3

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
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.	Severe Storm and Tornado	IDHS has completed installation of 20 residential safe rooms to date. IDHS Mitigation is also preparing to apply for another round of installations in the PDMC 2019 grant cycle. Future applications may be submitted, depending on available funding.	Complete	#4
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	Severe Storm and Tornado	IUPUI continues to partner with ISJ in updating and sharing SAVI data on social vulnerabilities. IDHS has also formed a partnership with Indiana University's Environmental Resilience Institute to share data and research projects to understand how different hazards impact different social vulnerabilities.	Ongoing. Merged as Item #32 & #24 in 2024 updates	#32 & #24
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.	Severe Storm and Tornado	IDHS Public Information Office continues to provide public information throughout the year concerning personal preparedness tips and risk information.	Identified	#21
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	Severe Storm and Tornado	As part of Indiana's Low Head Dam Initiative, the USGS designed an interactive map application to show paddlers when they are approaching a low head dam and where safe portages are located.	Ongoing	#31

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
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	Earthquake	IUPUI continues to partner with ISJ in updating and sharing SAVI data on social vulnerabilities. IDHS has also formed a partnership with Indiana Universities Resiliency Institute to share data and research projects to understand how different hazards impact different social vulnerabilities.	Ongoing. Merged as Item #35 & #24 in 2024 updates	#35 & #24
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	Earthquake	IDHS and embedded FEMA Planners are working on updating both the Catastrophic Earthquake Response Plan and Earthquake Recovery Plan.	Completed	#5
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	Earthquake	ISJ has added Indiana Geological & Water Survey to the membership of ISJ to bring more information on the State's earthquake risks and impacts to the team so project funding sources can be examined to identify possible earthquake resiliency projects. IDHS Mitigation has formed a partnership with earthquake subject matter experts at IU Bloomington to develop new earthquake project ideas.	Complete	#6
Medium	Integrate Indiana's mitigation policies and programs to maximize efficiency	Ensure better coordination of federal, state, and local	Work with CUSEC to further Indiana's Earthquake Mitigation Goals and National	Earthquake	IDHS Planning Division Director is a member of the CUSEC board and the Planning section works closely with the board to develop projects tied to the NEHRP funding	Ongoing	#32

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
	and leverage funding.	mitigation activities.	objectives for funding through NEHRP.				
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	Other Natural Hazards - Winter Storm, Drought, Extreme Temps, Wildfire, Disease Outbreak, Fluvial Erosion Hazard	IUPUI continues to update and share SAVI data on social vulnerabilities related to multiple hazards. Additionally, ISJ and IDHS Mitigation have partnered with the Purdue Climate Center to better understand social vulnerability issues.	Removed. Merged as Item #25 in 2024 update.	#25
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	Other Natural Hazards - Winter Storm	IDHS PIO's office has several pre scripted media releases related to winter storms, ice and extreme cold temperature events. These releases are sent out when an event is approaching and then during the event as well. Hazard specific Recovery information is provided once the event has ended.	Ongoing	#33

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
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	Other Natural Hazards - Extreme Temps	IDHS PIO's office has several pre scripted media releases related to extreme temperature events. These releases are sent out when an event is approaching and then during the event as well. Hazard specific Recovery information is provided as needed.	Removed. Merged as Item #33 in 2024 update.	#33
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	Other Natural Hazards - Drought	IDHS Recovery hosts a weekly drought monitor call with IDNR, NWS, IDEM, Midwestern Regional Climate Center, State Climatologist and the Purdue Extension office. These calls discuss the current drought status, upcoming predicted weather discussions and possible impacts resulting from an event. This information is shared with IDHS Response and Planning Divisions to inform tactical and strategic decision making.	Ongoing	#31
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	Other Natural Hazards - Winter Storm, Drought, Extreme Temps, Wildfire, Disease Outbreak, Fluvial Erosion Hazard	The State Mitigation Council has been replaced by the ISJ task force. Several State Universities are now part of the ISJ membership and IDHS Planning is invited to each monthly ISJ meeting.	Ongoing	#35

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
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	Other Natural Hazards - Winter Storm	NWS has been recruiting and training CoCoRAHS observers to improve the statewide monitoring of snowfall.	Ongoing	#36
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	Other Natural Hazards - Drought	The current Water Shortage Plan is being updated by IDNR Division of Water. Additionally, a water usage symposium was held in Indianapolis in October 2018 and follow up meetings are being scheduled.	Complete	#7
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	Other Natural Hazards - Wildfire	During times of burn ban activities, IDNR and IDHS Public Information Offices release ban information and best practice tips for avoiding wildfire.	Ongoing	#37
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	Technological Hazards - Communications System Failure, Public Utility Failure, Air Transportation, Explosion	IUPUI continues to partner with ISJ in updating and sharing SAVI data on social vulnerabilities. IDHS has also formed a partnership with Indiana University's Environmental Resilience Institute to share data and research projects to understand how different hazards impact different social vulnerabilities.	Ongoing. Merged as Item #35 in 2024 update.	#35

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
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	Technological Hazards - Dam/Levee Failure	IDNR, IDHS and OCRA have worked to develop IEAPS for over 30 of the state's high hazard dams. Periodic table top exercises are held with local jurisdictions to familiarize citizens of the risks and response procedures. IDHS Mitigation and OCRA have partnered to complete 20 local comprehensive Flood Response Plans.	Complete	#8
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)	Technological Hazards - Dam Failure	IDNR, IDHS and OCRA have worked to develop IEAPS for over 30 of the state's high hazard dams. Periodic table top exercises are held to familiarize citizens of risks and response procedures. IDHS Mitigation and OCRA have partnered to complete 20 local comprehensive Flood Response Plans. During potential dam failure/overtopping events, IDHS Recovery works closely with local EMA's, IDNR Dam Section, and Dam owners to monitor the condition of the dam and notify the public of potential issues.	Ongoing	#43
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	Human Hazards - Cyber Attack, Active Shooter, Arson, CBRNE	IDHS is in the process of updating its Continuity of Operations Plan(COOP) and the Continuity of Government (COG) Plans. Several state agencies have completed their plans.	Ongoing	#39

Priority	Goal	Objective	Strategy	Section	Strategy Status	Status for 2024 Update	Corresponding 2024 Item #
				Attack, Hostage Situation, Riot, Terrorism			

5 Risk Considerations

5.1 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.

Within this plan, several sections offer pertinent information crucial to the Risk Assessment process. Section 1 lists Federal and State Disaster declarations and their associated financial effects. This provides insights into what types of disasters have been particularly bad in the past. Section 2 expands on the vulnerability of certain areas in Indiana given location, geography, climate, and population information and communities at heightened risk of disaster. Sections 6 and 7 include historical data pertaining to past occurrences of disasters, their impact on communities, and some vulnerability assessments. This section is the precursor to Sections 6 and 7, outlining how vulnerability is assessed, in addition to describing how IDHS prioritizes hazards, outlining FEMA-provided areas of vulnerability, and providing locations of essential and state-owned facilities.

The risk assessment data has seen a couple significant changes since the 2019 plan update. In the 2024 plan, the State expanded on the data for risks to state-owned properties. Another significant change is a risk assessment was completed for every hazard, where assessments were only completed for a few hazards in the last plan.

After the State Plan is approved by FEMA and adopted by the Governor's Office, the document will be hosted on the IDHS Mitigation website until the plan is updated in 2029. Additionally, IDHS Mitigation staff will work with the agency's Public Affairs Office to publish a press release announcing the update and post the announcement on the agency's social media accounts.

5.2 Vulnerability Assessment

This SHMP includes 23 hazards: 11 hazards of interest (natural) and 12 other hazards of interest (technological, human-caused, or social). The hazards are listed in Table 17.

Table 17. Indiana Hazards Addressed in 2024 SHMP

Hazards of Interest (Section 6)	Other Hazards of Interest (Section 7)
Floods (includes Fluvial Erosion Hazards)	Diseases
Severe Weather	Environmental Harmful Organisms
Tornadoes	Cyberattack and IT Failure
Earthquakes	Public Utility Failure
Ground Failure (subsidence)	Structural Fire
Dam and Levee Failure	Transportation Incidents
Extreme Temperatures	Active Assailant
Winter Storms	Arson

Hazards of Interest (Section 6)	Other Hazards of Interest (Section 7)
Drought	CBRNE Attack
Hazardous Material Release	Hostage Situations
Wildfire	Terrorism
	Civil Disorder/Civil Unrest

5.2.1 Hazus-MH and other GIS Analysis of Flood and Earthquake Impacts

For the 2024 SHMP update, the State of Indiana provided parcel and property assessment data for all counties. Potential social and economic impacts from flood and earthquake hazards were quantified using FEMA's Hazus-MH Risk Assessment tool (https://www.fema.gov/hazus) and other forms of GIS analyses that leveraged this data. As a result, the analysis was able to consider factors such as the cost of building construction (labor and materials), the costs to replace building contents, and the value of building inventory. This process reflected an enhanced approach to analyzing hazards as defined for Hazus-MH. The approach included substitution of selected Hazus-MH provided data with local data to improve the accuracy of the model predictions.

As with the 2019 Plan, the 2024 SHMP update included substitution of selected default data with local data, and the improved building inventory process that involved placing a point on the center of the largest building of each parcel to represent buildings in the parcel instead of locating the point on the centroid of the parcel.

The 2024 SHMP update leveraged Hazus-MH version 6.1 to generate a combination of site-specific and aggregated loss estimates. Aggregated inventory loss estimates, which for this study included earthquake building economic and structural resiliency impact analysis, are based upon the assumption that buildings are evenly distributed across the landscape.

Site-specific analysis in this study was based upon loss estimations for individual structures. In Hazus-MH, factors that guide how structures will respond to hazards vary by what is being evaluated. For example, estimates of damage to structures from flooding consider the depth of water in relation to the structure. It is also important to note that Hazus-MH applies a number of assumptions in its processes. For instance, it is assumed 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 also based upon a point location rather than a polygon; therefore, the model does not account for factors such as 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 selected natural 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.

5.2.2 Hazard Identification Risk Assessment

The State of Indiana Hazard Identification Risk Assessment (HIRA) sets the stage for identifying the greatest threats and risks to counties and the state based on the greatest natural, human-caused, and technological hazards and threats. The HIRA is a quantitative process that addresses hazards, threats, and risk at the county, regional and state level. At the local level, the types of hazards and threats, the potential impact of those hazards and the overall risk to a community will vary widely from one area to another. The intent of the HIRA is to provide an overview of the statewide threat environment and to identify, analyze, and quantify each hazard/threat. A copy of the HIRA can be found in Appendix A.

As with most of the 2019 SHMP technological and human hazard sections, the 2024 plan does not include a detailed vulnerability analysis for many of the Other Hazards of Interest due to concerns over publication of sensitive data. These analyses exist in the HIRA and the State of Indiana Comprehensive Emergency Plan.

Community lifelines and mitigation strategies are interlinked in the realm of disaster management, as they both focus on ensuring the resilience of essential services and infrastructure during and after emergencies. Community lifelines encompass critical sectors, such as transportation, energy, water, healthcare, and communication, which are fundamental for maintaining public safety and societal functions. Structures and infrastructure are integral components of community lifelines forming the essential services and societal functions. Mitigation efforts aim to reduce the vulnerability of these lifelines to various hazards, such as natural disasters and/or human-made incidents. By identifying vulnerabilities in community lifelines and implementing mitigation strategies, communities can minimize the impact of disasters to ensure continuity of essential services to facilitate swift recovery.

Collaboration and coordination among stakeholders are essential aspects of effectively integrating community lifelines and mitigation efforts. Government agencies, emergency responders, private sector entities, and community organizations all play a vital role in identifying vulnerabilities, implementing mitigation measures, and ensuring the resilience of community lifelines. Through partnerships, information sharing, and joint planning, stakeholders can leverage resources, expertise, and capabilities to enhance the resilience of critical infrastructure and services. By fostering a culture of preparedness and investing in proactive mitigation measures, communities can build resilience, reduce risks, and better withstand the challenges posed by disasters, ultimately safeguarding lives, property, and the well-being of society.

5.2.3 FEMA Risk Rankings

National Risk Index (NRI)

FEMA's National Risk Index (NRI) can be used to better understand the disproportionate risks facing certain residents of Indiana. The NRI utilizes source data for 18 different natural hazards along with social vulnerability indices and community resiliency rankings. By combining these three risk factors, the NRI applies an overall Risk Rating that considers the likelihood and impact of natural disasters, the social vulnerability of the area, and the measured community resilience. This ranking is meant to be used to aid communities in better understanding the risk to their populations as well as a tool to help make better policies and is broken down by census tract.

Social vulnerability is the susceptibility of social groups to the adverse impacts of natural hazards. A component of the NRI, a Social Vulnerability score and rating represent the relative level of a community's social vulnerability. A higher Social Vulnerability score results in a higher Risk Index score. Indiana's social vulnerability index is mapped in Figure 39. Eighty-eight of Indiana's 92 counties contain a census tract with relatively high or very high social vulnerability. The four outlier counties are Brown, Pike, Putnam, and Warrick.

Community resilience is the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. Another component of the NRI, a Community Resilience score and rating represent the relative level of a community's resilience. A higher Community Resilience score results in a lower Risk Index score. Figure 40 shows Indiana's community resilience rating. Fourteen of 92 counties with a very low or relatively low community resilience rating. This means these counties are more likely to have more damages, injuries, and loss of life from disaster and will most likely have a harder time recovering from a disaster. These counties are Franklin, Fountain, Greene, Harrison, Jennings, Lagrange, Newton, Ohio, Owen, Parke, Scott, Switzerland, Union, and Washington.

The overall risk rating for Indiana is shown in Figure 41. Indiana does not have census tracts rated as having a very high overall risk rating. There are 8 counties that contain a census tract with a relatively high risk rating: Bartholomew, Harrison, Hendricks, Jefferson, Knox, Owen, Vanderburgh, and Vigo.

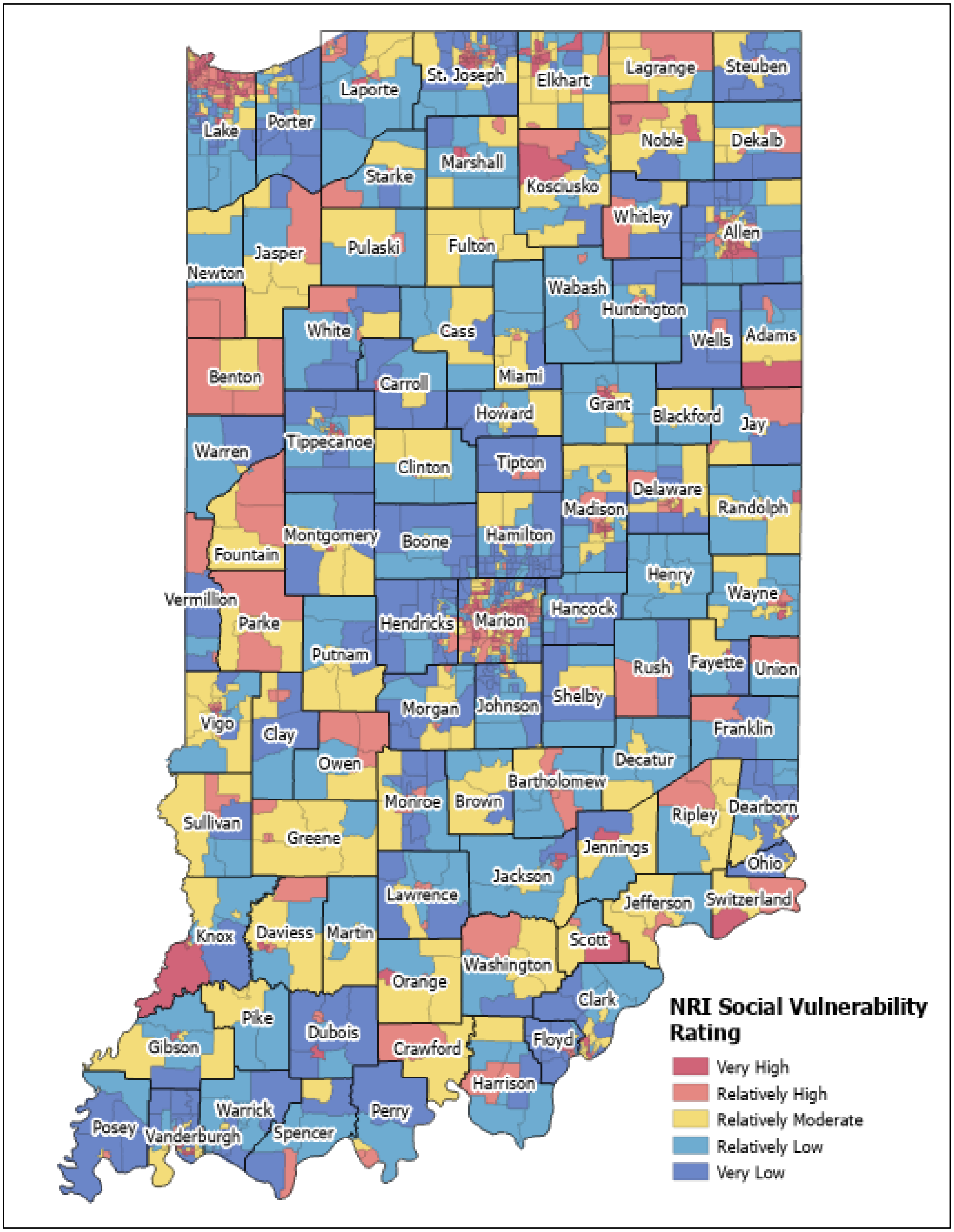


Figure 39. FEMA National Risk Index Social Vulnerability Rating

Figure 40. FEMA NRI Community Resilience Rating

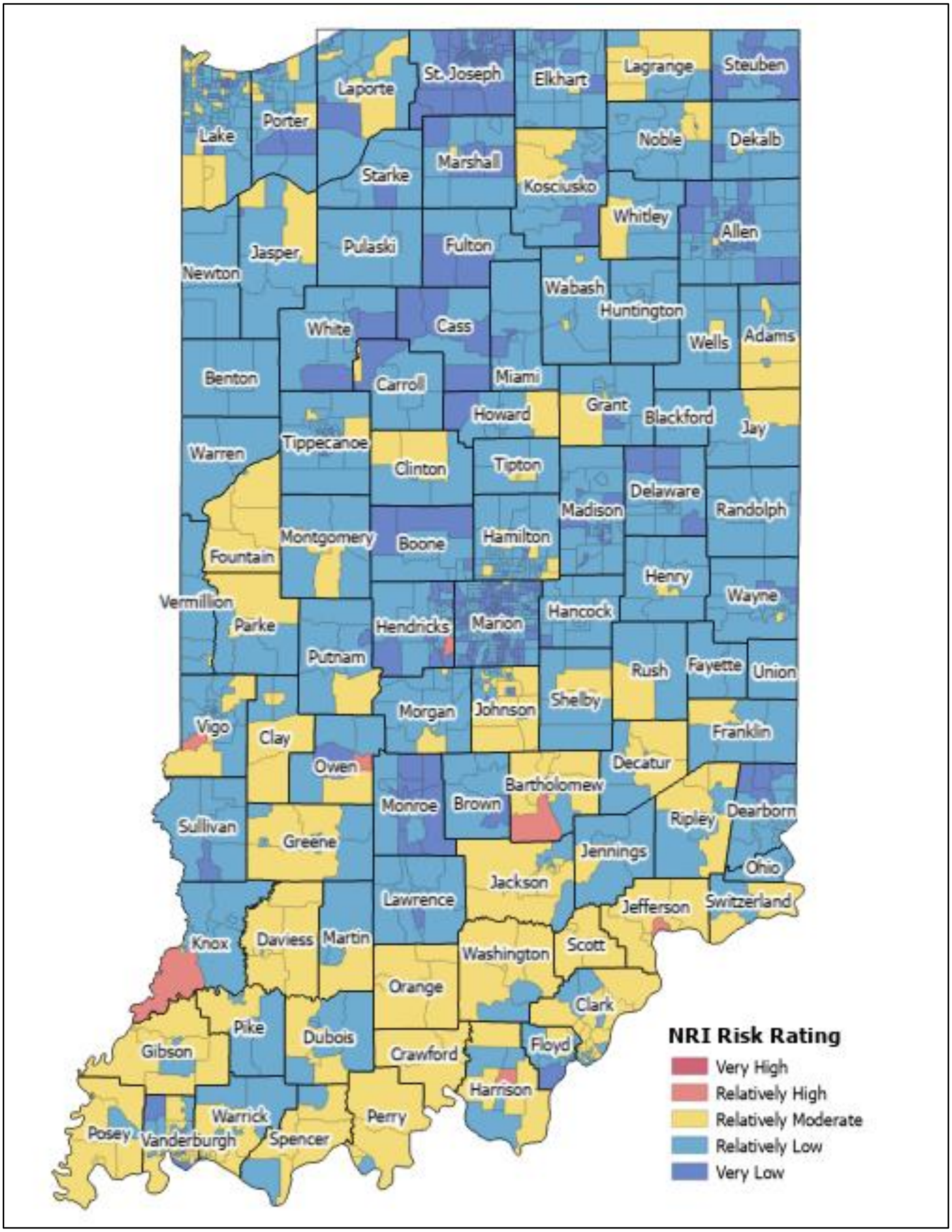


Figure 41. FEMA National Risk Index Risk Rating for Indiana

Community Disaster Resilience Zones

On December 20, 2022, President Biden signed the Community Disaster Resilience Zones Act into law. This legislation modifies the Robert T. Stafford Disaster Relief and Emergency Assistance Act, mandating FEMA to employ a natural hazard risk assessment index. The goal is to pinpoint census tracts most susceptible to the impacts of natural hazards and climate change. As of September 6, 2023, FEMA has made public the identified zones categorized by census tract. There are 8 census tracts identified in Indiana, affecting 9 cities or towns. The census tracts are shown in Figure 42. The identified census tracts are located in Bartholomew, Crawford, Jackson, Jefferson, Owen, Scott, and Vanderburgh Counties.

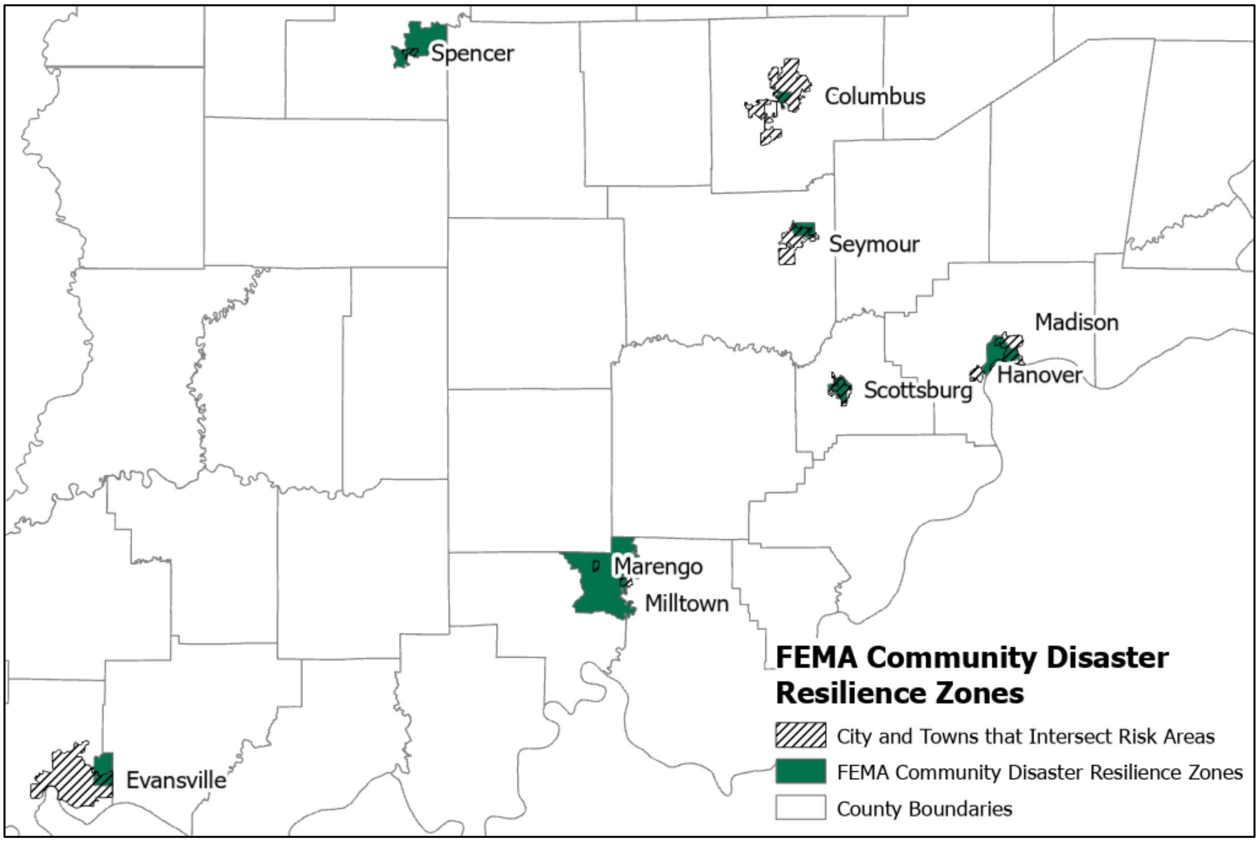


Figure 42. FEMA Community Disaster Resilience Zones

Implementing mitigation actions within disadvantaged communities, such as CDRZ, faces a multitude of challenges. These communities often grapple with limited resources hindering their ability to invest in infrastructure, technology, and community resilience initiatives. These communities may lack both financial and human resources. Limited budgets and understaffed teams can impede an organization's ability to dedicate the necessary time and resources to develop and implement effective mitigation strategies. The lack of resources hinders their ability to effectively address potential risks, leaving them more vulnerable to the adverse impacts of climate change. CDRZ may lack access to advanced technology and resources necessary for effective climate mitigation, further complicating implementation efforts. Existing social inequities, including poverty and discrimination, can exacerbate vulnerabilities to climate change and impede community engagement and participation in mitigation actions. Overcoming these challenges requires a comprehensive approach that addresses the underlying social economic and environmental factors contributing to vulnerability within disadvantaged communities, coupled with targeted support and resources tailored to their specific needs.

5.3 Hazard Prioritization

In 2018, IDHS conducted a unified State-level Threat Hazard Identification and Risk Assessment (THIRA) 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 18.

Table 18. Guidelines for Hazard Prioritization

PROBABILITY	
Low	Event is probable within the next 10 years
Medium	Event is probable within the next 5 years
High	Event is probable within the calendar year

IMPACT	
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
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.
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 43 represents the state's overall hazard vulnerabilities.

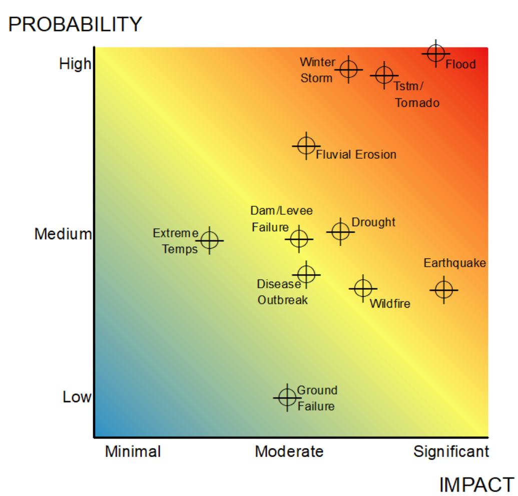


Figure 43. Hazards Risk Grid

5.4 Essential Facilities & State Facilities

5.4.1 Essential Facilities

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.

Table 19. Indiana Essential Facilities

Facility Name	Number of Facilities
Schools	3,304
Police Stations	644
Fire Stations	1,352
EOCs	117
Care	1,846

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 19.

In 2018, Microsoft released 125 million building footprints for the United States that were generated from imagery using machine learning (https://github.com/Microsoft/USBuildingFootprints). This data is licensed through the Open Data Commons Open Database License. The Polis Center extracted the building footprints for the State of Indiana and created point centroids of each building. Each building centroid was then joined spatially to the state's land parcels provided by the Indiana geographic Information Office on December 22, 2022 via IndianaMAP. This process provided the parcel identifier for each building and was then linked to the statewide Real Property Tax Assessment Data provided by the Indiana Department of Local Government and Finance (IDLGF) from October 2022. 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. The IDLGF data allows Polis to identify the occupancy class of each building based on the parcel within which it is located. Approximately 1% of the buildings were not located in a parcel and were not included. NOTE: The assessor records often do not include nontaxable parcels and associated building improvements; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated. Table 20 provides the number of parcels and their total improvement value from the IDLGF dataset, organized by occupancy class, along with the number of Bing buildings located within those parcels.

Table 20. Indiana Buildings and Exposure

Occupancy Class	Total Parcels	Estimated Total Buildings	Total Exposure
Agricultural	281,942	476,666	$19,460,236,857
Commercial	98,588	223,032	$50,098,506,906
Industrial	20,988	35,634	$17,795,002,885
Residential	1,530,588	2,408,300	$228,575,251,504
Other	125,120	82,976	$14,613,795,685
Total	**2,057,226**	**3,226,608**	**$330,542,793,837**

5.4.2 State Facilities

The Indiana Department of Administration (IDOA) began maintaining points in GIS in 2014 due to a recognized need for informed decision-making regarding resource allocation for construction and maintenance. Since then, direct collaboration has occurred with the 17 use agencies on a self-reporting basis, alongside the initiation of on-site inspections and collaboration with partner agencies to integrate data layers like flood plain hazards for identifying potential threats to infrastructure. Moving forward, the tracking method will expand to encompass proper work order systems, asset management, and historical data retention. The GIS data has proven valuable in identifying distances from population centers, facilitating hazard planning, and optimizing allocation of fiscal and physical assets across multiple locations. Concurrently, efforts to enhance and expand this initiative will persist at IDOA. Figure 44 shows all state-owned and leased facilities.

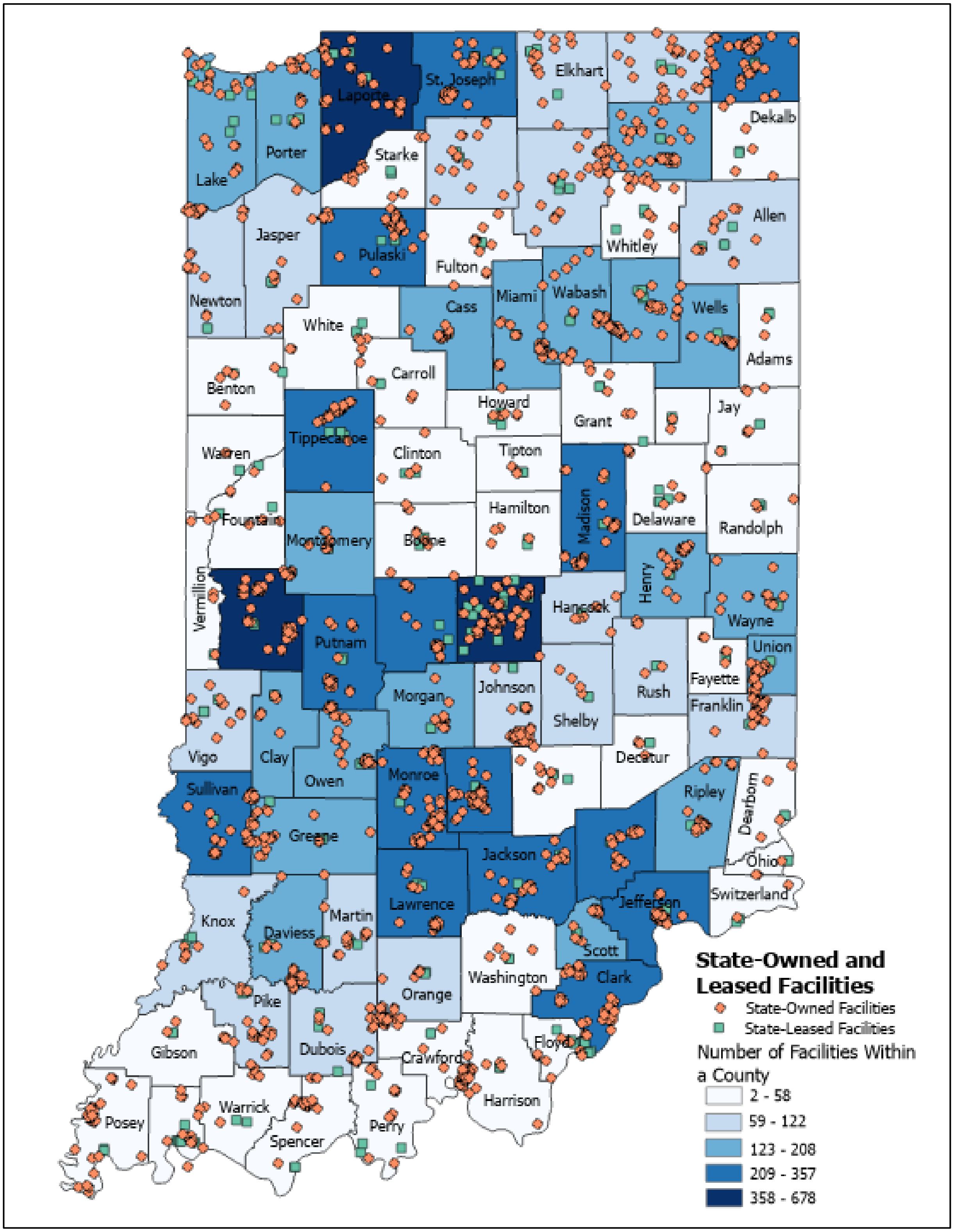


Figure 44. State-Owned and -Leased Facilities in Indiana (Source: IDOA)

6 Hazards of Interest

6.1 Flood

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

Flash Floods

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

Riverine Floods

Riverine floods refer to floods on large rivers at locations with large upstream catchments. Riverine 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 riverine floods than for flash floods, generally providing ample warning for people to move to safe locations and, to some extent, secure property against damage. Riverine flooding on the large rivers of Indiana generally occurs during either the spring or summer.

6.1.1 Historical Occurrences

From 2002 to 2022, Indiana received 6 federal disaster declarations related to flooding. Individual Assistance (IA) approved for these declarations totaled $108 million, Public Assistance (PA) obligated totaled $159 million, and $38.6 million in Hazard Mitigation Assistance (HMGP) obligated. The most recent flood-related federal disaster declaration, DR-4363, occurred in early 2018 when severe storms and flooding caused extensive and record flooding along the Yellow, Kankakee, and Iroquois Rivers.

Table 21. Federal Flood-Related Disaster Declarations (2002 – 2022)

Disaster (Year)	Counties	IA Dollars Approved	PA Dollars Obligated	HMGP Obligated
DR-1740 (2008)	(IA) Allen, Benton, Carroll, Cass, DeKalb, Elkhart, Fulton, Huntington, Jasper, Kosciusko, LaPorte, Lake, Marshall, Newton, Noble, Pulaski, St. Joseph, Starke, Tippecanoe, White, Whitley (PA) Allen, Benton, Carroll, Cass, DeKalb, Elkhart, Fulton, Jasper, Kosciusko, Marshall, Newton, Noble, Pulaski, Starke, White	$7,674,152	$4,976,848	$1,821,115
DR-1766 (2008)	(IA) Adams, Bartholomew, Brown, Clay, Daviess, Dearborn, Decatur, Gibson, Grant, Greene, Hamilton, Hancock, Hendricks, Henry, Huntington, Jackson, Jefferson, Jennings, Johnson, Knox, Lawrence, Madison, Marion, Monroe, Morgan, Owen, Parke, Pike, Posey, Putnam, Randolph, Ripley, Rush, Shelby, Sullivan, Tippecanoe, Vermillion, Vigo, Washington, Wayne (PA) Adams, Bartholomew, Benton, Brown, Clay, Daviess, Decatur, Fountain, Franklin, Gibson, Greene, Hancock, Hendricks, Henry, Jackson, Jay, Jefferson, Jennings, Johnson, Knox, Madison, Marion, Monroe, Montgomery, Morgan, Ohio, Owen, Parke, Pike, Posey, Putnam, Randolph, Ripley, Rush, Shelby, Sullivan, Switzerland, Union, Vermillion, Vigo, Wabash, Washington, Wayne	$56,466,751	$100,905,333	$26,420,370
DR-1795 (2008)	(IA) Clark, Crawford, Dearborn, Floyd, Franklin, Gibson, Harrison, Jackson, Jasper, Jefferson, Jennings, Knox, LaPorte, Lake, Lawrence, Martin, Ohio, Orange, Perry, Pike, Porter, Posey, Ripley, Scott, Spencer, St. Joseph, Switzerland, Vanderburgh, Warrick, Washington (PA) Clark, Crawford, Daviess, Dearborn, Decatur, Dubois, Fayette, Floyd, Franklin, Gibson, Harrison, Jackson, Jefferson, Jennings, LaPorte, Lake, Lawrence, Martin, Newton, Ohio, Orange, Perry, Pike, Porter, Ripley, Rush, Scott, Spencer, Switzerland, Union, Vanderburgh, Warrick, Washington, Wayne	$36,964,929	$25,003,384	$4,837,798
DR-1832 (2009)	(IA) Allen, Carroll, Daviess, DeKalb, Fulton, Jasper, Kosciusko, LaPorte, Lake, Lawrence, Marshall, Noble, Pulaski, St. Joseph, White, Whitley	$2,961,606	$0	$238,939
DR-1997 (2011)	(PA) Benton, Clark, Clay, Crawford, Daviess, Dearborn, Dubois, Floyd, Franklin, Gibson, Harrison, Jackson, Jefferson, Jennings, Knox, Lawrence, Martin, Monroe, Ohio, Orange, Parke, Perry, Pike, Posey, Putnam, Ripley, Scott, Spencer, Starke, Sullivan, Switzerland, Vanderburgh, Vermillion, Warrick, Washington, Wayne	$0	$13,658,731	$2,727,247
DR-4363 (2018)	(IA) Carroll, Clark, Dearborn, Elkhart, Floyd, Fulton, Harrison, Jasper, Jefferson, Kosciusko, LaPorte, Lake, Marshall, Ohio, Porter, Pulaski, Spencer, St. Joseph, Starke, Switzerland, Vanderburgh, White	$3,883,630	$14,326,677	$2,558,898

Disaster (Year)	Counties	IA Dollars Approved	PA Dollars Obligated	HMGP Obligated
	(PA) Benton, Clark, Crawford, Dearborn, Elkhart, Floyd, Fulton, Gibson, Harrison, Jasper, Jefferson, LaPorte, Marshall, Newton, Ohio, Perry, Porter, Pulaski, Spencer, St. Joseph, Starke, Switzerland, Vanderburgh, Vermillion, Wabash, Warren, Warrick, White			

Between January 1, 2018 and October 31, 2022, there have been 713 flood and flash flood events reported to the National Centers for Environmental Information (NECI). These events resulted in 12 deaths, 1 injury, and more than $80 million in damages to property and crops. Table 22 outlines NCEI-reported events by district. A complete table of all flood events by county can be found in Appendix A.

Table 22. NCEI-Reported Flood Events (2018-2022)

District	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
District 1	42	0	0	$4,493,000	$0
District 2	22	0	0	$5,050,000	$0
District 3	10	1	0	$384,000	$0
District 4	20	0	0	$891,750	$6,000
District 5	46	0	0	$927,250	$63,500
District 6	59	1	0	$655,000	$40,000
District 7	27	0	0	$20,182,000	$66,000
District 8	36	2	1	$27,723,500	$12,000
District 9	134	9	0	$19,504,500	$7,000
District 10	317	0	0	$1,635,000	$543,500
Total	**713**	**12**	**1**	**$81,446,000**	**$738,000**

As climate change continues to impact weather patterns, State officials are observing how flooding events that were once considered rare, are becoming more common in Indiana. A prime example of this occurred over Labor Day weekend September 2022 in Switzerland County. A small area experienced significant flash flooding and flooding due to unprecedented weather patterns caused by climate change. IDNR recorded 10 to 11 inches of rain poured down in just 6 hours, leading to overflowing creeks and streams throughout northwestern Switzerland County. The worst-hit areas were in and around Bennington and along Indian Creek, where multiple county bridges sustained severe damage, and some were even washed away.

Countless homes along Indian Creek suffered extensive damage, with trees knocked down by the force of the water and roadways washed out in various places. The intersection of State Route 129 and 250 was also affected by high water levels. One death occurred as a result of the flooding. According to IDNR, local individuals and property owners described the rushing water as, “sounding like a massive wall of water cascading down a hill.” The flood event led to Governor Holcomb declaring a disaster emergency for Jefferson, Ohio, and Switzerland Counties (Executive Order 22-15).

Figure 45. Photo of road and bridge damage to IN 250 from September 2022 flood event (Photo source: Morse, 2022, photo provided by Indiana Department of Transportation)

This event serves as a stark reminder of the growing impact of climate change on extreme weather events.

6.1.2 Vulnerability & Risk 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) an overview of repetitive and severe repetitive loss properties.

It is important to note that the losses to buildings, particularly essential facilities, 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 event and made calculations by clipping the digital elevation model (DEM) to the 100-year DFIRM boundary. Hazus-MH then utilized a level 2 user-defined analysis of the state with site-specific building data combined with IDLGF assessor data. More information on the creation of the statewide site-specific building data can be found in Section 5. It is important to remember that Hazus-MH is not a substitute for a detailed engineering study. Rather, it serves as a planning aid for communities interested in assessing their risk to flood, earthquake, and hurricane-related hazards.

Hazus-MH estimates the 100-year flood would damage 106,931 buildings at a replacement cost of over $1 billion statewide. IDHS District 5 experienced the most damage to buildings, totaling about $340 million in damages with 27,190 buildings affected.

The total estimated dollar amount of damages to buildings are listed in Table 23 and shown in Figure 46. The total estimated number of damaged buildings are listed by district in Table 24 and displayed by county in Figure 47. Figure 48 breaks down the estimated percentage of total buildings in a county that would be projected to be damaged given a 1% flood. According to Figure 48, Blackford, Carroll, Crawford, Martin, Orange, Owen, Pulaski, Ripley, Union, and Whitley would be projected to have the greatest number of buildings damaged.

There were 855 parcels with recent, potential, or projected development projects threatened within the SFHA.

Table 23. Building Damages per District by Occupancy Code

District	Building Loss	Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
1	$27,735,003	$695,817	$658,898	$74,693	$7,263,740	$1,611,330	$133,061	$17,297,463
2	$46,528,132	$673,463	$617,566	$0	$9,688,149	$729,329	$117,180	$34,702,443
3	$68,352,630	$1,040,658	$1,557,151	$1,137,415	$12,804,334	$18,291,105	$276,699	$33,245,267
4	$72,774,586	$10,270,575	$1,238,960	$0	$11,867,936	$35,586	$574,161	$48,787,368
5	$339,652,440	$3,224,740	$23,875,641	$176,546	$10,775,583	$9,589,501	$2,272,635	$289,737,796
6	$89,666,246	$1,704,188	$1,922,664	$9,088,762	$45,264,447	$4,956,054	$526,106	$26,204,025
7	$47,032,268	$9,468,145	$5,488,766	$0	$6,233,768	$1,207,213	$393,867	$24,240,509
8	$59,970,282	$4,779,981	$4,047,319	$3,008	$24,306,207	$2,494,503	$338,704	$24,000,559
9	$176,340,947	$8,634,054	$9,149,664	$78,367	$90,558,553	$4,335,004	$1,001,243	$62,584,062
10	$74,330,509	$6,707,291	$2,327,593	$3,817,415	$17,468,602	$5,172,230	$593,359	$38,244,019
Total	**$1,002,383,043**	**$47,198,913**	**$50,884,223**	**$14,376,206**	**$236,231,319**	**$48,421,856**	**$6,227,016**	**$599,043,511**

Table 24. Number of Damaged Buildings by Occupancy

District	Buildings Damaged	Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
1	5,567	865	356	4	214	381	46	3,701
2	7,273	882	350	1	282	141	55	5,562
3	10,748	993	499	22	344	333	122	8,435
4	6,542	614	182	0	119	48	70	5,509
5	27,190	1,129	1,965	29	267	612	275	22,913
6	10,176	1,677	801	32	518	273	160	6,715
7	8,114	1,603	595	0	42	58	184	5,632
8	8,309	1,658	785	5	173	257	154	5,277
9	10,036	1,529	1,331	6	366	164	240	6,400
10	12,976	2,795	970	22	189	762	262	7,976
Total	**13,745**	**7,834**	**121**	**2,514**	**3,029**	**1,568**	**78,120**	**106,931**

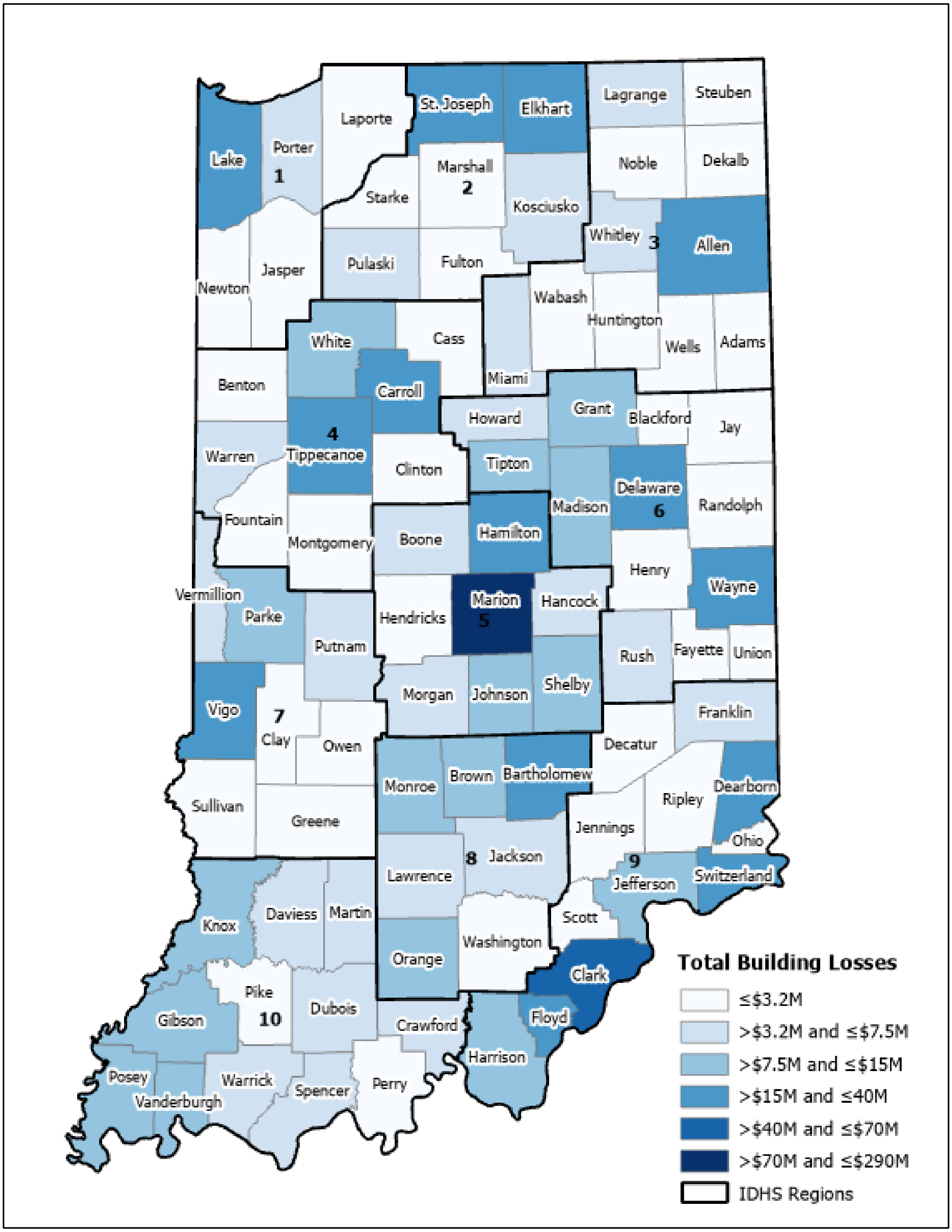


Figure 46. Projected Total Building Losses by County

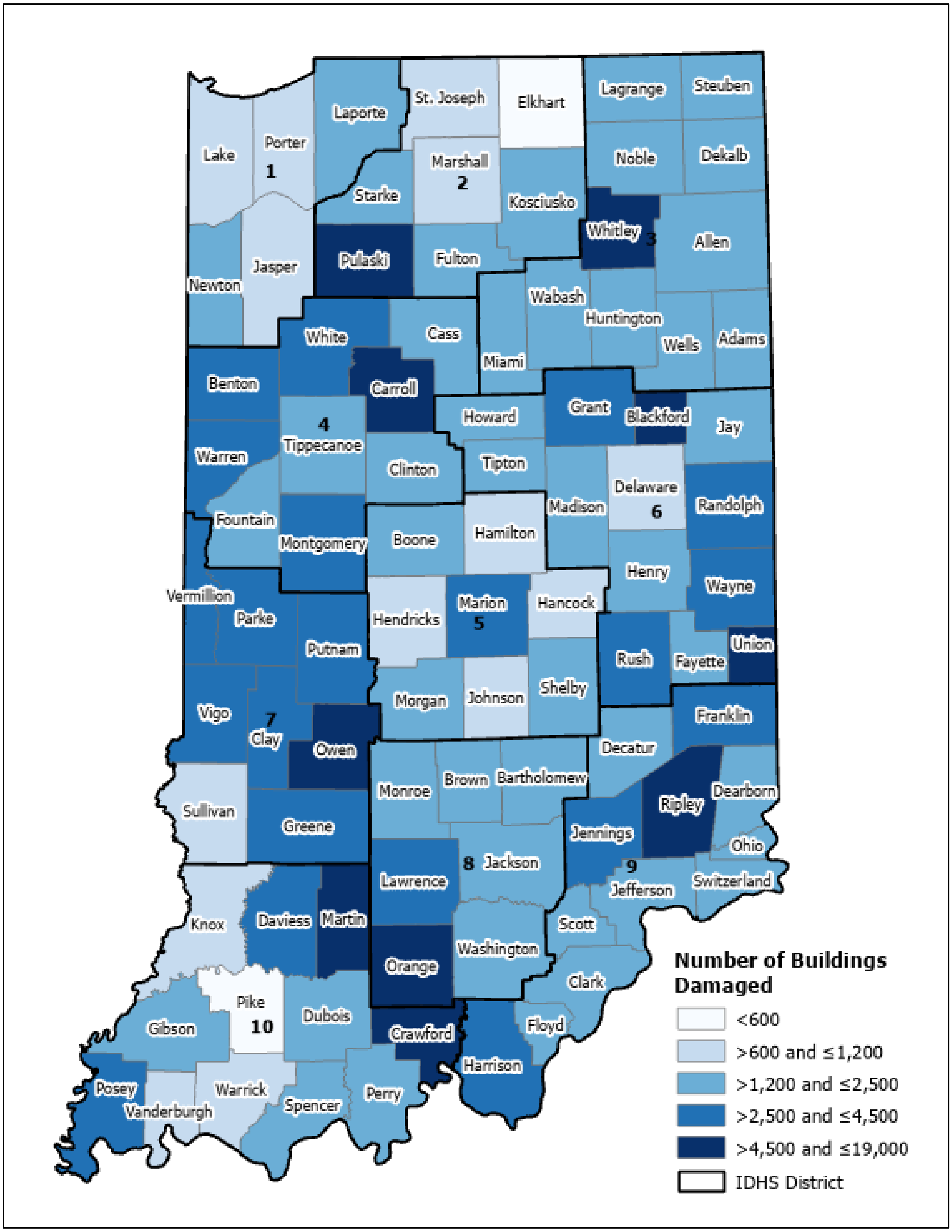


Figure 47. Projected Total Buildings Damaged

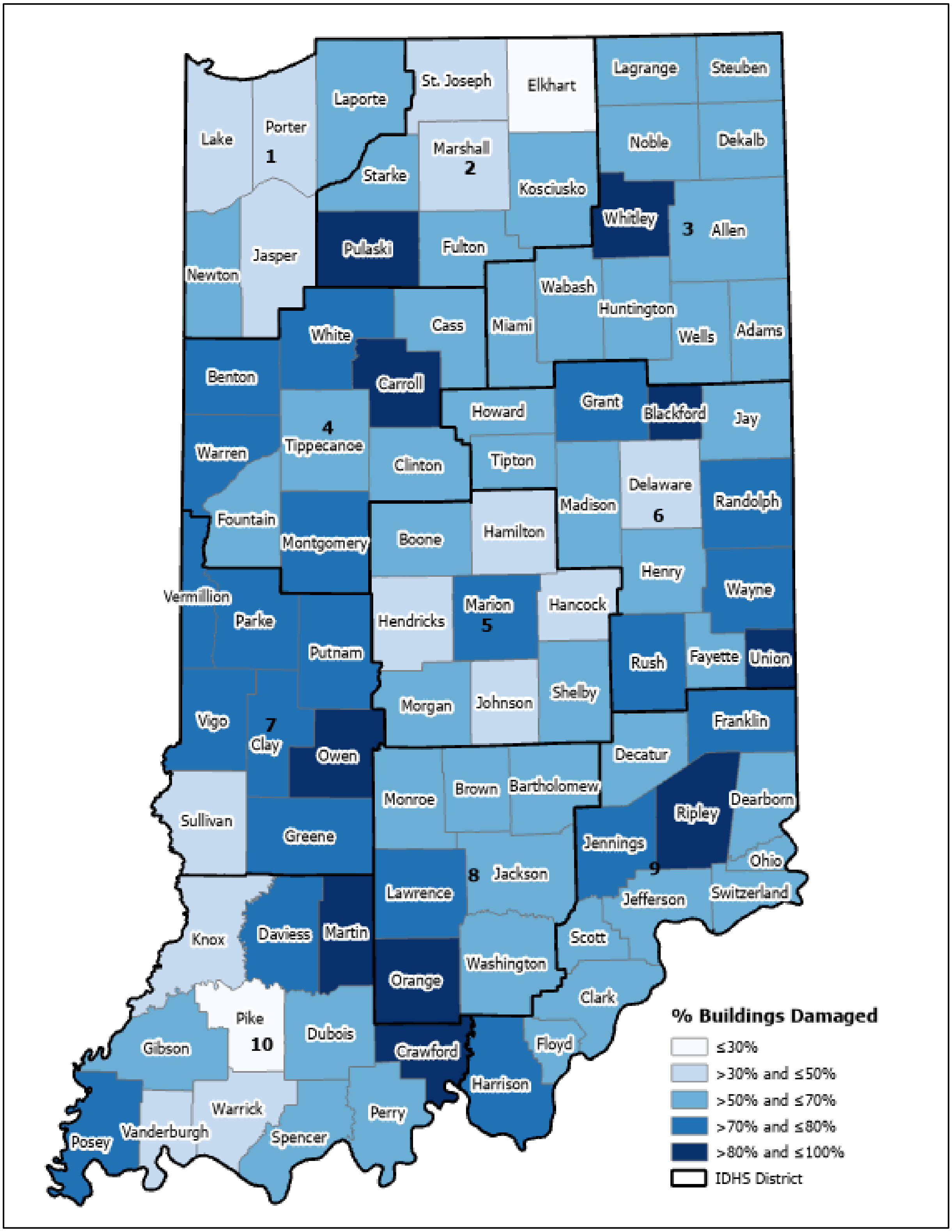


Figure 48. Percent Projected Buildings Damaged

6.1.2.2 Analysis of Essential Facilities

While damage to any building in the event of a flood would be detrimental, essential facilities are of particular concern as they provide necessary services to the emergency response abilities of the county. For this reason, essential facilities were closely examined in relation to the SFHA boundary. A total of 147 facilities were mapped as intersecting the SFHA for Indiana. Maps of essential facilities that intersect the SFHA can be found in Appendix B. These facilities have been listed, by type, in Table 25.

Table 25. Damaged Essential Facilities

Facility Type	State Total	Approximate Impacted by SFHA
Schools	3,304	33
Police Stations	644	15
Fire Stations & EMS	1,352	48
EOCs	117	3
Care Facilities	1,846	48

6.1.2.3 Analysis of State Facilities

The State of Indiana possesses and manages more than 12,000 buildings, with an additional 300 being leased. Among these, 975 state-owned facilities and 11 leased spaces fall within the Special Flood Hazard Area (SFHA), making them vulnerable to a 100-year flood. Refer to Figure 49 for a visual representation. Notably, there's a cluster of state-owned facilities in the northeastern counties (Steuben, Lagrange, and Noble) situated within the SFHA. Other counties have clusters of facilities within the SFHA with some counties having no state-owned facilities vulnerable to the 100-year flood.

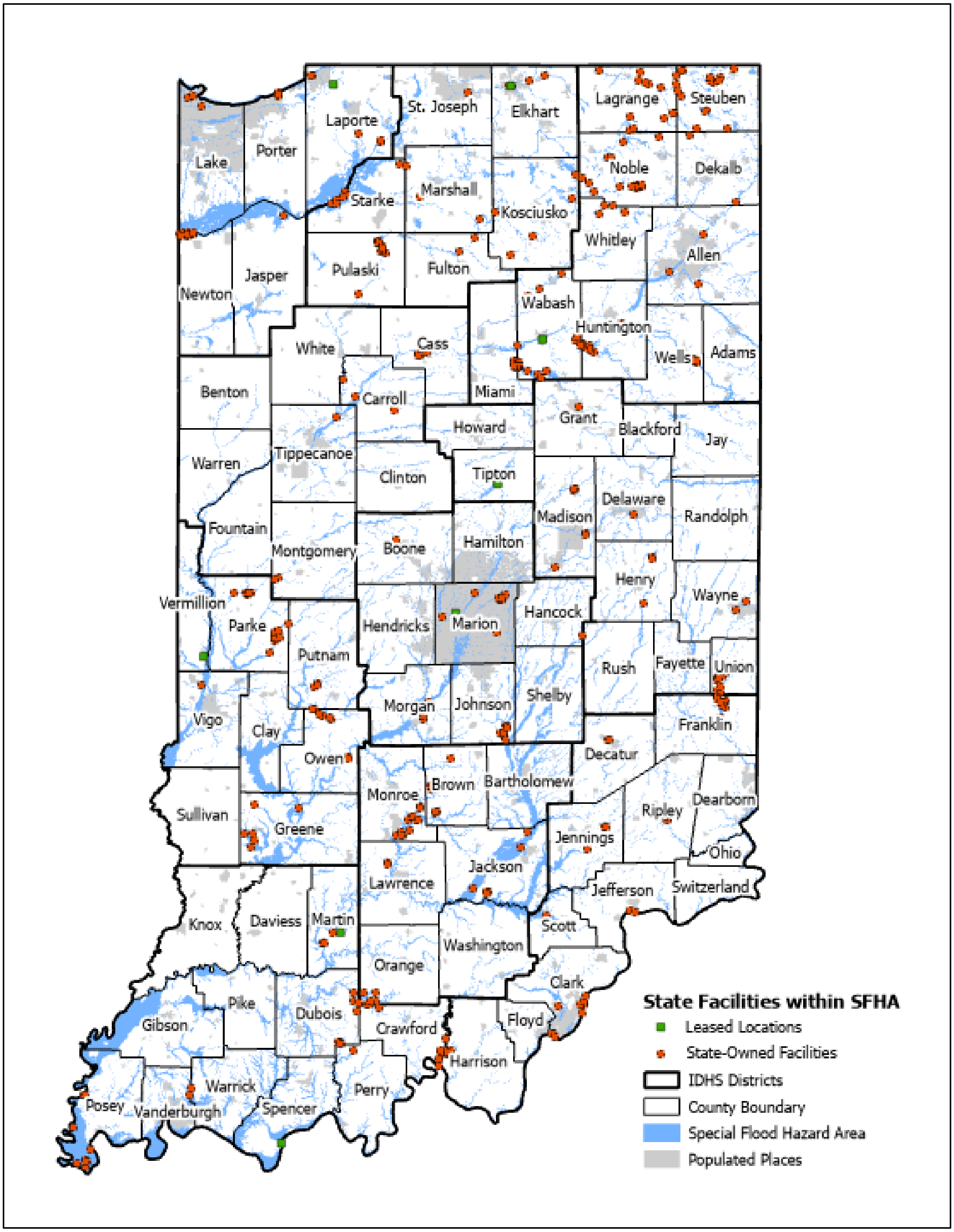


Figure 49. State Facilities within the SFHA

6.1.3 IDNR "Best Available" Floodplain layer

For many years, the IDNR Division of Water has assisted Indiana communities in determining base flood elevations (BFEs) and floodway limits for streams that did not have detailed floodplain information shown on their Flood Insurance Rate Maps (FIRMs). Typically, this included asking requestors for survey data, then using that data to run hydrology and hydraulic models to determine floodplain limits on a case-by-case basis.

Because this process took months to complete, both from obtaining the survey data and the modeling by the Division of Water, floodplain management activities suffered due to the time lag. However, with the advent of detailed GIS data, namely LiDAR elevation data, many of the traditional barriers to completing high-level floodplain information have been removed.

The Division of Water has completed a dataset for the state that incorporates the detailed level-floodplain data included in the FEMA FIRMs and enhanced it with a lower-level, but still quality, floodplain data for the majority of all streams in Indiana. This dataset is known as the "best available" floodplain layer (BAFL), due to the phrasing of the standard local floodplain ordinance in Indiana, which requires the use of the BAFL to make sound floodplain management decisions when the needed information is not available on the FEMA FIRM.

The dataset features flood elevations for five annual chance flood return periods (10%, 4%, 2%, 1% and 0.2%), as well as floodplain and floodway limits for more than 18,000 miles of stream that previously only had Zone A or Zone X designations on the FIRMs. Along with the 4,000 miles of stream published on the FIRMs with elevation and floodway data, this dataset provides floodplain data for more than 22,000 miles of stream in Indiana, covering every major waterway in the state, along with many critical tributaries.

Legislation passed in 2022 that required local floodplain administrators to are to use BAFL for permitting purposes where no FEMA detailed studies are yet available for sites in the floodplain of streams and where the upstream drainage area is greater than one square mile. In cases where the applicant disagrees with BAFL, they can request a review to determine if any changes are warranted, or the applicant can provide an engineering study to be approved by DNR. A comparison using building locations used for this report of the number of buildings within the BAFL to the number of buildings within the SFHA are listed in Table 21.

Table 26. Number of Buildings within the BAFL to Number of Buildings within the SFHA

County	Number of Buildings in BAFL	Number of Buildings in SFHA	BAFL Buildings Minus SFHA Buildings
Adams	937	969	(32)
Allen	6,462	6,258	204
Bartholomew	4,921	5,056	(135)
Benton	123	35	88
Blackford	151	140	11
Boone	1,638	1,510	128
Brown	1,128	1,308	(180)
Carroll	2,334	2,540	(206)

County	Number of Buildings in BAFL	Number of Buildings in SFHA	BAFL Buildings Minus SFHA Buildings
Cass	1,071	1,104	(33)
Clark	5,689	5,586	103
Clay	822	876	(54)
Clinton	423	431	(8)
Crawford	844	854	(10)
Daviess*	1,348	--	
Dearborn	1,182	1,433	(251)
Decatur	634	606	28
Dekalb	586	676	(90)
Delaware	2,992	3,052	(60)
Dubois	809	933	(124)
Elkhart	3,870	3,712	158
Fayette	737	1,217	(480)
Floyd	1,727	1,706	21
Fountain	475	202	273
Franklin	859	970	(111)
Fulton	617	424	193
Gibson	1,221	1,181	40
Grant	1,070	983	87
Greene	1,988	1,212	776
Hamilton	3,609	3,782	(173)
Hancock	2,147	2,080	67
Harrison	1,483	1,432	51
Hendricks	1,403	1,268	135
Henry	784	906	(122)
Howard	1,153	1,188	(35)
Huntington	463	468	(5)
Jackson	4,030	3,778	252
Jasper	2,014	1,766	248
Jay	548	512	36
Jefferson	889	819	70
Jennings	368	535	(167)
Johnson	4,237	4,152	85
Knox*	3,119	--	
Kosciusko	5,713	5,579	134
LaGrange	3,288	3,166	122
Lake	6,743	6,719	24
LaPorte	1,782	1,489	293
Lawrence	789	859	(70)

County	Number of Buildings in BAFL	Number of Buildings in SFHA	BAFL Buildings Minus SFHA Buildings
Madison	2,897	3,131	(234)
Marion	22,860	23,142	(282)
Marshall	693	853	(160)
Martin	767	786	(19)
Miami	1,013	893	120
Monroe	1,229	1,508	(279)
Montgomery	613	557	56
Morgan	2,514	1,839	675
Newton	1,147	838	309
Noble	2,573	2,542	31
Ohio	477	485	(8)
Orange	1,136	1,047	89
Owen	665	627	38
Parke	567	547	20
Perry	1,240	1,137	103
Pike	176	227	(51)
Porter	1,313	919	394
Posey	2,207	2,236	(29)
Pulaski	1,264	1,110	154
Putnam	586	835	(249)
Randolph	772	981	(209)
Ripley	271	354	(83)
Rush	896	688	208
Scott	1,923	2,019	(96)
Shelby	420	216	204
Spencer	2,285	2,447	(162)
St. Joseph	2,343	2,315	28
Starke	1,282	1,172	110
Steuben	1,693	1,836	(143)
Sullivan*	361	--	
Switzerland	1,204	1,167	37
Tippecanoe	1,630	1,814	(184)
Tipton	1,597	1,534	63
Union	47	87	(40)
Vanderburgh	8,430	8,662	(232)
Vermillion	819	733	86
Vigo	5,812	5,461	351
Wabash	891	880	11
Warren	232	170	62

County	Number of Buildings in BAFL	Number of Buildings in SFHA	BAFL Buildings Minus SFHA Buildings
Warrick	3,719	3,482	237
Washington	788	648	140
Wayne	1,649	1,529	120
Wells	292	306	(14)
White	2,410	2,168	242
Whitley	574	565	9
State Total	**179,497**	**171,965**	**7,532**

*Indicates counties that do not have SFHA to compare number of buildings in BAFL to number of buildings in SFHA

6.1.4 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. The NFIP is a federal program administered by the FEMA that enables property owners in participating communities to purchase federal flood insurance. Participation is based on an agreement between the local communities and the Federal government. Communities that join the NFIP agree to adopt and enforce floodplain management regulations that meet or exceed the minimum federal and state floodplain management regulations. 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 substantially improved structures.

Each NFIP participating community appoints a floodplain administrator to administer their floodplain regulations. Legislation passed by Indiana in 2023 now specifies after June 30, 2025, an individual may not serve as the floodplain administrator of a county or a municipality unless the individual has successfully completed: (1) the Certified Floodplain Manager program of the Association of State Floodplain Managers; or (2) another course or training program for local floodplain managers: (A) approved by the Federal Emergency Management Agency; or (B) approved by the department for the purposes of this section.

Indiana currently has 451 communities (cities, towns, and counties) participating in the NFIP program while 68 communities with identified flood risk do not.

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

1. **Risk Identification - 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. **Regulations - Reducing Flood Risk:** Establish safe building standards in high hazard flood areas. In Indiana, the key building standard requires that new or substantially improved structure be elevated or dry floodproofed (dry floodproofing is only an option for non-residential structures) to the flood protection grade, which is 2' above the base flood

elevation. Local floodplain managers are also encouraged to seek flood-related grants and assistance such as Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL).

3. **Insurance:** Provide affordable, federally backed flood insurance coverage in communities participating in the NFIP can purchase affordable protection to insure against flood losses. By law, FEMA can only provide flood insurance to homeowners of communities that adopt and enforce floodplain management regulations and meet NFIP's requirements.
4. **Mitigation:** Communities that participate in the NFIP and are in good standing may further reduce flood risk in their communities through a variety of FEMA mitigation programs. Communities should coordinate with the Indiana State Hazard Mitigation Officer about the current FEMA mitigation programs when there is interest in long term solutions that reduce the impact of disasters from flood in the future.

To help better assess flood risk, the total structures in the SFHA were compared to the total number of policies in the community. This is based on approximate building locations, therefore should not be used as an absolute comparison. However, this information may be used to target further mitigation through additional engagement with the NFIP. Table 27 displays the federal insurance policies, total coverage for each county, the estimated number of buildings in the SFHA, along with total estimated replacement cost. The last column represents the approximate percentage of buildings insured. Figure 50 maps the percentage of buildings insured, the total number of estimated buildings in the SFHA divided by the total number of polices in the county.

Table 27. Comparison of Estimated Building Exposure to Insured Buildings

County	Federal Policies In Force	Total Coverage	Total Buildings in the SFHA	Total Replacement Cost of Buildings in SFHA	Approximate % of Buildings Insured
Adams	59	$10,364,500	493	$1,276,810	12%
Allen	676	$143,957,500	3640	$39,747,808	19%
Bartholomew	501	$118,655,000	2532	$18,506,818	20%
Benton	1	$350,000	28	$273,541	4%
Blackford	6	$715,000	107	$577,808	6%
Boone	188	$38,335,500	892	$5,816,911	21%
Brown	96	$20,852,500	897	$11,903,910	11%
Carroll	237	$43,319,800	2129	$24,709,362	11%
Cass	105	$15,178,000	675	$1,841,569	16%
Clark	768	$162,581,600	3650	$67,494,321	21%
Clay	34	$4,868,000	645	$2,467,533	5%
Clinton	51	$10,543,700	301	$1,334,088	17%
Crawford	27	$3,514,100	694	$3,531,181	4%
Daviess	13	$2,290,000	1068	$3,266,867	1%
Dearborn	90	$24,714,900	930	$33,255,500	10%
Decatur	29	$6,222,900	302	$939,012	10%
Dekalb	68	$11,621,100	383	$2,840,599	18%
Delaware	368	$74,172,200	1512	$18,820,511	24%
Dubois	48	$15,590,000	600	$3,945,091	8%
Elkhart	419	$95,591,800	1065	$17,274,962	39%

County	Federal Policies In Force	Total Coverage	Total Buildings in the SFHA	Total Replacement Cost of Buildings in SFHA	Approximate % of Buildings Insured
Fayette	71	$10,355,100	853	$3,151,566	8%
Floyd	197	$53,121,300	921	$17,169,719	21%
Fountain	10	$1,570,900	110	$999,052	9%
Franklin	43	$6,981,500	758	$4,105,553	6%
Fulton	43	$7,288,400	260	$376,575	17%
Gibson	28	$4,984,500	692	$8,406,785	4%
Grant	95	$17,062,200	753	$9,026,819	13%
Greene	53	$10,282,400	909	$2,508,313	6%
Hamilton	655	$185,868,800	1804	$17,546,111	36%
Hancock	189	$39,363,100	994	$3,471,780	19%
Harrison	93	$19,296,000	1060	$12,068,766	9%
Hendricks	214	$57,779,700	481	$2,291,150	44%
Henry	52	$8,796,000	625	$1,266,350	8%
Howard	160	$46,429,300	784	$5,681,283	20%
Huntington	56	$9,139,000	279	$2,478,578	20%
Jackson	208	$44,436,800	2058	$3,405,982	10%
Jasper	123	$25,427,200	614	$964,527	20%
Jay	28	$5,344,000	291	$260,712	10%
Jefferson	110	$15,899,100	547	$14,867,486	20%
Jennings	23	$3,194,800	404	$2,915,971	6%
Johnson	483	$115,537,800	1975	$10,239,315	24%
Knox	94	$21,998,000	1165	$12,209,636	8%
Kosciusko	495	$99,737,300	3019	$7,140,135	16%
LaGrange	180	$37,017,500	1590	$3,835,535	11%
Lake	1205	$312,567,300	3156	$18,924,301	38%
LaPorte	172	$46,012,500	773	$2,268,000	22%
Lawrence	35	$5,772,600	608	$7,308,450	6%
Madison	290	$41,081,600	1930	$11,808,460	15%
Marion	3054	$683,875,100	18215	$285,800,132	17%
Marshall	65	$15,023,700	420	$1,495,867	15%
Martin	11	$1,910,000	654	$4,731,559	2%
Miami	74	$14,013,700	572	$5,517,245	13%
Monroe	221	$54,025,200	916	$9,400,448	24%
Montgomery	40	$7,432,500	416	$2,755,471	10%
Morgan	212	$61,565,800	1266	$4,805,700	17%
Newton	54	$9,987,500	569	$1,364,754	9%
Noble	202	$34,181,500	1547	$3,092,550	13%
Ohio	41	$8,840,300	282	$1,194,592	15%
Orange	74	$16,100,100	868	$7,502,346	9%
Owen	63	$10,096,300	526	$1,766,716	12%
Parke	19	$1,649,800	393	$11,455,343	5%
Perry	46	$7,052,000	756	$2,637,422	6%

County	Federal Policies In Force	Total Coverage	Total Buildings in the SFHA	Total Replacement Cost of Buildings in SFHA	Approximate % of Buildings Insured
Pike	8	$2,143,000	56	$449,905	14%
Porter	159	$42,122,700	455	$4,213,420	35%
Posey	106	$19,613,300	1572	$8,954,124	7%
Pulaski	59	$8,084,100	937	$4,110,459	6%
Putnam	43	$9,917,000	620	$5,603,020	7%
Randolph	71	$8,742,400	788	$2,281,346	9%
Ripley	17	$3,515,500	300	$1,479,771	6%
Rush	41	$7,139,400	479	$3,573,306	9%
Scott	16	$2,974,800	121	$312,190	13%
Shelby	213	$39,525,000	1563	$9,681,341	14%
Spencer	96	$12,191,800	1576	$4,715,736	6%
St. Joseph	264	$74,544,600	920	$15,017,953	29%
Starke	62	$8,588,200	652	$1,112,181	10%
Steuben	110	$21,603,500	1017	$3,064,093	11%
Sullivan	3	$86,000	151	$250,502	2%
Switzerland	51	$6,649,800	761	$20,538,066	7%
Tippecanoe	191	$46,979,700	1139	$21,295,082	17%
Tipton	149	$30,574,600	839	$8,845,988	18%
Union	2	$398,000	81	$503,175	2%
Vanderburgh	674	$188,198,700	2877	$14,326,899	23%
Vermillion	51	$4,742,600	569	$3,356,075	9%
Vigo	677	$135,090,100	4301	$19,624,765	16%
Wabash	98	$18,111,200	553	$1,621,057	18%
Warren	2	$175,000	116	$5,999,135	2%
Warrick	150	$37,512,700	1266	$7,155,303	12%
Washington	20	$1,939,400	430	$1,942,328	5%
Wayne	103	$14,831,600	1134	$23,868,921	9%
Wells	54	$15,887,000	193	$1,654,225	28%
White	130	$24,712,200	1628	$13,567,286	8%
Whitley	73	$14,770,000	481	$3,224,129	15%
State Total	**17058**	**$3,782,900,200**	**106931**	**$1,002,383,043**	**16%**

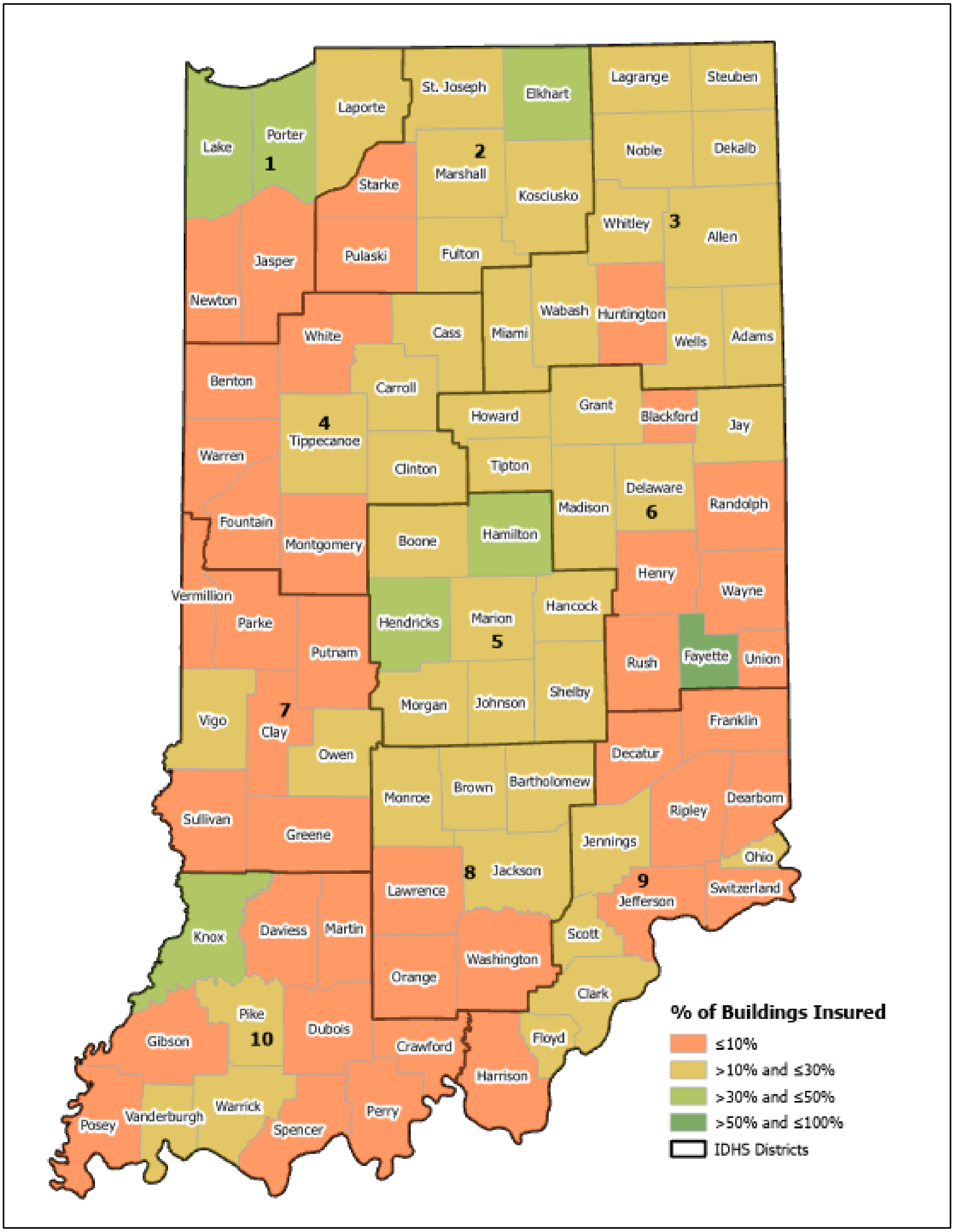


Figure 50. Projected Percentage of Buildings Insured per County

6.1.4.1 Community Rating System

The NFIP's Community Rating System (CRS) was implemented in 1990 and recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. Any community that is in full compliance with the NFIP's minimum floodplain management requirements may apply to join CRS. Nearly 3.6 million policyholders in 1,444 communities participate in the CRS by implementing local mitigation, floodplain management, and outreach activities that exceed the minimum NFIP requirements.

Under the CRS, flood insurance premium rates are discounted to reward community actions that meet the three goals of the CRS, which are: (1) reduce flood damage to insurable property; (2) strengthen and support the insurance aspects of the NFIP; and (3) encourage a comprehensive approach to floodplain management. Although CRS communities represent only 5 percent of the over 22,000 communities participating in the NFIP, more than 69 percent of all flood insurance policies are written in CRS communities.

Besides the benefit of reduced insurance rates, CRS floodplain management activities enhance public safety, reduce damages to property and public infrastructure, avoid economic disruption and losses, reduce human suffering, and protect the environment. Technical assistance on designing and implementing some activities is available at no cost. Participating in the CRS provides an incentive to maintaining and improving a community's floodplain management program over the years.

In Indiana CRS communities can get higher credit for Activity 340 Hazard Disclosure, Activity 410 Mapping and Regulations for the state having more restrictive floodway regulations, Activity 430 Higher Standards for having a 2' freeboard, and Activity 610 Dams if a community has a state-regulated high hazard dam that would affect them. Indiana has a total of 36 communities and counties participating in the CRS; however, 3 participants are class 10 and do not participate in CRS. They are Vigo County, the City of Fort Wayne, and Lake County. The City of Carmel is the most recent community to join in 2019. A list of participating communities is found in Table 28.

Table 28. Community Rating System Eligible Communities

Community or County	CRS Entry Date	CRS Class	% Discount for SFHA
Fort Wayne, City of	10/1/1991	10	0
Hamilton County	10/1/1991	7	15
Noblesville, City of	10/1/1991	7	15
Bartholomew County	10/1/1993	8	10
Decatur, City of	10/1/1993	7	15
Kokomo, City of	10/1/1995	8	10
Vigo County	10/1/1995	10	0
Kosciusko County	10/1/1997	9	5
Milford, Town of	10/1/1997	9	5
North Webster, Town of	10/1/1997	9	5
Syracuse, Town of	10/1/1997	9	5
Columbus, City of	10/1/1998	7	15
Evansville, City of	4/1/1999	8	10
Vanderburgh County	4/1/1999	9	5
Allen County	10/1/2002	8	10

Community or County	CRS Entry Date	CRS Class	% Discount for SFHA
Hancock County	10/1/2003	7	15
Anderson, City of	5/1/2007	9	5
Indianapolis, City of	10/1/2007	8	10
Hendricks County	5/1/2012	7	15
Lebanon, City of	10/1/2013	8	10
Clarksville, Town of	5/1/2014	8	10
Jeffersonville, City of	5/1/2014	8	10
Dyer, Town of	10/1/2014	8	10
Lake County	10/1/2014	10	0
Merrillville, Town of	10/1/2014	7	15
Andrews, Town of	5/1/2015	7	15
Bluffton, City of	5/1/2015	7	15
Huntington County	5/1/2015	7	15
Huntington, City of	5/1/2015	7	15
Ossian, Town of	5/1/2015	7	15
Roanoke, Town of	5/1/2015	7	15
Vera Cruz, Town of	5/1/2015	7	15
Warren, Town of	5/1/2015	7	15
Wells County	5/1/2015	7	15
Zanesville, Town of	5/1/2018	8	10
Carmel, City of	10/1/2019	8	10

6.1.4.2 Repetitive Loss

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 (SRL) 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.

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. Table 29 lists the top five communities with the most repetitive loss and severe repetitive loss properties reported. Table 30 lists the total amount of repetitive loss information by county. Statewide, there are 2,175 properties reported as RL, with the total number of losses submitted recorded at 6,6062. Of those losses reported, 1,933 were single-family properties, the remaining 242 were a mix of residential and non-residential properties.

Table 29. Top 5 Repetitive Loss Communities

Repetitive Loss Community Name	RL Properties	Count of RL	Total RL Payments
Marion County	255	798	$10,763,719.76
Indianapolis, City Of (Marion County)	253	791	$10,717,860.62
Lake County	221	539	$9,450,832.60
Allen County	160	413	$8,025,704.24
Fort Wayne, City Of (Allen County)	140	369	$6,633,755.17
Severe Repetitive Loss Community Name			
Marion County	38	243	$4,204,900.33
Clark County	25	141	$3,355,746.25
Carroll County	24	97	$3,620,620.67
Allen County	14	82	$2,647,563.99
Lake County	12	51	$1,424,818.52

Table 30. Number Repetitive Losses and Severe Repetitive Losses by County in Indiana

County	# of RL Properties	Total Count of RL Properties	Total RL Payments	# of SRL Properties	Total Count of SRL Properties	Total SRL Payments
Adams	6	12	$136,999	--	--	--
Allen	160	413	$8,025,704	14	82	$2,647,564
Bartholomew	41	95	$2,531,974	4	14	$355,267
Boone	6	13	$105,469	--	--	--
Brown	24	80	$2,641,019	4	32	$1,086,817
Carroll	110	330	$10,406,327	24	97	$3,620,621
Cass	5	13	$323,054	1	4	$214,401
Clark	101	341	$8,010,625	25	141	$3,355,746
Clay	3	7	$269,400	--	--	--
Clinton	2	5	$86,058	--	--	--
Crawford	14	39	$866,895	2	8	$156,588
Daviess	1	2	$9,983	--	--	--
De Kalb	6	14	$800,260	--	--	--
Dearborn	10	27	$535,922	--	--	--
Decatur	4	11	$703,947	1	4	$478,776
Delaware	38	104	$1,825,628	4	23	$428,915
Dubois	1	2	$7,632	--	--	--
Elkhart	38	112	$1,525,176	4	24	$391,022
Fayette	2	5	$25,964	1	3	$12,153
Floyd	26	77	$1,801,872	3	19	$565,239

County	# of RL Properties	Total Count of RL Properties	Total RL Payments	# of SRL Properties	Total Count of SRL Properties	Total SRL Payments
Fountain	1	2	$11,517	--	--	--
Franklin	4	10	$320,058	1	2	$66,381
Fulton	42	119	$1,735,385	8	36	$806,430
Gibson	4	9	$111,681	1	2	$55,065
Grant	19	65	$1,164,424	3	30	$684,545
Hamilton	57	164	$2,515,675	7	38	$722,352
Hancock	14	34	$696,490	1	4	$128,542
Harrison	27	82	$2,382,123	5	30	$648,218
Hendricks	10	21	$325,949	--	--	--
Henry	1	2	$21,461	--	--	--
Howard	87	242	$4,458,723	8	44	$920,915
Huntington	18	51	$747,101	1	6	$193,767
Jackson	8	20	$229,937	--	--	--
Jasper	9	23	$458,613	3	11	$316,656
Jay	4	8	$141,297	--	--	--
Jefferson	26	62	$1,805,976	3	13	$243,685
Jennings	2	4	$68,354	--	--	--
Johnson	42	97	$2,941,542	2	7	$255,586
Knox	12	36	$514,639	1	8	$301,568
Kosciusko	52	149	$2,461,564	9	41	$839,893
La Porte	7	17	$214,574	--	--	--
Lagrange	4	9	$45,410	--	--	--
Lake	221	539	$9,450,833	12	51	$1,424,819
Lawrence	9	21	$512,988	--	--	--
Madison	41	125	$2,354,912	5	33	$930,290
Marion	255	798	$10,763,720	38	243	$4,204,900
Marshall	27	81	$905,952	1	12	$188,507
Martin	1	2	$47,782	--	--	--
Miami	4	8	$80,330	--	--	--
Monroe	13	36	$973,659	1	7	$138,928
Montgomery	2	5	$95,661	--	--	--
Morgan	27	73	$1,980,938	4	20	$666,472
Newton	3	8	$56,757	--	--	--
Noble	31	93	$1,084,374	4	17	$249,606
Ohio	3	8	$64,656	--	--	--
Orange	17	53	$521,094	1	5	$55,022
Owen	25	57	$1,365,408	1	6	$144,320
Parke	1	3	$23,996	--	--	--
Perry	3	9	$75,500	--	--	--

County	# of RL Properties	Total Count of RL Properties	Total RL Payments	# of SRL Properties	Total Count of SRL Properties	Total SRL Payments
Porter	24	61	$990,906	1	6	$346,900
Posey	20	61	$1,134,371	6	22	$442,926
Pulaski	32	81	$1,479,858	3	12	$239,609
Putnam	2	6	$42,694	1	3	$32,981
Randolph	3	8	$34,253	--	--	--
Ripley	2	6	$100,669	1	4	$82,618
Rush	2	7	$43,023	--	--	--
Scott	1	2	$23,373	--	--	--
Shelby	34	95	$1,860,329	6	28	$533,321
St. Joseph	13	36	$613,097	2	10	$245,860
Starke	1	3	$83,735	--	--	--
Steuben	3	6	$37,719	--	--	--
Switzerland	6	15	$315,289	2	6	$151,918
Tippecanoe	43	104	$2,104,986	5	21	$587,203
Tipton	13	37	$645,116	2	16	$341,106
Union	1	2	$49,146	--	--	--
Vanderburgh	101	288	$4,582,076	11	63	$1,097,194
Vermillion	9	21	$223,557	--	--	--
Vigo	40	137	$3,340,487	8	41	$1,547,347
Wabash	4	8	$123,224	--	--	--
Warrick	8	20	$199,274	2	6	$49,150
Washington	10	26	$1,864,426	1	3	$1,430,525
Wayne	6	15	$210,290	1	5	$146,487
Wells	5	13	$202,026	1	4	$54,442
White	40	102	$2,573,080	4	19	$651,659
Whitley	4	8	$125,275	--	--	--
Grand Total	**2,175**	**6,062**	**$117,838,007**	**265**	**1391**	**$35,516,672**

6.1.5 Risk Mapping, Assessment, and Planning

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.

6.1.5.1 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 51 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.

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. Of the 92 counties in Indiana, 89 have had their flood maps modernized to digital form. The three counties that do not have completed digital form are Sullivan, Knox, and Daviess Counties. These three counties are funded by FEMA to have their FIRMs modernized in the FEMA 2020 Cooperative Technical Partner grant awarded to IDNR and the Polis Center.

The following lists some of the non-regulatory Risk MAP products the state of Indiana has completed:

- City of Tipton Flood Resilience Plan (Christopher B. Burke Engineering, Ltd.)
- North Vernon Tier 1 Country Squire Dam Inundation Mapping (IDNR, Polis)
- Logansport Tier 1 Goose Creek Report (IDNR, Polis)
- Owen County Transportation Vulnerability Analysis (IDNR, Polis)
- White Lick Creek System Assessment (Christopher B. Burke Engineering, Ltd.; Center for Earth and Environmental Sciences)
- Brown County Dam EAPs (IDNR, Polis)
- City of Washington Hawkins Creek Analysis (IDNR, Polis)
- City of Winchester Sugar Creek and Salt Creek Analysis (IDNR, Polis)
- Town of Ellettsville, Jacks Defeat Creek Analysis (IDNR, Polis)
- The City of Lebanon Flood Resilience Plan (Christopher B. Burke Engineering, Ltd.)
- City of Crawfordsville Sugar Creek Erosion Analysis (Christopher B. Burke Engineering, Ltd.)

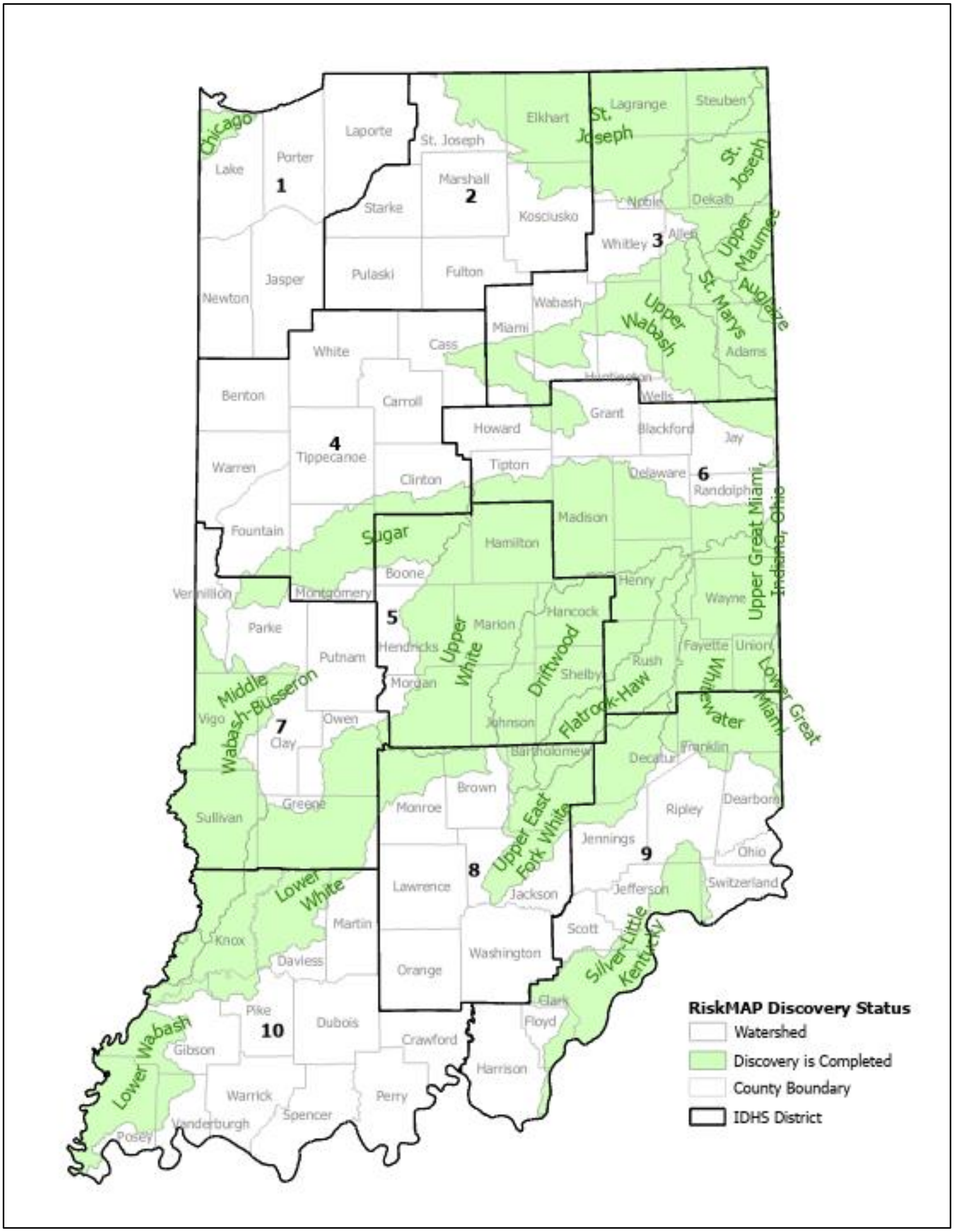


Figure 51. Risk MAP Discovery Projects Status as of August 2023

Additionally, mapping updates have been scheduled for counties within the following watersheds: Sugar Creek, Middle Wabash Busseron, Lower Wabash, Upper Wabash, Lower White, Upper White, and Lower East Fork White.

Depth Grid Development: Indiana has worked to create depth grids statewide and has made considerable progress. Below is a list of counties and/or community depth grid projects along with a brief description of the project.

- City of Noblesville, IN
    - Depth grids created for White River near the WWTP.
- Harrison County, IN
    - Depth grids created along the Ohio River.
- City of Salem, IN
    - Depth grids created for three areas identified by City.
    - These areas include portions of Highland Creek, Brock Creek and West Fork Blue River.
- Floyd County, IN
    - Depth grids created for five areas identified by County.
    - These areas include portions of Indian Creek, Yellow Fork, Georgetown Creek, Little Indian Creek, and Fall Run.
- Towns of French Lick and West Baden, IN
    - Depth grids created for two areas identified by the Towns.
    - These areas include portions of French Lick Creek within the town limits of French Lick and West Baden and Lost River to the north of the town limits of West Baden.
- Washington County, IN
    - Depth grids created for four areas identified by County.
    - These areas include portions of East Fork White River, Muscatatuck River, West Fork Blue River, South Fork Blue River and an area near West Washington School Road.
- Jackson County, IN
    - Depth grids created for five areas within the county. These areas were identified based on high populated areas within the 1-percent-annual-chance floodplain.
    - These areas include portions of Medora Creek and South Branch Medora Creek in the Town of Medora. Along a portion of East Fork White River northwest of the Town of Brownstown, along a portion of East Fork White River northwest of the City of Seymour, along a portion of Von Fange Ditch in the City of Seymour, and along a portion of Grassy Fork near intersection of County Road 600 and State Road 39.
- City of Tipton, IN
    - Depth grids were created as part of a demonstration project for the City of Tipton. These were part of a suite of Non-Regulatory products including Changes Since Last Firm and Chance of Flooding Over 30 Years.
    - These were created for a portion of Big Cicero Creek

6.1.6 Indiana Stream Gages

The USGS, in cooperation with many state agencies and local utility and surveyor offices, helps maintain stream gages, which provide the capability to obtain estimates of the amount of water flowing in streams and rivers. Water managers, emergency responders, utilities, environmental agencies, universities, consulting firms, and recreational enthusiasts use data from the stream gage network to understand the flow of water in their area. IDNR and IDEM use the stream gage data for water quantity and quality measurements. Local public safety officials use the data at these sites, along with the resources from the NWS, to determine emergency management needs during periods of heavy rainfall. Stream gages for the state of Indiana have been mapped in Figure 52.

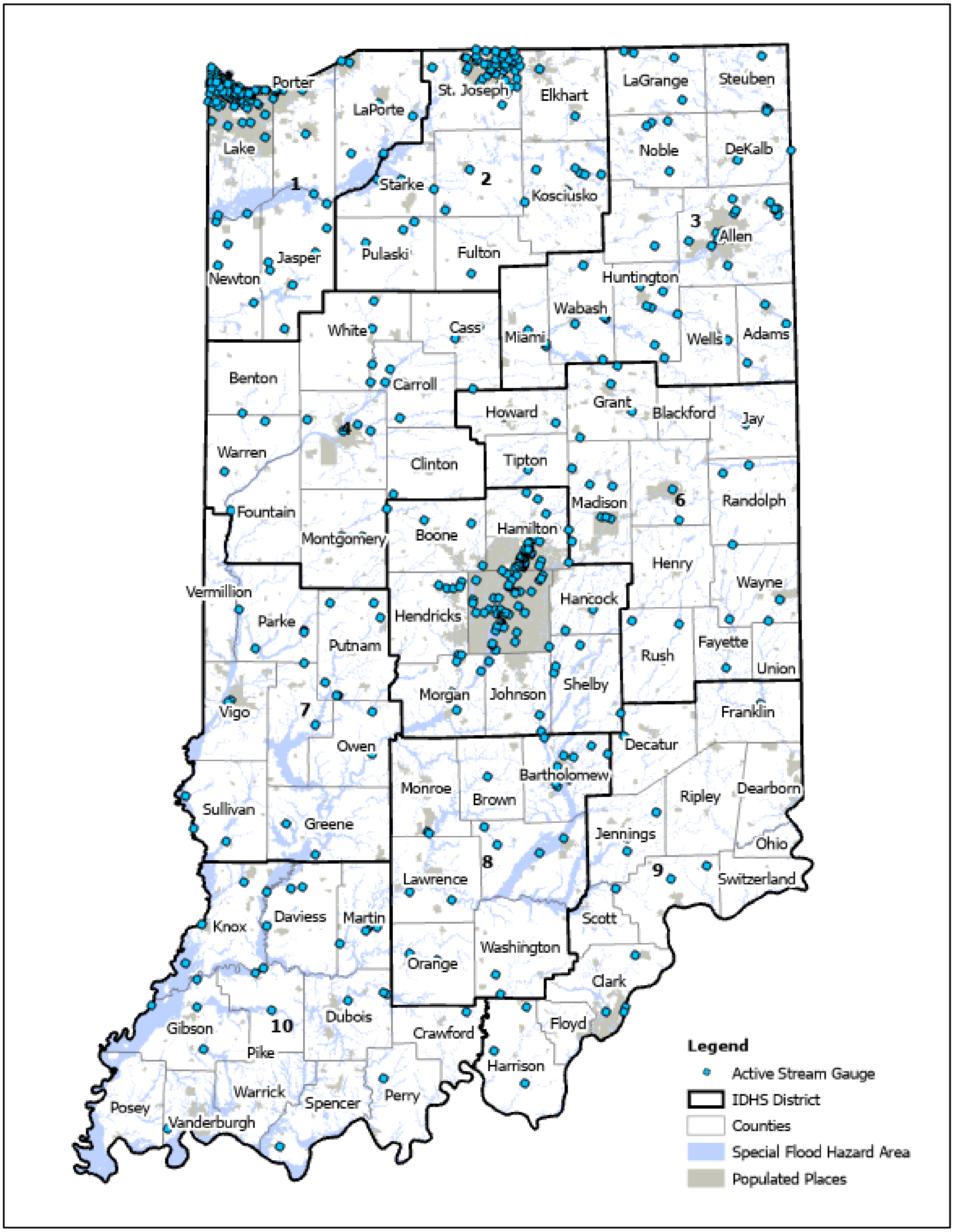


Figure 52. Indiana Active Stream Gages

6.1.7 Fluvial Erosion Hazard (FEH)

Fluvial erosion is defined as the erosion caused by the channel migration of streams, rivers, creeks, and other flowing bodies of water.

Removing homes or restricting property development in the floodway, floodway fringe, or fluvial erosion hazard zone, 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 development of floodways.

FEH has been of particular focus in recent years in Indiana and has resulted in the development of a number of reports. In 2013, the USGS published a report document channel-migration rates of selected streams in Indiana (Robinson, 2013). More recently, in 2017, the USGS published another report addressing vulnerable transportation and utility assets near actively migrating streams in the state (Sperl, 2017). Meanwhile, the Indiana Silver Jackets are supporting a program to identify mitigation resources for individuals and communities wanted to adopt FEH-avoidance strategies. Funding for this project has been provided by the Indiana Office of Community and Rural Affairs (OCRA). The Indiana Fluvial Erosion Hazard Program website (http://feh.iupui.edu) provides a link to an interactive map of major streams and rivers in Indiana that are more susceptible to being impacted by fluvial erosion (https://indnr.maps.arcgis.com/apps/webappviewer/index.html?id=43e7b307a0184c7c851b5068941e2e23). Figure 53 and Figure 54 show examples of erosion in the state while Figure 55 shows the location of actively migrating and relatively stationary streams in Indiana.

While Indiana's FEH program has been going on for several years, the state is currently seeking additional funds in order to identify and mitigate at-risk infrastructure. Meanwhile, numerous counties are starting to use the FEH zone in their planning and zoning, considering them to be areas of avoidance and areas that should be avoided for a planned expansion.

Figure 53. Fluvial Erosion Example (from http://feh.iupui.edu/)

Figure 54. Fluvial Erosion Example (from http://feh.iupui.edu/)

In 2016, a FEMA RiskMAP mitigation grant funded a system assessment of the White Lick Creek, a major tributary to the West Fork White River (Christopher B. Burke Engineering, LLC, 2016). The stream originates in Boone County and flows through Hendricks and Morgan counties. Multiple recommendations resulted from the study, including passive mitigation strategies for reducing fluvial and flooding risk, site-specific mitigation of fluvial and flooding risk, and system monitoring and adaptive management.

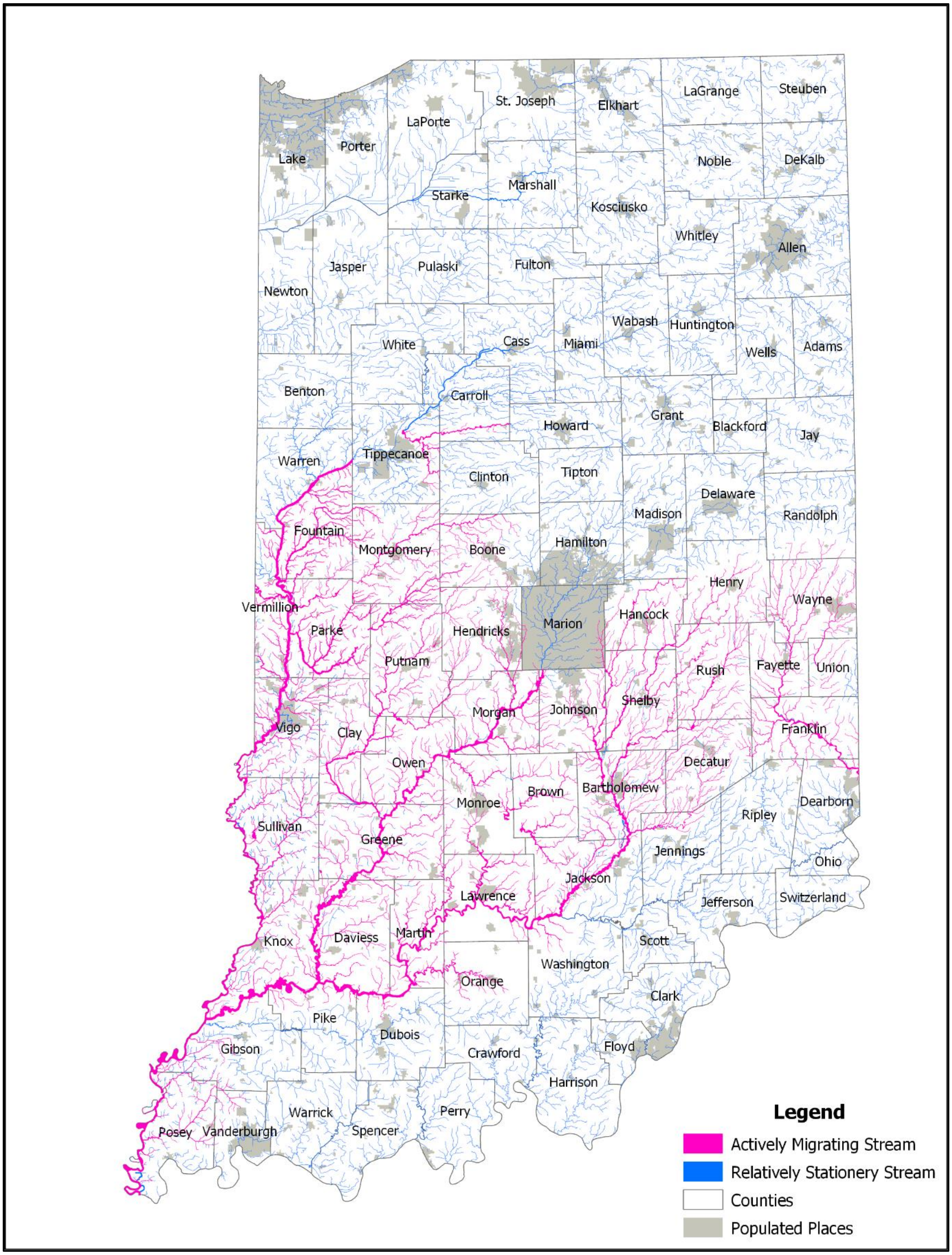


Figure 55. Stream Migration

6.1.8 Probability of Future Occurrences & Possible Effects from Climate Change

In the Midwest, there has been a 42% increase in heavy rain events (defined as total annual precipitation falling in the heaviest 1% of events) from 1901 to 2016. During the same time frame, there has been a 42% increase in the amount of rain falling in heavy downpours. According to the Intergovernmental Panel on Climate Change Report (IPCC, 2007), anthropogenic climate change is predicted to bring more extreme precipitation and changes to the soil moisture content, accelerating the frequency of flooding in regions already experiencing periodic flooding. Recent studies (Du, 2019; Wright, 2019) also support this argument, as frequent heavy rainfall and flooding events were observed globally and across the United States. Extreme rainfall events (exceeding 0.86” of rain in a day) have increased over the past century, with the northwestern part of Indiana experiencing the most significant rise.

Moreover, rainfall totals during these events are on the upswing. These events contribute to soil erosion and nutrient runoff, impacting water quality and crop productivity. Rainfall during the four wettest days has also increased by about 35 percent. Over the next century, spring precipitation and severe rainstorms will likely intensify, further contributing to the risk of flooding (Wobus, 2017; US EPA, 2016).

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). Due to the unpredictability of this hazard, both rural and urban areas in Indiana are at risk.

Controlling floodplain development is an important step to reducing food-related damages. Areas with recent development within the state may be more vulnerable to drainage issues, which could induce flash flooding as well as exacerbating flooding problems.

As was covered in Section 2 of this plan, the predicted wetter winters and springs Indiana is expected to experience due to climate change causes extra strain on combined sewer systems, which often overflow in the event of flooding. An increase in frequency and intensity of flooding events in the years to come means an even greater strain on flood control systems statewide.

6.2 Severe Weather

The World Meteorological Organization defines severe weather as any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. For Indiana, those include thunderstorms, tornadoes, high winds, hail, and excessive precipitation. Floods are covered in Section 6.1 and winter storms are covered in Section 6.8. This section focuses on thunderstorms and related severe weather such as tornadoes, damaging winds, hail, and lightning.

Severe weather 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. Thunderstorm wind is the most common storm event type in Indiana (see Section 2.2.1, Table 5).

Thunderstorms

According to NOAA’s National Severe Storms Laboratory (NSSL), a thunderstorm is a rain shower that includes lightning. Severe thunderstorms occur in the environment with large amounts of convective available potential energy (CAPE) and deep-tropospheric wind shear (Brooks, Severe Thunderstorms and

Climate Change, 2013). A severe thunderstorm is a thunderstorm that has one or more of the following: hail one inch or greater, winds gusting in excess of 50 knots (57.5 mph), or a tornado.

There are about 100,000 thunderstorms each year in the United States; about 10% of which are severe.

Damaging Winds

The main cause of wind is differential heating, or the difference in temperature between different areas. Damaging winds are often called “straight-line” winds resulting from strong thunderstorms in order to differentiate the damage they cause from tornado damage. Damaging winds are classified as those exceeding 50-60 mph.

Until around 2010, data showed global surface winds decreasing. From 1975 to 2005, observations indicated a decline of about −0.3 meters per second in the northern mid-latitudes land surface wind speed. However, the global average annual wind speed increased from 3.13 meters per second in 2010 to 3.30 m/s in 2017.

A derecho is a widespread, long-living, and fast-moving windstorm, associated with bands of showers or thunderstorms. Although a derecho can produce destruction similar to that of a tornado, the damage typically occurs in one direction along a relatively straight path. By definition, if the swath of wind damage extends for more than 250 miles, includes wind gusts of at least 58 mph along most of its length, and includes multiple instances of wind gusts of at least 75 mph or more, then the event may be classified as a derecho. A derecho is known for its distinctive bow signature, and the fact that they can occur over a period of several hours.

Derechos are most common during the summer months, making those involved in outdoor activities especially at risk. The rapid movement of a derecho’s parent convective system can also pose a threat. Typically, derecho producing storm systems move at speeds of 50 mph or greater, with a few clocked at greater than 70 mph.

Hail

Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into balls of ice. Hail can damage aircraft, homes, cars, and can be deadly to livestock and people.

Lightning

Lighting is a giant spark of electricity in the atmosphere between clouds, the air, or the ground. Thunder, the sound wave caused by lightning, can be heard up to 25 miles away from the lightning discharge.

6.2.1 Historical Occurrences

From January 1, 2018 to December 31, 2022, there have been 2,399 high wind, lightning, and thunderstorm wind events reported to NCEI. These events resulted in 12 deaths, 23 injuries, and almost $18 million in damages. Table 31 lists the NCEI reports by county and district. See Appendix A for a list of NCEI storm events by county.

Table 31. NCEI-Reported High Wind, Lightning, and Thunderstorm Wind Events (2018-2022)

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
District 1	226	0	4	$46,000	$0
District 2	327	3	4	$834,300	$0
District 3	376	4	6	$972,200	$0
District 4	188	0	1	$1,403,450	$0
District 5	258	3	7	$4,805,650	$0
District 6	259	0	0	$2,615,250	$130,000
District 7	122	0	0	$1,059,500	$3,000
District 8	120	1	0	$1,320,400	$3,000
District 9	286	0	1	$1,621,900	$0
District 10	237	1	0	$3,074,750	$0
Grand Total	**2,399**	**12**	**23**	**$17,753,400**	**$136,000**

According to NWS, Indiana saw 2,205 wind events between 2018 and 2022, which is displayed in Figure 56. These events are categorized as weather events in which winds exceeded 35 mph. District 3, in the northeastern portion of the State, had the greatest number of events over the 4 years with 342 events. Conversely, portions of the state, specifically districts 9 and 10, had more wind events with faster gusts (greater than 70mph).

Indiana saw a total of 501 hail events between 2018 and 2022 according to NWS. The events are mapped in Figure 57. District 3 had the most hail events with 85 recorded between 2018 and 2022.

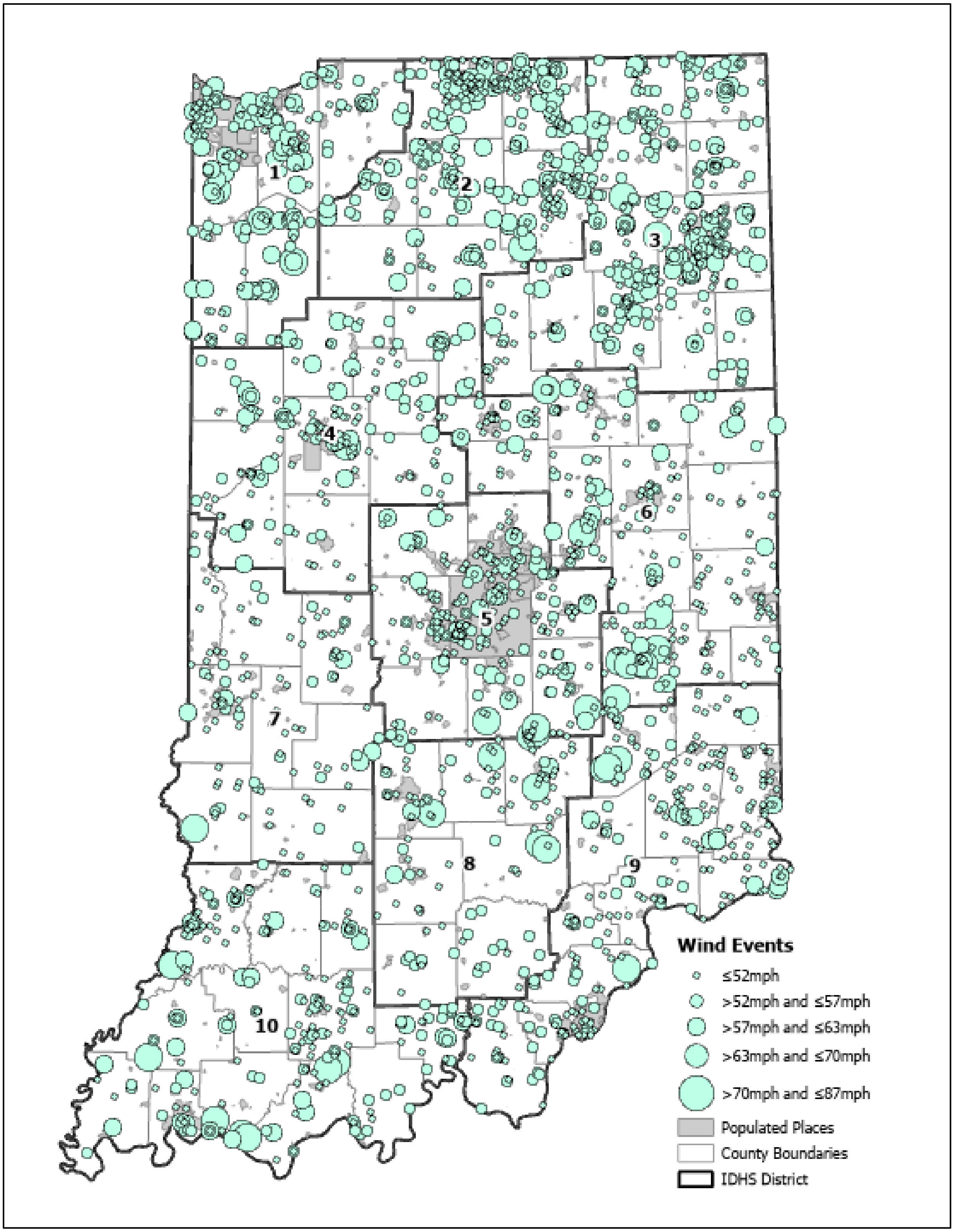


Figure 56. Wind Events in Indiana (2018-2022)

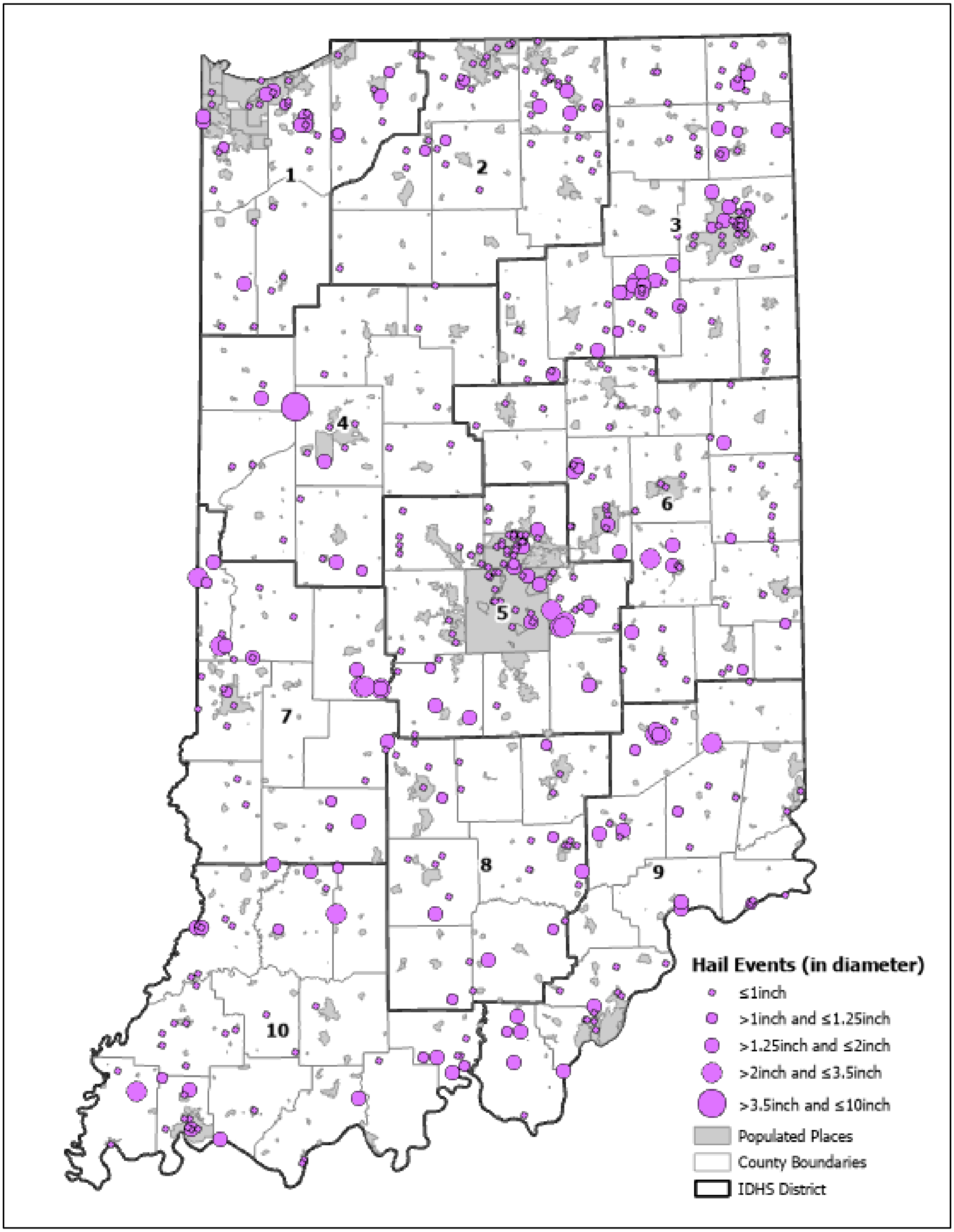


Figure 57. Hail Events in Indiana (2018-2022)

6.2.2 Vulnerability & Risk Assessment

Severe weather equally threatens all communities and infrastructure, such as roadways, utility lines, railroads, and bridges. Physical impacts range from structural failure to flying debris, roof damage, impassable routes, fires, and loss of building functionality. High winds can cause tree and power line damage, building collapses, power outages, and transportation disruptions. Hailstorms pose extreme hazards to aircraft and automobiles. Aircraft caught in severe hailstorms can sustain serious damage. Similarly, hail can shatter vehicle windows, reduce visibility, and make roads slippery, all of which make travel during a hailstorm extremely dangerous.

Economically, hailstorms lead to losses through building and vehicle damage, including dents and penetration of glass-roofed structures.

Farming is heavily affected by hailstorms, with crops suffering physical damage and heavy losses for farmers.

Hailstones of significant size can be deadly, especially to those unable to seek shelter, posing severe danger to individuals experiencing homelessness.

Wind and hail occurrences are frequent in Indiana, as delineated in Table 5 and Table 31, yet challenging to forecast due to their potential statewide and countywide occurrence. Moreover, their unpredictable extent, speed, size, and duration necessitate a nuanced approach to risk assessment. To address this, we employed GIS technology to make assumptions utilizing the 2018 to 2022 locations of hail and wind events shown in Figure 56 and Figure 57. For each storm event, a conservative buffer radius of one mile was assumed, followed by an intersection analysis with state-owned, state-leased, and essential facilities. It's important to note that our assumptions do not encompass potential repeated threats to the same structures or the impacts of events exceeding a one-mile radius, which is highly probable. Figure 58 and Figure 59 illustrate the number of state or essential facilities that fall within a hail or wind buffer by county.

Every county, except White County, had state facilities threatened by wind or hail between 2018 and 2022. Brown, Owen, and Perry Counties had the fewest with two state facilities falling within a hail or wind event. Marion County had the greatest with 532 state facilities being threatened. In total, at least 6,677 state-owned facilities—totaling a possible $588,910,333 in damages that the State would be responsible for—and 551 state-leased facilities totaling over $230,000,000 of content damage.

Every county had essential facilities threatened by wind or hail between 2018 and 2022. Clay and Tipton Counties had the fewest number of incidents with eight essential facilities falling within a hail or wind event. Allen County had the greatest number of incidents with 625 essential facilities being threatened. Table 32 summarizes the number of each type damaged.

There were 407 state projects and 7,576 parcels with recent, potential, or projected development projects threatened by a wind or hail event. Generally, wind or hail will not cause significant damage to new development, but it is important to acknowledge possible sets backs to the State, developer, and economy associated with possibly having to delay work.

Table 32. Number of Essential Facilities Damaged by Wind or Hail Between 2018 and 2022

Facility	# of Buildings Damaged
Schools	2,799
Police Stations	807
Fire Stations	1,264
Emergency Centers	151
Care Facilities	1,162

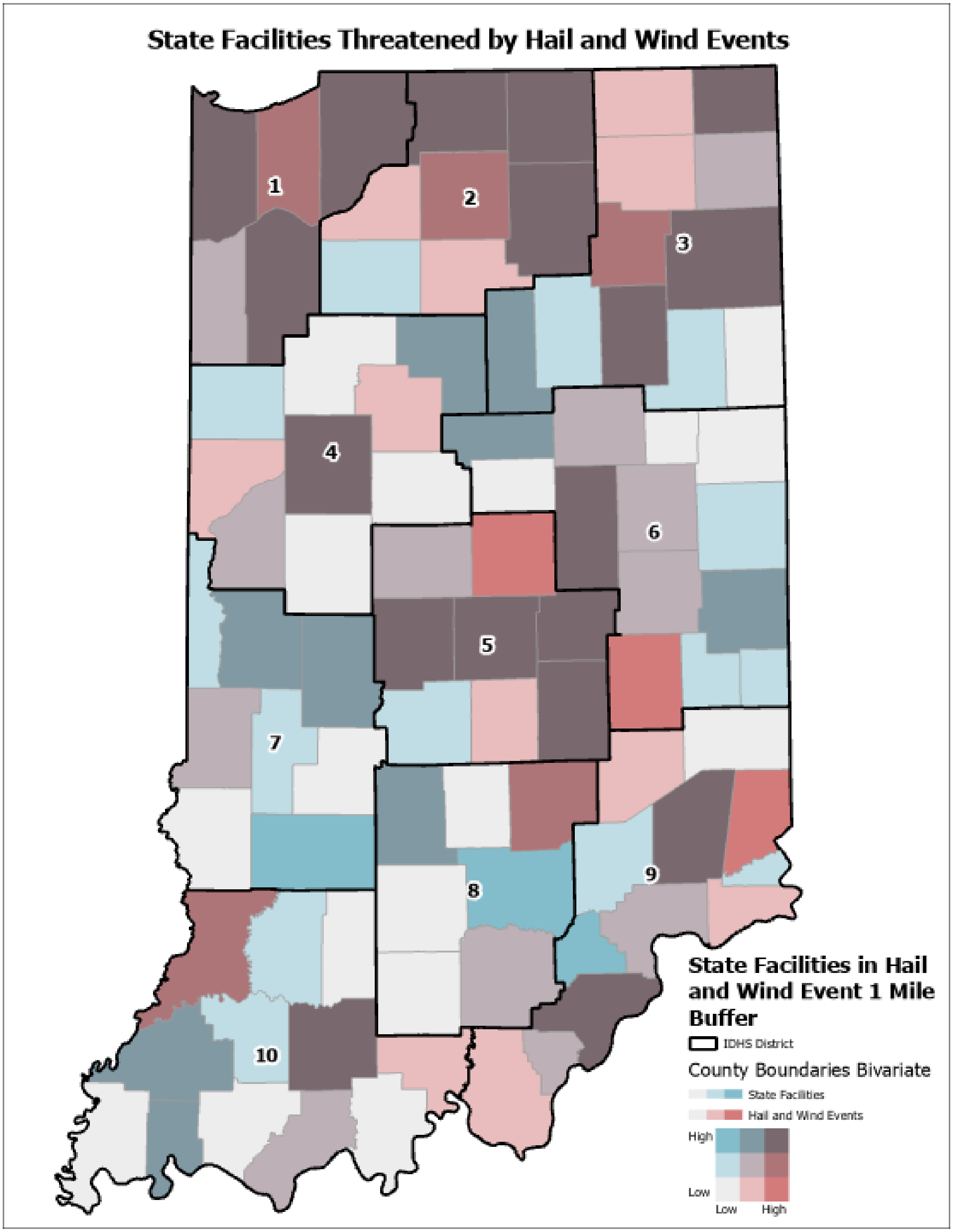


Figure 58. State Facilities Threatened by 1-mile Buffer of Hail and Wind Events Between 2018-2022

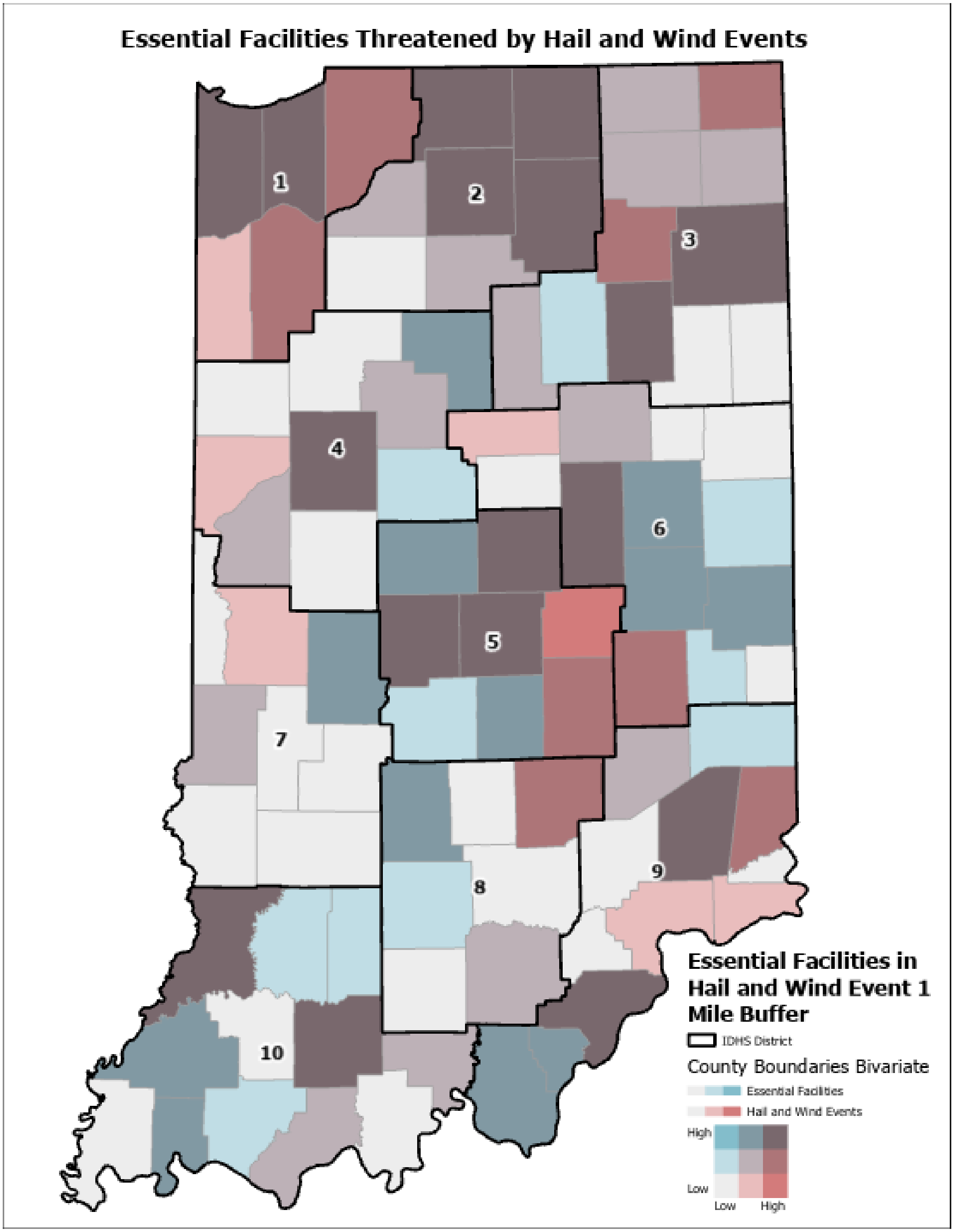


Figure 59. Essential Facilities Threatened by 1-mile Buffer of Hail and Wind Events Between 2018-2022

6.2.3 Probability of Future Occurrences & Possible Effects from Climate Change

The probability of future severe weather will remain high. As the planet is getting warmer, several climate model simulations (Grunwald S. B., 2010; Brooks, Severe Thunderstorms and Climate Change, 2013; Trapp R. D., 2007) predict an increase in surface temperature and boundary layer moisture which could result in a rise in CAPE, producing a more favorable environment for severe thunderstorms.

Research is young in understanding how climate change will affect wind events, but analyses indicate winds have been getting faster.

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.

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.

6.3 Tornadoes

The World Meteorological Organization defines severe weather as any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. For Indiana, those include thunderstorms, tornadoes, high winds, hail, and excessive precipitation. Floods are covered in Section 6.1, thunderstorms, high winds, and hail are covered in Section 6.2, and winter storms are covered in Section 6.8. This section focuses on tornadoes.

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.

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 (EF) intensity scale shown in Table 33.

Table 33. 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.

Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
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.

6.3.1 Historical & Current Occurrences

Between 1950 and 2022, 330 fatalities and 5,318 injuries have occurred in Indiana due to tornadoes. In terms of seasonality, June was the most common month for tornadoes with 24% of total tornadoes occurring during June. The second most common month was April at 18%, followed by May at 15% (Indiana Department of Insurance, 2023). 2012 had the most tornadoes with 72 occurring during the year (Indiana Department of Insurance, 2023). Tippecanoe County has had the most tornadoes with 57. A complete list of tornado occurrences by county and district since 2018 is available in Appendix A. Figure 63 shows tornado paths between 1950 and 2022.

Table 34. NCEI-Reported Tornado Events (2018-2022)

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
District 1	9	0	0	$0	$0
District 2	10	0	0	$20,000	$0
District 3	8	0	2	$0	$0
District 4	8	0	0	$1,059,000	$5,000
District 5	8	0	0	$1,878,000	$5,500
District 6	14	0	3	$1,140,000	$500
District 7	3	0	0	$355,000	$10,000
District 8	9	0	0	$301,000	$0
District 9	16	0	0	$1,188,000	$0
District 10	17	0	3	$2,673,000	$23,000
Grand Total	**102**	**0**	**8**	**$8,614,000**	**$44,000**

The spring and summer of 2023 saw an unprecedented tornado season with record-setting events. Below outlines influential events from the season.

On March 31, 2023, 23 tornadoes touched down in 13 counties in Indiana leaving 5 people dead and 11 with injuries (WISH-TV, 2023). The March 31st outbreak of tornadoes has already eclipsed the yearly annual average for tornadoes in Indiana, which is 22 (WTHR, 2023) and is the fifth largest tornado outbreak event in Indiana history. Figure 60 shows an aerial photo of one tornado that touched down in the Town of Whitestown, Boone County. This was the largest outbreak in central Indiana since November 17, 2013 (Weather Forecast Office, 2023). On April 6th, Governor Holcomb declared an expedited major disaster declaration, followed by President Biden declaring a major disaster on April 15th (see Figure 61). In the aftermath of the storms, FEMA performed a preliminary damage assessment report that estimated total individual assistance would total over $4.3 million. FEMA approved $1.64 million in total housing assistance and nearly $200,000 in other needs assistance (FEMA, 2023).

Figure 60. Aerial photo of tornado path and damage to Whitestown from March 31, 2023 tornado
Source: https://www.wthr.com/article/weather/severe-weather/3-dead-some-missing-sullivan-county-indiana-tornado-deaths-search-recovery-cleanup-severe-weather-march-31-2023/531-85fb0770-17de-4b68-bd7e-f4d7193b3e72

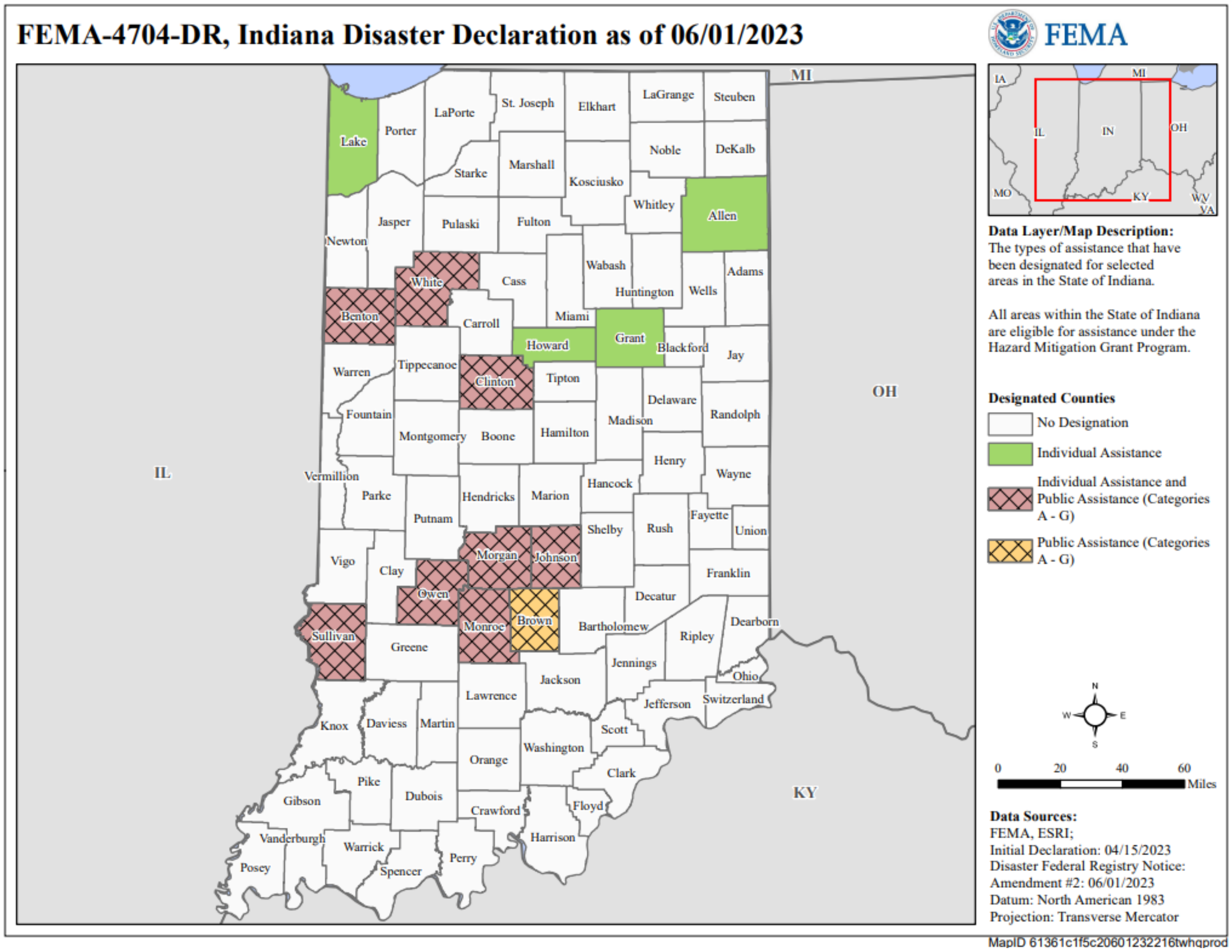


Figure 61. Designated Areas under FEMA's Disaster Declaration DR-4704

Numerous severe thunderstorms developed during the afternoon of June 25, 2023 across central Indiana. The storms produced tornadoes, damaging winds, and very large hail. The NWS reports 4 tornadoes (2 EF1 and 2 EF1) that touched down across Daviess, Dubois, Johnson, Martin, and Monroe counties. One person was killed in a tornado with 1 injured by the same tornado in Martin County.

Figure 62. Photo of tornado racking through apartments in Greenwood, Johnson County (Source: https://www.nytimes.com/2023/06/25/us/indiana-tornado-storm-hail.html)

On August 7, 2023, another series of tornadoes struck, marking yet another record-setting event. Stretching from west of US-31 in Dubois County to the southwest of the Town of Paoli in Orange County, the tornado holds the record for the longest path traveled in Indiana, covering a total distance of 25.89 miles. With changing weather patterns attributed to climate change, Indiana has witnessed a rise in the occurrence of tornadoes which is expected to continue (Montgomery, 2023).

Indiana has seen more variability from year to year in number and intensity of tornadoes and tornado outbreaks are on the rise. The year 2023, Indiana had the second greatest number of recorded tornadoes in Indiana history, with over 50 tornadoes recorded.

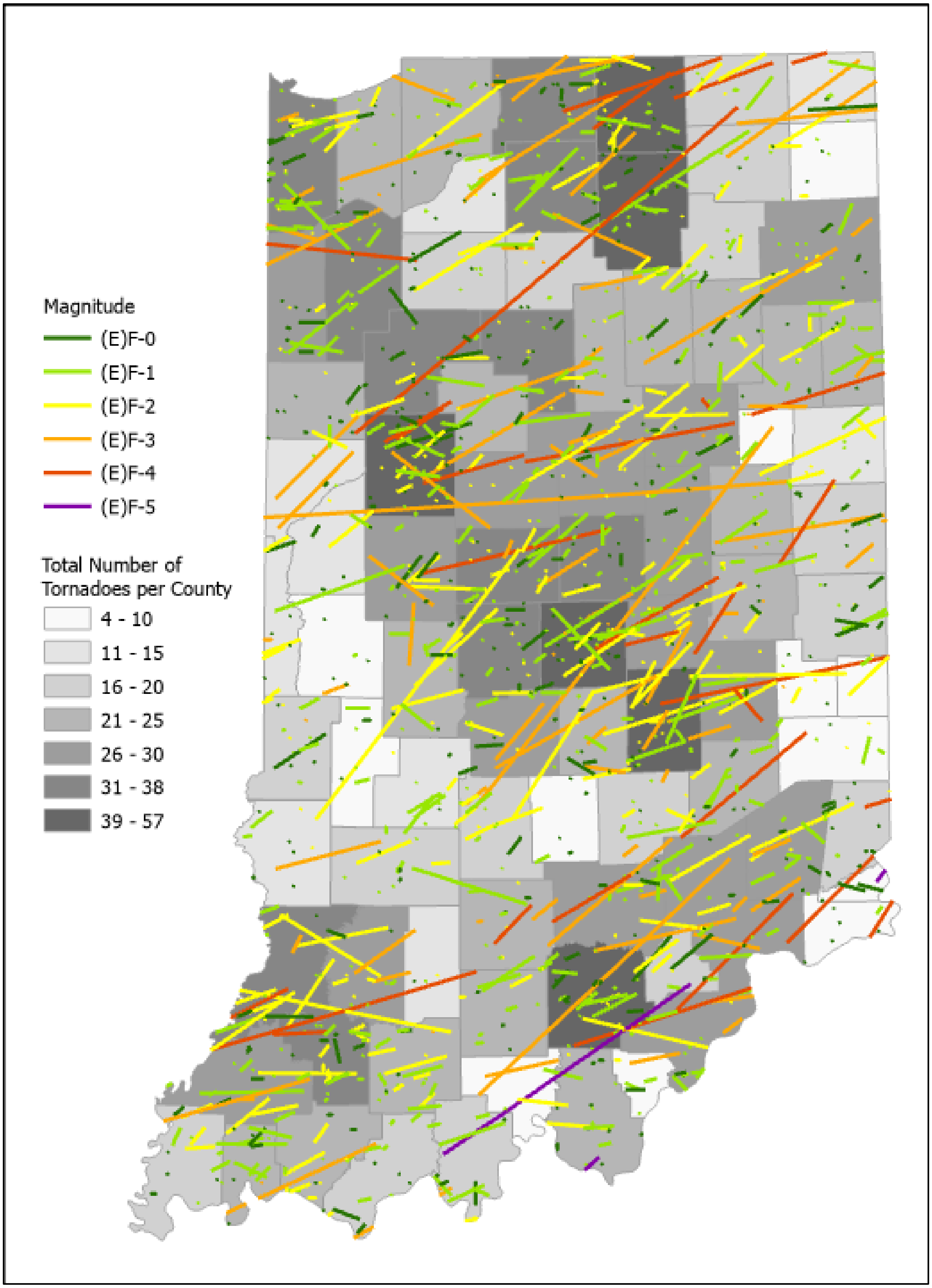


Figure 63. Historic Tornado Paths in Indiana from 1950-2022

6.3.2 Vulnerability & Risk Assessment

Because the threat of severe weather 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.

Tornadoes are a threat to the community, especially vulnerable populations. The 15.7% of the population over the age of 65 and 13.8% with a disability are more likely to lack physical ability or have limited mobility which makes getting to safety in a basement or storm cellar strenuous. 53% of dwellings in Indiana do not have basements, which means they need to know where to go for safety. The residents on the 2,208 parcels of manufactured homes may not have access to a safe shelter, which can lead to severe injury and/or loss of life.

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.

In 2014, IDHS worked with Salem Community Schools in Washington County, IN, to apply for and receive a FEMA Pre-Disaster Mitigation grant to build a community safe room at Bradie Shrum Elementary School, in Salem, IN. The safe room, completed in May 2018, consists of four classrooms and a multi-purpose room that can be used to protect the entire student body of the school, along with staff and guests, during severe weather events. Additional schools and not-for-profit organizations have worked with IDHS to apply for FEMA grant funding in recent years to construct similar community safe rooms.

The preceding SHMP update conducted a risk assessment based on hypothetical scenarios. In light of the record-setting tornado events of 2023, this risk assessment was completed considering the state-owned, state leased facilities, and essential facilities that intersect the reported 2023 tornado paths. Utilizing GIS technology, tornado paths were buffered based on reported width, followed by an intersection analysis with state-owned, state-leased, and essential facilities. Figure 64 illustrates state facilities intersected by tornadoes in 2023. No state-leased facilities were affected. Of the twenty-six state-owned facilities potentially impacted, four are located in Jasper County, in Indiana's northwestern region, while the remaining twenty-two are situated in Owen County, located southwest of Marion County. This analysis holds significance beyond financial implications for the state, as the damages incurred hinder state assistance operations during and following the storm event. Damage sustained by essential facilities can pose a threat to citizens, reducing access to emergency services, vital resources such as food and water, and community lifeline support.

There were no state projects and 60 parcels with recent, potential, or projected development projects threatened by a tornado in our scenario. It is important to note it is assumed that any development project unlucky enough to fall within a tornado track would experience work delays at the minimum, up to complete destruction.

Table 35 provides a summary of potential damages.

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There were no state projects and 60 parcels with recent, potential, or projected development projects threatened by a tornado in our scenario. It is important to note it is assumed that any development project unlucky enough to fall within a tornado track would experience work delays at the minimum, up to complete destruction.

Table 35. Summary of Potential Damage to State and Essential Facilities from 2023 Tornadoes

Facility Type	# of Buildings Damaged ($ Amount of Damage)	Counties Containing Potentially Damaged Facility
	State Facilities	
State-Owned Facilities	26 ($694,108)	Jasper, Owen
State-Leased Facilities	0	--
	Essential Facilities	
Schools	9	Allen, Grant, Floyd, Vanderburgh
Police Stations	8	Grant, Johnson, Orange
Fire Stations	6	Dubois, Johnson, Orange
Emergency Centers	2	Orange
Care Facilities	3	Allen, Dubois

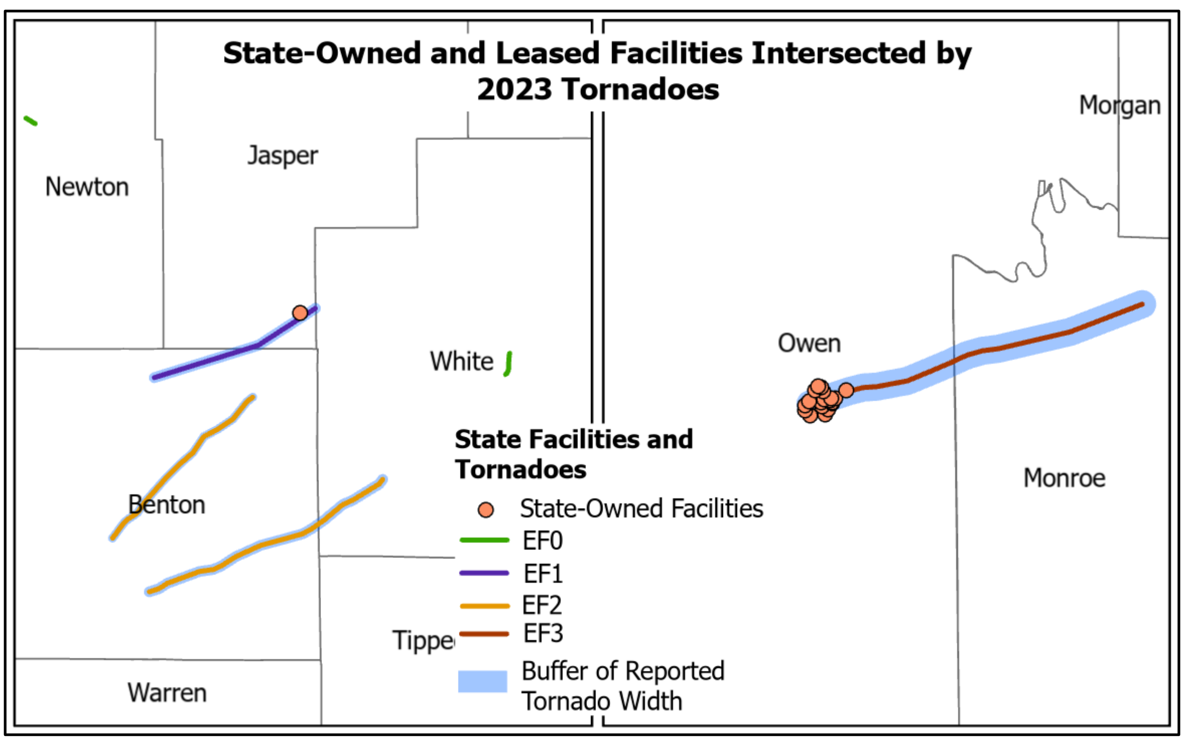


Figure 64. State-Owned and Leased Facilities Intersected by the Reported 2023 Tornado Paths

6.3.3 Probability of Future Occurrences & Possible Effects from Climate Change

Historically, tornadoes occurred most frequently in the Southwest in Indiana, over less populated areas. Increased frequency, spatial variation, and increased activity will put more residents and property at risk, while increasing response and recovery costs. Research demonstrates that while "national annual frequencies of tornado reports have remained relatively constant, significant spatially varying temporal trends in tornado frequency have occurred since 1979" (Gensini & Brooks, 2018). Historically, tornado alley included areas where the borders of South Dakota, Nebraska, Kansas, Oklahoma, Colorado, New Mexico, and Texas touched. Research suggests that the traditional US "tornado alley" is gradually shifting eastward, encompassing a larger portion of Indiana. According to a study conducted by AccuWeather (Finch, Is 'Tornado Alley' shifting east?, 2023), Figure 65 illustrates a noteworthy trend, indicating a decrease in tornado frequency within the traditional tornado alley regions and an increase in tornado frequency within the Mississippi Valley areas. Although different research states varying portions of Indiana that fall within the new tornado alley, Indiana is predicted to see an increase in favorable conditions for tornado activity (Moore, 2018).

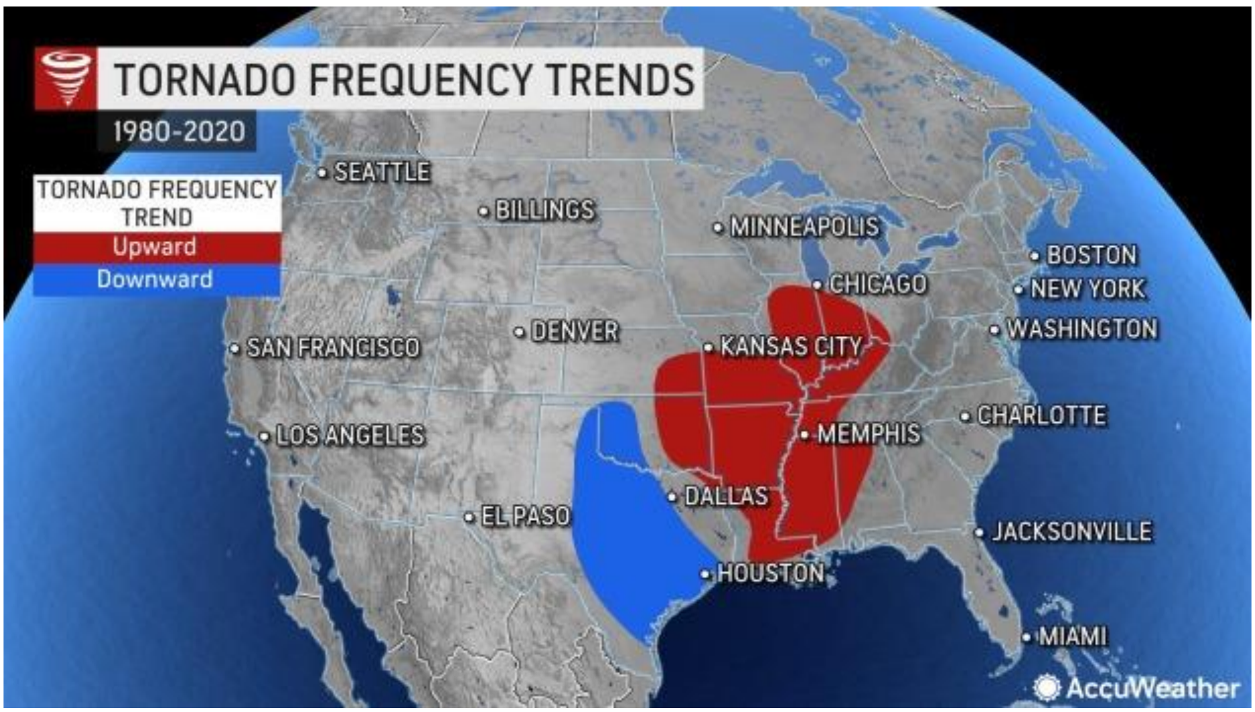


Figure 65. Shift in Tornado Alley (Source: https://www.accuweather.com/en/severe-weather/is-tornado-alley-shifting-east/1162839)

Further, while the number of annual tornado days is decreasing, the number of tornadoes that occur on days where there are tornadoes is increasing (Moore, 2018). Tornadoes and severe thunderstorms are among the largest contributors to property damages and fatalities in the US (Diffenbaugh, Trapp, & Brooks, 2008; Allen, 2018). Severe thunderstorms occur in the environment with large amounts of convective available potential energy (CAPE) and deep-tropospheric wind shear (Brooks, Severe thunderstorms and climate change, 2013). As the planet is getting warmer, several climate model simulations (Trapp, et al., 2007; Brooks, Severe thunderstorms and climate change, 2013; Grunwald & Brooks, 2010) predict an increase in surface temperature and boundary layer moisture which could result in a rise in CAPE, producing a more favorable environment for severe thunderstorms and tornadoes. Thus, the probability of future environments conducive for tornadoes to form 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.

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.

6.4 Earthquake

6.4.1 Background

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath Earth's surface. Ninety-five percent of earthquakes occur at the boundaries between tectonic plates, such as the San Andreas Fault along the North America – Pacific plate boundary. However, a significant number of earthquakes also occur in the middle of plates, as is the case for seismic zones in the Midwestern United States. The most seismically active "intraplate" area in the central US is the New Madrid seismic zone. In addition to the New Madrid fault system there are other zones in the central US capable of producing damaging earthquakes. The Wabash Valley seismic zone, located near the Wabash River in southwestern Indiana and southeastern Illinois, shows evidence of large earthquakes in its geologic history, and the Anna seismic zone in western Ohio also have a history of moderate-sized earthquakes that could affect Indiana. Residents of Indiana could be affected both by moderate-sized earthquakes within the state's borders, as well as by larger earthquakes with epicenters outside of the state. Due to its proximity to the New Madrid seismic zone and exposure to the neighboring Wabash Valley seismic zone, the southwestern part of the state is considered the most earthquake-vulnerable portion of Indiana.

Earthquakes are also capable of producing a wide variety of secondary effects, including landslides and liquefaction (loss of cohesion of unconsolidated soils), fires, large waves or seiches in lakes, and damage or collapse of human structures. Many critical facilities, such as bridges, dams, and power stations, may be particularly sensitive to earthquake shaking.

A statistical analysis of the long-term record of seismic activity by the US Geological Survey (USGS, 2022) indicates that, on average, the northern part of Indiana might expect only a small number (2-4) of damaging earthquakes over an extended period (10,000 years), while that number increases to 4-10 for the southern half of the state (including Indianapolis) and a significantly larger number (10-50) for the southwestern most corner of the state (including Evansville). Thus, the earthquake hazard systematically increases from north to south within the state's boundaries.

Ground shaking from strong earthquakes can collapse buildings and bridges, disrupt gas, electric, and phone services; and sometimes trigger landslides, flash floods, and fires. Buildings with foundations resting on unconsolidated landfill and other unstable soil, as well as trailers or homes not tied to their foundations, are at risk because they can be shaken off their mountings or the soil itself can give way during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage. Older structures, particularly those constructed of unreinforced masonry (stone or brick) are particularly sensitive to the impacts of earthquake shaking. Table 36 and

Table 37 define earthquake magnitudes and their corresponding intensities.

Special thanks to the earthquake team at IU and IUPUI for their analysis and drafting of earthquake section: Dr. Michael Hamburger, Dr. M. Anna Nowicki Jessee, Elizabeth Sherrill, and Carter Dills.

Table 36. 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 37. Earthquake Magnitude in relation to expected maximum shaking on the 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

6.4.1.1 Historical Occurrences

Residents of Indiana have been affected by earthquakes both within the boundaries of the state and those occurring in neighboring areas of the Midwest. Prominent sources of earthquake activity include the New Madrid seismic zone, located along the Mississippi River valley in southeastern Missouri/ western Tennessee and Kentucky, and the Wabash Valley seismic zone, extending along the Wabash River valley along the Indiana/Illinois border.

A majority of seismic activity in Indiana occurs in the southwestern region of the state. A significant number of earthquakes also originate just across the boundary in Illinois and can be felt in Indiana. The largest recent event in the region, the M5.2 Mt. Carmel, Illinois earthquake, occurred on April 19, 2008. It was widely felt by residents in Indiana, Illinois, Kentucky, and many more states across the central US. The most recent event in this zone was a small earthquake near the Illinois-Indiana border on August 14, 2023, located at 4.2 kilometers (2.6 miles) depth. There is evidence of larger, prehistoric earthquakes in this area as well (Obermeier, et al., 1992), as shown in Figure 66. In addition to these zones, the Anna seismic zone in west-central Ohio (near the town of Anna, Ohio), has also been the site of continuing, moderate-level seismic activity. this zone also has the potential to affect Indiana residents in the eastern part of Indiana.

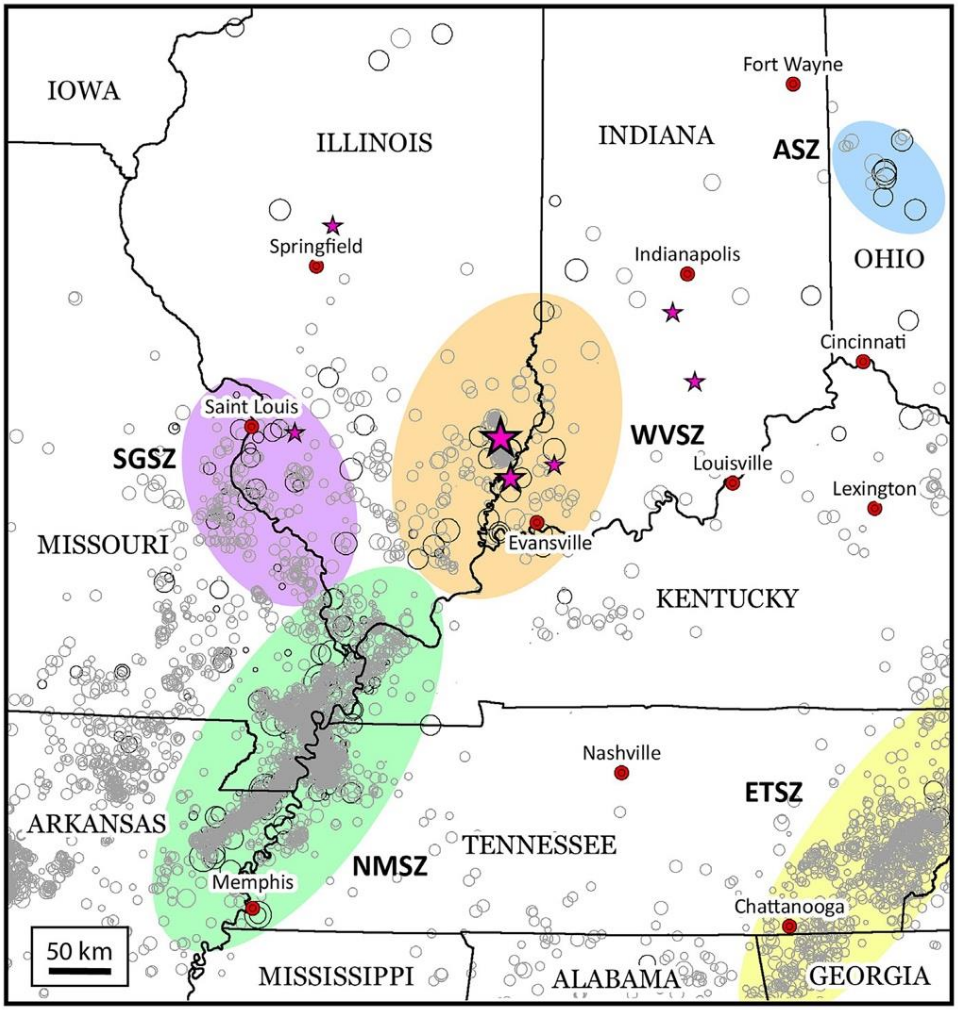


Figure 66. Regional Seismicity Map, reproduced from Sherrill et al. (2022)
Regional seismicity map showing major cities (red dots), felt earthquakes between 1811 and 1975 (black open circles), instrumentally recorded earthquakes between 1975 and 2020 (gray open circles), and prehistoric earthquakes ranging from M6.0 to 7.5 (pink stars). Named seismic zones are shaded polygon regions on the map, including the New Madrid Seismic Zone (green), the Wabash Valley seismic zone (orange), the Anna seismic zone (blue), the Eastern Tennessee seismic zone (yellow), and the St. Genevieve seismic zone (purple). Figure from Sherrill et al. (2022); see data sources therein.

6.4.2 Vulnerability & Risk 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; highways, railways, rivers, and ports may not allow transportation to the affected region. Critically, some of the most highly affected areas of southwestern Indiana are also the most dependent on major bridges crossing the Ohio and Wabash rivers for transport of goods and services in the aftermath of an earthquake; these lifelines are themselves highly vulnerable to earthquake-related damage.

Soils with little clay and a 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.

6.4.2.1 Seismic Hazard Analysis

A research team from IU's Department of Earth & Atmospheric Sciences and IUPUI's Department of Earth Sciences provided geological information and recommendations for modeling earthquake hazards that might affect the state of Indiana. The research team used a combination of the USGS ShakeMap and Ground Failure software and FEMA's Hazus-MH software and examined a suite of earthquake scenarios that might affect the state.

Two distinct approaches were applied to analyze seismic hazards facing the state of Indiana, probabilistic and deterministic seismic hazard analysis.

6.4.2.2 Probabilistic Seismic Hazard Analysis

A broad overview of Indiana's earthquake risk is provided by the USGS [National Seismic Hazard Model](), which provides a uniform assessment of earthquake hazards facing the United States. The model, which is designed to integrate the full range of seismic sources that have the potential to affect a given area, is updated approximately every five years. The last comprehensive update was completed in 2018 (Peterson et al., 2019).

The NHSM model (Figure 68) quantifies the expected hazard associated with future earthquakes across the country, shown as the specific level of ground shaking (expressed as a percentage of Earth's gravitational acceleration, *g*) expected at a given level of probability (in this case, 2% likelihood in a 50-year period) as a function of location. The national map shows the expected pattern of high hazard associated with active faults in the western US, but also shows areas of higher earthquake hazard in the eastern and central US. Notably, the red "bulls-eye" area near the central Mississippi Valley reflects the known hazards associated with the New Madrid seismic zone (Tuttle et al. 2002), which experienced damaging earthquakes in the winter of 1811-12 and appears to host large earthquakes every 300-500 years (Tuttle et al., 2005). The zone of

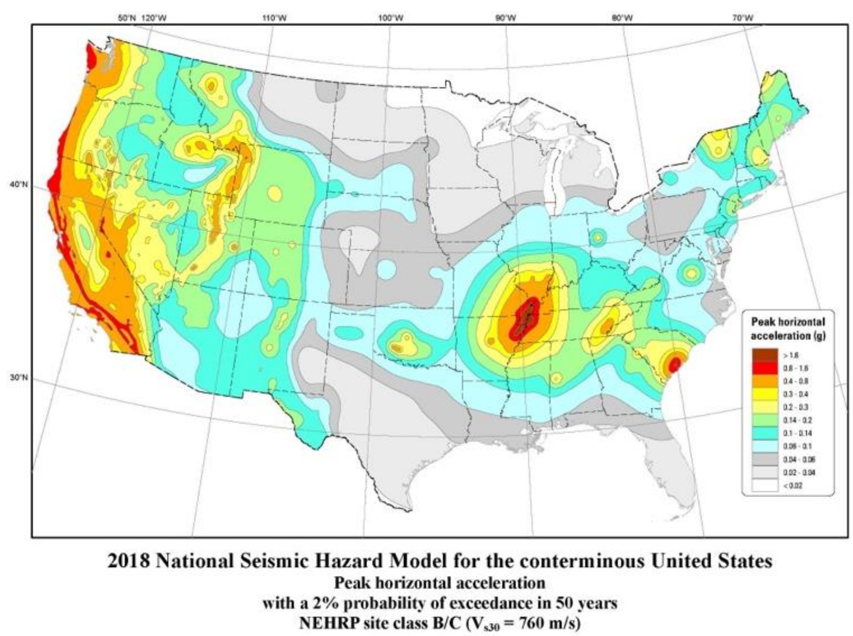


Figure 67. Map showing the earthquake hazard throughout the coterminous United States, presented as relative levels of shaking (expressed in Peak Ground Acceleration, or PGA) that would be expected to occur at a one-in-ten probability during a 50-year time interval.

relatively high hazard, which is influenced by both the New Madrid and Wabash Valley seismic zones, extends into the southwestern part of the state, including the urban areas of Evansville, Vincennes, and Terre Haute. The entire southern half of the state (including Indianapolis) is subject to elevated seismic risks.

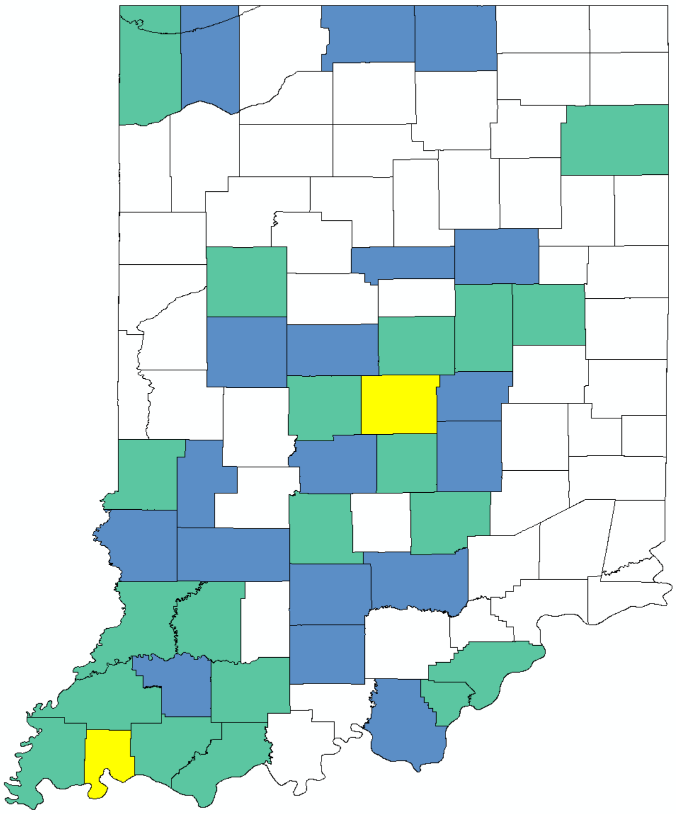


Figure 68. Annualized earthquake losses (by county) within the state of Indiana. White = losses < $.5M ; Teal = losses $.5 - $1M; Blue = losses $1-5M; Yellow = losses > $5M. Data from FEMA (2023)

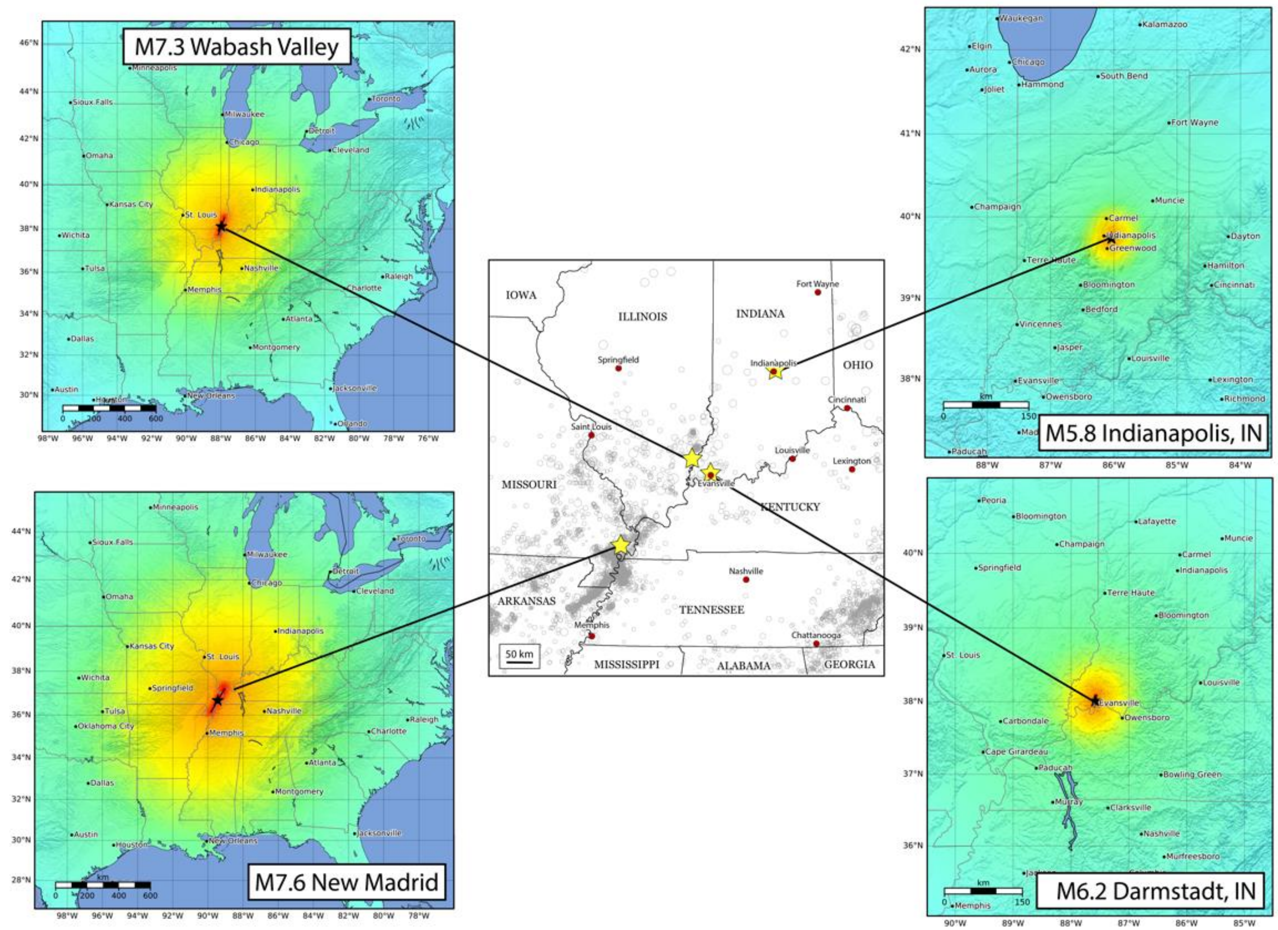
The probabilistic seismic hazard map can also be used to assess the potential impacts, including annualized economic losses, associated with earthquakes and their secondary effects. This approach was adopted by FEMA's study of annualized earthquake losses for the United States (FEMA, 2023). That study, which uses the output of the probabilistic seismic hazard model as input to FEMA's loss analysis software package Hazus-MH, predicts future losses from earthquakes across the nation. That national analysis estimates annualized losses for the state of Indiana in excess of $87M. That estimate places Indiana in the top third of US states anticipating earthquake-related losses, significantly higher than neighboring states of Ohio ($37M) and Michigan ($9M), but significantly lower than states directly bordering the New Madrid seismic zone (e.g., Tennessee, $284M, Missouri, $188M). That study also estimates annualized losses by county, which shows considerable variability in estimated losses. A detailed view of Indiana's annualized losses (by county) is shown in Figure 68. Because of increased valuation of buildings and infrastructure in urban areas, those counties with significant urbanization (e.g., Marion, Vanderburgh, Vigo) show relatively higher losses relative to surrounding counties. The FEMA study notes several Indiana communities among the top 100 metropolitan areas in the U.S. with significant annualized earthquake losses (Evansville, $24.4M; Indianapolis, $22.4M; greater Louisville/Jefferson County area, $17.8M). These estimates underscore the need for considering earthquakes as a significant potential hazard facing Indiana residents—particularly for the counties in the southern part of the state in greatest proximity to both the New Madrid and Wabash Valley seismic zones.

6.4.2.3 Deterministic Seismic Hazard Analysis

The second approach uses a "deterministic seismic hazard assessment" to illustrate the impacts of a series of specific possible future events that might affect residents of the State of Indiana. These deterministic case studies are by definition arbitrary scenarios representing individual cases of a virtually infinite set of possible combinations of earthquake location, magnitude, source type, depth, and wave propagation characteristics that might influence the impact of earthquakes in Indiana's future. Nonetheless, they serve to illustrate the potential impacts of particularly significant cases of geologically realistic disasters. The selection of events reported includes four possible scenario events, two within the state's borders and two outside the state that could have significant impacts on Indiana's communities. This approach follows the analysis of Sherrill et al. (2022), who analyzed the impact of potential earthquake sources in and around the state of Indiana. They concluded that the "deterministic scenario models indicate that moderate-sized urban earthquakes may represent a greater threat to a state like Indiana than a large-magnitude event from the New Madrid seismic zone." They also conducted a sensitivity analysis that investigated the detailed impacts of variability in source magnitude, fault orientation, and depth, and concluded that source magnitude and depth exert a first-order control on earthquake impacts. The analysis reported here follows the same methodology as the Sherrill et al. study but uses updated versions of the impact analysis software Hazus-MH, which is based on updated building inventory data, assessed valuation, and fragility estimates for the state's building stock. In addition to the four scenarios examined here, Sherrill et al. also assessed the potential impacts of a moderate-sized event in the Anna, Ohio seismic zone, and found only modest impacts in the east-central part of the state. Thus, that event is excluded from the results reported here.

Table 38. Earthquake parameters for the deterministic scenarios

Scenario	Latitude	Longitude	Depth (km)	Strike	Dip	Geological reference
M7.3 Wabash Valley	38.116	-87.970	13	N20E	85SE	Mt. Carmel—New Harmony Fault
M7.6 New Madrid	36.676	-89.434	15	N30E	85SE	Composite New Madrid Fault
M6.2 Darmstadt, IN	38.009	-87.583	9	N10E	70SE	Caborn Fault
M5.8 Indianapolis, IN	39.739	-86.038	8	N20E	85SE	Fortville Fault



SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	None	None	None	Very light	Light	Moderate	Moderate/heavy	Heavy	Very heavy
PGA(%g)	<0.0066	0.0795	0.954	4.99	8.76	15.4	27	47.4	>83.2
PGV(cm/s)	<0.0028	0.0383	0.524	3.03	6.48	13.9	29.6	63.4	>136
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based on Atkinson and Kaka (2007)
△ Seismic Instrument ○ Reported Intensity ★ Epicenter ▭ Rupture

Figure 69. Summary maps showing locations of deterministic scenarios.
(Top middle) Index map showing earthquakes from 1811 to 2020 (gray circles; USGS) and major cities (red dots). Yellow stars represent the approximate locations of the four deterministic scenario events examined in this report. Intensity maps for the four scenarios encircle the index map. The color scale and symbols are all the same for the four intensity maps and are shown in the bottom panel. (Modified from Sherrill et al., 2022).

6.4.2.4 *Economic losses*

A comparison of losses due to expected ground shaking from each of the four main scenario sources is presented for the entire area of impact, as well as for the state of Indiana and three representative cities, Indianapolis, Evansville, and Fort Wayne. These comparisons help to provide a general perspective on how the impacts of a moderate earthquake within the state compare to the impacts of a larger regional event at the regional, state, and city levels. Table 37 summarizes total economic losses calculated in Hazus-MH for each of the five main scenarios and each of the five calculation areas.

Table 39. Hazus-estimated economic losses from the four scenario earthquakes presented here, in millions of dollars.

Calculation Area	New Madrid	Wabash Valley	Darmstadt	Indianapolis
>5% g area	$65,276	$43,253	$13,044	$11,237
State	$2,232	$24,529	$11,637	$11,237
Evansville	$440.27	$1,885	$5,981	$0
Indianapolis	$87.26	$718	$0.43	$11,189
Fort Wayne	$0.09	$5.87	$0	$0.03

The scenario with by far the greatest losses overall, estimated at $65.3 billion, is the M7.6 New Madrid scenario. This is expected since it has the largest spatial extent and is anticipated to be felt across the United States and Canada, with pronounced impacts on major midwestern cities such as Memphis, St. Louis, and Little Rock. For the state of Indiana, however, the M7.3 Wabash Valley scenario has significantly greater losses, estimated at $24.5 billion, compared to $2.2 billion for the New Madrid event. Although significantly smaller than the New Madrid earthquake, its proximity to the state, and particularly population centers in the southwestern portion of Indiana, produce significantly higher economic losses and casualties. Additionally, for the state of Indiana, the M5.8 Indianapolis scenario and the M6.2 Darmstadt scenario have estimated losses of $11.6 billion and $11.2 billion, respectively. This means that losses due to these moderate events are nearly half of the losses due to the larger Wabash Valley event and ~5 times greater than the New Madrid event from the perspective of the state. The losses in the city of Evansville due to the M6.2 Darmstadt scenario are estimated at $5.98 billion, which is over three times as great as the city’s losses estimated for to the much larger Wabash Valley scenario that is located only 40 km to the west, across the state border and nearly ten times the impact of the New Madrid earthquake. Similarly, the losses for the city of Indianapolis are by far greatest for the M5.8 Indianapolis scenario ($11.2 billion) and none of the other scenarios come close in estimated losses.

6.4.2.5 *Potential Damage to State and Essential Facilities*

Earthquakes pose a significant risk to critical infrastructure. They not only require state or local governments to take responsibility for rebuilding or repairing the damage caused, but they also impact state functions and emergency response times. Table 40 provides a summary of the number of buildings affected and the potential damage to state facilities for each scenario. According to the predictions, the Indianapolis scenario is expected to incur the most significant damage, potentially exceeding $500 million.

Table 40. Potential Damage of State Facilities for Deterministic Scenarios

Scenario	# of State-Owned	State-Owned $ Amount	# of State-Leased	State-Leased $ Damage (Minimum)
New Madrid (PGA ≥10%)	254	$38,147,971	5	$220,000,000
Wabash Valley (PGA ≥25%)	297	$14,919,390	14	$3,600,000,000
Darmstadt (PGA ≥25%)	206	$36,462,167	7	$200,000,000
Indianapolis (PGA ≥25%)	532	$518,682,587	25	$3,300,000,000

Table 41 provides a summary of essential facilities expected to sustain more than 25% damage in each earthquake scenario. Among these scenarios, an earthquake in the Wabash Valley scenario is projected to cause the most significant disruption to emergency response efforts. Appendix C contains maps showing the locations of these facilities that could be damaged.

Table 41. Potential Damage of Essential Facilities for Deterministic Scenarios

Scenario	Care Facility	Emergency Operations Center	Fire Station	Police Station	Schools
New Madrid	4	1	13	6	26
Wabash Valley	15	11	114	59	178
Darmstadt	12	5	42	18	91
Indianapolis	14	1	48	23	247

6.4.3 Earthquake Secondary Effects

The primary damage caused by an earthquake is associated with the ground motion caused by seismic waves. Most earthquake damage results when those seismic waves pass beneath buildings, roads, and other structures. For example, ground shaking may cause a building's exterior walls to crumble. This can injure people, block sidewalks and streets, and bringdown utility lines. The earthquake impacts are highly variable, depending on a site's location relative to the earthquake. Damages at a particular site are determined by the earthquake source parameters (magnitude, duration of shaking, depth), the distance to the site, and the local site conditions (including what type of Earth material is present at that location.

These factors contribute to generating the spatial variation of ground motions (represented by ground acceleration or intensity). The direct impact of the earthquake depends largely on the characteristics of affected buildings in which people live or work. For instance, older buildings constructed of unreinforced brick or stone are particularly vulnerable to earthquake-related damage. Newer construction types with more flexible building materials such as steel or wood tend to be more resistant to the effects of ground vibration.

Earthquake-resistant construction is one of the main ways of reducing the enormous destructive potential of earthquakes and the threat they pose to human life. Rigorous building codes for exposed regions, and enforcement of those codes, are essential to widespread implementation of state-of-the-art earthquake-resistant building methods. Since the late 1970s, Indiana has incorporated seismic design criteria into its residential and commercial building codes. The code provisions are geographically variable, based on the area's proximity to significant seismic sources. Thus, the seismic design categories vary from International Building Code zones "A" (in the northern part of the state) to "B" (central and southern Indiana) and "C" (in the southwestern counties), as a function of increasing proximity to the New Madrid and Wabash Valley seismic zones.

In addition to the primary impacts of the ground-shaking on buildings, strong earthquakes often trigger serious secondary effects which also have a high potential for damage and loss of life. They are often the main factor for determining whether an earthquake is categorized as a catastrophe. These are the main secondary effects: fire, landslide, liquefaction, disruption, and tsunami and seiche.

6.4.3.1 Fires

Fire has long been recognized as a major hazard following earthquakes. Earthquake shaking can rupture gas lines, trigger electrical sparks, upset burning candles, stoves and fireplaces. The effects of fire can in some cases be more severe than the primary impacts of the earthquake shaking. In addition to their direct impacts, earthquakes can block access to fire-fighting equipment and damage water supplies, making fighting the blazes, of which there might be many across a city, especially challenging. The potential impacts of post-earthquake fires are, in principle, incorporated into the damage estimates provided by the Hazus models discussed in the previous section.

6.4.3.2 Landslides

Earthquakes can trigger landslides, especially in areas with steep slopes and water-saturated soils, often associated with riverbanks or other areas of high relief. Landslides may result in falling rocks, soils, and fluid masses that impact people, buildings, and vehicles. They also can block roads, temporarily dam streams, and disrupt utility lines. In general, areas of landslide risk are associated with the zones of strongest ground motion and zones of high relief and weak soils.

6.4.3.3 Liquefaction

Soil liquefaction is a secondary effect of earthquakes in which the strength of a soil is modified by earthquake shaking. Liquefaction and related phenomena have been responsible for tremendous amounts of damage in historical earthquakes around the world.

Liquefaction is a process that turns normally solid soils in "quicksand." The process occurs in soils that are saturated with water. Prior to an earthquake, the pressure in the soil pore spaces is relatively low--the weight of the buried soil rests on the framework of grain contacts that comprise it. However, earthquake shaking can disrupt the structure. The soil particles no longer support all the weight, the groundwater pressure begins to rise, and the soil particles can become entrained in the water and flow. Liquefied soil will force open ground cracks in order to escape to the surface in the form of "mud volcanoes" or "lateral spreads". The ejected material often results in flooding and may leave cavities in the soil.

Whether and where liquefaction will take place depends on many factors. These include (1) the degree of soil saturation, (2) the soil thickness and distribution of soil grain sizes, (3) the strength, duration, and frequency content of the shaking. The vulnerability to soil liquefaction can be determined based on these characteristics. The potential impacts of post-earthquake liquefaction could potentially increase the damage estimates provided by the Hazus-MH models discussed in the following section.

6.4.3.4 Disruptions

The primary impacts of earthquakes have the potential to destroy roads and bridges, disrupt power grids and other utilities, and shut down manufacturing and production plans in the affected areas. These disruptions may, in turn, impact the delivery of life critical products and services such as groceries, water, heating and cooling, availability of prescription drugs, and access to medical care. The duration of these large-scale disruptions could be hours, days, or even weeks until temporary repairs or workarounds are made to essential systems. The impact to human and animal health may be significant, especially to those injured by the primary impacts of the earthquake event and will worsen over a longer-term disruption period.

Currently, broadband infrastructure cannot withstand strong earthquake shaking. Downed broadband inhibits emergency personnel from responding at full capacity, may affect residents' ability to get in contact with first responders in case of injury or building collapse, and impacts the ability for residents to be in contact with family and friends after an event.

6.4.4 Induced Seismicity

In addition to the occurrence of naturally occurring earthquake activity, Indiana residents could be affected by "induced seismic activity," the process by which human activity affects the ambient state of stress in the earth's crust enough to trigger earthquakes. Although this phenomenon has been well documented for many years (e.g., Healy, 1968), there has been a pronounced increase in induced seismic activity over the past decade, associated in particular with subsurface injection of fluids associated with oil and gas production (Ellsworth, 2013; National Research Council, 2013; Ground Water Protection Council, 2015). Other engineering activities, such as impoundment of reservoirs and mining, construction, or weapons testing explosions, also have the potential of inducing seismicity (National Research Council, 2013). Well documented cases of induced seismic activity have been observed throughout the Midwest, including some cases of damaging earthquakes. Although small earthquakes have been linked to the process of hydraulic fracturing (or "fracking"), larger events are typically associated with large-volume wastewater injection. The high volume of wastewater is produced either as a result of the hydraulic fracturing or as a byproduct of petroleum production.

Induced earthquakes are, in essence, the equivalent of naturally occurring earthquakes whose timing has been triggered by human activity. Factors influencing the occurrence of induced earthquakes include the durations and volumes of injection, spatial proximity of injection to active faults, and changes in hydraulic pressures that bring the faults to failure.

A recent study by the Indiana Geological and Water Survey (Rupp et al., 2016) summarized the state of knowledge about induced seismic activity in the state. Indiana is an oil- and gas-producing state that also disposes of wastewater related to oil production through subsurface injection. Compared to other states, Indiana shows limited evidence of earthquakes that are associated with these practices. Indiana has not been identified by the USGS annual assessment of short-term induced seismicity hazards (Petersen, et al., 2018). However, at least one research study (Weingarten et al., 2015) provided circumstantial evidence for induced earthquakes in Indiana and Illinois; a second study (Eagar et al., 2006) suggested that the occurrence of a swarm of very small-magnitude earthquakes in the mid-1990s along the Wabash River in southwestern Indiana may have been triggered by oil and gas exploitation in the region. Because the majority of the wastewater injection wells are located in the southwestern part of the state—the area most heavily dominated by active natural seismic activity—it is in the state's best interest to monitor wastewater injection and seismic activity within Indiana so that any future activity can be assessed with high-quality observational data.

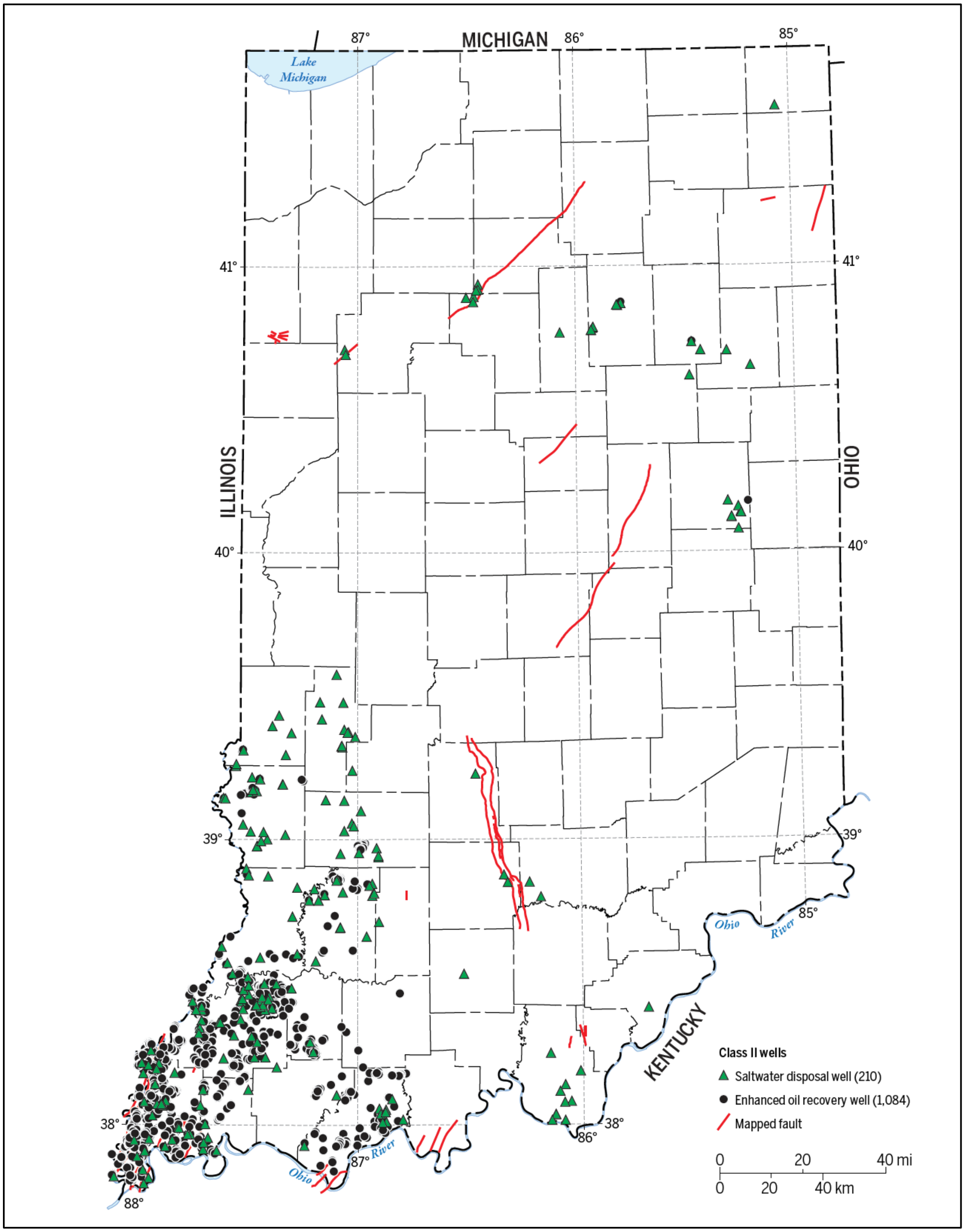


Figure 70. Indiana Class II Injection Wells Active from 2004 to 2014 (Rupp et al., 2016)

6.4.5 Probability of Future Occurrences & Possible Effects from Climate Change

While it is well known that destructive earthquakes follow cyclic patterns, the history of earthquake occurrence in this part of the country is poorly known, and thus, the probability of future earthquakes occurring is poorly constrained. While we know that significant earthquake activity, particularly in southwestern Indiana, places our state at risk, it is currently impossible to predict when such an earthquake will occur. According to the Johnston and Nava (1984) study, there is a 25 to 40% chance of a magnitude 6.0 or greater earthquake in the next 50 years for the central US, with a significantly lower probability of a repeat of events similar to the New Madrid earthquakes of 1811-12.

There is no hard evidence specifically linking the effects of climate change on earthquakes, especially in Indiana. Some scientists are beginning to consider that associated changes in ground water levels due to changing precipitation patterns as result of climate change could theoretically influence stress on faults and could potentially cause minor seismic activity. This is not scientifically acknowledged or agreed upon to-date.

Future earthquake events will affect larger populations, business development, and aged vulnerable infrastructure. Upgraded building 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, which presents a serious problem.

6.5 Ground Failure

Ground failure refers to processes that can affect the land surface through gravitational movement of unstable geologic materials. Some types of ground failure (e.g., land subsidence) involve a slow movement of earth materials, over time scales of days to years; others (e.g., landslides) can occur suddenly and have the potential to produce severe damage and loss of life. Many types of ground failure are associated with human activity, such as mining, dam construction, or roadway development. Indiana has four principal types of ground failure that could affect Indiana residents. These include landslides, fluvial erosion, liquefaction, and ground subsidence, the latter includes both naturally occurring processes such as karst sinkholes and human-induced processes such as the collapse of underground coal mines. Soil liquefaction, a particular type of ground failure associated with earthquakes, is discussed in Section 6.4.

6.5.1 Landslides

The term “landslide” describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows, to slowly moving earth slides that develop over decades. Landslides are a geologic hazard that cause environmental and infrastructure damage worldwide.

Landslides are classified by the mechanism and type of material in which they occur (Varnes, 1978). As a result, there can be different types of landslides with variable effects on the surrounding area. Landslide causes can be classified based on geological, geomorphological, physical, or human/anthropogenic factors (Cruden, 1996). Landslide movement often results from a combination of causes and triggers. A trigger is an event that happens quickly, such as a high precipitation event, whereas a cause is an event that takes place over an extended period, such as bedrock weathering. Common landslide triggers include ground vibration, changes in water table or surface water, removal of vegetation, human causes, or erosion by rivers.

A nationwide survey produced by the United States Geological Survey (USGS) in 1982 (Radbruch-Hall et al., 1982) assessed the areas of the United States that are susceptible to landslides and summarized the sites where landslides have occurred across the country. Most landslides are concentrated in the areas of high topographic relief in south-central and southeastern Indiana. The southeastern portion of Indiana has an area of high landslide susceptibility and incidence, indicating that a high number of landslides have occurred in this portion of the state in the past—and that significant hazard exists for future landslides in that area. At the time of this report, a landslide susceptibility map at the state scale has not been developed.

In 1999, Indiana's first landslide inventory was compiled by the Joint Transportation Research Center. In 2023, the Indiana Geological and Water Survey (IGWS) updated Indiana's landslide inventory by compiling Indiana Department of Transportation landslide records dating from 1940-2022 (Leffel, 2023). The updated inventory outlines 618 landslide areas including repaired and unrepaired landslides. Natural landscape landslides and coal mining-related landslides (discussed further in the coal mining section) have not yet been inventoried. IGWS is in the process of expanding their inventory to include other landslide records and there is an ongoing project to map natural landscape landslides.

At the time of this report, FEMA's national risk index, specifically the landslide risk score is mapped as "relatively low" for most of Indiana (Federal Emergency Management Agency, 2023). Indiana's landslide risk index score may change as data is incorporated into various hazard maps.

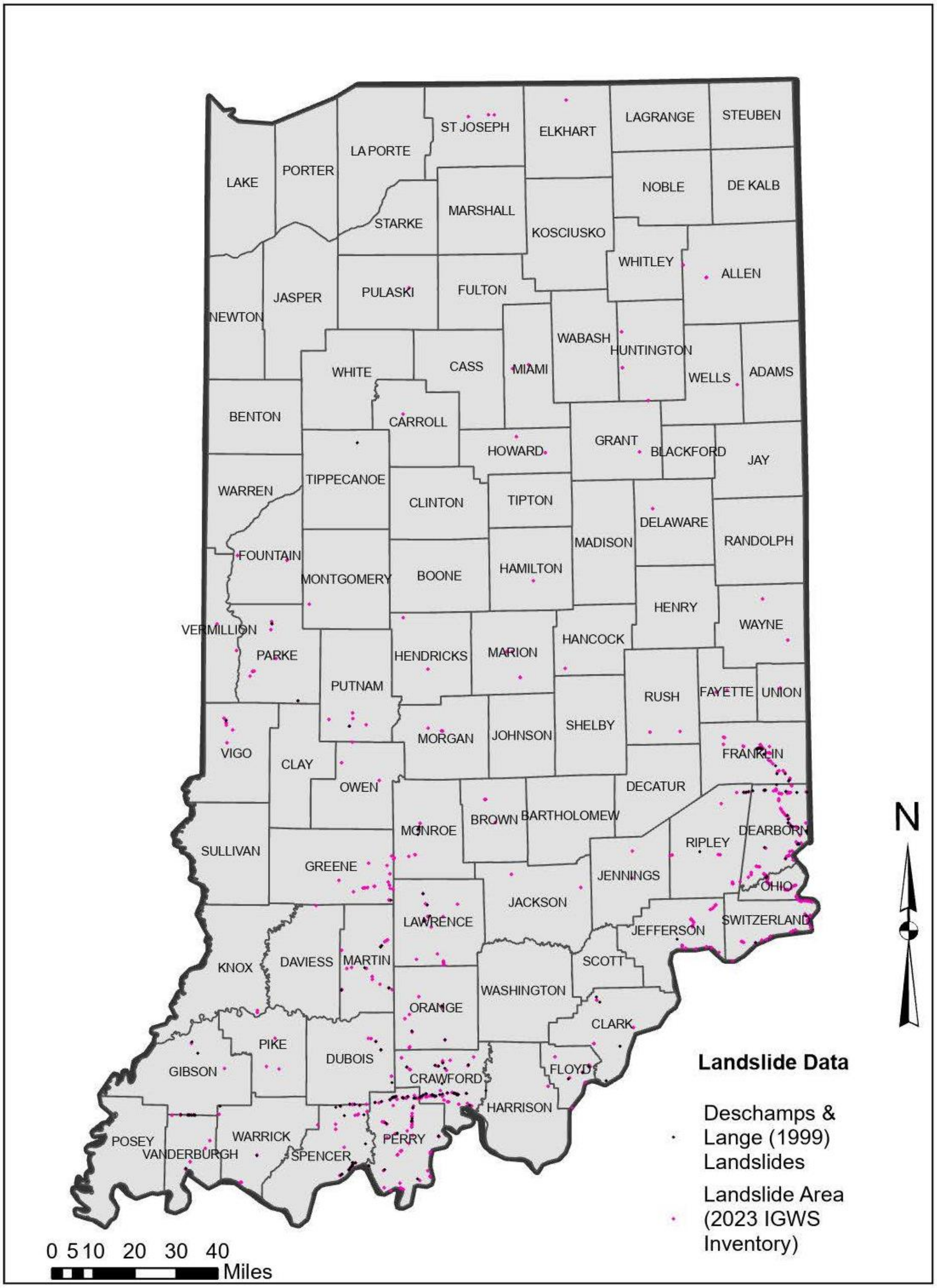


Figure 71. Occurrence of known landslides (Indiana Geological and Water Survey, 2023)

A portion of Indiana's landslides are triggered by seasonal weather changes. Precipitation seeping into a slope affects the stability of the slope. Over time, water may cause the weathering or disaggregation of materials, such as shale. In effect, landslide movements are more likely to occur in the spring and fall when precipitation is greater, and temperatures are above freezing. Average annual rainfall is higher in southern Indiana. Precipitation differences within the state are such to encourage landslide movement in regions that are already landslide prone (Figure 82). However, past landslide reporting has been sporadic, and more research is needed to determine the relationship between precipitation and its effect on landslides, due to both having temporal and spatial components. As climate patterns change, increased rainfall within landslide prone areas may trigger landslide development and movement.

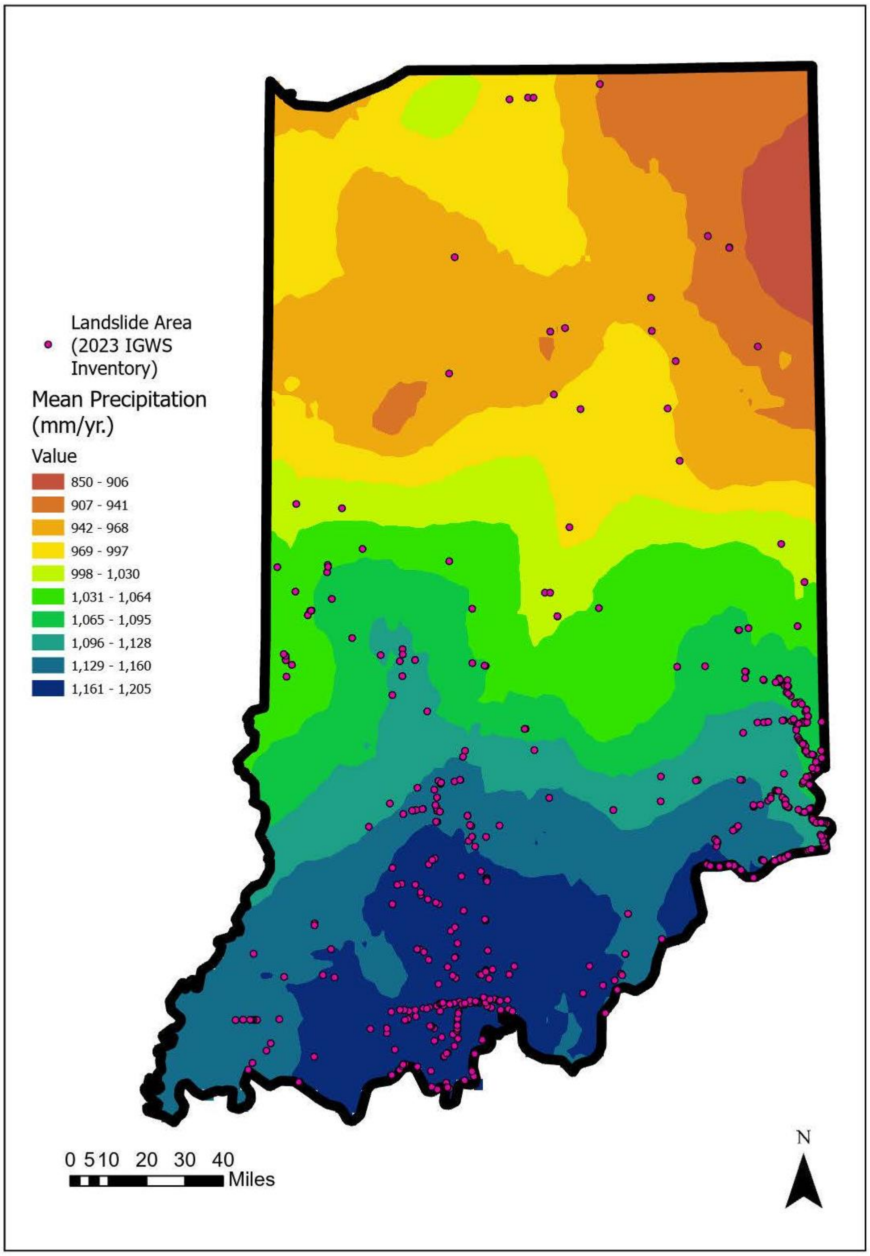


Figure 72. Landslides in relation to historical precipitation averages from 1970-2000 (Fick, 2017)

Streambank slope failures were also included in the IGWS inventory. Streambank failures may be caused and (or) triggered by erosion of the toe of the slope by stream undercutting or sloughing through rapid drawdown. Rapid drawdown conditions can arise when flood water submerges slopes and then recedes rapidly causing a reduction of the external water level. Low permeability soils are affected more by rapid drawdown conditions compared to sandy soils (Terzaghi, 1950). In 2018, rapid drawdown conditions were expected to play a role in a slope failure along the Ohio River near Bridgeport, Indiana. Substantial movement took place after the flooding event causing damage to State Road 111 resulting in a lane closure. The damage required emergency repairs consisting of multiple retaining walls prior to reopening the roadway (IGWS, 2023). Figure 83 illustrates the spatial relationship between landslides and waterways in Indiana based on the current data available. Additional fluvial erosion hazards are discussed further in Section 6.1.7.

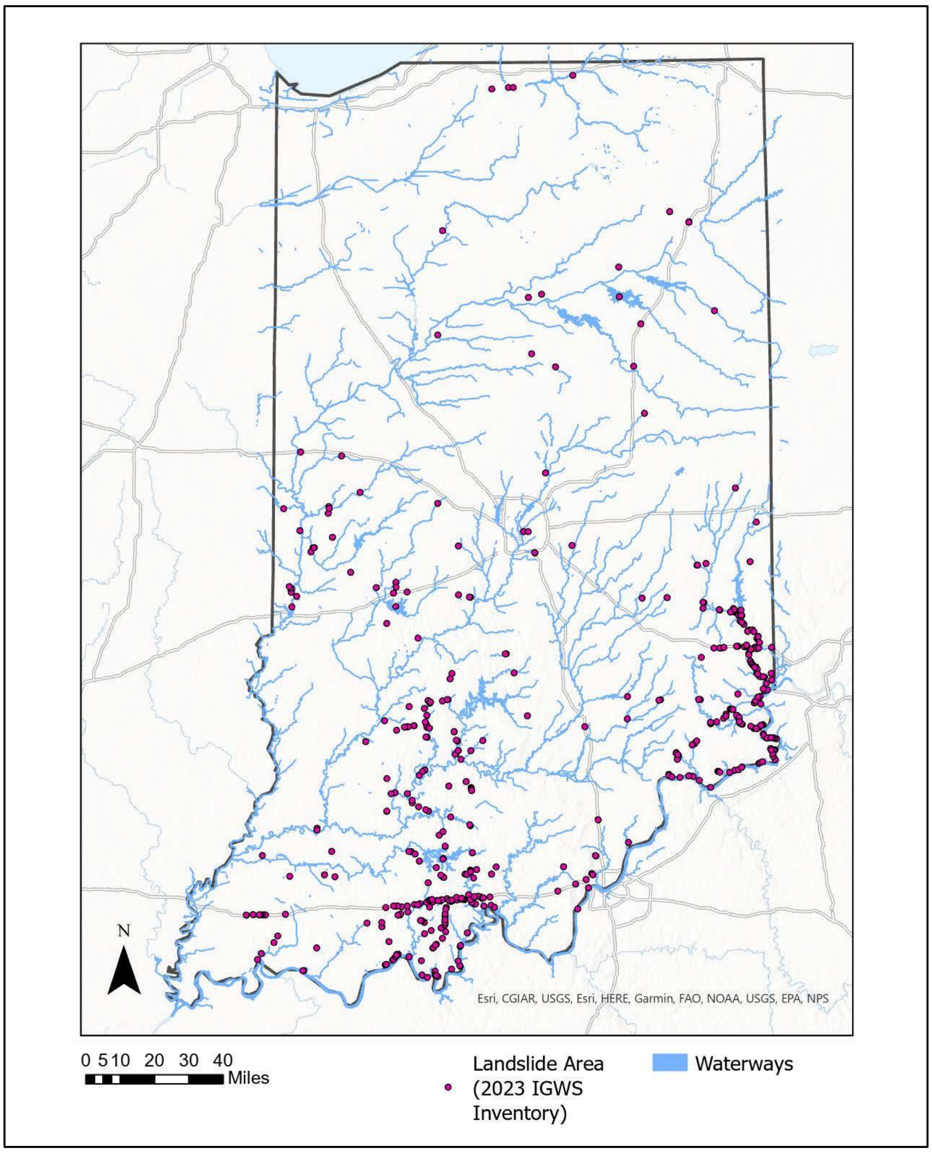


Figure 73. Landslides in relation to major highway infrastructure and major waterways (United States Geological Survey, 2022)

Although seismic activity was not listed as a probable trigger for any landslides in the Indiana Geological and Water Survey's inventory, landslides triggered by earthquakes are possible in Indiana (Sherrill, 2022). Earthquake induced landslides are also discussed in Section 6.4. Indiana has geologic materials that are sensitive to ground shaking such as valley-train deposits, lacustrine deposits, loess, and alluvial deposits (Hill, 2008). Earthquake-induced landslides are affected by earthquake magnitude, local geologic conditions, earthquake focal depth, and specific ground-motion characteristics of a particular event (Keefer, 1984). Indiana's earthquake hazard is greatest in southwestern Indiana. Figure 84 illustrates the spatial relationship between past earthquakes with a magnitude of 3.0 or greater and the IGWS landslide inventory.

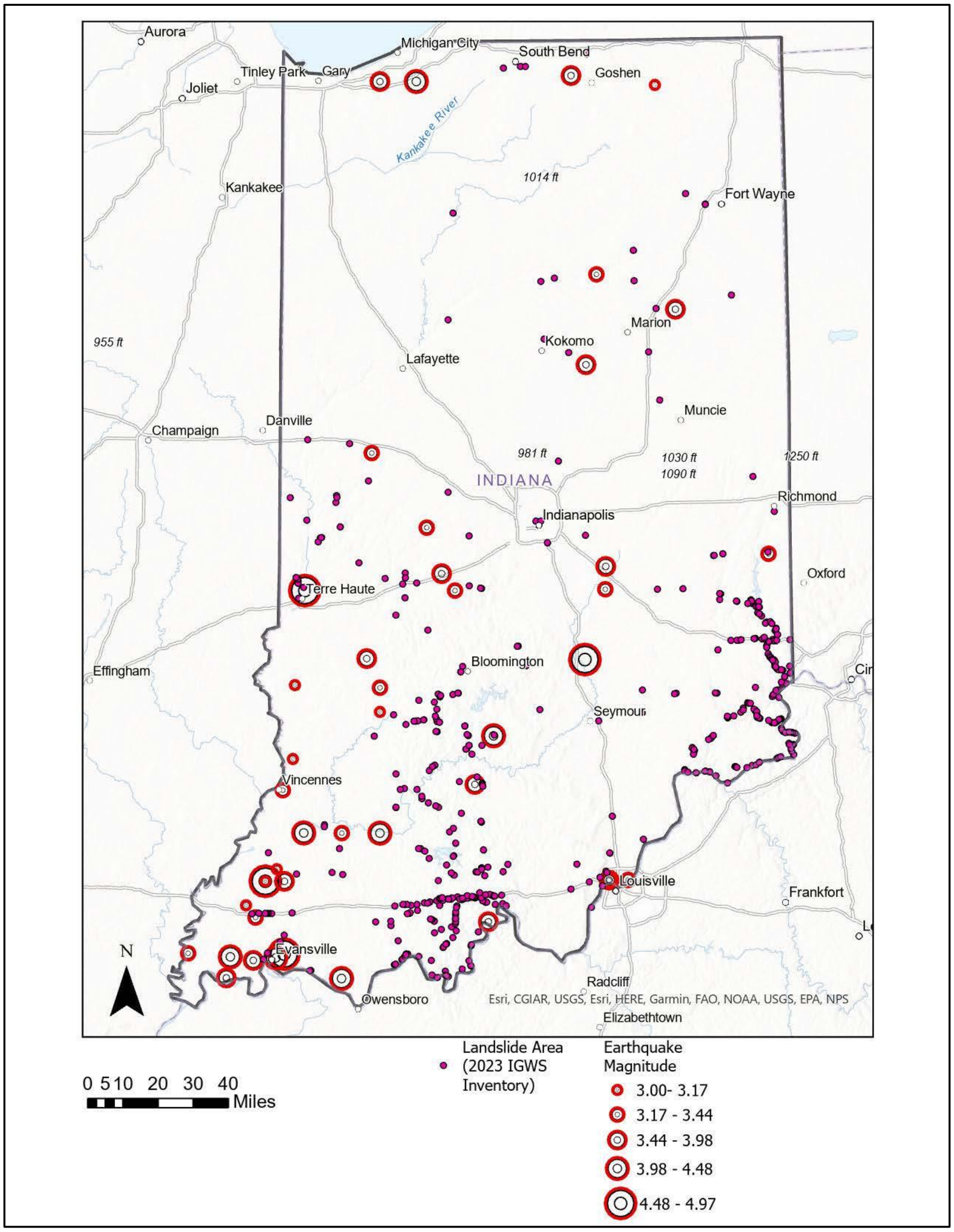


Figure 74. Landslides in relation to past earthquakes (Indiana Geological and Water Survey, 2014)

At the time of this report, rock falls, slides, and topples are not well represented in the IGWS landslide inventory. Rock falls can be triggered by freeze-thaw action, rainfall, seismic events, and differential weathering, and are among the most common types of slope movement during seismic events (Keefer, 1984). There is potential for rock fall hazards in Indiana with the presence of natural bedrock bluffs, cliffs, outcrops, and constructed rock cuts.

Preventative and remedial mitigation measures include:

- modifying the landscape of a slope to reduce erosion and increase stability,
- controlling the groundwater and draining water, when necessary,
- constructing tie backs,
- spreading rock nets,
- using landslide hazard inventories and susceptibility maps to develop land use regulations,
- building retaining walls at the toes of areas likely to landslide, and
- removing mass from the top of slopes or increasing mass at the toe (Highland & Bobrowsky, 2008).

Over the years, several landslides have been mitigated. The IGWS's landslide inventory contains landslide mitigation information. For example, a landslide located within a few feet from a historic wooden cabin in Newburgh, caused structural damage to utility power lines, a gas line, and a wooden fence (Figure 85). In 2011, the FEMA Public Assistance Program funded a project to remove and repair damaged infrastructure and reduce the risk of future landslides by improving the surface drainage (Figure 86).

Figure 75. Newburgh landslide prior to mitigation

Figure 76. Newburgh landslide post mitigation

6.5.2 Karst

Karst is a type of landscape or topography that is formed on limestone, gypsum, and other soluble rocks, primarily by dissolution. The landscape is characterized by sinkholes, caves, and underground drainage. In Indiana, karst features are formed when slightly acidic water in the soil travels through bedrock fractures dissolving the rock. Southern Indiana has several well-developed areas of karst landscape. The Mitchell Plateau, located in south-central Indiana, is Indiana's primary karst physiographic division.

Figure 87 shows the density of karst sinkholes in southern Indiana. The possibility of sinkhole formation is dependent on the physical characteristics of the geology and hydrology of an area. Karst development occurs where: (1) soluble rock is at or near the surface; (2) the bedrock is a dense, highly fractured, thinly bedded rock; (3) the area contains major valleys; and (4) the area has moderate rainfall (Adams, 1984). In Indiana, karst development is most pronounced in the St. Louis and Ste. Genevieve bedrock formations (Adams, 1984). A 2015 study by the Indiana Geological & Water Survey determined the probability of sinkhole formation throughout southern Indiana. Their analysis is based on the density of known sinkholes, as well as several geologic, topographic, and hydrologic variables that indicate the future vulnerability to sinkhole formation.

Karst landscape can cause engineering problems, such as groundwater flowing into underground mines, leakage from reservoirs or containment structures, and karst collapse. Karst development typically erodes material in the subsurface, resulting in caves and open space underground. Underground karst cavities have the potential to collapse under the weight of the soil and/or the rock above them and create a sinkhole. Ground failure of this nature is known as land subsidence.

Figure 88 shows the results of the 2015 study, indicating that areas with the highest probability of sinkhole development generally occur throughout south-central Indiana, with less chance of sinkhole occurrence toward the eastern and western parts of southern Indiana. The karst formation process may occur multiple times in a given area, as the interaction between groundwater and bedrock continues to weaken the subsurface and remove additional material.

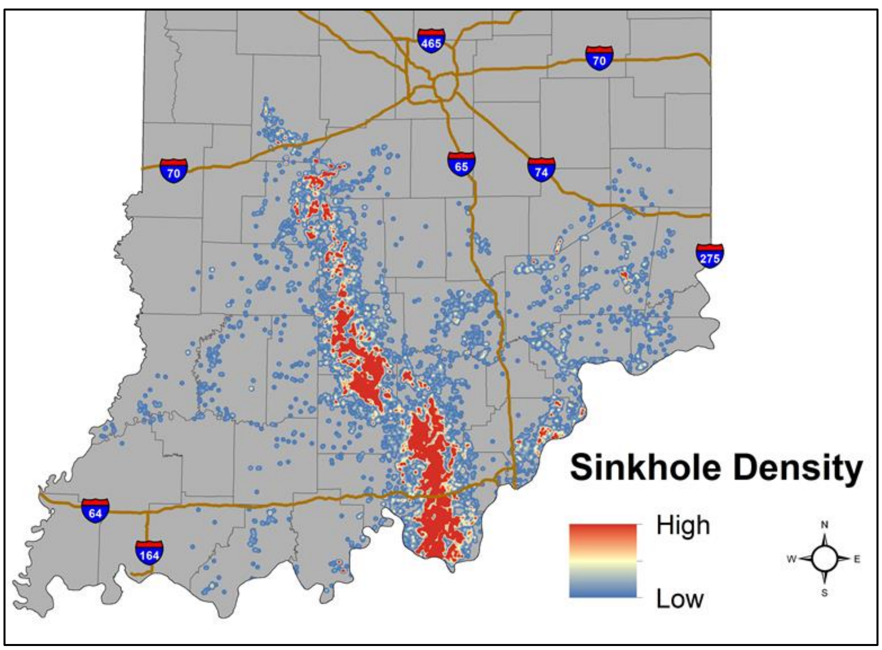


Figure 77. Indiana sinkhole density (Indiana Geological and Water Survey, 2011)

Karst features have the potential to impact more than ground failure concerns. Karst areas have complex and somewhat random ground surface drainage and underground drainage patterns. Karst hydrology can worsen both drought and flooding issues. Another potential impact is the pollution of karst aquifers. Karst aquifers are typically more vulnerable than non-karstic aquifers because their underground conduits provide limited filtration. It also may be difficult to determine groundwater flow direction and distance impacted from pollution. Karst features and their development could potentially impact surface and ground water quality if within hazardous material spill areas. Due to karst's unique hydrology, karst features and ecosystems are more difficult to restore once polluted.

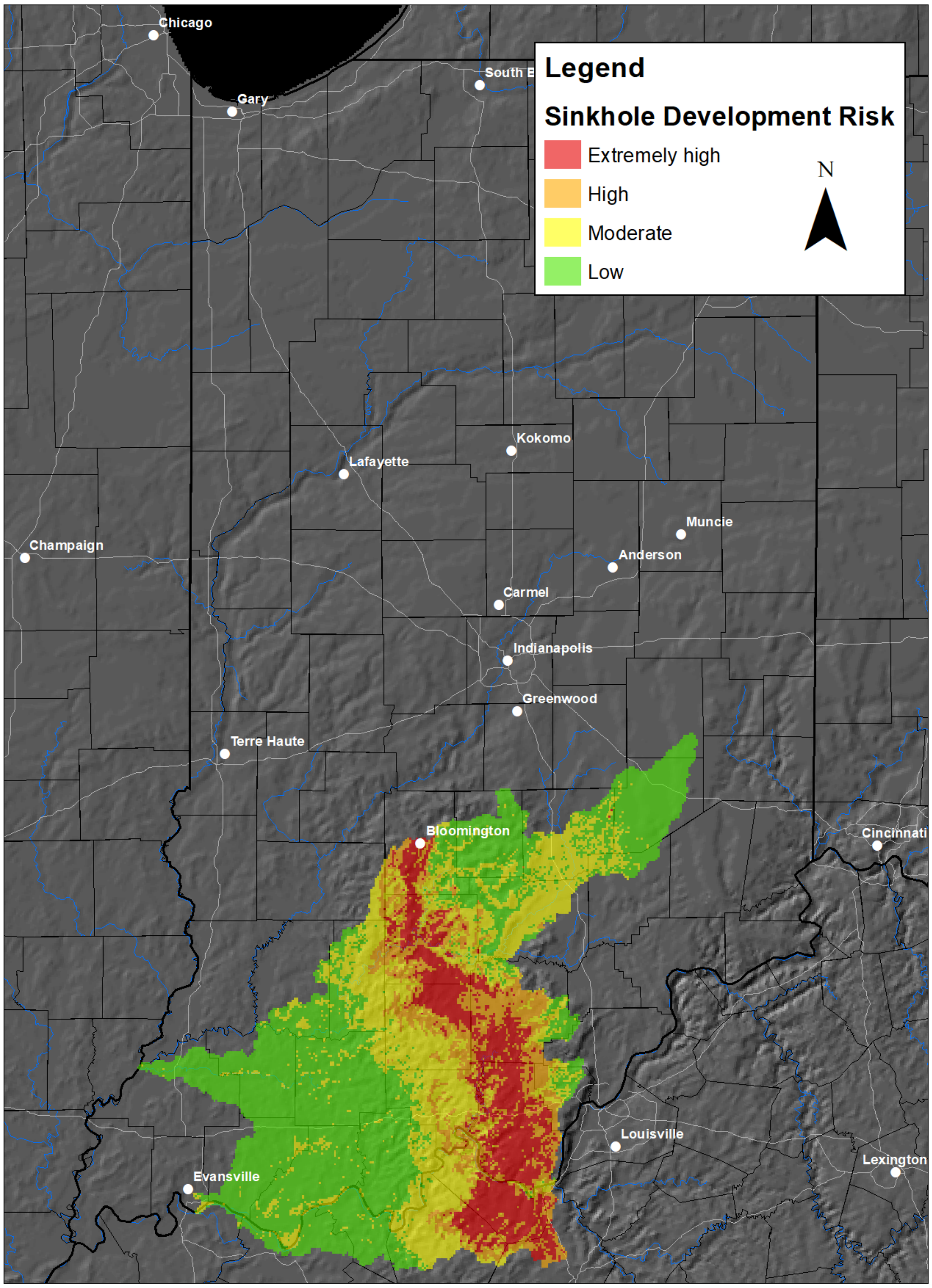


Figure 78. Risk of sinkhole development in southern Indiana (data from Letsinger, 2015)

6.5.3 Coal Mines

Indiana is among the top ten coal-producing states in the nation each year. In Indiana, coal is mined through surface and underground mining methods. Southwestern Indiana (containing the Crawford Upland, Wabash Lowland, Tipton Till Plain, Booneville Hills, and the Wabash Central Till Plain physiographic divisions) has been mined for coal (Figure 89).

Surface and underground mining methods both pose challenges to ground failure. The Indiana Department of Natural Resources oversees active coal mining and restoration of land disturbed by coal mining. However, in Indiana prior to 1941, mining areas were abandoned, or not reclaimed, leading to potentially unstable site conditions (United States Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2020). Abandoned mine land (AML) sites include processing facilities, waste banks, subsidence prone areas, unstable highwalls, unstable embankments, clogged streams, barren mine spoil areas, and coal refuse deposits left from surface mining operations.

In Indiana, room and pillar mining has been the dominant method of underground mining (Harper, 1982). Room and pillar mining leaves coal sections as pillars to support the overburden. With time, the supporting pillars deteriorate, and the cavity enlarges, resulting in instability, and mine subsidence leading to ground failure may occur. Common mine subsidence features include sinkholes, sags, and troughs. The areas where subsidence is of greatest concern are areas where coal was mined extensively underground. Underground mine areas most at risk for subsidence include areas where:

- mining was done within 150 ft of the surface,
- circulating groundwater has weakened the underground mine roof layers, or
- mined at the time when the system of mining was haphazard.

Today, underground mining remains potentially hazardous. Due to ongoing underground coal mining within the state, Indiana has a Mine Rescue Team in the case of a mining disaster. However, due to strict regulatory control and diligence on the part of Indiana’s coal industry, the risk of a catastrophic mine disaster such as a flood or collapse is low. Indiana’s mine safety record is high, with no major mining accidents reported for decades.

Abandoned surface mine areas may also be at risk for ground failure. The placement of steeply sloped unconsolidated mine spoils, prevalent on abandoned surface mines, can result in landslides. The abandoned mine inventory maintained by Indiana’s AML Program and the OSMRE contained 12 landslide areas caused by surface and underground mining (United States Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2020).

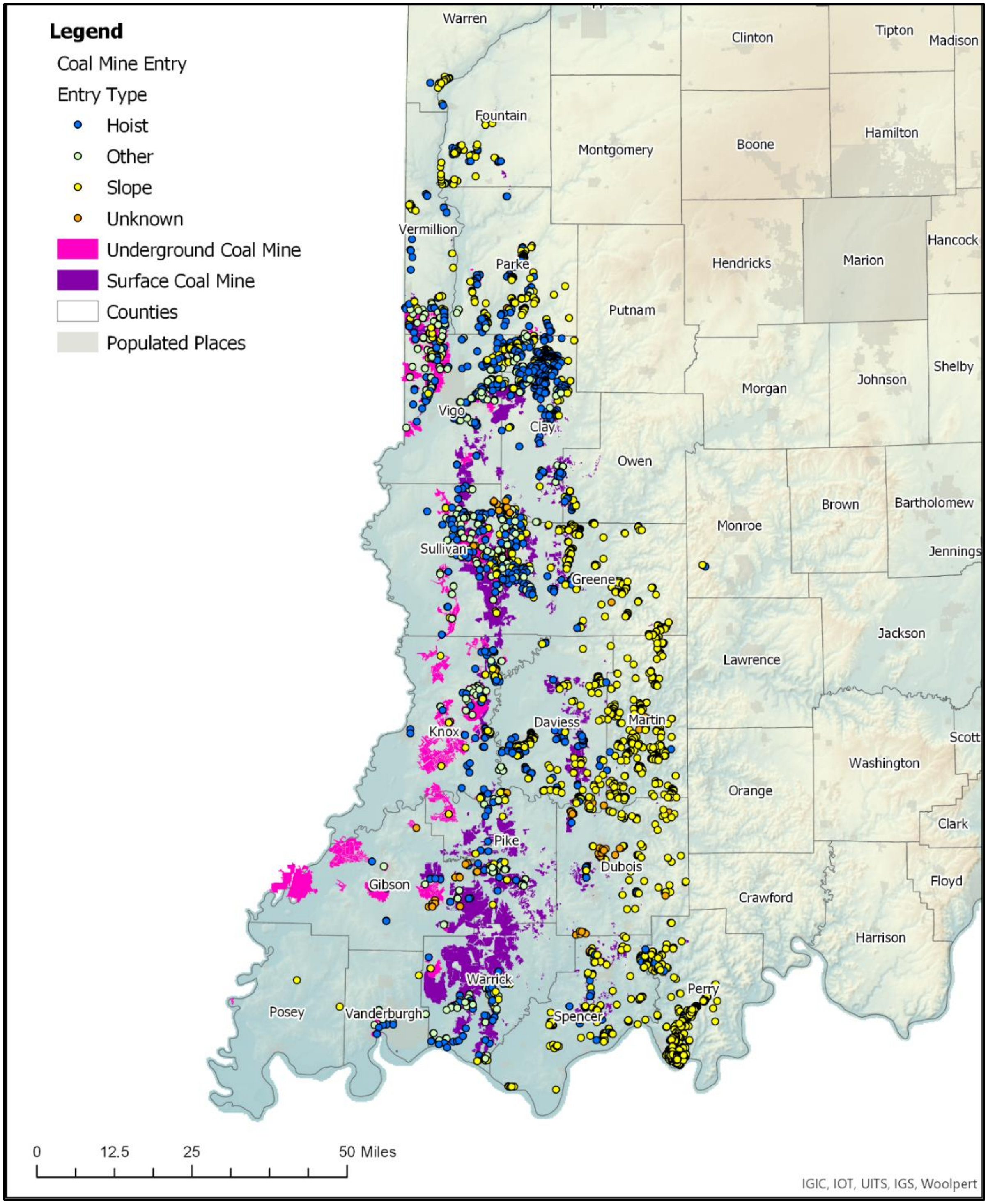


Figure 79. Indiana coal mines (Indiana Geological and Water Survey, 2017)

6.5.4 Vulnerability & Risk Assessment

Landslides have been estimated to cause up to $2 billion in damages and from 25 to 50 deaths annually in the United States. Landslides have been documented causing damage to Indiana's highway infrastructure. INDOT on average spent $5,378,000 per year on landslide repair projects from 2010-2020. The INDOT landslide repair estimate is incomplete, as it only includes the construction repair costs. Maintenance repair costs, such as roadway repaving costs, are not tracked by landslide area and are not included in the estimate.

Built infrastructure such as bridges, roads, pipelines, dams, railroads, and buildings can be vulnerable to damage from landslides. The expansion of urban and recreational development into hillside areas has resulted in an increasing number of properties subject to landslide damage. Landslides commonly occur in connection with other major natural disasters such as earthquakes, wildfires, and floods. During natural disasters, landslides have the potential to damage infrastructure, such as roadways, and may impede disaster recovery efforts.

Structures built within karst regions are at higher risk of land subsidence and karst collapse. Areas with increasing urban development may also be vulnerable to aggravating karst sinkholes during development. Dewatering and alteration of drainage can lower the water table, which in turn removes the supporting pressure needed to support the overlying soil and land surface. Increased drainage flow into karst features may also increase karst development through increased rates of bedrock dissolution. The formation of new karst features may reroute existing surface drainage. Conversely, in extreme precipitation events in karst areas, once the underground drainage systems have filled, areas that are typically dry may become flooded.

Abandoned mine land and coal mine subsidence can affect various types of infrastructure including buildings, roadways, and railroads. The Indiana Mine Subsidence Program, created by the Indiana State Legislature, protects home and property owners in 26 affected counties in southwestern Indiana. Due to the nature of subsidence damage, standard insurance policies do not cover mine subsidence claims. On average the Indiana Department of Insurance (IDOI) paid approximately $1,974,000 per fiscal year in mine subsidence claims from 2010-2020 (Indiana Department of Insurance, 2023).

Twenty-eight counties in southern Indiana contain risk of sinkhole developments associated with Karst. Figure 80 displays the state-owned and state-leased facilities at risk of possibly sinkhole development, totaling a potential damage amount of $101,313,067 to state-owned facilities and minimum $34,000,000 of content damage to state-leased facilities. Table 42 summarizes the number of essential facilities that fall within a sinkhole development area.

Table 42. Number of Essential Facilities at Risk of Sinkhole Development

Care Facility	Emergency Operations Centers	Fire Stations	Police Stations	Schools
235	37	315	129	420

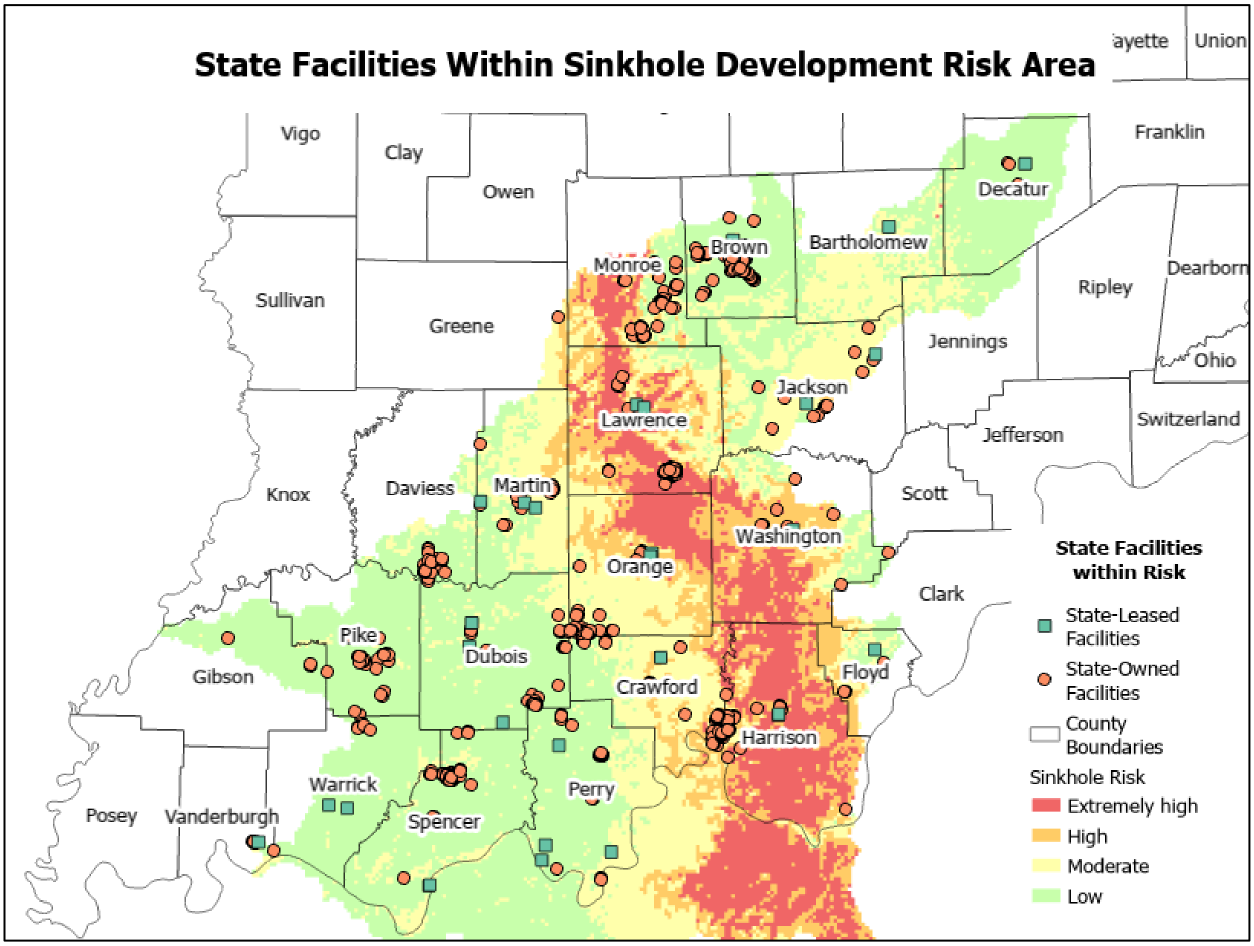


Figure 80. State Facilities Threatened by Risk of Sinkhole Development

6.5.5 Probability of Future Occurrences & Possible Effects from Climate Change

Increased frequency and intensity of extreme weather events like heavy rainfall, prolonged droughts, and rapid snowmelt contribute to ground failures. In regions prone to landslides, heavy rainfall can saturate the soil, reducing its stability and triggering landslides on steep slopes. Conversely, prolonged droughts lead to soil desiccation, making it more prone to subsidence and sinkholes.

Refer to Section 6.9 for additional information on Drought and the effects of climate change of drought. Refer to Section 6.8 for more information regarding snowmelt and the associated affects from climate change.

6.6 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 fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage.

Many communities view both dams and levees as permanent and infinitely safe structures. This sense of security may well be false, leading to significantly increased risks. Both downstream of dams and on floodplains protected by levees, a false sense of security often leads to new construction, added infrastructure, and increased population in at risk areas 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.

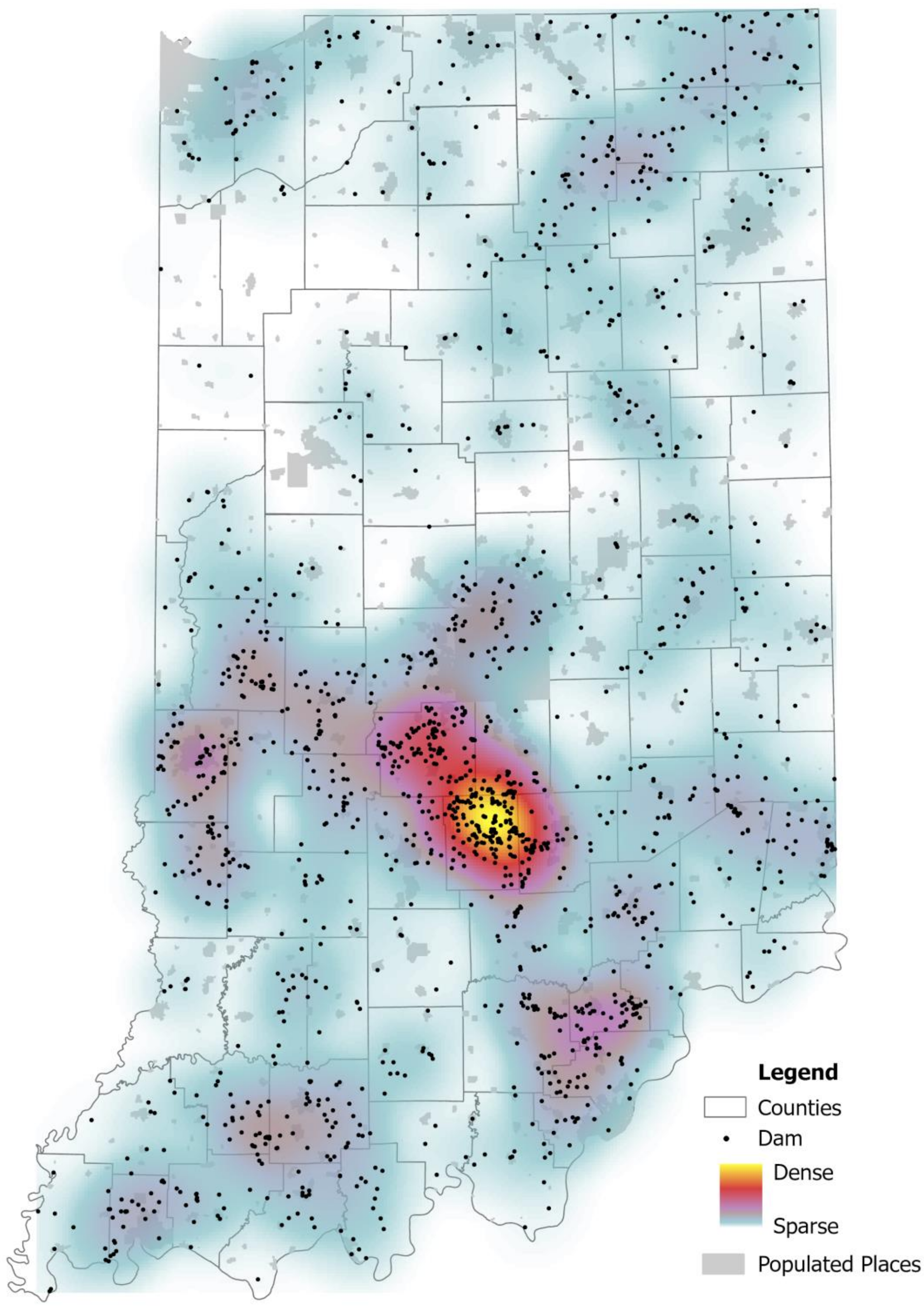
In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. IDNR has created the Indiana Dam Safety Inspection Manual, which can be found at https://secure.in.gov/dnr/water/3593.htm. The regulation of dams in Indiana is addressed under Indiana Code: IC 14-27-7.5 Regulation of Dams, and 312 IAC Article 10.5 Regulation of Dams. 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. Once dams reach 50 years or older, statistically there is more risk of failure, and many dams are of-age. Additionally, levees prohibit the natural dissemination and storage of flood waters resulting in more water being forced downstream than would otherwise be the case.

The IDNR Division of Water assigns the hazard potential for dams and levees as dictated in IC 14-27-7.5-8. Table 43 below describes each hazard classification.

Table 43. Hazard Potential Classification System for Dams

Federal Classification	Description
High	A structure the failure of which may cause the loss of life and serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads.
Significant	A structure the failure of which may damage isolated homes and highways, or cause the temporary interruption of public utility services.
Low	A structure the failure of which may damage farm buildings, agricultural land, or local roads.

Both population and infrastructure located downstream are at risk in the event of a dam or levee failure. Developing an Emergency Action Plan (EAP) and updated inundation maps is the first step toward highlighting the areas of greatest vulnerability in each community. Figure 81 shows the locations of all dams in Indiana. Figure 82 shows state-regulated dams in Indiana symbolized by their federal hazard classification.



Disclaimer: Information on dams not regulated by the State of Indiana may be extremely limited and/or inaccurate and should only be considered following field verification by the user. Hundreds of other dams, either not regulated by the State of Indiana or reported to IDNR, exist within Indiana and are not listed in the index or reflected on this map.

Figure 81. All Dams

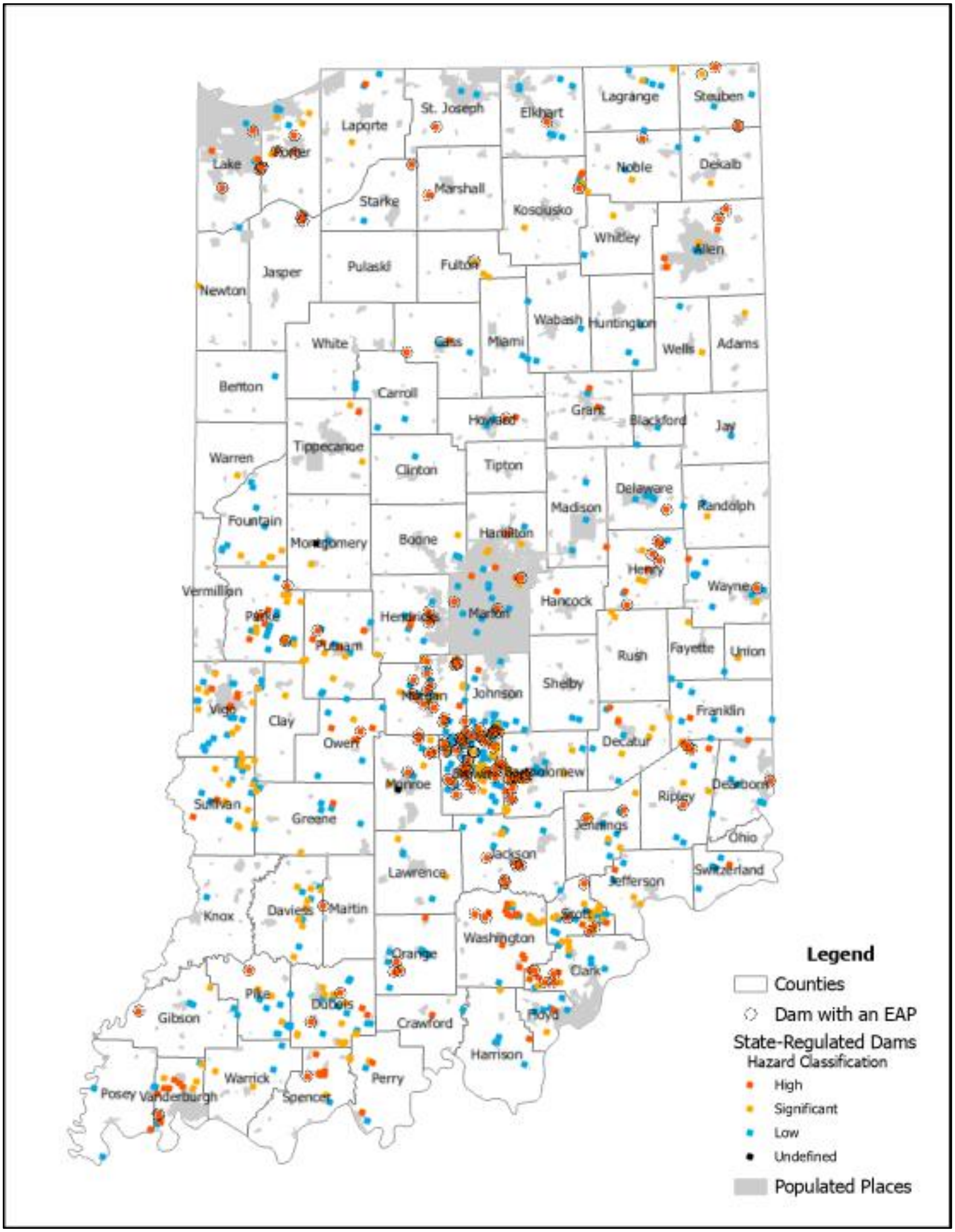


Figure 82. State-Regulated Dams

6.6.1 Low-Head Dams

Low-head dams were first built in Indiana in the 1800s to provide energy for milling, power generation, and water diversion. Over time, many of these dams were damaged or abandoned and left in rivers. Low-head dams obstruct the general flow of water in rivers and span from bank to bank. As of 2022, 162 low-head dams were known to remain in Indiana Waterways (see Figure 83). The number of low-head dams fluctuates as they are discovered and/or removed. In Indiana, from 2010 to May 2020 there were 25 deaths near or at low head dams, with at least 17 people injured, and 50 rescued at dams of all types.

Eleven low-head dams have been removed in Indiana. Ten of those since 2012 and 4 in just last year.

Thanks to a grant IDHS received in 2015 to conduct education and outreach activities on the risks and hazards of low-head dams, a number of activities have taken place. These include the development of a 30-minute documentary, a 14-minute youth-oriented program, and a 1-minute social media piece; a one-day low-head dam symposium attended by over 300 people; an inventory of low-head dams; the development of a web-based interactive map (https://indnr.maps.arcgis.com/apps/webappviewer/index.html?id=729f94f7963a42d9ab0d38c639590fea); and the development of an outreach campaign.

"Over, Under Gone – The Killer in Our Rivers" documentary received the National Association of State Dam Safety Officials Midwest Region Award of Merit in 2017. The documentary is available online at https://www.wfyi.org/programs/over-under-gone/television/over-under-gone-the-killer-in-our-rivers. The documentary has gotten national attention.

Indiana Silver Jackets team members have developed artwork for a low-head dams warning sign that both verbally and visually warns people of the hazard and utilizes color schemes and word choices similar to workplace warning signs. 37 such signs were placed upstream and downstream of the 3 low-head dams in the Fort Wayne area and Citizens Energy has deployed smaller signs near dams where the public can walk near their low-head dam structures. Team members have presented at both statewide and national conferences including INAFSM, ASDSO, Boat Sport and Travel Show, and Stay Afloat Biannual Conference, encouraging public education (https://www.in.gov/dnr/outdoor/9419.htm) and the development of local champions to help educate and encourage the removal or modification of low-head dam structures. A student curriculum has been developed to teach students about low-head dams. The curriculum is currently being beta tested with a few select teachers. The goal is to provide the board of education compliant curriculum, and all the teaching materials to local schools, scouting groups, and agricultural youth organizations so they can spread the message. Most recently, team members have been working with IDEM and the USACE to develop a set of guidelines to assist dam owners navigate the environmental testing and permitting processes for dam removals. Most recently, the team is working on Indiana Dam Education & Awareness (IDEA) Project. This effort consists of development of materials focused on general dam safety topics, best practices, federal & state programs and authorities, inundation maps, and the importance of Emergency Action Plans. Three workshops were held in late 2022.

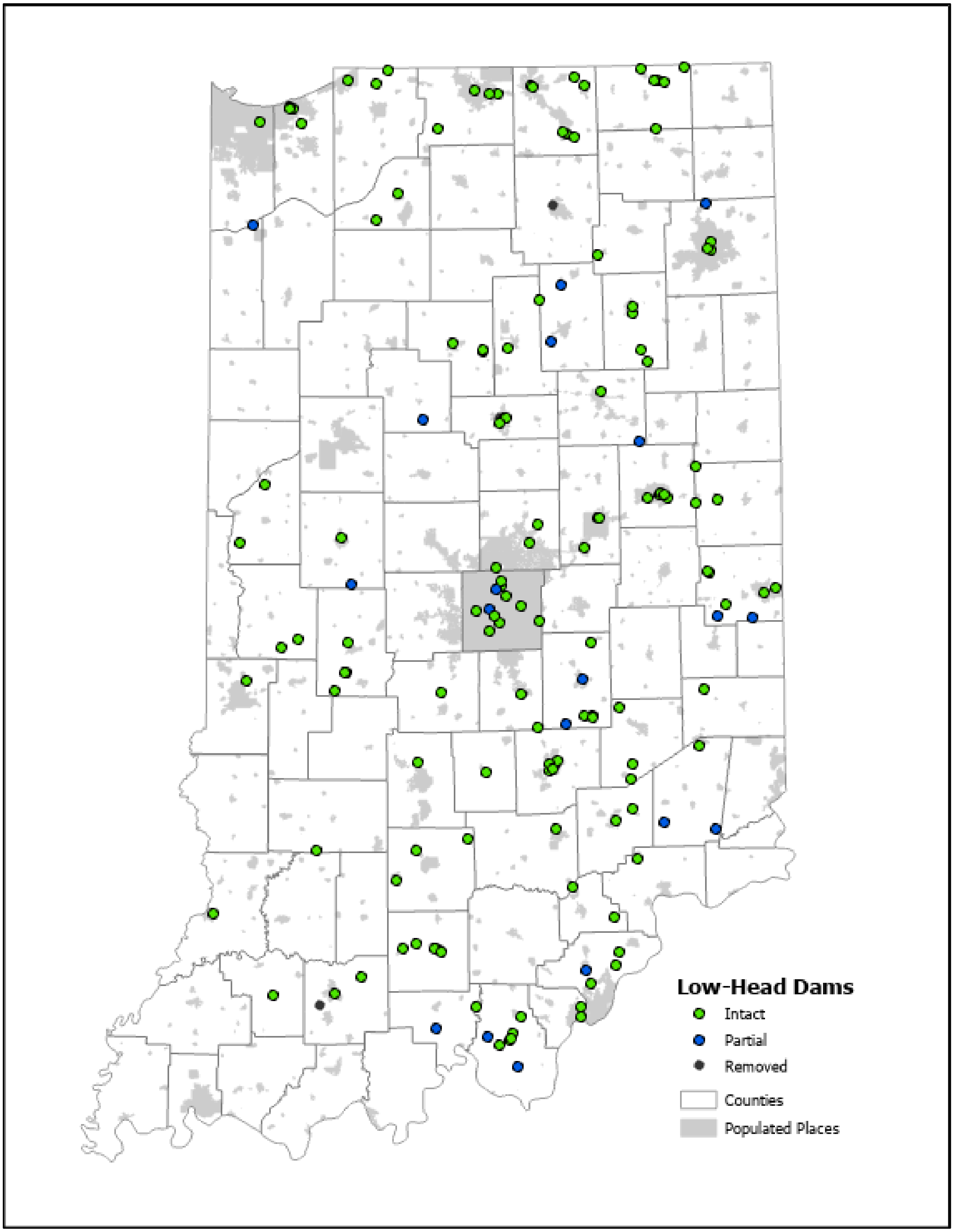


Figure 83. Known Low-Head Dams

6.6.2 High-Hazard Potential Dams

High hazard potential classification applies to dams whose failure or malfunction could result in loss of human life and extensive property damage. On December 16, 2016, the president signed in law the Water Infrastructure Improvements for the Nation Act (WIIN Act), which introduced a new grant program under FEMA's National Dam Safety Program (33 U.S.C. 467f). Section 5006 of this Act, known as Rehabilitation of High Hazard Potential Dams, facilitates grants for technical assistance, planning, design, and construction support for the rehabilitation of qualifying high hazard potential dams. Eligibility extends to states with established dam safety programs, the State Administrative Agency, or an equivalent state entity.

Inundation zones denote areas downstream of dams that could be temporarily flooded upon dam failure. IDNR has systematically delineated and mapped inundation areas across the state. The comprehensive mapping is accessible at the link: https://indnr.maps.arcgis.com/apps/webappviewer/index.html?id=509929365726496d841fcc6d06335381. It is important to note that due to security concerns, not every dam in Indiana has an inundation area mapped. However, the potential impact of dam failure on homes and businesses within inundation areas remains significant. Prudence should be exercised with any new development in these zones. The map aids officials in making informed decisions about dam maintenance and development projects. Presently, Indiana lacks policies or regulations that restrict homeowners, businesses, or developers from constructing in these areas. As emphasized earlier in this section, consistent dam maintenance and upgrades are pivotal in averting such incidents.

Although there are likely more not recorded, Indiana has 245 high hazard dams, of which 128 possess an EAP. Figure 84 displays the distribution of high hazard dams across the state, highlighting their density. The southern region, particularly around Brown County, stands out with the highest concentration of these dams. Updates to State of Indiana 2007 Indiana Dam Safety & Inspection Manual now requires EAPs for HHPDs. The manual is a strategic planning tool that enhances preparedness and responsiveness in emergency scenarios involving dam failure.

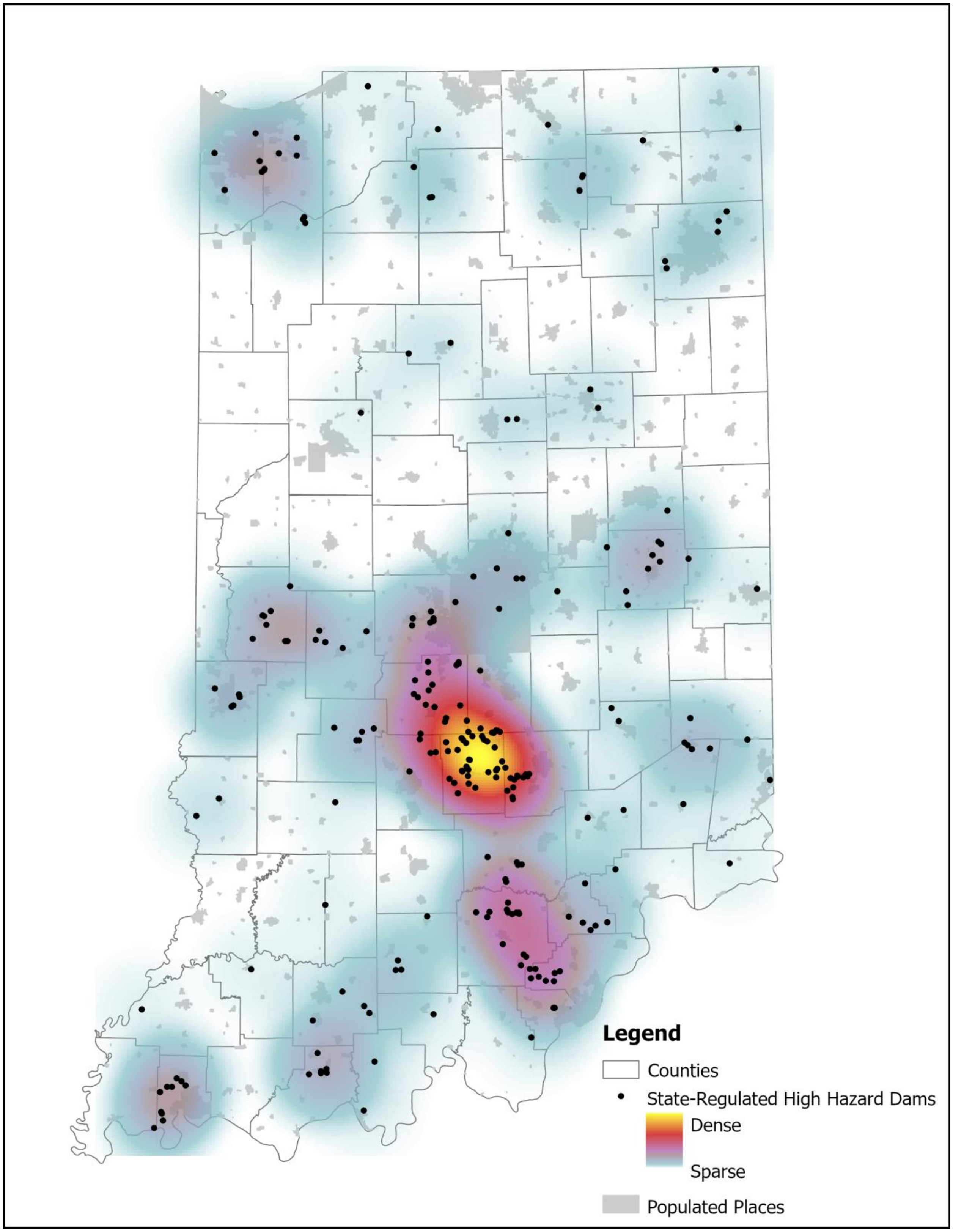


Figure 84. State-Regulated High Hazard Dams

6.6.3 Non-Levee Embankments

Along with accredited levees regulated by federal agencies, there are also what are referred to as Non-Levee Embankments (NLE), which typically parallel the direction of natural flow. An embankment is an artificial mound of soil or broken rock that supports railroads, highways, airfields, and large industrial sites in low areas, or impounds water. NLEs are often highways or railroads built on fill in low lying areas and thus tend to impose lateral constraints on flood flows, and typically contain the following characteristics:

- They are elevated linear features adjacent to waterways and within the floodplain.
- They are typically man-made and include agricultural embankments built by landowners and road and railroad embankments banks.
- They are levee-like structures but are not certified or engineered to provide flood protection.

The National Committee on Levee Safety estimates that the location and reliability status of 85% of the nation's NLEs are unknown. In Indiana, the majority of NLEs are unidentified and are typically not maintained. NLEs impose lateral constraints on flood flows, reducing the floodplain storage capacity and increasing the flood velocity. As a result, downstream flooding and the potential for stream erosion can increase. As such, NLEs can give a false sense of security and protection to the people residing near NLEs. For these reasons, it is extremely important to map where these features are located.

Living with levees is a shared responsibility. While operating and maintaining levee systems are the levee sponsor responsibility, local officials are adopting protocols and procedures for ensuring public safety and participation in the NFIP.

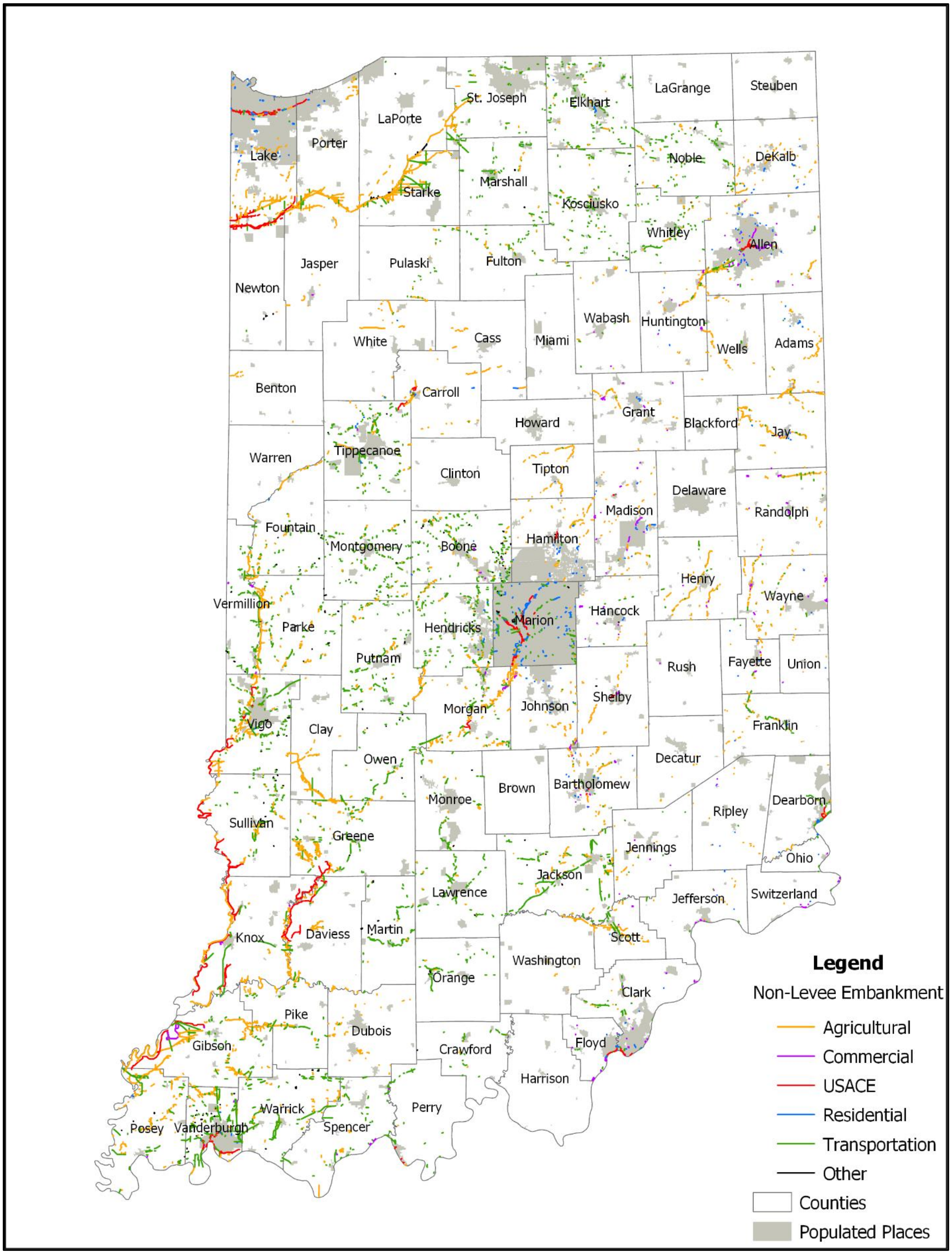


Figure 85. Non-Levee Embankments

6.6.4 Vulnerability & Risk Assessment

Dams can pose a great risk to water enthusiasts due to many structures being in disrepair. Additionally, the hydraulic churning motion that takes place as the water velocity drives the water to the river bottom and recirculates the highly aeriated water back to the surface can be a hazard. This churning action, much like a washing machine, traps debris, boats and people who mistakenly get too close to the structures and are pulled to the face of the dam. Intact or partial dams mapped in Figure 83 threaten Hoosiers until they are removed.

Concerns about dam failure are growing due to the increased number of HHPDs and dam deterioration. The IDNR Department of Water created a mapping service that delineates projected inundation areas downstream of state-regulated dams in Indiana. While not all dams have been mapped as of this update, the mapped areas aim to provide the most current information possible regarding potential hazards. However, as with any natural hazard, predicting the exact extent remains challenging.

Of the inundation areas mapped, there are at least 12,488 buildings totaling a potential damage cost of $918,295,437 within inundation areas in Indiana. Table 44 outlines the number of buildings and the corresponding dollar amount of damage for each county within the mapped inundation areas. Counties with the highest number of buildings located within inundation areas are highlighted for emphasis.

Figure 86 and Figure 87 illustrate the total number of state and essential facilities within inundation areas, categorized by county.

There were 3 state projects and 76 parcels with recent, potential, or projected development projects threatened by a dam inundation of the inundation areas mapped.

Dam failures encompasses various risks, including disruptions to state and emergency operations, increased financial resources required for rebuilding, as well as the potential for injuries and fatalities among Hoosiers.

Table 44. Buildings within Inundation Areas by County

County	# of Buildings	$ of Potential Damage	County	# of Buildings	$ of Potential Damage
Bartholomew	1,165	$85,241,834	**Montgomery**	18	$422,488
Brown	1,571	$133,851,600	**Morgan**	846	$41,052,358
Clark	1,106	$62,790,352	**Orange**	769	$157,354,837
Dearborn	186	$23,923,062	**Owen**	20	$398,598
Dekalb	3	$64,402	**Parke**	51	$3,152,330
Delaware	18	$639,096	**Perry**	51	$1,080,137
Dubois	9	$318,600	**Pike**	443	$35,098,840
Floyd	152	$6,751,755	**Porter**	55	$11,432,162
Fountain	2	$65,507	**Putnam**	95	$2,849,829
Greene	103	$3,377,868	**Ripley**	145	$6,691,944
Hamilton	208	$24,630,080	**Rush**	4	$231,363
Hendricks	4	$34,957	**Scott**	516	$24,868,218
Henry	1,022	$101,214,407	**Spencer**	95	$4,494,560
Jackson	270	$9,757,652	**St. Joseph**	881	$51,896,270
Jefferson	3	$63,097	**Starke**	614	$22,173,192

County	# of Buildings	$ of Potential Damage	County	# of Buildings	$ of Potential Damage
Jennings	381	$13,924,791	**Steuben**	894	$41,698,024
Johnson	358	$26,251,990	**Sullivan**	54	$1,623,215
Lagrange	124	$3,834,789	**Tippecanoe**	10	$236,210
Marion	7	$622,970	**Vanderburgh**	17	$1,033,055
Marshall	46	$1,527,196	**Vigo**	19	$656,890
Martin	3	$151,876	**Washington**	67	$1,828,741
Monroe	83	$8,984,295			

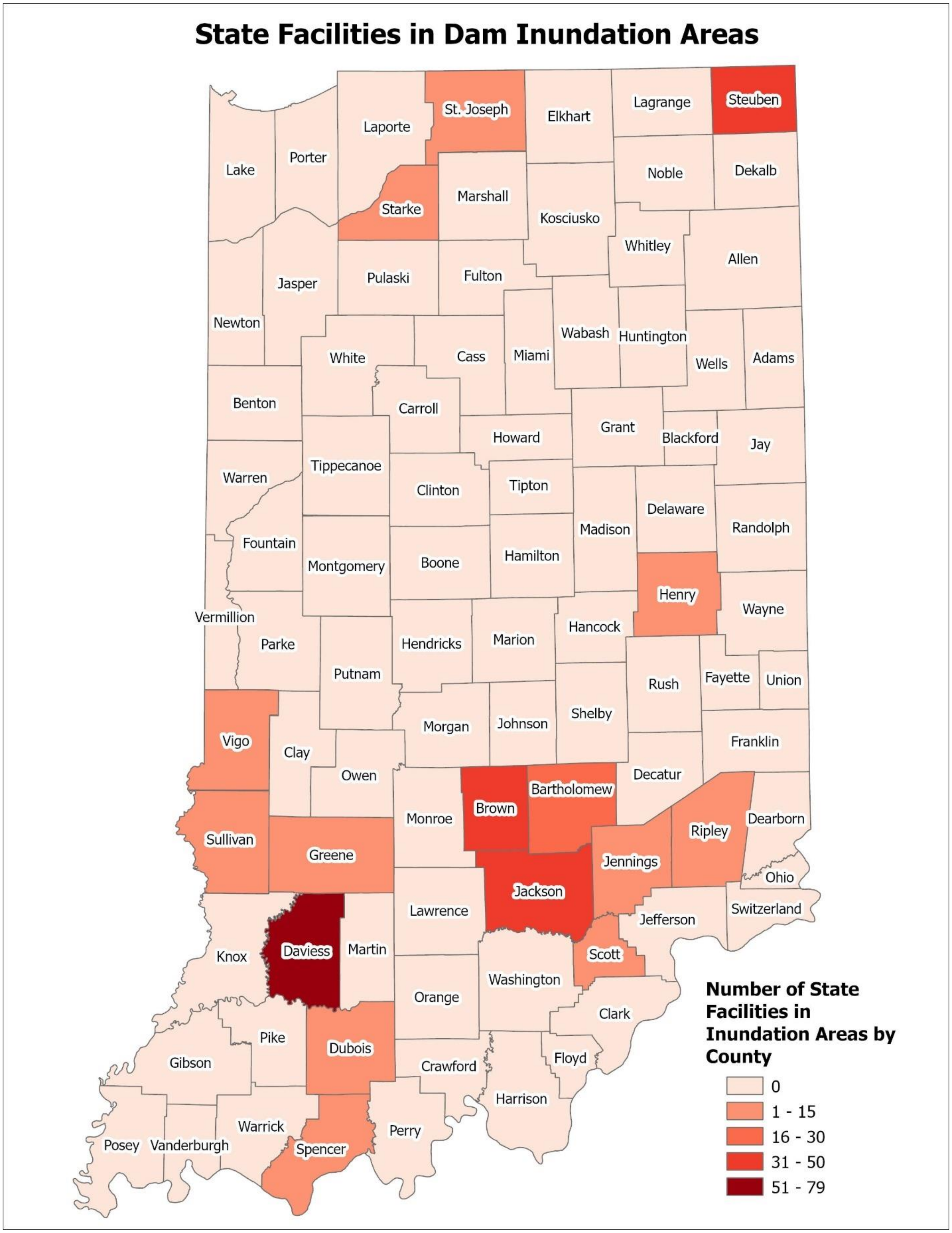


Figure 86. State Facilities within Inundation Areas by County

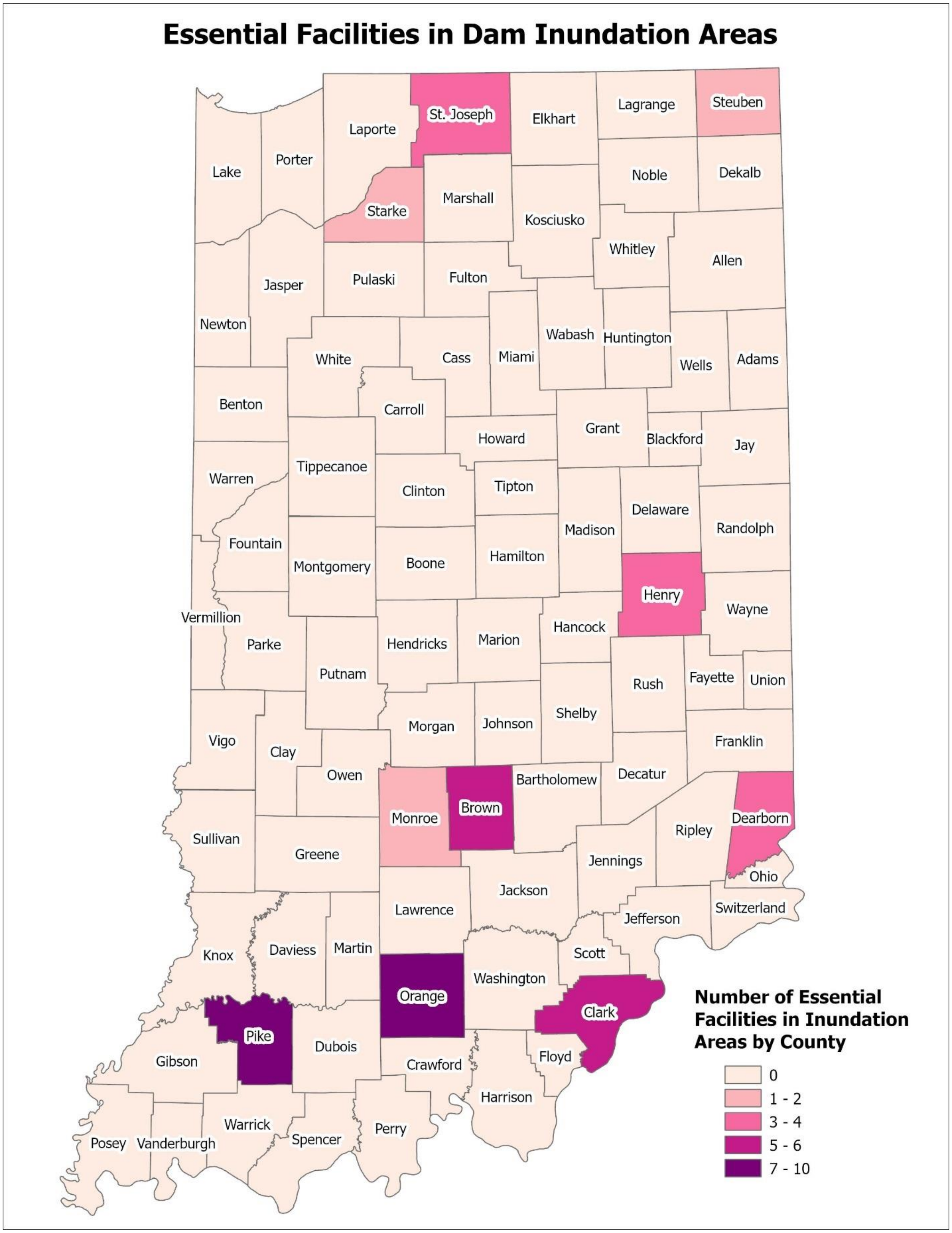


Figure 87. Essential Facilities within Inundation Areas by County

6.6.5 Probability of Future Occurrences & Possible Effects from Climate Change

The occurrence of dam failures in various parts of the country has resulted in catastrophic consequences for affected communities. HHPDs that remain without essential retrofitting or repairs are at a significantly elevated risk of failing, posing a severe threat to the populations downstream. Vulnerable communities downstream are particularly susceptible to the devastating impacts of these failures, including the loss of homes, financial resources to facilitate recovery, and even the potential for loss of life.

Increased variability and intensity in precipitation patterns can lead to more frequent and intense rainfall events. Elevated rainfall can overload dams and levees, putting them at greater risk of failure. There is no specific research regarding the impact of climate change on dams and levees. However, the projected elevated rainfall outlined in Section 2 could potentially led to increase in overloading dams and levees.

6.7 Extreme Temperatures

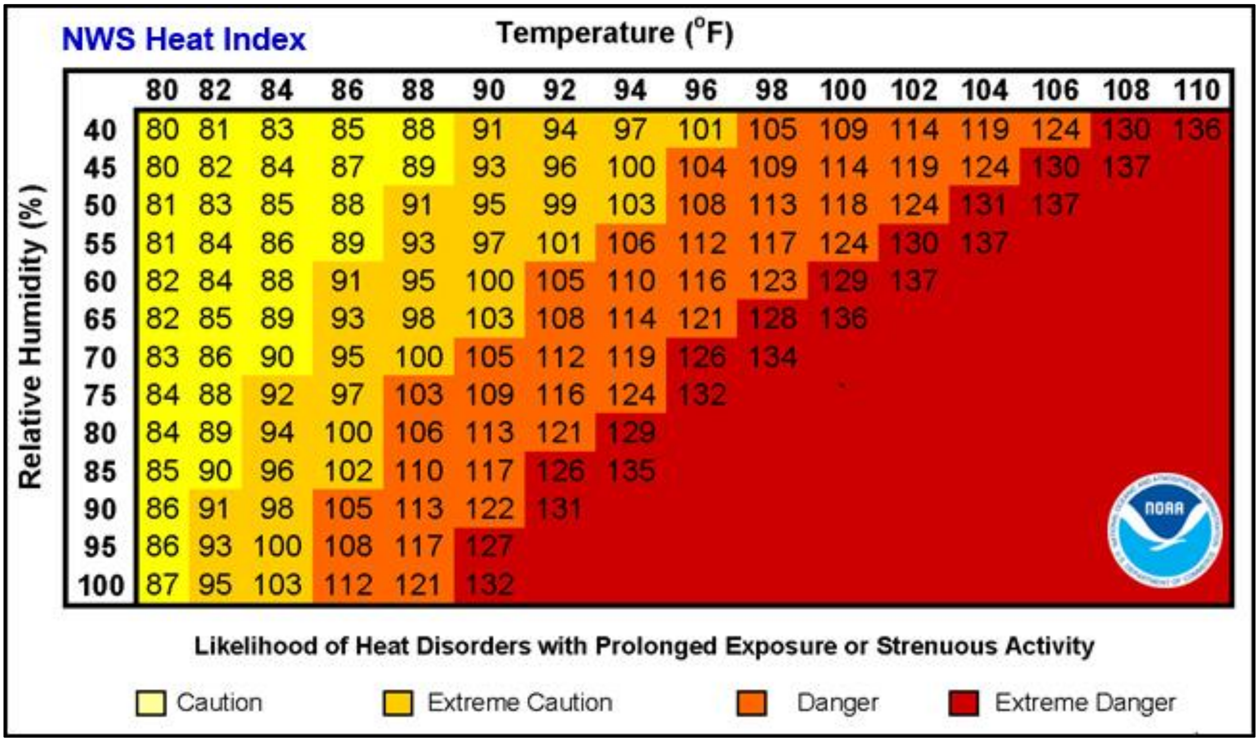
Extreme temperatures—both hot and cold—can significantly impact human health and safety, commercial businesses, agriculture, and primary and secondary effects on infrastructure (e.g. burst pipes, power failures, etc.). Weather conditions described as extreme heat or extreme cold vary across different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

Extreme Heat

According to the CDC, there is no single agreed upon definition of an extreme heat event. These events typically refer to an extended period of time, such as several days or more, with unusually hot weather conditions that can potentially harm human health.

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 in combination with the actual air temperature. The National Weather Service Heat Index Chart can be seen below in Figure 88.

IDHS has created an extreme heat and heat-related illness fact sheet (https://www.in.gov/dhs/get-prepared/files/Extreme-Heat-Safety.pdf). Heat-related illnesses include heat cramps, heat exhaustion, and heat stroke.



RH (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

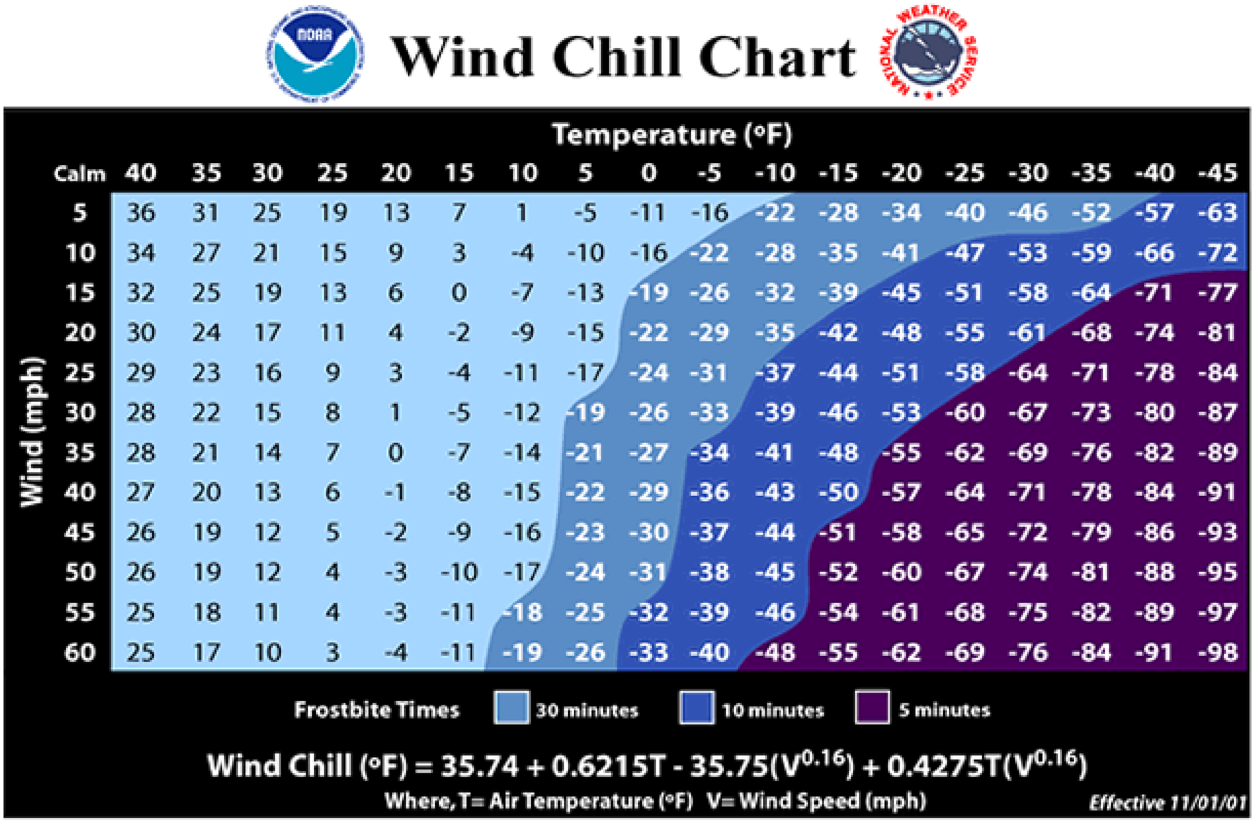
Figure 88. National Weather Service Heat Index Chart

Extreme Cold

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 89, includes a frostbite indicator, showing points where temperature, wind speed, and exposure time will produce frostbite in humans.



Wind Chill Chart

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Figure 89. National Weather Service Wind Chill Chart

6.7.1 Historical Occurrences

Indiana encountered 90 instances of excessive heat between 2012 and 2022, as documented by the NCEI, 16 of which occurred since the previous plan. Recent occurrences took place in July 2019, June 2022, and July 2022. In July 2019, elevated temperatures and dewpoints led to heat index values near 105°F in several counties. In mid-June 2022, southwestern Indiana, including Evansville, marked a record-breaking spell of temperatures surpassing 100°F for three consecutive days. Following the June 2022 heatwave, the southwest region of Indiana witnessed significant heat indices ranging from 101°F to 115°F over the July Fourth holiday.

Over the period from 2012 to 2022, Indiana witnessed 181 instances of extreme cold and wind chill, as noted by the NCEI. One hundred and twenty of these occurred since the last plan. Notably was the occurrence of an extreme cold event in 85 out of Indiana's 92 counties a few days prior to Christmas 2022. From December 22 to 24, an arctic front brought sub-zero temperatures and robust wind gusts. Wind chills plummeted to as low as -45°F, accompanied by wind gusts of up to 50mph. The NCEI documented 5 injuries and 7 fatalities stemming from this extreme cold. Beyond its direct impact, the sub-zero temperatures triggered numerous secondary effects, including vehicular accidents, bursting pipes, travel advisories during the holiday season, and downed power lines that left households without heating amidst the harsh conditions.

6.7.2 Vulnerability & Risk Assessment

Extreme temperature events often lead to severe short- and long-term health conditions, or even death, particularly for special needs populations, youth, 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.

Research has shown temporary cooling mechanisms, such as a fan, do not cool an individual's internal temperature leaving them at risk of heatstroke or death. Home cooling systems reduce the internal body temperature. According to the IDLGF, 21% of dwellings in Indiana do not have central air. Similarly, heating systems protect individuals from effects of extreme cold temperatures. About 1% of dwellings in Indiana do not have a form of heating.

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 can 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. According to NWS, extreme heat is the number one cause of weather-related fatalities in the United States over the past 30 years, with an average of 134 per year (see Figure 90).

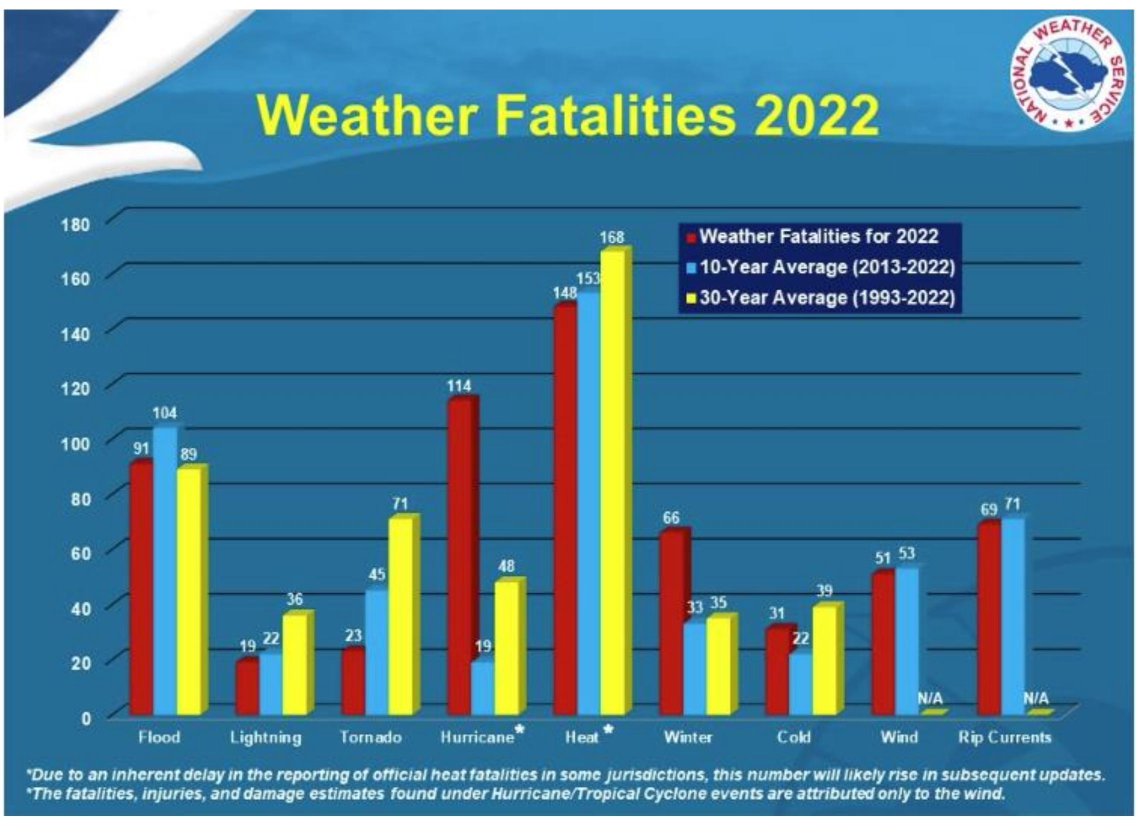


Figure 90. Weather Fatalities 2022 (Source: National Weather Service)

Extreme heat and cold events can have significant impacts on various types of infrastructure, impacting daily functions and business across agriculture, commercial, industry, and residential uses. Roads, railways, and airport runways can buckle or become icy, leading to disruptions. Power grids, thermal power plants, natural gas pipelines, and electrical systems can be strained, leading to blackouts. Water pipes can burst due to freezing or deteriorate in extreme heat, leading to water supply disruptions. Heat can strain bridges, overpasses, and cooling systems. Crops, livestock, and irrigation systems can be damaged, impacting agricultural productivity.

Such disruptions not only affect daily processes but also hinder the ability of emergency services to reach accidents and serve the community in times of need. Given the unpredictable nature of extreme temperature events and their wide-ranging impacts, we assessed the likelihood of state facilities being damaged based on the number of events between 2012 and 2022 and the number of facilities in each county. (Note, the colors are not a count of the event type over that time, but an illustration of the ratio).

The analysis revealed that state facilities in the southwest, northwest, and eastern parts of Indiana were more likely to experience disruptions from extreme heat and cold events with an estimated $3,800,000,000 of content damage to state-leased facilities. Conversely, facilities in the northern half of the state were more susceptible to disruptions from extreme cold events. Figure 91 illustrates this pattern, indicating higher vulnerability in certain regions.

Figure 92 presents a more scattered picture, with essential facilities across the state showing sporadic vulnerability to extreme heat and cold events, except for a concentration in the southwestern corner. Counties in this area were more likely to experience disruptions from extreme cold events.

Comparing the two figures, it's clear that the southwestern corner near the Illinois/Kentucky borders and the eastern corner near the Ohio/Kentucky borders have emerged as the most vulnerable regions over the past decade. The most at-risk counties: Lake, Porter, Newton, Jasper, Howard, Fayette, Franklin, Dearborn, Ohio, Switzerland, Knox, Pike, Gibson, Posey, Vanderburgh, Warrick, and Spencer threaten the state with $99,949,304 in damages.

There were22 state projects and 1 parcel with recent, potential, or projected development projects threatened by an extreme heat and cold event. Generally, extreme heat does not cause significant damage to new development, but it may cause setbacks to the State, developers, and economy by possibly having to delay work.

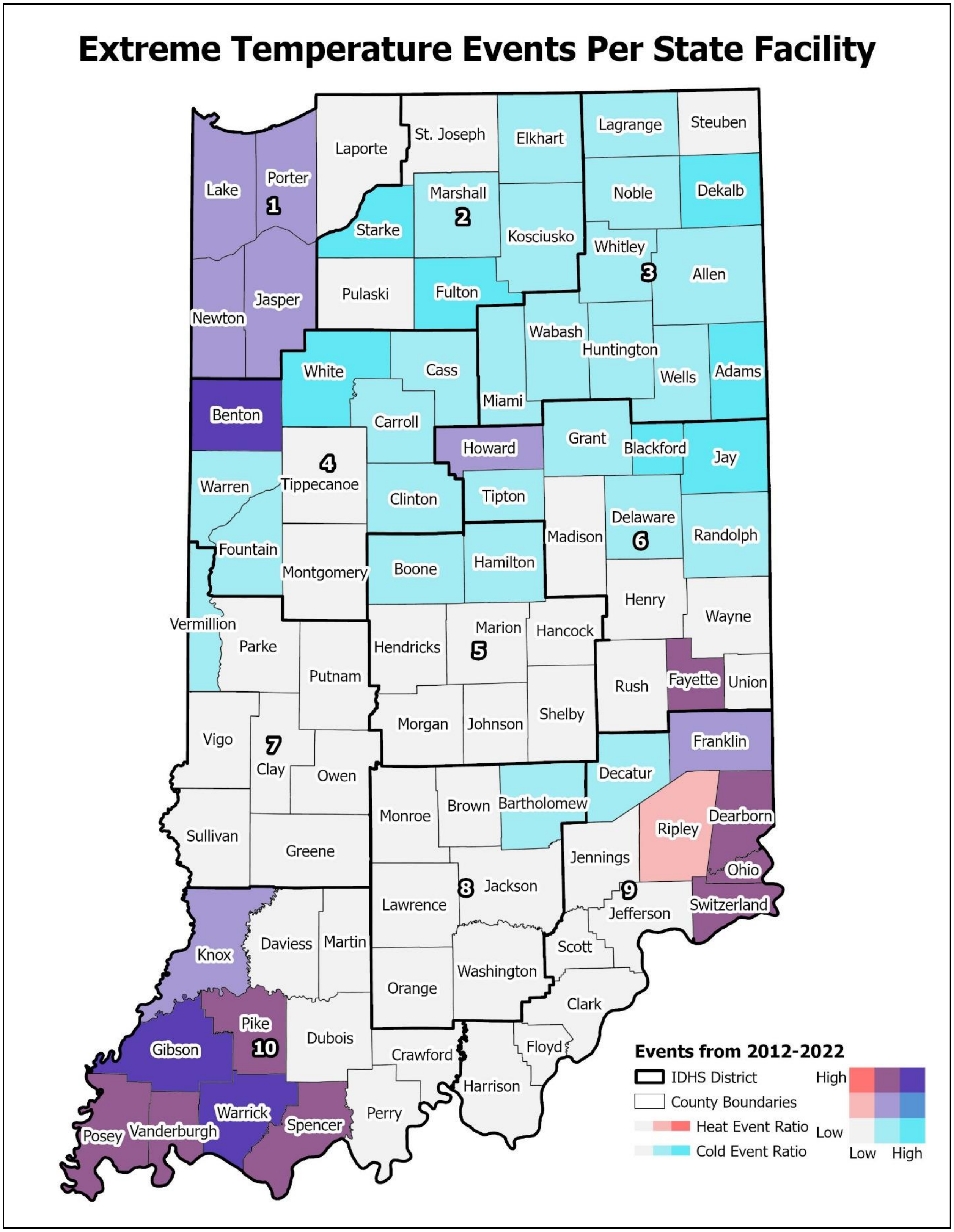


Figure 91. Number of State Facilities Versus Extreme Temperature Occurrences by County

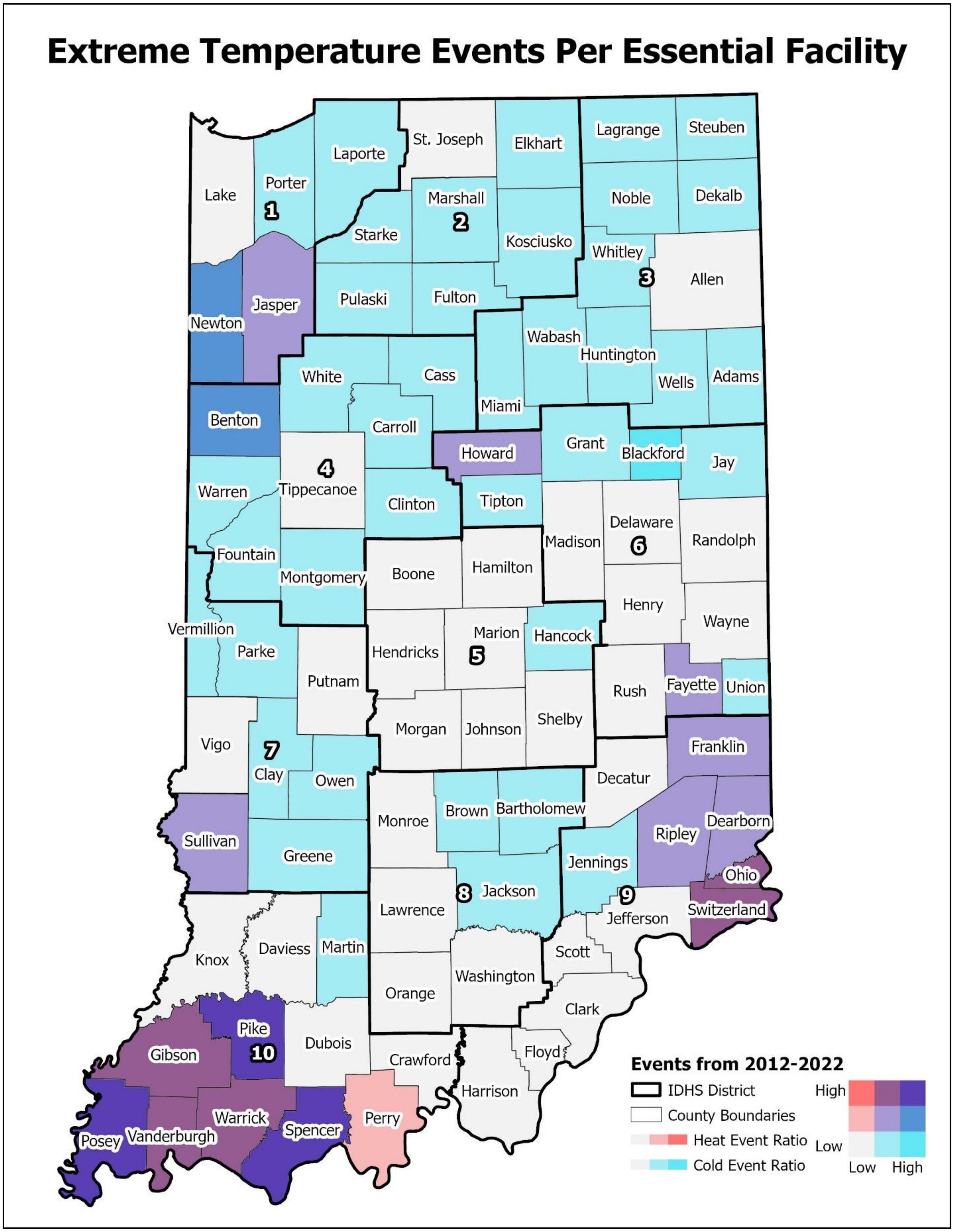


Figure 92. Number of Essential Facilities Versus Extreme Temperature Occurrences by County

6.7.3 Probability of Future Occurrences & Possible Effects from Climate Change

According to the 2018 Indiana Climate Change Impacts Assessment, extreme cold events are predicted to decline while the number of extremely hot days will rise. Current temperature trends show increasing global temperatures leading to increased number of record setting highs for winter and summer.

While the annual number of extremely hot days remained steady between 1960 and 2020, future projections indicate a significant increase. By mid-century, the hottest day of the year is expected to rise by approximately 8°F. These rising temperatures can lead to road and pavement damage and pose health risks to both people and pets due to heat-related illnesses.

6.8 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. Extreme low temperatures can be viewed in Section 6.6.

Ice Storms

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

Snowstorms

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

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

Damages from blizzards can range from significant snow removal costs to human and livestock deaths. Due to the blinding potential of heavy snowstorms, drivers are also at risk of collisions with snowplows or other road traffic. Stranded drivers can make uninformed decisions, such as leaving the car to walk in conditions that put them at risk. Drivers and homeowners without emergency plans and kits are vulnerable to the life-threatening effects of heavy snowstorms such as power outages, cold weather, and inability to travel, communicate, obtain goods, or reach their destinations. Heavy snow loads can cause structural damage, particularly in areas where there are no building codes or for residents living in manufactured home parks.

6.8.1 Historical Occurrences

Ice Storms

Based on NCEI data since 1996, Indiana is at risk of ice storms from November through March. There was no record of ice storms occurring in the month of November until 2018. In mid-November 2018, a wintry mix of snow, sleet, and freezing rain blew across 40 counties bringing down trees and power lines, leaving thousands of Hoosiers without power and/or heat. Ice amounts ranged from a tenth of an inch to three-tenths of an inch. The event was responsible for 7 injuries and 10 deaths.

Snowstorms

Indiana can experience snowfall during most years from November 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.

NCEI produced a Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the US. Similar to the Fujita scale (tornadoes) and Saffir-Simpson scale (hurricanes), RSI is based on the spatial extent of a storm, the amount of snowfall, and population from the 2000 Census. 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 (Table 45). It is produced for each of the six NCEI climate regions. Indiana is in the Ohio Valley region with Illinois, Ohio, Kentucky, Missouri, Tennessee, and West Virginia.

Table 45. 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

Since 2012, the NCEI has reported 31 snowstorms in the Ohio Valley region. The vast majority (22 or 71%) were category 1 storms, seven were category 2, and two were category 3. The most recent category 2 or above storm occurred February 1-5, 2022, in which a total of 41,966,114 individuals were impacted over an area of 250,676 square miles. The storm impacted all 92 counties. The storm's RSI was 5.5.

6.8.2 Vulnerability & Risk Assessment

The hazard extent of a winter storm is statewide. These storms are characterized by heavy snow and intensified by wind speeds that can rival hurricanes (up to 74 mph). Rapid snowfall rates, sometimes exceeding an inch per hour, coupled with strong winds result in drifting snow, can lead to the paralysis of entire regions and impassable roads, and cause travel restrictions for prolonged periods.

Compounding these threats, the retreat of low-pressure systems ushers in cold air, causing temperatures to plummet. Subsequent incursion of arctic high-pressure areas can drive temperatures 20 to 30 degrees below normal, lasting up to a week until the arrival of the next weather system. This can strain utility systems already operating at peak output, while also posing risks to structures due to the weight of snow and the potential for collapse.

The impact of winter storms is far-reaching, posing risks to population exposure, human services, transportation, utility infrastructure, and the economy. Special needs populations, individuals experiencing homelessness, and the elderly face heightened vulnerability due to limited mobility and reliance on accessible roads. Human service agencies grapple with disruptions to transportation and communication, potentially overwhelming smaller agencies and straining larger ones. Improper facilities or lack of warmth for animals can cause death.

Transportation networks face immediate impacts from winter storms. Snow and ice accumulation can make travel difficult or impossible, leading to cascading effects such as debris-related crashes and incidents or snowmelt-induced flooding. Utility infrastructure, including power and communication systems, faces significant damage from wind and ice, potentially leaving communities without essential services like water and heat. Industries and agriculture suffer economic losses from disrupted transportation, structural collapses, and crop or livestock damage.

Winter storms can have significant impacts on various types of infrastructure, impacting daily functions and business across agriculture, commercial, industry, and residential uses. Our assessment of state and essential facilities from 2012 to 2022 reveal the distribution of winter storm events per facility highlighting specific counties that have experienced more occurrences of the adverse conditions. Figure 94 presents the winter storm event per state facility ratio by county. The analysis reveals that Adams, Blackford, Dearborn, Dekalb, Fayette, Fulton, Gibson, Jay, Ohio, Stark, Switzerland, Warrick, and Whitley all have experienced more winter storm events per state facility within the decade range than those in the western portion of the state with an estimated minimum of $3,800,000,000 of content damage to state-leased facilities. (Note, the colors are not a count of the event type over that time, but an illustration of the ratio).

The same analysis on essential facilities reveals a similar result to the state facilities with slightly higher event ratios in the western side of the state. Figure 95 shows this difference where there are fewer counties with more winter storm events per essential facilities overall. Fulton, Ohio, Stark, Switzerland, and Union are all above a 100% ratio with Union being the only county to now have a ratio above 100% different from the state facilities assessment.

These analyses reveal the correlation between counties that have few facilities but have experienced multiple winter storm events over the decade range which display a general vulnerability by county. The counties that are more susceptible to these events may either have experienced more events relative to the other counties or have a lower number of facilities accounting for a higher event ratio over this decade. The most at-risk counties: Adams, Blackford, Dearborn, Dekalb, Fayette, Fulton, Gibson, Jay, Ohio, Stark, Switzerland, Warrick, and Whitley threaten the state with $14,192,713 in damages.

There were 22 state projects and 1 parcel with recent, potential, or projected development projects threatened by a winter storm. Generally, winter storms do not cause significant damage to new development, but it may cause setbacks to the State, developers, and economy by possibly having to delay work.

Although history offers limited information for loss estimates, severe winter storms like the one in January 2014 have triggered federal disaster declarations and substantial public assistance expenditures. These storms, besides causing physical damage, can lead to exposure-related health risks, accidents, and fatalities. As technology dependence grows, public awareness, preparedness, and mitigation become critical to mitigate increasing losses. Initiatives such as burying electric and communication lines, public education on alternative heating systems, and safety measures during storms can significantly reduce risk and potential loss.

The Sperry-Piltz Ice Accumulation Index, also known as the SPIA Index, is a forward-looking predictive tool designed to forecast ice accumulation and its potential damage. Much like how the Enhanced Fujita Scale categorizes tornadoes, the SPIA Index classifies ice storms. Utilizing a sophisticated algorithm incorporating meticulously researched parameters and National Weather Service forecast data, the SPIA Index accurately anticipates the expected ice accumulation, projected affected area, and potential resulting damage caused by imminent ice storms. Figure 93 shows how SPIA categorizes an area's risk of ice damage and impact for any given 24-hour period of time.

The SPIA serves as a real-time reference based on prevailing weather conditions and patterns within a 24-hour period of time. Given this plan serves a five-year span, please visit the SPIA website (https://www.spia-index.com/index.php) on a given day to determine Putnam County's current SPIA category and risk.

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
4	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Figure 93. SPIA Index Categories (Source: https://www.spia-index.com/index.php)

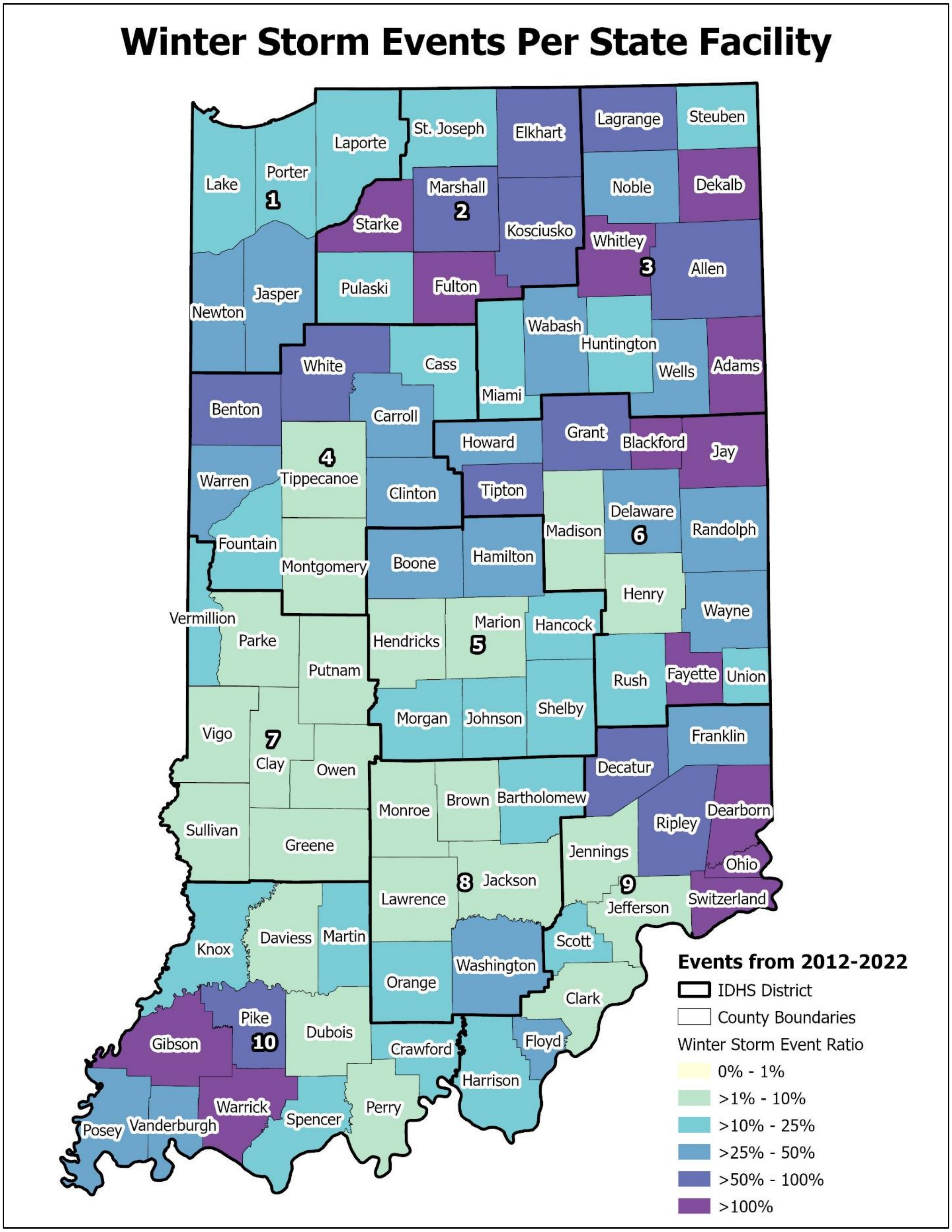


Figure 94. Winter Storm Event Ratio per State Facility by County

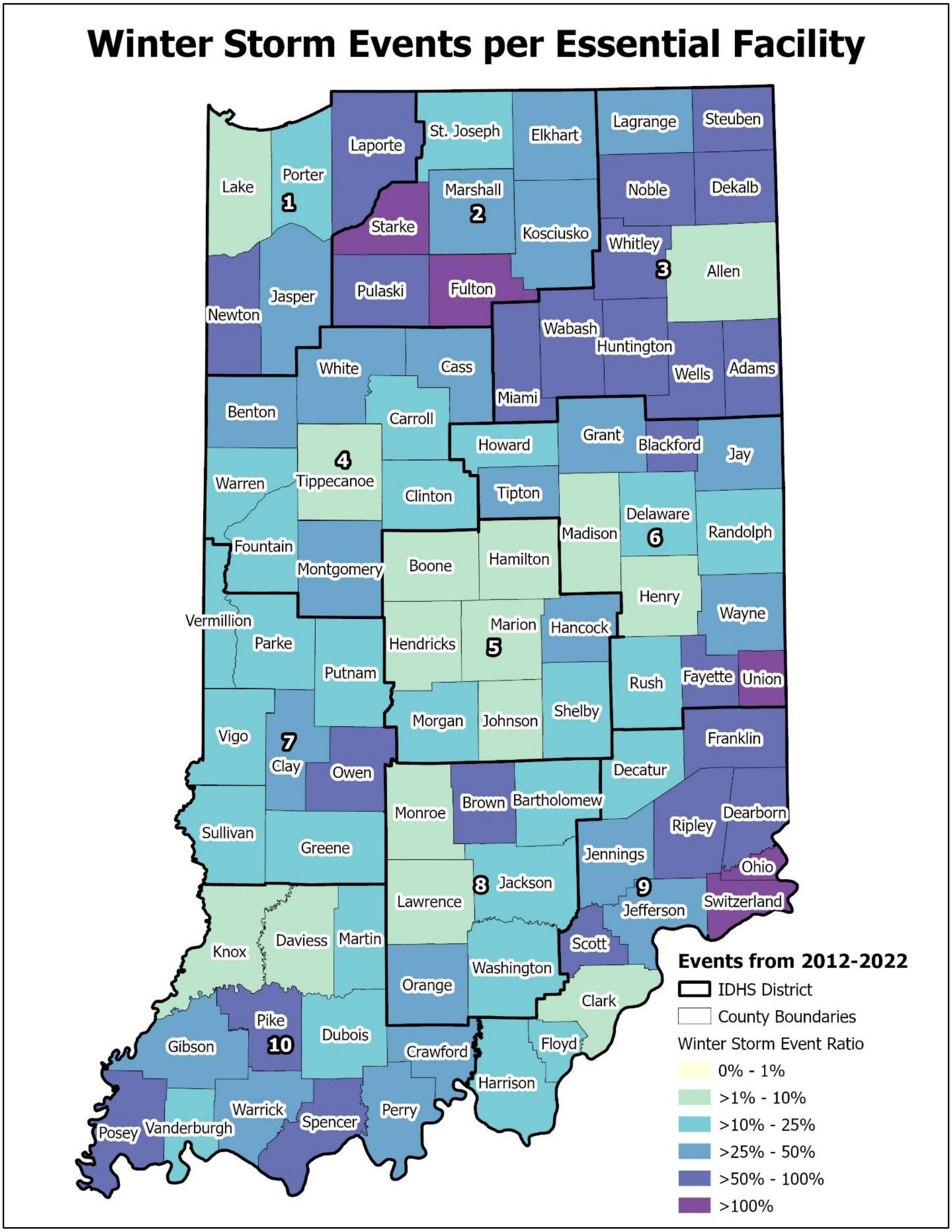


Figure 95. Winter Storm Event Ratio per Essential Facility by County

6.8.3 Probability of Future Occurrences & Possible Effects from Climate Change

The probability of future winter storms in Indiana remains high due to the unpredictability of this hazard. Consequently, all buildings and infrastructure across the state are at risk, which could lead to temporary or permanent loss of function. Current climate predictions indicate an increase in precipitation, particularly during the winter and spring seasons, with a shift from snow to rain in the colder months.

These changes in temperature and precipitation patterns significantly impact Indiana's winter weather, resulting in more variable snowfall and ice events. These weather phenomena can cause various issues, including travel difficulties, safety concerns for travelers, and potential hardships for vulnerable populations without access to heating facilities. Additionally, they may lead to power outages, frozen water pipes, and degradation of infrastructure.

6.9 Drought

Droughts are created by lower-than-normal rainfall; however, excessive heat can lead to increased evaporation, which can 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 Table 46.

Table 46. US Drought Monitor – Categories of Drought Severity

Category	Description	Possible Impacts	Palmer Drought Severity Index
D0	Abnormally Dry	-Going into drought: short-term dryness slowing planting, growth of crops or pastures. -Coming out of drought: some lingering water deficits	-1.0 to -1.9
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
D2	Severe Drought	-Crop or pasture losses likely -Water shortages common -Water restrictions imposed	-3.0 to -3.9
D3	Extreme Drought	-Major crop/pasture losses -Widespread water shortages or restrictions	-4.0 to -4.9
D4	Exceptional Drought	-Exceptional and widespread crop/pasture losses -Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less

6.9.1 Historical Occurrences

Since 2012, there have been 204 drought events in Indiana reported to the NCEI (see Figure 96). There were no reports of deaths, injuries, or crop damage in NCEI records. All but one of these drought events occurred from 2010 to 2012. The latest recorded drought was in November 2016, affecting the southern Indiana counties of Pike, Spencer, Vanderburgh, Warrick, Gibson, and Posey. Its drought category was at most a D1.

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.

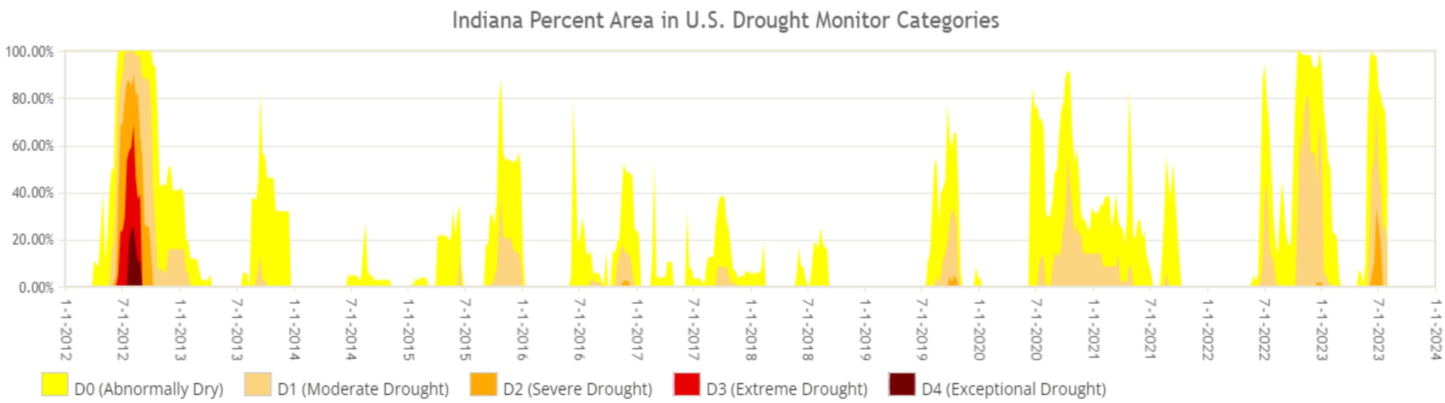


Figure 96. US Drought Monitor Indiana Time Series

6.9.2 Vulnerability & Risk 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.

Our assessment of drought events from 2012 to 2022 show the distribution of counties that have experienced these conditions. Figure 97 shows the drought events per state facility by county in five classes with an estimated minimum of $3,800,000,000 of content damage to state-leased facilities. This analysis reveals the central and southernly extent of counties affected by drought within the decade with a few counties having higher ratios. Figure 98 shows the same event ratio but for essential facilities where the ratio is slightly higher in a similar area. (Note, the colors are not a count of the event type over that time, but an illustration of the ratio). Counties with higher event ratios are most likely vulnerable to similar or worse events in the future given current climate trends. The most at-risk counties: Decatur, Gibson, Warrick, Warren, and Tipton threaten the state with $10,602,495 in damages.

There were no state projects and 1,200 parcels with recent, potential, or projected development projects threatened by drought in recent years, and it is assumed drought would do not cause significant damage to new development. It may cause setbacks to the State, developers, and economy by possibly having to delay work.

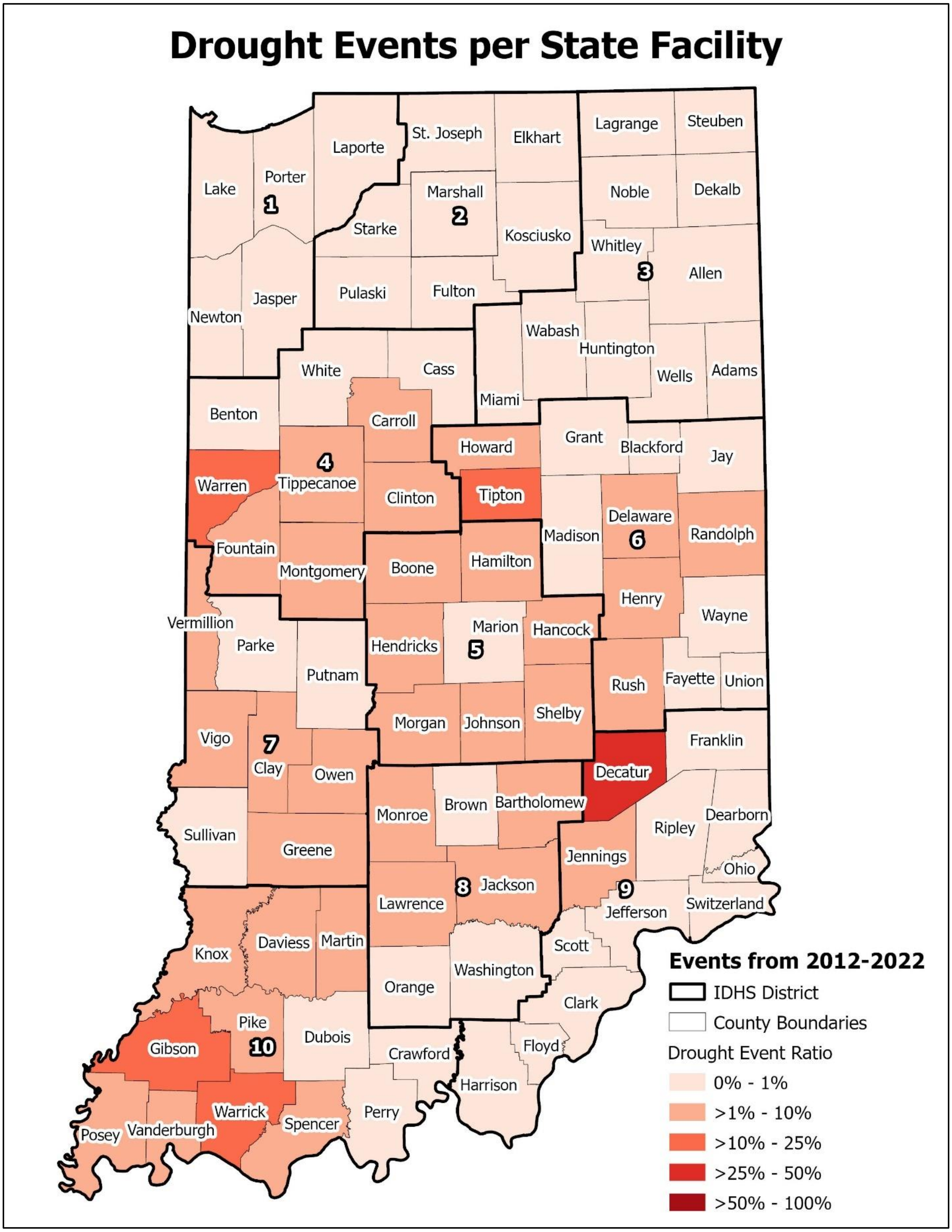


Figure 97. Drought Event Ratio per State Facility by County

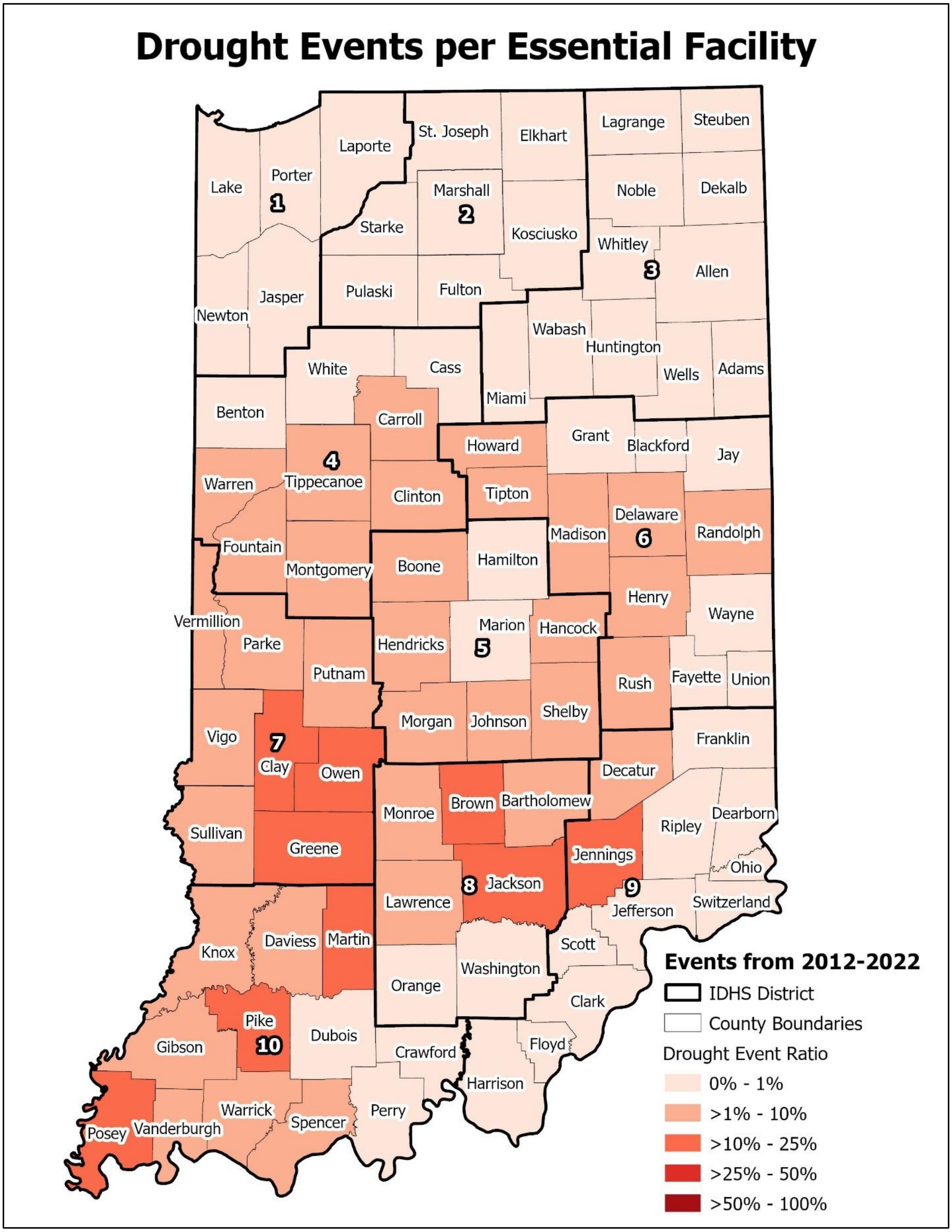


Figure 98. Drought Event Ratio per Essential Facility by County

6.9.3 Probability of Future Occurrences & Possible Effects from Climate Change

Although the state has not encountered significant droughts since the last plan update in 2019, the 2018 Indiana Climate Change Impacts Assessment (IN CCIA) foresees the potential for reduced soil moisture due to rising temperatures, decreased summer precipitation, and heightened water demand. This combination increases the likelihood of drought or drought-like conditions. In a separate study by Mishra et. al. (2010), which integrated long-term historical data (1916-2007) and future climate projections (2009-2099) for the Midwestern US, a land surface model indicated possible changes. The research anticipated an ascending trend in precipitation, minimum air temperature, and total column soil moisture, while noting a descending trend in maximum air temperature, frozen soil moisture, and snow water content. These shifts could potentially impact the scope and severity of droughts across Indiana. These results are likely given trends outlines in Section 2.2.

6.10 Hazardous Material 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.

The emergency personnel assigned to IDHS's Division of Fire and Building Safety serve as on-site technical advisors at large fires and hazardous materials incidents to the more than 900 fire departments within the state. They respond to a wide range of emergencies, often working side by side with other state agencies, such as the Indiana State Police, IDEM, and state and local health departments. When an incident becomes so involved or so large that local resources are taxed beyond their capabilities, the emergency responders often assist these jurisdictions by identifying and placing in action the appropriate state resource.

IDEM's Office of Land Quality's Emergency Response program responds to incidents involving spills to soil or waters of the state. Responders in IDEM's four regional offices work closely with local, federal, and other state responders to protect Indiana's environmental resources.

Environmental emergencies can be reported by calling IDEM's 24-hour Emergency Spill Line at 1.888.233.7745 or 1.317.233.7745. The Office of Land Quality's emergency responders are available any time to receive spill reports and provide response assistance.

Indiana Code requires any shipment of low-level radioactive waste, high-level radioactive waste, spent nuclear fuel, and/or Highway Route Control Quantity radioactive material be permitted before traveling in Indiana. An online application is available for low-level radioactive waste.

6.10.1 Vulnerability & Risk Assessment

Tier II facilities may store a wide range of hazardous chemicals, including but not limited to flammable substances, toxic materials, and substances that pose environmental hazards. Tier II hazmat facilities are subject to reporting requirements under the Emergency Planning and Community Right-to-Know Act (EPCRA) in the US. These facilities are required to submit annual reports to the State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC), and the local fire department. These reports provide information about the hazardous chemicals stored and used at the facility, which helps local emergency responders plan for and respond to chemical emergencies. Tier II facilities in Indiana are required to submit Tier II reports annually by March 1st. The SERC oversees the Tier II reporting program in Indiana. They work with LEPCs and local fire departments to ensure that accurate and up-to-date information is available to first responders. The information provided in Tier II reports is generally available to the public, allowing residents to be aware of the hazardous chemicals stored in their communities. Table 47 lists the number of Teri II facilities registered in Indiana by county.

The tier II form to fill out for IDHS and additional information regarding Tier II facilities and requirements can be found can be found here: https://www.in.gov/dhs/fire-and-building-safety/fire-investigations/hazmat-and-radiation/tier-ii-manager/.

Table 47. List of Tier II Facilities by County in Indiana

County	Number of Active Facilities	Number of EHS Chemicals	County	Number of Active Facilities	Number of EHS Chemicals
Adams	67	38	**Lagrange**	35	31
Allen	353	270	**Lake**	341	222
Bartholomew	114	83	**Madison**	94	59
Benton	19	8	**Marion**	769	556
Blackford	20	17	**Marshall**	88	47
Boone	112	60	**Martin**	14	11
Brown	9	1	**Miami**	36	25
Carroll	22	20	**Monroe**	83	42
Cass	58	40	**Montgomery**	68	47
Clark	129	70	**Morgan**	49	26
Clay	39	22	**Newton**	26	22
Clinton	51	48	**Noble**	83	60
Crawford	17	3	**Ohio**	3	2
Daviess	45	31	**Orange**	27	9

County	Number of Active Facilities	Number of EHS Chemicals	County	Number of Active Facilities	Number of EHS Chemicals
De Kalb	102	84	**Owen**	14	6
Dearborn	38	22	**Parke**	25	14
Decatur	41	44	**Perry**	17	19
Delaware	90	53	**Pike**	37	16
Dubois	72	56	**Porter**	157	115
Elkhart	297	187	**Posey**	128	75
Fayette	25	9	**Pulaski**	32	15
Floyd	49	34	**Putnam**	60	23
Fountain	32	19	**Randolph**	29	18
Franklin	28	15	**Ripley**	47	30
Fulton	27	13	**Rush**	31	16
Gibson	76	53	**Scott**	22	9
Grant	75	37	**Shelby**	81	57
Greene	42	18	**Spencer**	47	32
Hamilton	225	102	**St. Joseph**	242	151
Hancock	72	68	**Starke**	18	9
Harrison	29	15	**Steuben**	75	38
Hendricks	195	199	**Sullivan**	37	31
Henry	53	30	**Switzerland**	9	2
Howard	72	46	**Tippecanoe**	144	111
Huntington	75	39	**Tipton**	30	18
Jackson	71	64	**Union**	10	4
Jasper	56	34	**Vanderburgh**	183	116
Jay	28	19	**Vermillion**	24	22
Jefferson	44	34	**Vigo**	139	96
Jennings	27	12	**Wabash**	62	31
Johnson	124	86	**Warren**	21	9
Knox	63	60	**Warrick**	44	51
Kosciusko	112	66	**Washington**	26	10
La Porte	133	90	**Wayne**	96	63
Lagrange	35	31	**Wells**	40	27
Lake	341	222	**White**	49	38
Lawrence	36	16	**Whitley**	46	35

Figure 99 and Figure 100 provide a visual representation of the comparison between the number of state and essential facilities versus Tier II facilities within each county. Hamilton, DeKalb, Elkhart, Allen, and Adams have the greatest number of Tier II facilities per state facilities by county. Posey, Bartholomew, Elkhart, Vigo, and LaPorte have the greatest number of Tier II facilities per essential facilities by county.

Each county faces the potential risk of hazardous material releases at state and essential facilities, which could significantly impact state operations and emergency response efforts. Moreover, it is crucial to note the presence of common transportation routes, notably railroads, interstates, and major highways, throughout Indiana, carrying hazardous materials. Transportation-related spills pose a significant threat to communities and community lifelines. Further details regarding transportation incidents can be accessed in Section 7.6.

6.10.2 Probability of Future Occurrences & Possible Effects from Climate Change

Climate change has an indirect impact on hazardous material releases in Indiana. Increased frequency and intensity of extreme weather events, rising temperatures, and altered precipitation patterns, elevate the risk of hazardous material incidents. For example, extreme weather events like floods and severe storms damage industrial facilities, storage tanks, and transportation routes, leading to hazardous material releases.

Moreover, shifts in temperature and weather patterns affect the behavior and stability of certain hazardous substances, potentially making them more volatile or prone to chemical reactions that could result in accidental releases. Rising temperatures increase the pressure on aging infrastructure, making pipelines and storage tanks more susceptible to failures and leaks.

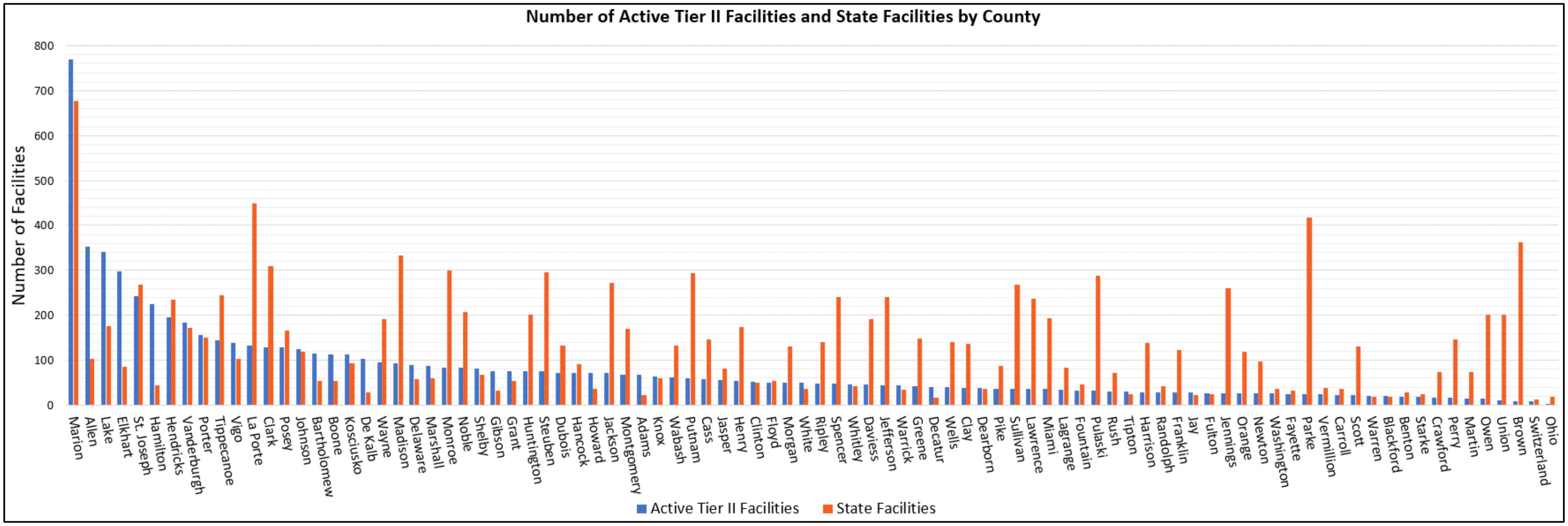


Figure 99. Number of Tier II to Number of State Facilities by County

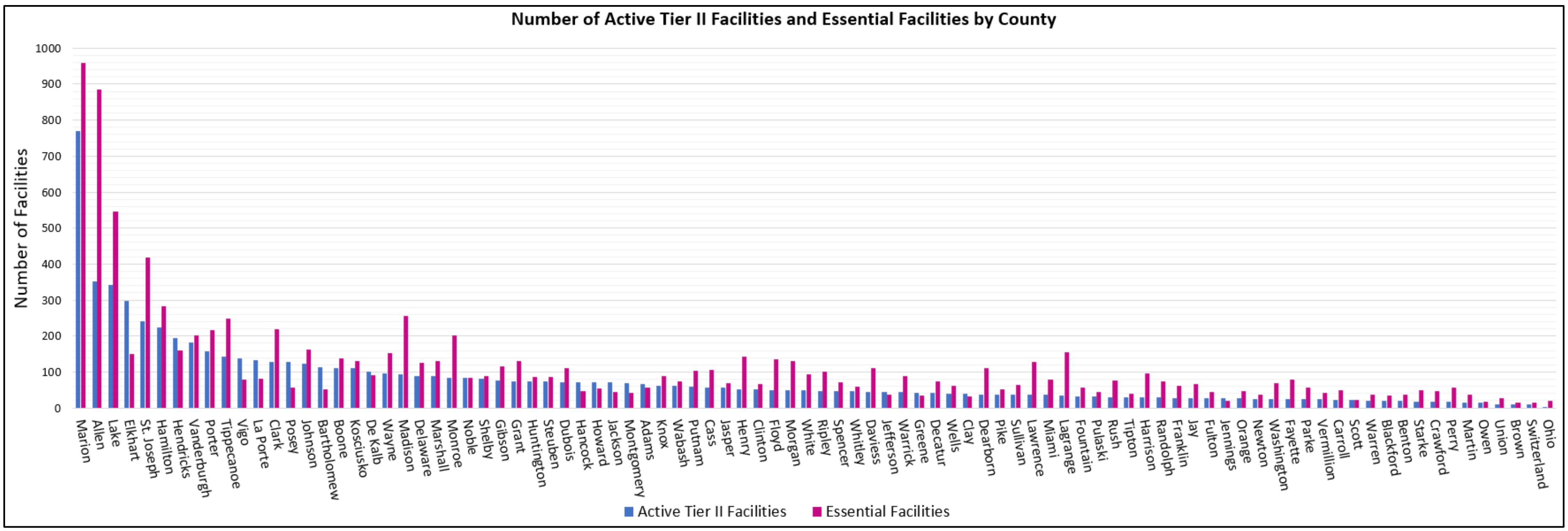


Figure 100. Number of Tier II to Number of Essential Facilities by County

6.11 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 help prevent fires from starting and can be burned proactively to help prevent uncontrolled burning.

6.11.1 Historical Occurrences

On October 26, 1952, at 1:15 PM, a fire was accidently started when a homeowner improperly disposed of hot ashes from his wood stove into a nearby field just east of the community of Bartlettsville, Indiana, in northeastern Lawrence County. The fire danger at the time was said to have been "past the extreme stage", with the humidity lower than had ever been previously recorded to date. The fire burned until November 3, when rainfall helped to control the fire. This fire alone burned approximately 4,000 acres. Adding in several other smaller fires in the area at this same time, an estimated 6,200 acres were burned during this time period.

On November 10, 1964, at 2:18 PM, a wildfire was spotted in the Hoosier National Forest in southwestern Lawrence County, IN. The fire was reported by Clarisse Carroll, who was stationed in a nearby fire lookout tower (Georgia Tower) at the time. During this period of time, Lawrence County was experiencing record drought conditions and had not seen rain in days. By 4:00 PM that afternoon, the fire was under control with the exception of a small parcel of private land that firefighters were told they could not gain access to. By the next morning, with winds gusting up to 35 mph, the fire was again out of control. After an additional four days of battling, the fire was considered controlled, with patrols taking place until there was adequate rainfall. An estimated 2,500 acres were burned, with the initial cause of the fire remaining unknown.

In the northwest part of the state, the Indiana Dunes National Park experiences, on average, 20 to 30 wildland fires in the park each year. Park fire management staff work closely with the 13 local fire departments in the event of a wildfire.

A map of the number of wildfires per county is shown in Figure 101 totaling 364 wildfires recorded in Indiana.

6.11.2 Probability of Future Occurrences & Possible Effect from Climate Change

The probability of future wildfires is directly related to the extreme heat and drought vulnerabilities. Per NCEI, notable heat events occurred in 2019, 2022, and 2023 since the last plan update. According to the United States Drought Monitor, Indiana experienced a severe drought in 2012 and 2016. Rising temperatures and frequent heatwaves promote hot and dry conditions creating arid conditions conducive to optimal fire weather, elevating the wildfire risk (Parks, 2016; Abatzoglou, 2016). Global studies reveal an increase in fire weather occurrence, averaging eight more days between 1979 and 2019 (Jolly, 2015).These indicate a low but increasing threat of wildfires in Indiana.

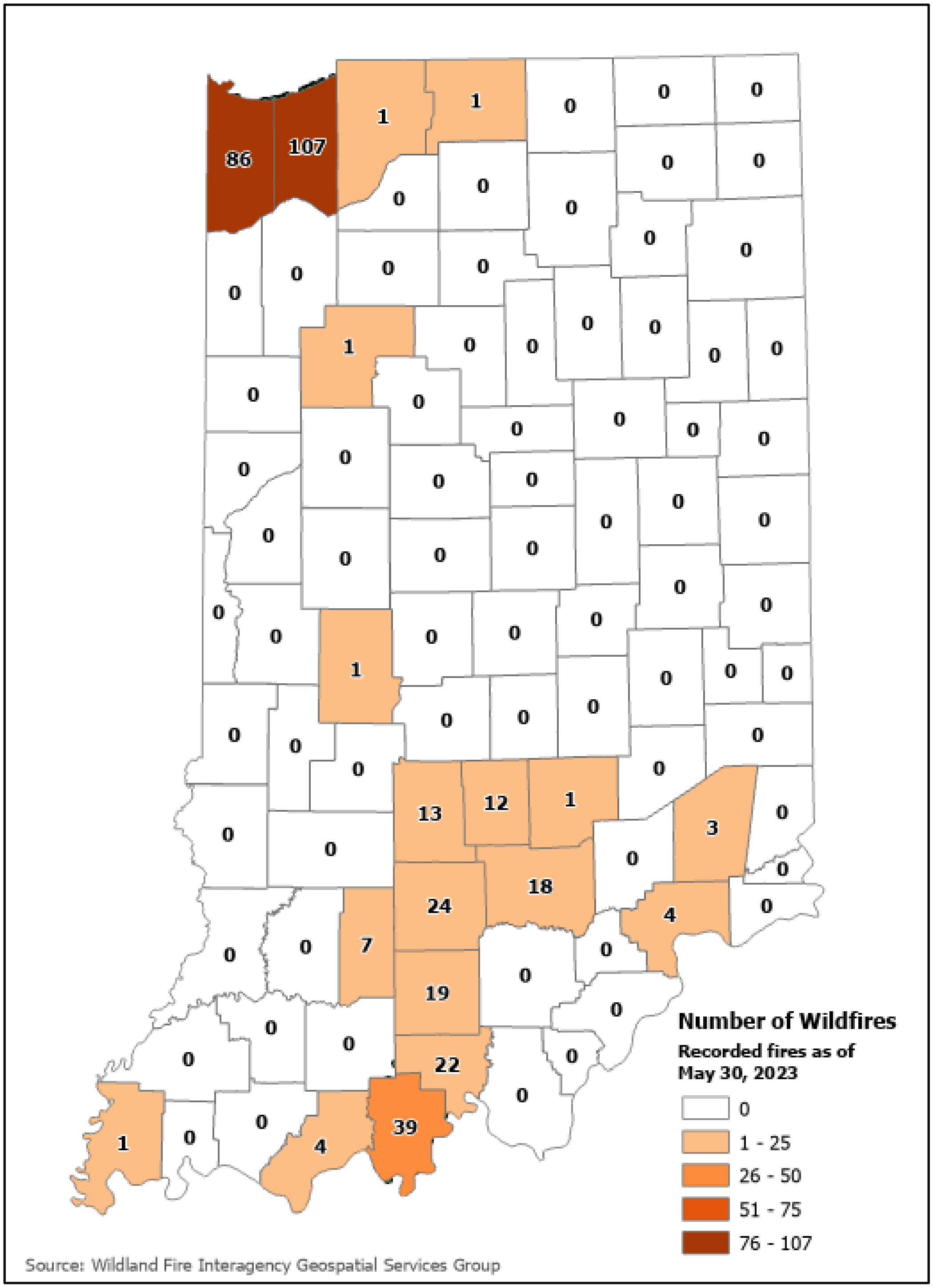


Figure 101. Number of recorded wildfires per county as of May 30, 2023

7 Other Hazards of Interest

The SHMP places greater emphasis on assessing and mitigating the risks associated with natural hazards due to several compelling reasons, traditionally because there exists a more comprehensive understanding of the recurrence patterns for most natural hazards. Although this is changing with effects of climate change. Conversely, other hazards outlined in the SHMP, both in terms of their frequency and potential severity, exhibit a significantly lower degree of predictability but significant impact. This section delineates hazards that possess a direct yet immeasurable impact on natural hazards, as well as those that exert an indirect influence. The topics covered in this section encompass diseases, environmentally detrimental organisms, communication failures, structural fires, failures in public utilities, incidents involving transportation, cyberattacks, situations involving active assailants, acts of arson, CBRNE attacks, hostage scenarios, and civil unrest.

7.1 Diseases

With the FEMA COVID-19 disaster declaration for Indiana (DR-4515), the need to understand untraditional natural disasters arose with the realization that these hazards affect emergency management training, response, and supplies capabilities.

The Centers for Disease Control and Prevention (CDC) characterizes a disease outbreak as a sharp increase in the incidence of a disease in the population. When the expected or routine incidence of a disease rapidly grows into a public health threat, medical care professionals, public health officials, and emergency management personnel, must act swiftly to limit morbidity and mortality. The CDC requires state and local health departments to report 75 different types of infectious diseases along with foodborne and waterborne disease outbreaks. 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.

7.1.1 Historical Occurrences and Probability of Future Occurrences

Since the 2019 Standard Multi-Hazard Mitigation Plan, several major disease outbreaks have occurred, most notably the COVID-19 pandemic that began in 2020. Other outbreaks have included the Mpox outbreak that began in the summer of 2022 in addition to other recurring outbreaks such as West Nile virus.

The Disease Reporting and Control Rule requires health care providers, hospitals, and laboratories to report communicable diseases and conditions.

The Indiana State Department of Health Epidemiology Resource Center publishes an annual report of infectious diseases documented in the state and their incidence. Recent reports can be found at https://www.in.gov/isdh/20667.htm.

The 2018 Indiana Climate Change Impacts Assessment (INC CCIA) predicts a rise in temperature and fewer extremely cold temperature days. As a result, more pests may survive winter, leading to a potential increase in cases of the West Nile virus, the Zika virus, and Lyme disease. According to the report “Traps in Marion County already show a 500% increase in the number of mosquitoes from 1981 to 2016” (Widhalm, 2018).

Continued reduction of wildlife habitats may also lead to additional interactions between humans and animals, which could cause zoonotic diseases to spread, such as the H1N1 flu (World Health Organization, 2023).

Additionally, the World Health Organization has designated antimicrobial resistance (AMR) as a major global public health threat (World Health Organization, 2021). AMR develops as pathogens become adaptive to antimicrobial medicines over time and the effectiveness of the drug decreases. Overuse and misuse of antimicrobial and a lack of access to clean water and sanitation is leading to greater resistance.

7.1.2 Diseases in Indiana

Outlined below are disease categories provided by IDOH.

7.1.2.1 Airborne Diseases

Airborne diseases are spread when droplets of a pathogen are expelled into the air due to coughing, sneezing, or talking. Many airborne diseases require prolonged exposure for the threat of infection to occur.

Examples of airborne diseases include meningitis, varicella-zoster virus (VZV), tuberculosis (TB), and influenza.

Influenza, or flu, is a communicable respiratory illness that is often circulated in communities throughout the fall and winter months. In 2021, Indiana had an influenza/pneumonia mortality rate of 9.2 per 100,000 people (Centers for Disease Control and Prevention, 2022). Prevention of influenza can be accomplished through vaccination, preventative actions (such as washing hands), or taking antiviral drugs if ill (Centers for Disease Control and Prevention, 2022). Influenza season over the past several years has also coincided with developments such as the onset of COVID-19 in 2020 and an earlier surge of RSV cases. The plot in Figure 102 below illustrates the number of deaths for the last five flu seasons.

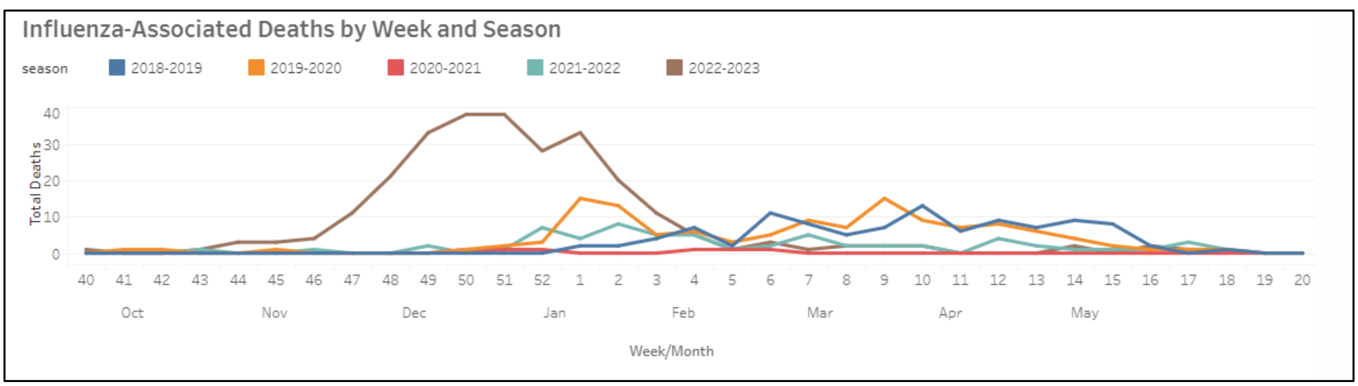


Figure 102. Influenza trends since 2018 for Indiana
Source: https://www.in.gov/health/erc/infectious-disease-epidemiology/diseases-and-conditions-resource-page/influenza/influenza-dashboard/

Respiratory syncytial virus (RSV) poses a particular threat to infants and older adults. RSV can lead to other conditions including bronchiolitis and pneumonia. Typically, RSV cases peak in the winter months, but have begun spiking earlier in the year (NBC News, 2022). On November 7, 2022, the Indiana Hospital Association noted that 70% of pediatric beds in the five largest hospitals in Central Indiana were occupied by RSV cases (Indiana Hospital Association, 2022). Figure 103 below illustrates the seasonal peaks of RSV over the past two years. Riley Hospital for Children reported 97 patients treated for RSV in September 2022 which was an increase from September 2021 where only 51 patients were treated. A similar trend followed for October with 134 patients being treated in 2022 as opposed to only 33 in October 2021 (WTHR, 2022).

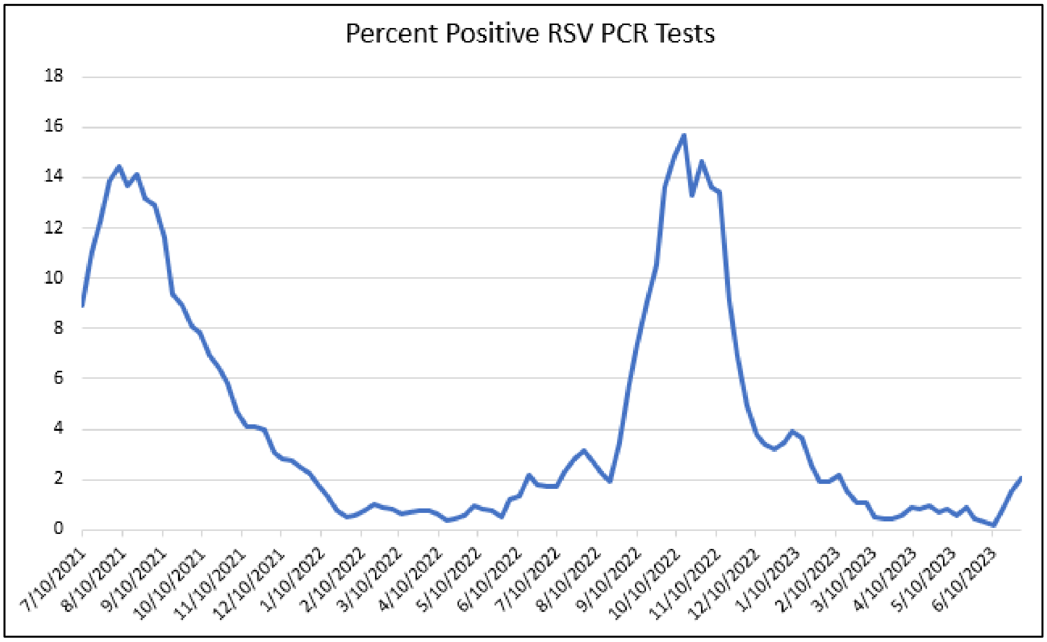


Figure 103. Positive RSV cases between July 2021 and June 2023

7.1.2.2 Vector-borne Diseases

Vector-borne diseases are infections transmitted by the bite of infected arthropod species, such as mosquitoes, ticks, triatomine bugs, sandflies, and blackflies. Arthropod vectors are cold-blooded (ectothermic) and thus especially sensitive to climatic factors.

Lyme disease is a vector borne disease that is transmitted to humans through the bite of a blacklegged tick (Indiana Department of Health, 2023). Prevalence of Lyme disease is higher during warmer months in the spring and summer, when nymphs (immature ticks that most commonly transmit Lyme disease to humans) are most active, but it is still possible to be infected during cooler months (Indiana Department of Health, 2023). In Indiana, Lyme disease is more common in the northwest corner of the state (see Figure 8).

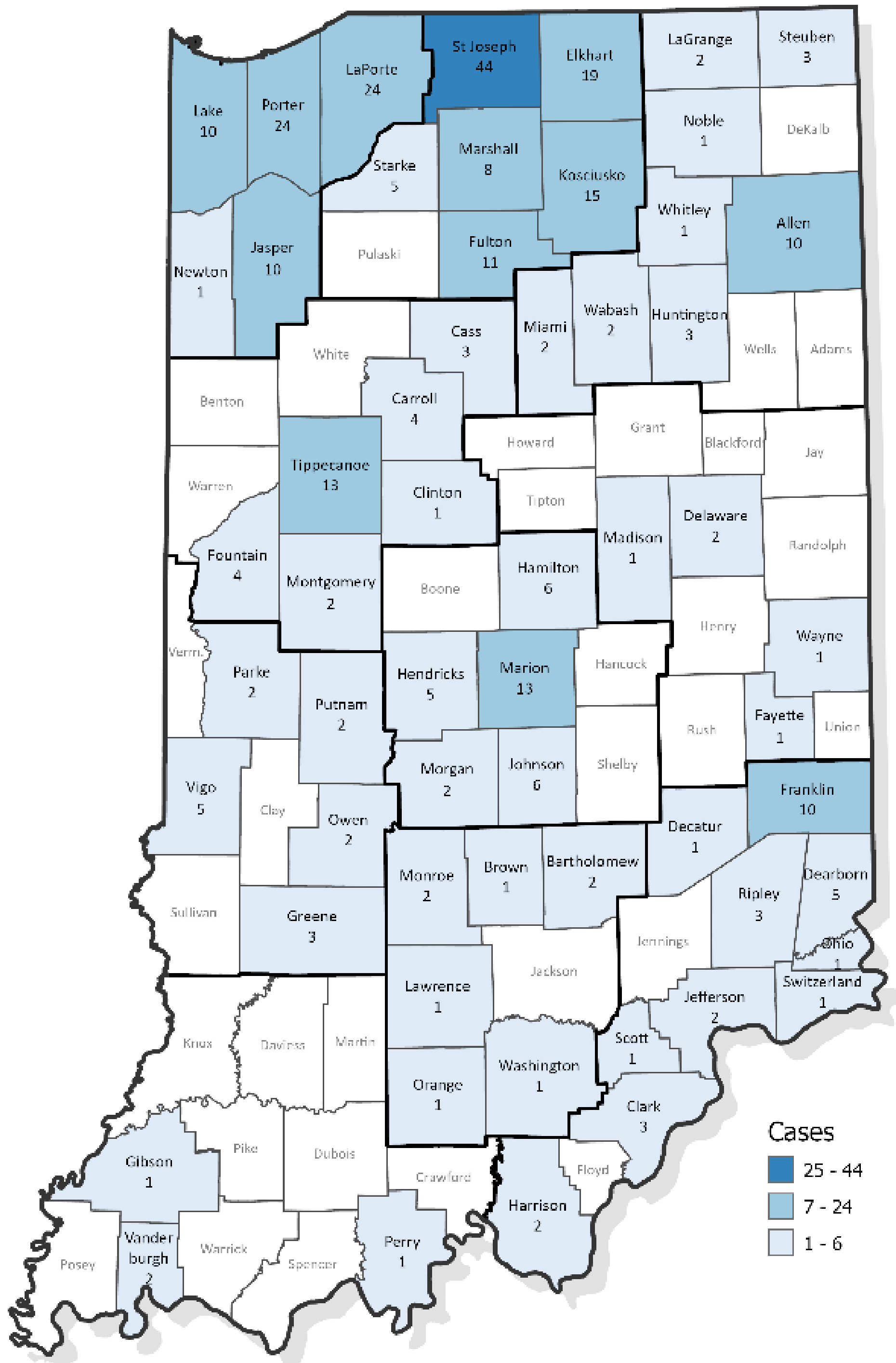


Figure 104. Indiana cases of Lyme disease by county in 2021 (*Source: https://www.in.gov/health/erc/zoonotic-and-vectorborne-epidemiology-entomology/maps-and-statistics/lyme-disease-data-and-statistics/)*

Mosquitos are often transmitters for diseases such as West Nile and Zika viruses. Although the Zika virus has not yet been found in Indiana mosquitoes, Indiana residents have contracted the disease when traveling outside of the United States (Indiana Geological and Water Survey, 2023).

West Nile virus is also a mosquito transmitted vector-borne disease. Mosquitoes feed on birds that have been infected and then spread the virus to humans and other mammals (Indiana Department of Health, 2023). The transmission from birds to mosquitoes to humans and other mammals also applies to eastern equine encephalitis (EEE). In 2021, 14 cases of West Nile virus were reported in Indiana, and two deaths were associated with the disease (Indiana Department of Health, 2023). Figure 105 below displays West Nile virus infections by county in 2022.

Other vector-borne diseases include malaria and dengue virus.

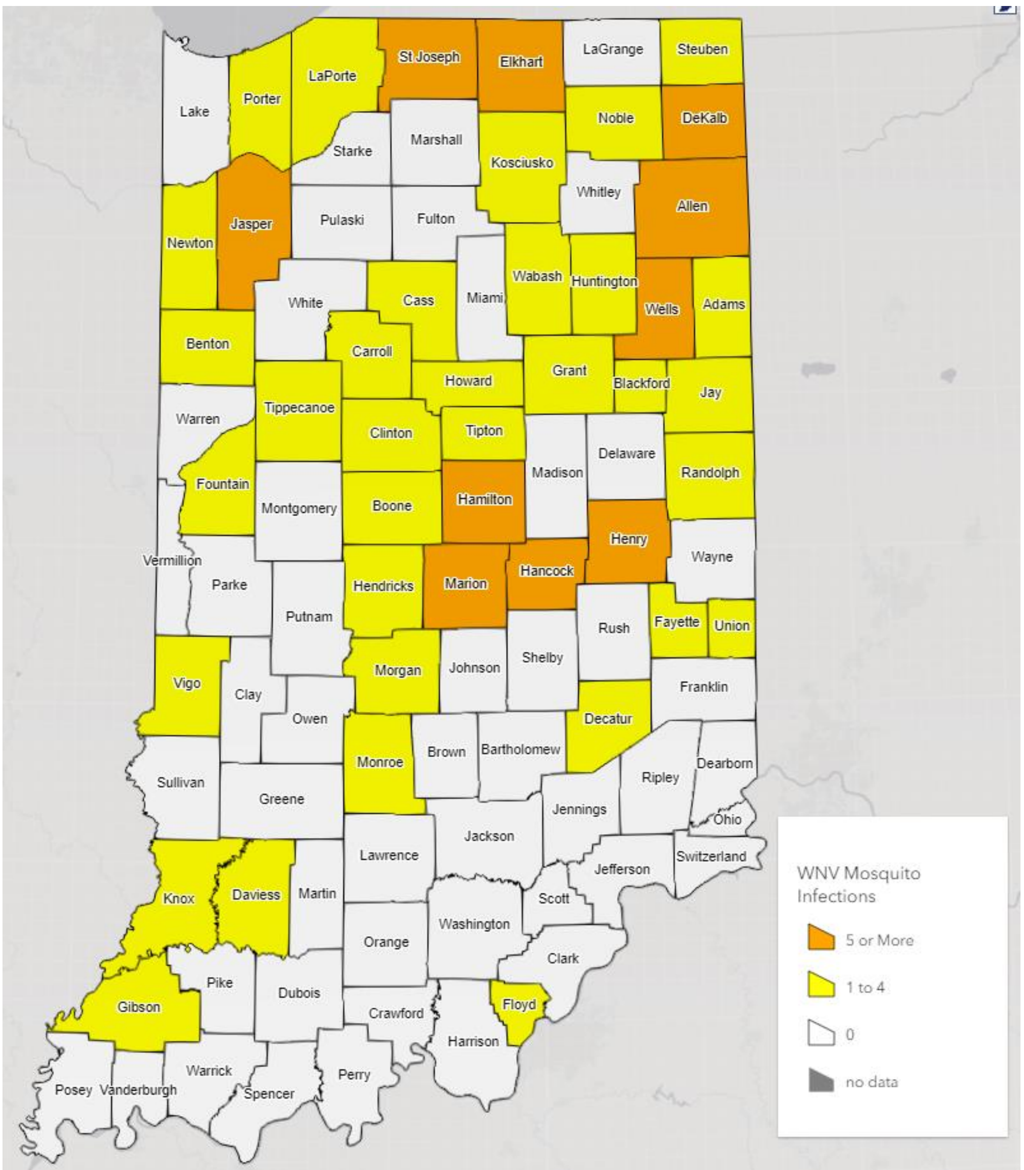


Figure 105. 2022 WNV Mosquito Infections. (Source: https://gis.in.gov/apps/ISDH/Arbo/)

7.1.2.3 Foodborne Diseases

Foodborne illness is an infection or irritation of the gastrointestinal (GI) tract caused by contaminated food or beverages that contain harmful bacteria, parasites, viruses, or chemicals.

Norovirus, salmonella, clostridium perfringens, and campylobacter are all common examples of foodborne disease.

7.1.2.4 Waterborne Diseases

Waterborne diseases are conditions caused by pathogenic micro-organisms that are transmitted in water. Disease can be spread while bathing, washing or drinking water, or by eating food exposed to infected water.

In 2019, Indiana had 322 cases of cryptosporidium, a gastrointestinal illness that spreads through feces of infected humans and animals (Centers for Disease Control and Prevention, 2021). The spread of cryptosporidium has been linked to pools and water playgrounds since the bacteria with its protective shell can live in chlorine pools for up to 10 days (IndyStar, 2019).

Common examples of waterborne diseases include giardia, dysentery, and typhoid fever.

7.1.2.5 Fomite Diseases

Fomite exposure requires an inanimate object to carry a pathogen from one susceptible animal to another. Fomite exposure often involves a secondary route of exposure such as oral or direct contact for the pathogen to enter the host.

Enterovirus (Hand, Foot, and Mouth disease), staphylococcus aureus (staph infection), rotavirus, and norovirus are all common examples of fomite diseases.

7.1.2.6 Biologic Diseases

Biologic diseases are often caused by pathogenic microorganisms, which exist in blood and other bodily fluids, such as semen, urine, saliva, breast milk, and vaginal secretions. These pathogens are microorganisms such as viruses or bacteria that are carried in blood and other fluids and can cause disease in people.

Since the beginning of the 2022 Mpox outbreak, the United States has seen 30,505 cases with 43 total deaths. Indiana has seen 288 cases of Mpox since the beginning of the outbreak (Centers for Disease Control and Prevention, 2023).

Other biologic diseases include hepatitis B, HIV/AIDS, cytomegalovirus (CMV), and syphilis.

7.1.2.7 Emerging Infectious Diseases

Emerging infectious diseases are infections that have recently appeared within a population or those whose incidence or geographic range is rapidly increasing or threatens to increase in the near future.

The outbreak of the SARS-CoV-2 virus “COVID-19” on March 11, 2020, marks the official date that the WHO declared the virus a pandemic. Since the initial discovery of the virus on December 12, 2019, in the city of Wuhan in China’s Hubei Province, there have been 766,440,796 confirmed cases, and 6,932,591 deaths as of March 20, 2023 (World Health Organization, 2023).

In Indiana, there have been a total of 2,077,285 cases and 25,231 deaths related to COVID-19 (Indiana Department of Insurance, 2023). This global pandemic changed the view of viruses on populations and has been at the forefront of medical research over the last few years. The WHO and the Centers for Disease Control and Prevention (CDC) not only aim to prevent the spread of viruses like COVID-19 and others like the influenza virus, but also to educate communities on the effects of these illnesses.

Of particular concern with a novel respiratory virus like COVID-19 is the threat to those in settings such as long-term care facilities, such as nursing homes, where patients are more likely to have severe cases. Figure 106 illustrates that older individuals were more likely to be hospitalized than younger individuals (Regenstrief Institute, 2023).

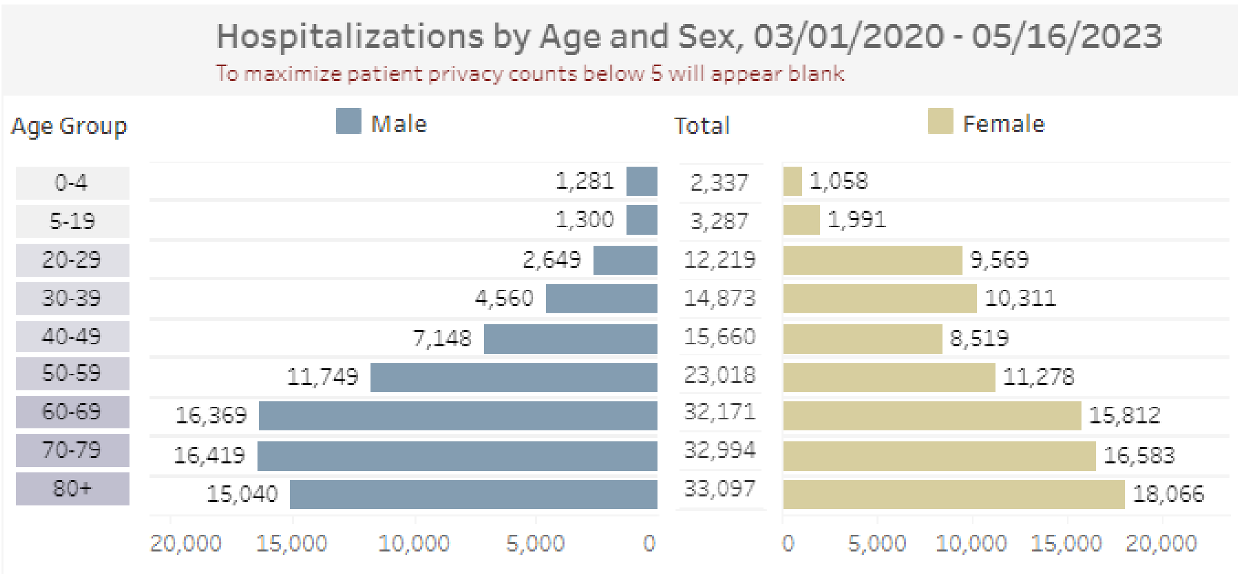


Figure 106. COVID-19 hospitalizes by age and gender for Indiana COVID-19 Hospitalizes by age and gender for Indiana (Source: https://www.regenstrief.org/covid-dashboard/)

In addition to COVID-19 and Zika, other emerging infectious diseases include Middle East Respiratory Syndrome (MERS) and Chikungunya virus.

7.1.2.8 Healthcare-associated Infections Diseases

Healthcare-associated infections (HAI) are infections that patients get while receiving treatment for medical or surgical conditions.

Examples of HAIs include catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs) and surgical site infections (SSIs).

7.1.3 Mitigation Activities

In order to prevent and protect populations from disease, mitigation activities can be taken to monitor and act to reduce health impacts. Identification is a key action to understanding the scope and status of a disease. This can occur by using laboratory tests and diagnostics, clinical evaluations, and using disease surveillance and reporting programs. Contact tracing and monitoring for close contacts of disease can also be utilized to prevent further spread of infectious disease.

Other interventions that individuals can do to prevent spread of disease can involve handwashing, vaccinations, isolating and quarantining when sick, utilizing masks, and in some cases closing schools. Much of this work can also be accomplished through public outreach and education programs from health agencies and partners.

To prevent spread of disease in healthcare settings, additional actions can be taken such as utilizing personal protective equipment (PPE) like masks, gloves, and eye protection. Ensuring that clinics and hospitals have adequate staff, resource demands, and alternate care sites can also assist with managing care for populations.

For vector-borne diseases the best mitigation is to eliminate breeding and feeding locations near homes. This can be accomplished by emptying containers of standing water, blocking or screening entrances into homes, and cutting high brush close to the home. Community mosquito control programs can also mitigate risk through elimination of mosquito habitats and applying insecticides to mosquito-prone areas.

7.1.4 Vulnerable Populations

Diseases and associated impacts are not uniformly distributed across populations. Certain groups may be more susceptible to diseases. These groups include aging populations, children, pregnant women, people who do not have access to transportation, people who may experience language barriers, people with disabilities, minority populations, migrant workers, people in correctional facilities, people with pre-existing chronic medical conditions, and people who are dependent on electric-powered medical devices. In order to best serve these vulnerable populations during a disease outbreak, messaging regarding prevention can be tailored to be culturally responsive to different populations. This can include disseminating information in other languages or providing pop-up clinics in local communities.

7.2 Environmentally Harmful Organisms

Environmentally harmful organisms, often referred to as invasive species, are organisms that are not native to a particular ecosystem and can cause significant negative impacts on the environment, economy, and human health. These organisms can outcompete native species, disrupt ecosystems, and damage natural resources. The spread of environmentally harmful organisms is occasionally overlooked, potential natural hazards that can be exacerbated following other natural disasters. Invasive alien species and climate change, with land use change and changes in the nitrogen and carbon cycles, are identified as the top four drivers of global biodiversity loss.

7.2.1 Historical Occurrences

Numerous well-known invasive species exist in Indiana, including feral swine, Asian Carp, Zebra Mussels, and Common Carp. Keeping track of occurrences for all 92 counties is a challenge. This section focuses on the impactful Emerald Ash Borer (EAB), which significantly affected recreational and agricultural areas, gaining notoriety.

Between 2017 and January 2021, Indiana was under the Federal quarantine boundary for the EAB. The EAB is The Emerald Ash Borer (Agrilus planipennis) is a highly destructive invasive insect species native to Asia that has had a significant impact on ash trees in North America. The adult beetles are metallic green in color and about half an inch long. The EAB’s larvae stage feed on the inner bark of the ash trees, disrupting a tree’s ability to transport nutrients and water.

The EAB is responsible for killing millions of ash trees in North America. The loss of ash trees has disrupted ecosystems where they were once a significant component. Ash trees provide habitat and food sources for various wildlife, and their decline can affect the balance of local ecosystems. As Ash trees are commonly found in urban and suburban areas, their decline and removal have incurred costs for municipalities, homeowners, and businesses. Removal, replacement, and treatment of affected trees can be expensive. To combat the spread of the Emerald Ash Borer and mitigate its impact, various measures have been taken in Indiana and other affected areas. These measures include:

- Tree Removal: Infested trees are often removed to prevent the spread of the beetle to healthy trees nearby.
- Insecticide Treatment: Insecticides can be used to protect high-value ash trees, although this can be costly and requires ongoing maintenance.
- Public Awareness and Quarantine: Educating the public about the importance of not moving firewood and implementing quarantines on the movement of ash wood and products can help slow the beetle's spread.

Figure 107 displays identified locations of EAB throughout Indiana. Allen, Huntington, and Jay Counties have had the greatest number of detections with 162, 74, and 69 finds, respectively.

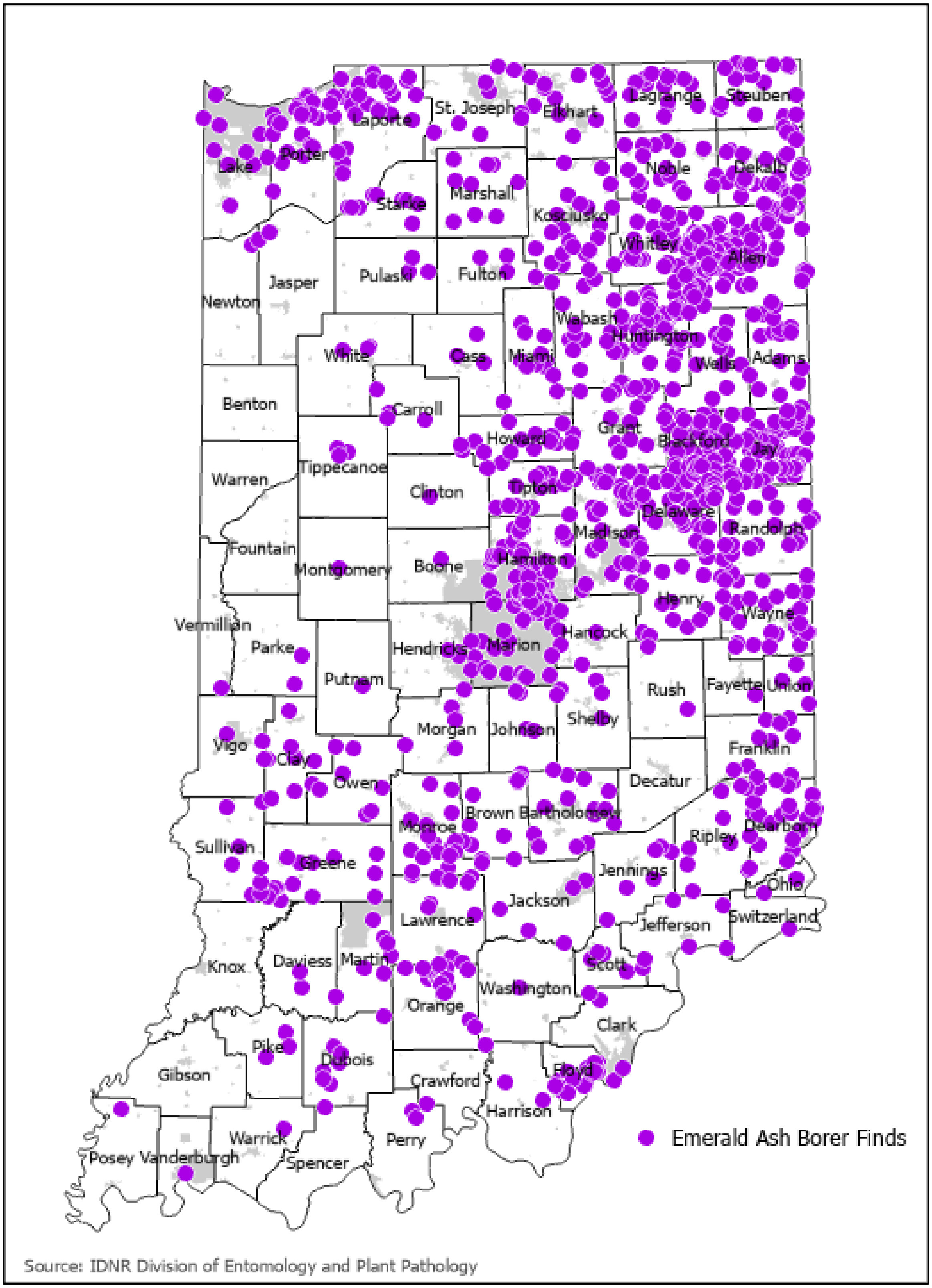


Figure 107. Emerald Ash Borer finds in Indiana

7.2.2 Probability of Future Occurrences

Predicting future occurrences of EAB in Indiana is challenging due to the dynamic nature of invasive species' spread and the influence of various factors. Based on historical trends and management efforts of EAB, general insights into how the EAB's presence could evolve in Indiana can be made.

The EAB could continue to spread. The EAB has already spread to a large portion of Indiana and many other states. While the rate of spread may slow as the beetle reaches its maximum potential distribution, it's possible that new infestations could still be detected in previously unaffected areas.

Over time, the EAB is likely to continue causing declines in ash tree populations in Indiana. The extent of this impact will depend on factors such as the success of management strategies, the resistance of certain ash tree varieties, and the ability of new trees to grow and replace those lost.

Continued public awareness campaigns about not moving firewood and the importance of reporting EAB sightings will play a role in managing the beetle's spread.

Ongoing research into EAB biology, management techniques, and the development of resistant ash tree varieties could influence the beetle's future impact. If new and effective management strategies or resistant trees are developed, they could alter the trajectory of EAB infestations.

It's worth noting that the situation can evolve rapidly, and responses to invasive species can adapt accordingly.

7.3 Cyberattack and Information Technology Failure

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.

Cyberattacks

Cyberattacks are malicious attempts to access or damage computer information systems (US Department of Homeland Secuirty, 2022). Unlike physical attacks which can be immediately responded to, cyberattacks are often difficult to identify and address. Cyberattacks can be in the form of viruses or the introduction of malware 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. Cyberattacks 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, healthcare, 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.
- Unauthorized access to individually owned devices such as computers, tablets, mobile phones, and gaming systems that connect to the Internet. Personal information may be at risk without proper security.

In February 2021, the global-issues, news-outlet Gallup had a poll listing cyberterrorism as the number one critical threat to the US (Gallup, 2021). In 2014, the FBI expanded its "Most Wanted" list with a "Cyber Most Wanted" list. As of February 2023, it included 118 individuals or groups. By December 9, 2022, finance and insurance companies worldwide had experienced 566 data breaches amounting to 254 million leaked documents (Flashpoint, 2022). Identity theft affected about 120 million Americans in the first half of 2021 through cyberattacks (Identify Theft Resource Center, 2021).

The Indiana Information Sharing and Analysis Center (IN-ISAC) offers high-level consulting at no cost to organizations. This consulting is intended to help those with limited or no cybersecurity knowledge or skills in-house, get their questions answered and their security programs started. See https://www.in.gov/cybersecurity/in-isac/3649.htm.

While ransomware has been publicized in the news in recent years, a growing number of attacks were remote code execution attacks associated with cryptomining. In 2022, a resulting $3 billion was lost through cryptocurrency-related attacks (Flashpoint, 2022). Additionally, new threats are arising from the use of artificial intelligence technology. The North Atlantic Treaty Organization (NATO) has referred to artificial intelligence as a "double-edged sword" that can both fend off cyberattacks but also be used to attack and hack into networks (Davies, 2022).

The past few years have seen several high-visibility attacks in Indiana. These include attacks on Community Health Network (HeatlhITSecurity, 2022), Johnson Memorial Health (IndyStar, 2021), Goodman Campbell Brain and Spine of Carmel, IN (Becker's Health IT, 2022), the Vigo County Sheriff's Office and 911 Systems (Government Technology, 2019), and Eskenazi Health (IndyStar, 2021). As of July 1, 2021, all political subdivisions and state agencies must report cyberattacks to IOT under HEA 1169 (IndyStar, 2021).

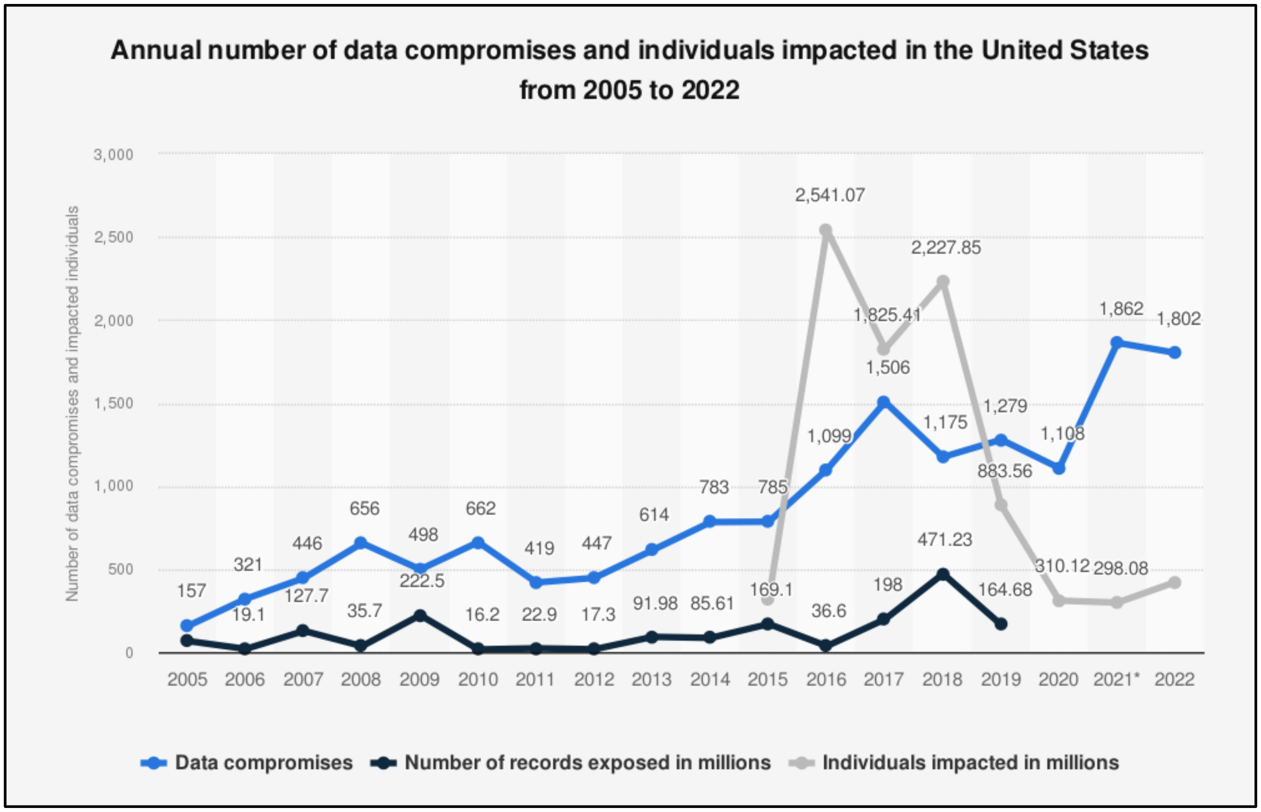


Figure 108. Data Compromises, Number of Records Exposed in Millions, and Individuals impacted in millions by cyber threats from 2005-2022 published by the Identity Theft Resource Center (Source: [https://www.statista.com/statistics/273550/data-breaches-recorded-in-the-united-states-by-number-of-breaches-and-records-exposed/)](https://www.statista.com/statistics/273550/data-breaches-recorded-in-the-united-states-by-number-of-breaches-and-records-exposed/)

In 2021 alone, according to the Federal Bureau of Investigation (FBI) more than 11,000 Indiana residents were victims of cyberattacks totaling more than $60 million in losses (FBI, 2022). The Indiana Cybersecurity Strategic Plan of 2021 states that the 2021 Verizon Data Breach report listed 61 percent of cyberattacks involved the use of unauthorized credentials, and phishing rose to 36 percent from 25 percent the previous year (Indiana Executive Council on Cybersecurity, 2021).

7.4 Public Utility Failure

Public utility failure refers to short- or long-term disruptions to services such as electricity, natural gas, water, and telecommunications. Public utility failures have a significant impact on people's lives, affecting their daily routines, safety, health, and overall well-being. The consequences of utility failures can vary depending on the type of utility service affected (electricity, water, gas, etc.) and the duration and extent of the failure.

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. As shown in Figure 109, weather is a main contributor of reported electrical outages.

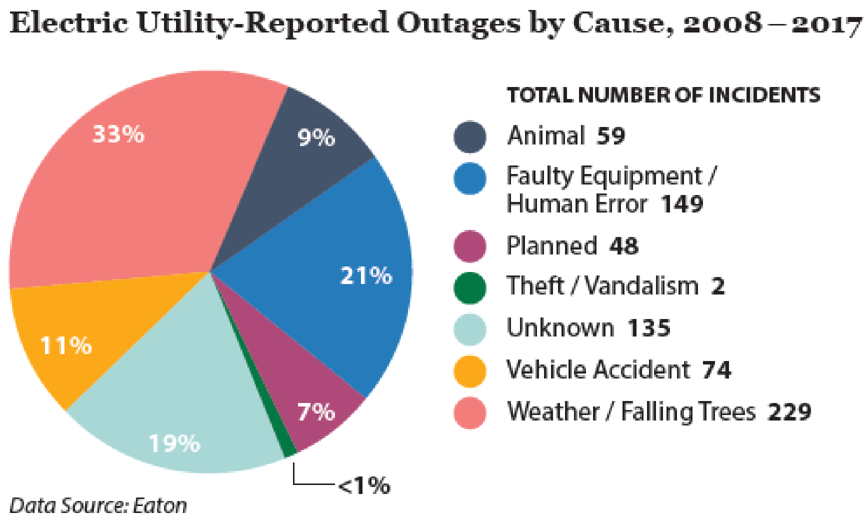


*Figure 109. Causes of Electric Utility Outages from 2008-2017 (*Source: State of Indiana Energy Sector Risk Profile, 2019)

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.

Natural 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. 64% of Indiana's natural gas transmission system and 19% of the distribution system were constructed prior to 1970 or in an unknown year.

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.

Cybersecurity is continuing to have effects on systems outside the IT-realm. In May 2021, a ransomware attack hit the Colonial Pipeline Company, downing the pipeline for six days. The Colonial Pipeline operates the largest fuel pipeline system in the United States. It stretches over 5,500 miles carrying gasoline, diesel, jet fuel, and other refined petroleum products from the Gulf Coast of Texas to the East Coast of the US. The attack encrypted the company's computer systems and disrupted its operations, forcing Colonial Pipeline Company to shut down the pipeline. This led to a disruption in fuel supplies along the East Coast, causing panic buying and shortages of gasoline and other fuel products in several states. The Colonial Pipeline attack was part of a growing trend of ransomware attacks on industries globally. This showed that critical infrastructure needs better cybersecurity, and Indiana is no exception.

Man-made impacts on public utilities refer to negative effects and disruptions caused by human actions, decisions, or events that influence the functioning, reliability, safety, and sustainability of essential utility services provided to the public. These impacts are distinct from natural factors and can arise from various intentional or unintentional actions, often leading to consequences that affect infrastructure, operations, and the communities relying on these services. Man-made effects on public utilities can arise from a variety of factors, including accidents, policy changes, technological failures, and intentional or accidental events. These effects can have significant impacts on the functioning, reliability, and safety of public utility services and are increasingly a concern for State and local officials. Efforts to mitigate these man-made effects on public utilities often involve proactive planning, risk assessment, infrastructure investment, cybersecurity measures, regulatory oversight, emergency response planning, and public education. Collaborative efforts among utility companies, government agencies, and communities are essential to ensure the resilience and sustainability of public utility services in the face of these challenges.

The Indiana Utility Regulatory Commission (IURC) is a state agency responsible for regulating public utility services within the state. It was established to ensure that utility services are provided in a safe, reliable, and affordable manner to the residents and businesses of Indiana. The primary functions and responsibilities of the IURC include:

- regulate rates,
- service quality and reliability,
- consumer protection,
- ensure environmental compliance,
- oversee utility infrastructure development,
- hold public hearings to gather input from consumers, utility companies, and other stakeholders,
- enforce regulations, and
- promote energy efficiency and conservation.

Overall, the IURC plays a crucial role in balancing the interests of utility companies, consumers, and the state's overall welfare, ensuring that utility services are accessible, affordable, reliable, and environmentally responsible.

Utility failures can be a secondary effect of natural hazards due to the direct impact of hazards on infrastructure and systems that provide essential services to communities. Natural hazards, such as floods, tornadoes, earthquakes, and severe storms, can damage or disrupt utility infrastructure, leading to utility failures. Efforts to address secondary utility failures from natural hazards include disaster preparedness, investing in resilient infrastructure, implementing redundancy in systems, developing emergency response plans, and establishing coordination mechanisms between utility providers, emergency services, and government agencies.

The State of Indiana's Department of Energy (DOE) has taken a proactive step by establishing a grant program that empowers local communities to develop their own energy plans. Additionally, the DOE and IURC consistently collaborate to improve their understanding of how to make utilities more resilient and how natural hazards impact utilities.

7.5 Structural Fire

Structural fires, which imperil life and property, stem from various sources like smoking, arson, industrial accidents, electrical glitches, utility line damage, lab incidents, lightning, and flammable materials. They can also arise as aftermaths of natural hazards. For instance, earthquakes may harm gas lines, power systems, and infrastructure, leading to gas leaks, sparks, and ignitions. Wildfires, termed forest or bushfires, can extend to populated zones, setting structures ablaze. Windborne embers can ignite rooftops and flammable materials. Lightning strikes can directly kindle structures and vegetation, particularly in dry spells. Floods inflict harm on electrical systems, triggering short circuits, while displacing combustibles, heightening fire risks. Tornadoes can damage infrastructure like power lines and gas setups, fanning fires. Prolonged droughts parch vegetation, heightening susceptibility to ignition and exacerbating firefighting water shortages. As structural fires related to a natural disaster are often secondary, exact numbers of structural fires caused by natural hazards is difficult to quantify. Unstable or variable weather patterns may contribute to an elevated risk of structural fires.

Structural fires occur in virtually every community and are one of the most common hazards facing most communities in Indiana and across the country. According to 2021 data by the National Fire Incident Reporting System (NFIRS), the Indiana average for all fire casualties was 1.3 deaths and 4.9 injuries per 1,000 fires, and 4.8 deaths and 154.4 injuries per 1,000 fires for residential structure fire casualties. The US Fire Administration with US New Medias reports fire fatalities by year for all states. As of August 2023, Indiana had 51 home fire fatalities and 1 on-duty firefighter fatalities from Farmland, IN. The 2022 total for home fire fatalities was 57 (Indiana Fire Loss and Fire Department Profile, n.d.).

On January 11, 2004, a major structural fire swept through the historical district of Jeffersonville, IN. Winds gusted at 20-30 mph at the time of the blaze, which made it difficult for firefighters to combat. The fire started in an electrical junction box in the first-floor ceiling of the Horner Novelty Company on Spring Street. This was a two-story building occupying around 40,000 square feet of the district. Seven area mutual aid engines were called in to assist, including assistance from Kentucky. These mutual aid engines included over 100 firefighters on scene. In total, seven commercial buildings, one apartment building, one residential structure, and three garages were completely destroyed, with damages exceeding $7,000,000.

At noon a massive fire destroyed the 1.2 million square foot Walmart fulfillment Center in Plainfield, IN, just west of Indianapolis. Crews from the local Plainfield Fire Department were first on the scene. Approximately 1,000 employees were working in the building we the fire erupted. All were evacuated safely. One firefighter suffered minor injuries while fighting the blaze. It took the work of about 350 firefighters and 30 fire agencies to assist in fighting the fire. Crews worked in in 4 to 6 hour shifts and spent more than 50 hours to extinguish the blaze. At the onset of the blaze, crews spent about 30 minutes inside the warehouse fighting the fire amid thick smoke and zero visibility (Fire, n.d.).

It's important for communities to be prepared for these hazards by implementing fire-resistant construction techniques, maintaining defensible spaces around structures, and having evacuation plans in place.

7.6 Transportation Incidents

Transportation accidents, whether in the air, on trains, show the serious threat to life and logistics. In aviation, these incidents can lead to significant loss of life due to the complexities of air travel, including technical issues and human errors. Train incidents also endanger passengers and disrupt daily commutes and cargo transport.

Air

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.

On October 31, 1994, American Eagle Flight 4184 headed to Chicago O'Hare from Indianapolis crashed into a field in Roselawn, IN while on a hold pattern in Chicago. All 64 passengers and 4 crew perished. The NTSB determined that the probable causes of the accident were the loss of control, attributed to a sudden and unexpected aileron hinge moment reversal that occurred after a ridge of ice accreted beyond the deice boots.

On August 15, 2007, a vintage World War II-era P-51D Mustang airplane crashed during a practice session for the Gary Air Show in Gary, IN. The pilot was killed in the crash.

On September 27, 2009, Southwest Airlines Flight 2294, a Boeing 737-300, experienced a rapid decompression due to a fuselage rupture while en route from Nashville, Tennessee, to Baltimore, Maryland. The flight made an emergency landing at Yeager Airport in Charleston, West Virginia. Although the incident occurred over Kentucky, it is worth mentioning due to its proximity to Indiana.

Train

A train derailment occurs when one or more train cars deviate from the tracks upon which they are traveling. This can happen due to a variety of factors, such as equipment failure, track defects, excessive speed, poor weather conditions, or operator error. When a train derails, it can result in serious consequences, including damage to infrastructure, potential injuries or fatalities among crew members and passengers, and even environmental hazards if the train is carrying hazardous materials.

Train derailments can vary in scale, from minor incidents involving only a few cars to major accidents involving multiple cars and potentially causing significant destruction. Safety measures and regulations are in place to prevent derailments, including regular inspections of tracks, proper maintenance of rolling stock, and adherence to speed limits and operational procedures.

In October 2009, a freight train derailed in Dyer, IN. The train was carrying hazardous materials, including anhydrous ammonia. The incident led to evacuations and road closures in the area.

In October 2015, a CSX train derailed near Princeton, IN. The train was carrying ethanol, and the derailment led to a large fire that burned for hours. Nearby residents were evacuated as a precaution.

In April 2019, a train carrying ethanol derailed in Montpelier, IN. The derailment resulted in a massive fire that burned for several days. Local residents were evacuated, and there were no reported injuries. The incident led to concerns about environmental impacts.

In May 2020, a freight train derailed in Whiting, IN, near the BP oil refinery. The derailment caused a fire to break out, and nearby residents were temporarily evacuated due to concerns about hazardous materials. Fortunately, there were no reported injuries.

Notably on February 3, 2023, a train derailed east of East Palestine, Ohio, near the Ohio/Pennsylvania boundary. The 51 cars of the Norfolk Southern trail line derailed. Of the 51 derailed cars, 11 of them were tank cars which dumped 100,000 gallons of hazardous materials, including vinyl chloride, benzene residue, and butyl acrylate. Several railcars burned for more than two days, with emergency crews then conducting a controlled burn of several railcars, which released hydrogen chloride and phosgene into the air. Residents within a 1-mile radius were evacuated, and an emergency response was initiated from agencies in Ohio, Pennsylvania, and West Virginia. Officials believe the spark between railcar wheel and rail line that was caught on camera about an hour before the derailment caused a mechanical problem to one of the railcars.

Transportation incident mitigation is essential for safeguarding lives, property, and the environment, and for ensuring the efficient functioning of transportation networks that are vital to modern societies and economies.

7.7 Active Assailant

The term active assailant refers to an individual or a group of individuals who are actively engaged in a violent attack or threat, typically in a public or populated area. These individuals may use firearms, knives, explosives, or other weapons to cause harm to people in the vicinity. The key characteristic of an active assailant situation is that the threat is ongoing, and the attacker is actively seeking to cause harm or casualties. 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. Active shooter is a common type of active assailant. 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. In 2022, the US Federal Bureau of Investigation (FBI) recorded 50 total incidents in 25 states plus Washington DC. Figure 110 shows the number of active shooter incidents between 2018 and 2022.

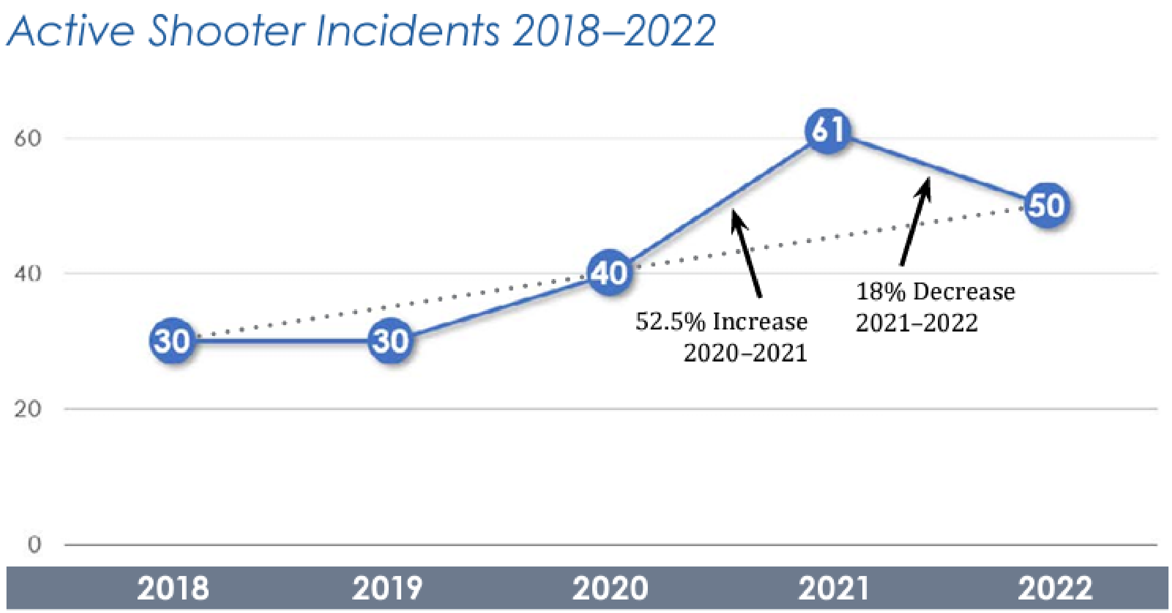


Figure 110. FBI's Active Shooter Incidents in the United States from 2018-2022 (Source: [https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2022-042623.pdf/view)](https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2022-042623.pdf/view)

In recent years, the United States has experienced several active shooter events on school campuses. According to the Washington Post, 220,000 students have experienced gun violence at school since the Columbine High School shooting in 1999 (The Washington Post, 2019). The majority of active shooter incidents since 1999 have happened in high schools—nearly 60% (Vigderman, 2023). Indiana has also been affected, including a shooting involving a 13-year-old boy at Noblesville West Middle School on May 25, 2018, (IndyStar, 2018) that injured a teacher and a student, and a shooting at Dennis Intermediate School in Richmond on December 13, 2018, that resulted in the death of the 14-year-old shooter (IndyStar, 2018).

On July 17, 2022, a mass shooting occurred at the Greenwood Park Mall in Greenwood, IN about 20 miles south of Indianapolis. Three people were killed and two others were injured in the shooting before the perpetrator was fatally shot. A bomb squad was also sent to the mall to investigate a suspicious backpack. The backpack was later deemed not to be a threat. By 7:45 pm during a news conference, the Indianapolis Metropolitan Police Department stated there was no ongoing threat.

Preparedness and training in how to respond to active assailant situations have become increasingly important in many communities to help mitigate the potential harm caused by such incidents.

Active assailant incidents can occur in various settings, including schools, workplaces, shopping malls, entertainment venues, and other public spaces. They are a significant concern for law enforcement agencies and emergency responders, as they require a coordinated and swift response to minimize casualties and neutralize the threat.

The Indiana State Police has prepared several resources for schools and places of work, worship, and recreation to help the public understand how to respond to an active shooter event. These are available from https://www.in.gov/isp/3191.htm. The Indiana State Police will do live Active Shooter Event presentations upon request.

Indiana is one of just a handful of states that has a “Red Flag Law”. This law addresses circumstances where it would be appropriate for a police officer to take custody of a citizen’s firearms, by way of a warrant, or immediately when exigent circumstances are present, and it can be clearly articulated the safety of the public was in jeopardy. In Indiana, this law is more commonly referred to as the “Jake Laird Law”.

Jake Laird was an Indiana Metropolitan Police Department (IMPD) officer killed on August 18, 2004, when IMPD responded to numerous 911 calls reporting gunfire in a near south side neighborhood of Indianapolis.

7.8 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 2019, law enforcement agencies reported 33,395 arson cases in the nation, representing a rate of 10.9 arson offenses for every 100,000 inhabitants nationwide. More than 42 percent of all arson offenses involved structures (e.g., residential, storage, public, etc.) Mobile property was involved in 22.6 percent of arsons, and other types of property (such as crops, timber, fences, etc.) accounted for 35.2 percent of reported arsons.

The FBI’s Crime Data Explorer arson rate in Indiana in 2020 was 12 incidents per 100,000 people, which was lower than the rate of the United States as a whole. Overall, the arson rate has generally declined since 2011 (see Figure 111).

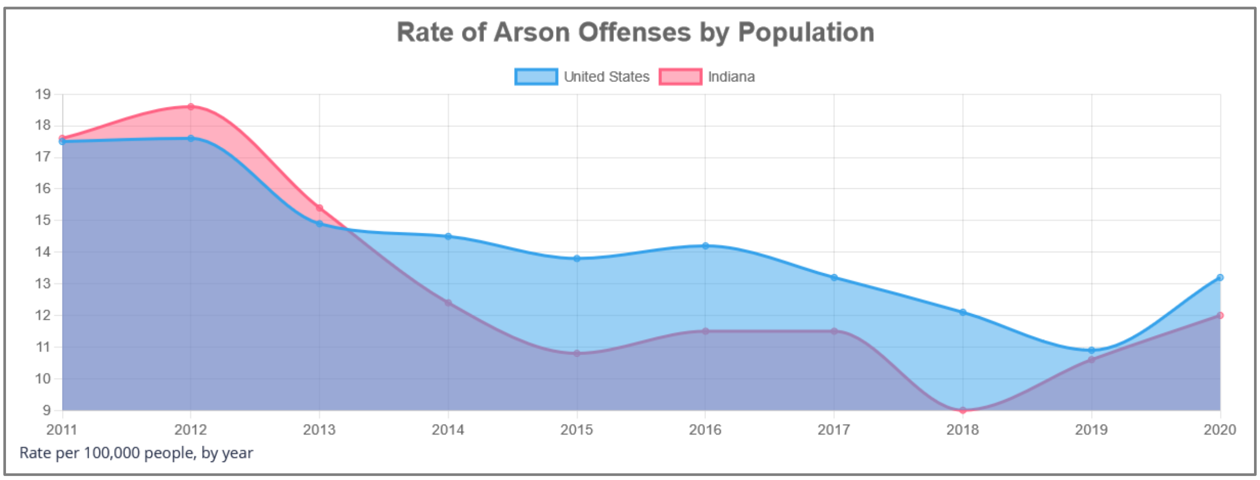


Figure 111. Arson Rate from 2011 to 2020 (Source: https://cde.ucr.cjis.gov/LATEST/webapp/#/pages/explorer/crime/crime-trend)

Arson prevention efforts often include public education campaigns, community involvement, and encouraging responsible behavior around fire and flammable materials. Mitigating arson requires a multi-pronged approach that involves proactive community engagement, education, law enforcement efforts, and targeted interventions to address underlying factors that may lead individuals to commit arson. Mitigation actions for arson vary and include options such as public education and awareness, community involvement, enhancing security measures, increasing occupancy standards, teaching fire safety education in schools, and mandating law enforcement and fire investigator training.

7.9 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.

The emergency response staff assigned to the CBRNE section of IDHS are hazardous materials and radiation specialists who have been trained and equipped to assist local jurisdictions with any major incident. Services provided by the CBRNE section are provided at no cost to the requesting agency.

Local, state, or federal emergency response agencies needing emergency assistance from the IDHS CBRNE staff can request this assistance by calling the State of Indiana Emergency Operations Center at 1.800.669.7362 (press 1).

The IDHS Radiological Emergency Preparedness Program (REP Program) coordinates efforts to protect and respond to incidents involving commercial nuclear power plants. The REP Program provides the State of Indiana and local communities with plans, training, and guidance related to nuclear energy incidents. The IDHS REP Program follows federal guidance and policies to ensure capabilities exist to prevent, protect against, mitigate the effects of, and respond to and recover from incidents involving nuclear power plants.

Indiana is considered part of the emergency preparedness zones for three active commercial nuclear power plants, one in Michigan and two in Illinois (see Figure 112). This is a geographical area surrounding a commercial nuclear power plant for which specialized emergency planning is needed. Indiana is part of the ingestion pathway emergency preparedness zone, which includes a radius of approximately 50 miles from each of the nuclear power plants.

A nuclear facility, the Donald C. Cook nuclear power plant in Michigan, extends into Native American service regions in Indiana. Specifically, it intersects with the Indiana Pokagon Potawatomi service area, encompassing the following five counties: Elkhart, Kosciusko, Laporte, Marshall, Starke, and St. Joseph. In a native land service area, native individuals may not reside within the county, but the tribe holds ownership and responsibilities for specific aspects within these counties. Notably, within the potentially affected area lies the Blue Chip casino in Michigan City, IN. In the event of a radiological incident at the Donald C. Cook plant, not only could the casino be impacted, but also local wildlife, land, and areas of potential tribal significance, including burial sites.

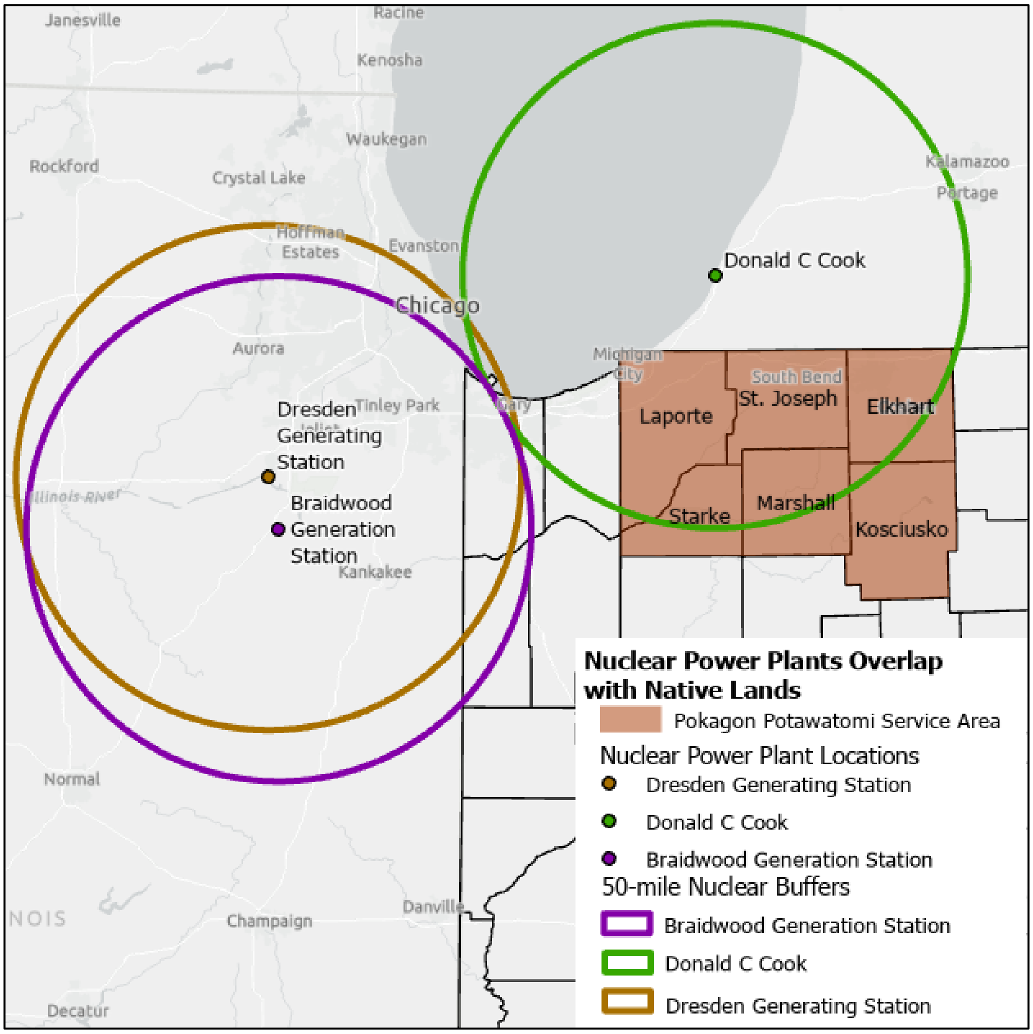


Figure 112. Nuclear Power Plants Overlap with Native Lands

The IDHS REP Program provides training and education regarding nuclear power plants and the ingestion pathway, including the basic effects of radiation, identification of possible preventative protective actions taken for food and water as well as sampling techniques for soil, water, and food stuffs. FEMA-evaluated exercises for Ingestion Emergency Planning Zone are conducted every eight years. The Pokagon Potawatomi Emergency Management Agency works closely with the counties to plan for possible radiological events.

7.10 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 has 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. The Indiana State Police operates an Emergency Response Team (SWAT) Section and Hostage Crisis Negotiators that are trained for hostage situations (Indiana State Police, 2023).

7.11 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 during 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.

The Indiana Intelligence Fusion Center is a collaborative effort of multiple agencies operated by the Indiana State Police that provides resources, expertise, and information to the Center with the goal of maximizing the ability of local, state, and federal partners to detect, prevent, investigate, and respond to criminal and terrorist activity. The primary product of the Fusion Center is situational awareness provided through notifications, warnings, and alerts supported by law enforcement intelligence derived from the application of the intelligence process. Based on law enforcement’s requirement of actionable intelligence, information is collected, integrated, evaluated, analyzed, disseminated, and maintained.

The core function of the Fusion Center is the Intelligence process, which is the orderly, systematic process by which information is gathered, assessed, and distributed. Regardless if the mission of the Fusion Center is All-Crimes, Terrorism focused, or All-Hazards, regardless if the stakeholders supported are strictly Law Enforcement, Public Health, or Emergency Response, and regardless of the types of information the Fusion Center receives, the intelligence process is means by which raw information becomes a finished intelligence product for use in decision making and action planning.

7.12 Civil Disorder/Civil Unrest

Civil disorder and unrest occurs 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. Civil disorder events often stem from a complex mix of social, economic, and political factors, and they reflect broader national and regional trends in the US. In extreme cases, riots and civil unrest can result in injuries, deaths, and property damage. Common activities associated with civil disorder and unrest include protests, demonstrations, looting and vandalism.

Indiana has seen several demonstrations of civil disorder for various reasons in its history, including labor protests and race protests. Like many other cities across the US, Indiana saw protests in 2020 following the killing of George Floyd by a police officer in Minneapolis. Demonstrators called for an end to police violence and racial injustice. It is important to note that Indiana, like other states, has also seen many peaceful protests and movements advocating for positive social change throughout its history.

8 Mitigation Strategies

In sections 6 and 7 of this plan the risk assessment identified a number of natural, technological, and man-made hazards that the State of Indiana experiences. The state planning team members understand that although hazards cannot be eliminated altogether, the state can work with partners towards building a more disaster-resistant state.

Priorities

The planning team ranked priorities based on the desired timeline for completion. The timelines described below are based on funding availability.

- High: desired to be accomplished within the next year
- Medium: desired to be accomplished within the next two to three years
- Low: desired to be accomplished within the next four to five years

Goals & Objectives

The goals and objectives listed below are a valid representation of the long-term and broad visions of the state's mitigation efforts. The strategies listed in Table 48 are how the state will work towards achieving the goals and objectives listed here.

1. Integrate Indiana's mitigation policies and programs to maximize efficiency and leverage funding.
    a. Ensure better coordination of federal, state, and local mitigation activities.
    b. Identify new partners to collaborate on the state hazard mitigation planning team.
    c. Develop a program of affordable housing that is resilient to flooding.
2. Lessen the impacts of disaster to new and existing infrastructure, residents, and responders.
    a. Encourage the integration of Hazard Mitigation Planning into local Comprehensive Plans.
    b. Evaluate and strengthen communication and transportation emergency services.
    c. Retrofit critical and essential facilities and structures to withstand disasters.
    d. Support compliance with the NFIP.
    e. Identify opportunities to reduce repetitive loss and severe repetitive loss incidents.
3. Minimize the loss of life and injuries caused by disasters.
    a. Develop public awareness and outreach programs.
    b. Improve emergency sheltering.
4. Promote research education and outreach to expand Indiana's knowledge about disasters and their impacts.
    a. Conduct new studies/research to profile hazards and promote mitigation.
    b. Improve education and training of emergency personnel and public officials.
    c. Review and update existing, or create new, community plans, maps, and ordinances.

Table 48. 2024 Mitigation Strategies

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
1	High	Flood	4/c	Collaborate with Silver Jackets to determine a sustainable funding source for continued collection of LiDAR data.	IDNR continues to work with their funding sources. Mapping progress continues and the goal is to have the state completely mapped by 2020.		Complete				Yes
2	High	Flood	1/a	Coordinate with IHCDA and OCRA to consider good floodplain management and resiliency programs and ideas when considering awarding local projects for funding under their programs for economic development.	IDHS continues to partner with OCRA and will be joining them in their 2019 resilience outreach to Indiana communities.		Complete				Yes
3	High	Severe Storm and Tornado	3/b	Work to implement safe rooms in any school structures that will accommodate all students and surrounding neighborhood populations.	IDHS has partnered with locals to build storm shelter areas in one school and is beginning construction at a Scout Camp. IDHS has applied to FEMA to install 2 more in schools and a second scout camp.		Complete				Yes
4	High	Severe Storm and Tornado	3/b	Work with local communities, EMA Directors, Statewide building trades, home builders, and architects to design and install	IDHS has completed installation of 20 residential safe rooms to date. IDHS Mitigation is also preparing to apply for another round of		Complete				Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
				saferooms in residential and businesses.	installations in the PDMC 2019 grant cycle. Future applications may be submitted, depending on available funding.						
5	Medium	Earthquake	4/c	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, embedded FEMA Planners, and the Indiana Geologic Survey are working on updating both the Catastrophic Earthquake Response Plan and Earthquake Recovery Plan.		Complete				No
6	Medium	Earthquake	4/b	Convene a Seismic Council to meet regularly and discuss issues, concerns, and opportunities.	IDHS Mitigation has formed a partnership with earthquake subject matter experts at Indiana University to develop new earthquake project ideas.		Complete				No
7	Low	Drought	4/a	Develop drought contingency plans to include residential and agricultural water delivery.	The current Water Shortage Plan is being updated by IDNR Division of Water. Additionally, a water usage symposium was held in Indianapolis in October 2018 and follow up meetings are being scheduled.		Complete				No

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
8	High	Dam/Levee Failure	3/a	Develop guidance for communities 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.	IDNR, IDHS and OCRA have worked to develop IEAPS for over 30 of the state's high hazard dams. Periodic table top exercises are held with local jurisdictions to familiarize citizens of the risks and response procedures. IDHS Mitigation and OCRA have partnered to complete 20 local comprehensive Flood Response Plans.		Complete				Yes
9	Low	Earthquake	4/c	Create plans specific to earthquake safety and recovery for Indiana.	IDHS created a Wabash Valley catastrophic seismic plan. The plan includes recovery processes that will be used in the State Recovery Plan.	IDHS operational funds	Complete				Yes
10	Low	Drought, Extreme temperatures	4/a	Develop drought contingency plans to include residential and agricultural water delivery.	The current Water Shortage Plan is being updated by IDNR Division of Water. Additionally, a water usage symposium was held in Indianapolis in 2023.	IDNR grants	Complete				Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
11	High	All hazards of interest and other hazards of interest	3/a	Promote education and outreach to citizens.	IDHS will develop a crisis and disaster communication plan. The plan should include who we are doing outreach to, including citizens.	IDHS operational funds, Other state grants	Identified	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes
12	High	All hazards of interest and other hazards of interest	3/a	Create partnerships and work toward providing resources for citizens during an disaster event.	IDHS and INVOAD will partner with Indiana's Emergency Food Resource Network at Purdue University to investigate how to better provide food security to citizens during a disaster, and how the state can help.	Other public/private grants, EPA environmental education grants	Identified	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes
13	High	All hazards of interest and other hazards of interest	4/c	Work with local communities, EMA Directors, floodplain administrators, and building officials to facilitate and support code enforcement and building code activities.	IDHS to work with counties and local communities to expand capabilities and support code enforcement and building code activities at the state and local levels.	BRIC grants, HMA grants, Other public/private grants	Identified	Staff with subject matter expertise	None	Personnel expenses, operational expenses, travel costs	New
14	High	Dam/Levee Failure	3/a	Develop guidance for communities to develop response plans to dam failures.	USACE will be conducting IEAP sessions to teach locals how to write plans for local HHPDs.	USACE funds, HHPD grants	Identified	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
15	High	Dam/Levee Failure	1/a & 2/a &2/b & 3/a	Develop mobile applications to communicate risks to the public.	IDNR created inundation maps to show locals if they are in the inundation area. IDNR and other state department will work with local emergency manager to prepare and education citizens for evacuations.	HHPD grants, IDNR grants	Identified	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes
16	Medium	Dam/Levee Failure	1/a	Indiana Silver Jackets work to identify vulnerable populations in inundations areas.	USACE, IDNR, and IDHS will partner to complete an analysis on vulnerable communities downstream an dam inundation area	HHPD grants, BRIC grants, FMA grants, HMA grants, Floodplain Management Services funding, Planning Assistance to States, Other public/private grants	Identified	Staff with hazard mitigation, GIS, and data acquiring expertise	None	Data acquisition, GIS tools, personnel expenses, public outreach	Yes
17	Medium	All hazards and other hazards of interest	1/a & 2/e	Provide State funding opportunities to citizens after disasters.	IDHS is working with state legislature on re-vamping State Disaster Relief Fund (SDRF) program.	IDHS operational funds	Identified	Staff with hazard mitigation and disaster response/re covery expertise	None	Printed materials, public outreach, personnel expenses	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
18	Low	Severe weather, Tornado, Earthquake, Extreme temperatures, Structural fire	3/a	Create types of advertisements, such as brochures and campaigns, that outline types of insurance for Hoosiers.	IDHS will work with the Department of Insurance and local authorities to better advertise citizens on insurances for homeowners, including earthquake, sewer backup, fire, renters, wind, hail, lightning, homeowners, etc.	IDHS operational funds, IDOI grants	Identified	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes
19	Low	All hazards of interest and other hazards of interest	2/c	Support purchasing generators for essential critical facilities	IDHS to coordinate with county EMAs to identify funding opportunities to provide emergency generators for essential facilities (fire houses, schools, shelters).	BRIC grants, HMA grants, Other public/private grants	Identified	Staff with subject matter expertise	None	Personnel expenses, operational expenses, travel costs	New
20	Medium	Tornadoes, Severe Weather	3/a	Support development of a program to obtain weather radios for distribution to local communities	IDHS to work with county and local community officials to develop a plan on how best to support local jurisdictions with distributing weather radios within local communities.	BRIC grants, HMA grants, Other public/private grants	Identified	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	New
21	Low	All hazards of interest and other hazards of interest	1/c	Coordinate with Indiana Housing and Community Development Association (IHCDA), Department of Natural Resources and Office of Community and Rural Affairs (OCRA) to consider good floodplain	IDHS will work to create and provide brochures on floodplain and resiliency options. Brochures are to include mitigation options.	Other public/private grants, HMA grants, BRIC grants, FMA grants, OCRA grants, IHCDA grants	Identified	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
				management and resiliency programs, and to brainstorm ideas when considering awarding local projects for funding under their programs for economic development.							
22	High	Flood	2/d	Provide Best Available Flood Layer for state and local permitting and development. Support compliance with the NFIP.	IDNR continues to work to update the Best Available Flood Layer. IDNR will partner with IDOA to maintain state-owned or -managed facilities.	IDNR operational funds, Floodplain Management Services funding, Planning Assistance to States	In Progress	Staff with hazard mitigation, GIS, and data acquiring expertise	None	Data acquisition, GIS tools, personnel expenses, public outreach	Yes
23	High	Flood	1/a	Engage regularly with elected officials, floodplain administrators, and local emergency personnel to provide status of state and local mitigation activities.	IDHS and IDNR are in constant contact with elected officials, floodplain administrators, and local emergency personnel in normal business operations and during emergency events. Communication is consistent via email, site visits, and meetings to ensure continuous coordination.	BRIC grants, HMA grants, FMA grants, Departmental operational funds, Floodplain Management Services funding, Planning Assistance to States	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	No
24	High	All hazards of interest and other hazards of interest	1/b	Between plan updates, network with representatives outside state government to	IDHS will work with internal and external partners on identifying additional plan participants, such as	BRIC grants, HMA grants, FMA grants, Donations, Public/private	Ongoing	Staff with hazard mitigation expertise	None	Program maintenanc e and operational expenses	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
				participate in the next update.	INVOAD/COAD, native lands emergency management, Indiana University, and Purdue University.	grants, Budgetary funding					
25	High	All hazards of interest and other hazards of interest	4/a	Conduct research on the social vulnerabilities associated with all hazards.	IDHS continues to work with Indiana University to research social vulnerabilities. IDHS is partnering with the Polis Center to complete a flood equity analysis and report. In addition, the Environmental Resilience Institute (ERI) continues to provide baseline information to complete social analyzes.	BRIC grants, FMA grants, Floodplain Management Services funding, Planning Assistance to States	Ongoing	Staff with hazard mitigation, GIS, and data acquiring expertise	None	Data acquisition, GIS tools, personnel expenses, public outreach	Yes
26	High	All hazards of interest and other hazards of interest	3/a	Conduct research on the social vulnerabilities associated with all hazards.	IDHS is partnering with Indiana University to share this information with all aspects of IDHS activities. IDHS GIS is working with federal partners and the Polis Center to research and show socially vulnerable populations using SAVI. IDHS is working with FEMA to communicate and analysis SAVI data for	BRIC grants, HMA grants, FMA grants, Floodplain Management Services funding, Planning Assistance to States	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	New

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
					preparedness and response, including how to partner with INVOAD/COAD.						
27	High	Flood	3/a	Work with local communities, EMA Directors, floodplain administrators, and building officials to encourage good floodplain management development and mitigation to reduce flood insurance costs and property losses.	DNR and IDHS continue to partner on the biennial "Stay Afloat" conference to educate jurisdictions and elected officials on good floodplain management best practices. IDHS Mitigation has also reached out to begin partnering with the Indiana Department of Insurance to educate homeowners on types of insurance coverage available to Hoosiers.	IDNR operational funds, BRIC grants	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes
28	High	Flood	3/a	Facilitate development of projects and programs that educate or protect vehicular traffic and emergency responders from driving into flooded roads.	IDHS and IDNR use social media and press releases to advise drivers to "Turn Around Don't Drown" during rain and flooding events. IDNR and IDHS began talks with INDOT on locations of fatalities and posting emergency signage during these events.	IDHS operational funds, INDOT operational funds	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
29	Medium	All hazards of interest and other hazards of interest	1/a & 2/e	Develop a good working definition of resiliency for local communities, focusing on physical risk, socioeconomic risk, and risk to community development.	IDHS will work with locals to update MHMPs and the local definition of physical, socioeconomic, and risks. Indiana University's ERI provides information of how to define as well as data to help define physical, socio, and community risks.	BRIC grants, HMA grants, FMA grants, Floodplain Management Services funding, Planning Assistance to States	Ongoing	Staff with hazard mitigation, GIS, and data acquiring expertise	None	Data acquisition, GIS tools, personnel expenses, public outreach	New
30	High	All hazards of interest and other hazards of interest	3/a	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.	IDHS Public Information Office continues to provide public information throughout the year concerning personal preparedness tips and risk information.	BRIC grants, FMA grants, IDHS state funding	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes
31	Low	Dam Failure	3/a	Develop mobile applications to communicate risks to the public.	As part of Indiana's Low Head Dam Initiative consisting of IDHS, IDNR and Indiana Silver Jackets, the USGS maintains an interactive map application to show paddlers when they are approaching a low head dam and where safe portages are located.	BRIC grants, FMA grants, HMA grants	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
32	Medium	Earthquake	1/a	Work with CUSEC to further Indiana's Earthquake Mitigation Goals and National objectives for funding through NEHRP.	IDHS Executive Director is a member of the CUSEC board and he and the planning division works closely with the board to develop projects tied to the NEHRP funding.	NEHRP grants, USGS Earthquake Hazards Program	Ongoing	Staff with subject matter expertise	None	Personnel expenses, operational expenses,	No
33	High	All hazards of interest and other hazards of interest	3/a	Develop and distribute information on resources available for each type of hazard. Create a media campaign that outlines the dangers of hazards to populations at risk and actions to minimize exposure.	IDHS PIO's office has several pre-scripted media releases related to winter storms, ice and extreme cold temperature, and flooding events. These releases are sent out when an event is approaching and then during the event as well. Hazard specific Recovery information is provided once the event has ended. IDNR PIO's office posts media during flooding events. IDNR has been doing social media theme weeks to emphasize flood risk and flood insurance.	IDHS agency funding, IDNR agency funding, BRIC grants, HMA grants, FMA grants	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
34	Medium	Drought	2/a & 2/e & 4/a	Work with local officials in communities to discuss issues, concerns, and opportunities in design, training, and exercising to reduce risk to responders and built environment.	IDHS work with communities and local MHMP contractors to include drought risk in plans. Incorporate education and outreach in the local MHMPs. Include NWS and State Climatologist in education. IDHS and IDNR work together to update the drought plan.	BRIC grants, HMA grants, FMA grants	Ongoing	Staff with hazard mitigation, GIS, and data acquiring expertise	None	Data acquisition, GIS tools, personnel expenses, public outreach	New
35	Low	All hazards of interest and other hazards of interest	1/a	IDHS representatives will participate in the ISJ meetings, in addition to inviting local universities to participate.	IDHS along with several state university partners will attend the monthly Indiana Silver Jackets meetings.	USACE funds, IDHS operational funds, University grants	Ongoing	Staff with hazard mitigation expertise	None	Personnel expenses, operational expenses, travel costs	No
36	Medium	Winter Storm, Extreme Temperatures, Severe Weather, and Tornadoes	4/c	Enhance statewide weather monitoring to better predict and communicate severe weather.	NWS has been recruiting and training CoCoRAHS observers to improve the statewide monitoring for winter storms, severe weather, and tornadoes. IDHS will work with Purdue University to extend the work of mesonet in Indiana. The studies from Purdue Institute for Sustainable Future can help provide data for better prediction and communication.	NWS funds, IDHS operational funds	Ongoing	Staff with hazard mitigation, GIS, and data acquiring expertise	None	Data acquisition, GIS tools, personnel expenses, public outreach	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
37	Low	Drought, Extreme temperatures, Wildfire	4/b	Provide enhanced public awareness of open burn bans.	During times of burn ban activities, IDNR and IDHS Public Information Offices release ban information and best practice tips for avoiding wildfire. IDHS will maintain a burn ban map for citizens for real-time risk communication.	IDNR operational funds, IDHS operational funds	Ongoing	Staff with hazard mitigation, GIS, and data acquiring expertise	None	Data acquisition, GIS tools, personnel expenses, public outreach	No
38	High	Dam Failure	2/e & 4/c	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)	During potential dam failure/overtopping events, IDHS EM&P Division works closely with local EMA's and IDNR Dam Section who works with Dam owners to monitor the condition of the dam and notify the public of potential issues.	HHPD grants, BRIC grants, HMA grants, FMA grants, IDHS operational funds, IDNR operational funds	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	New
39	High	Other Hazards of Interest	4/c	Work with state agencies to complete the state recovery plan, continuity of government, and continuity of operations plans for all state agencies.	IDHS is in the process of updating its Continuity of Operations Plan (COOP) and the Continuity of Government (COG) Plans. Several state agencies have completed their plans; however, these plans are continually reviewing and updating their COG.	IDHS operational funds	Ongoing	Staff with hazard mitigation, GIS, and data acquiring expertise	None	Data acquisition, GIS tools, personnel expenses, public outreach	Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
40	High	All hazards of interest and other hazards of interest	3/a	Promote education and outreach to citizens.	State departments including IDHS and IDNR will work with community organizations to apply for public outreach grants to get funds and resources for community-based outreach.	HMA grants, BRIC grants, FMA grants, Other public/private grants, Floodplain Management Services funding, Planning Assistance to States	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	New
41	High	All hazards of interest and other hazards of interest	3/a	Create partnerships and work toward providing resources for citizens during an event.	IDHS will partner with INVOAD/COAD to access their network of citizens and network. IDHS continues to work with state agency partners to develop outreach programs.	HMA grants, BRIC grants, FMA grants	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	New
42	High	Tornadoes, Severe Weather	3/b	Work to implement safe rooms in any school structures that will accommodate all students and surrounding neighborhood populations. Work in implement safe rooms in residential structures.	IDHS will continue to apply for safe room funding through the BRIC and HMGP funding. State departments will work will local emergency management in providing public education and outreach for citizens, including what to do in case of hazardous weather.	BRIC grants, HMA grants, Other public/private grants	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	New

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
43	High	Dam/Levee Failure	3/a	Develop guidance for communities 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.	IEAPs for HHPDs are required by law as of July 2023. IDNR will continue working with dam owners on creating IEAPs for all HHPDs. Templates are available for local IEAPs on the IDNR website.	IDNR operational funds, HHPD grants	Ongoing	Staff with subject matter and public information outreach expertise	None	Printed materials, public outreach, travel expenses	Yes
44	High	Flood	2/d	Use new LiDAR data and ortho products to compile a comprehensive database of building footprints, which will help to promote flood insurance	IDNR continues to work on updating flood maps with new LiDAR data through both the RiskMap efforts and the State Best Available data project.		Removed				Yes
45	High	Severe Storm and Tornado	4/a	Conduct research on the social vulnerabilities associated with these hazards.	IDHS will partner with internal/external partners to conduct research on the social vulnerabilities associated with these hazards.		Removed				Yes
46	High	Earthquake	4/a	Conduct research on the social vulnerabilities associated with these hazards.	IDHS will partner with internal/external partners to conduct research on the social vulnerabilities associated with these hazards.		Removed				Yes

#	Priority	Hazard	Goal & Objective Met	Strategy	Strategic Action	Current or Potential Funding Sources	Status	Technical Feasibility	Environmental Considerations	Cost Effective-ness	Revis-ed for 2024
47	High	All hazards of interest and other hazards of interest	4/a	Conduct research on the social vulnerabilities associated with these hazards.	IDHS will partner with internal/external partners to conduct research on the social vulnerabilities associated with these hazards.		Removed				Yes
48	Medium	Extreme Temperatures, Other Natural Hazards	3/a	Create a media campaign that outlines the dangers of extreme temperatures, populations at risk, and actions to minimize exposure.	IDHS PIO's office has several pre scripted media releases related to extreme temperature events. These releases are sent out when an event is approaching and then during the event as well. Hazard specific Recovery information is provided as needed.		Removed				Yes
49	High	Other Hazards of Interest	4/a	Conduct research on the social vulnerabilities associated with these hazards	IDHS will partner with internal/external partners to conduct research on the social vulnerabilities associated with these hazards.		Removed				Yes

9 Local Capabilities to Mitigate Hazards

9.1 Local Funding and Technical Assistance

IDHS supports the development of local mitigation plans through funding, technical assistance, and expertise. IDHS relies on ongoing partnerships with Indiana Silver Jackets, nonprofit entities, private contractors, and academic institutions working with local jurisdictions to support education, outreach, and planning.

An 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 becoming 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.

Another 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, 58 of Indiana's 92 counties have completed a MHMP update and most of the rest are in the process of completing their first five-year update. For 77 of these counties, IDHS partnered with The Polis Center at IUPUI to include Hazus-MH 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 (IARC), a statewide association of regional planning organizations that promotes regional strategies and solutions to address local issues and supports grant writing.

IARC Regions (Figure 113):

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 Commission
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
14. North Central Indiana regional Planning Council
15. Eastern Indiana Regional Planning Commission

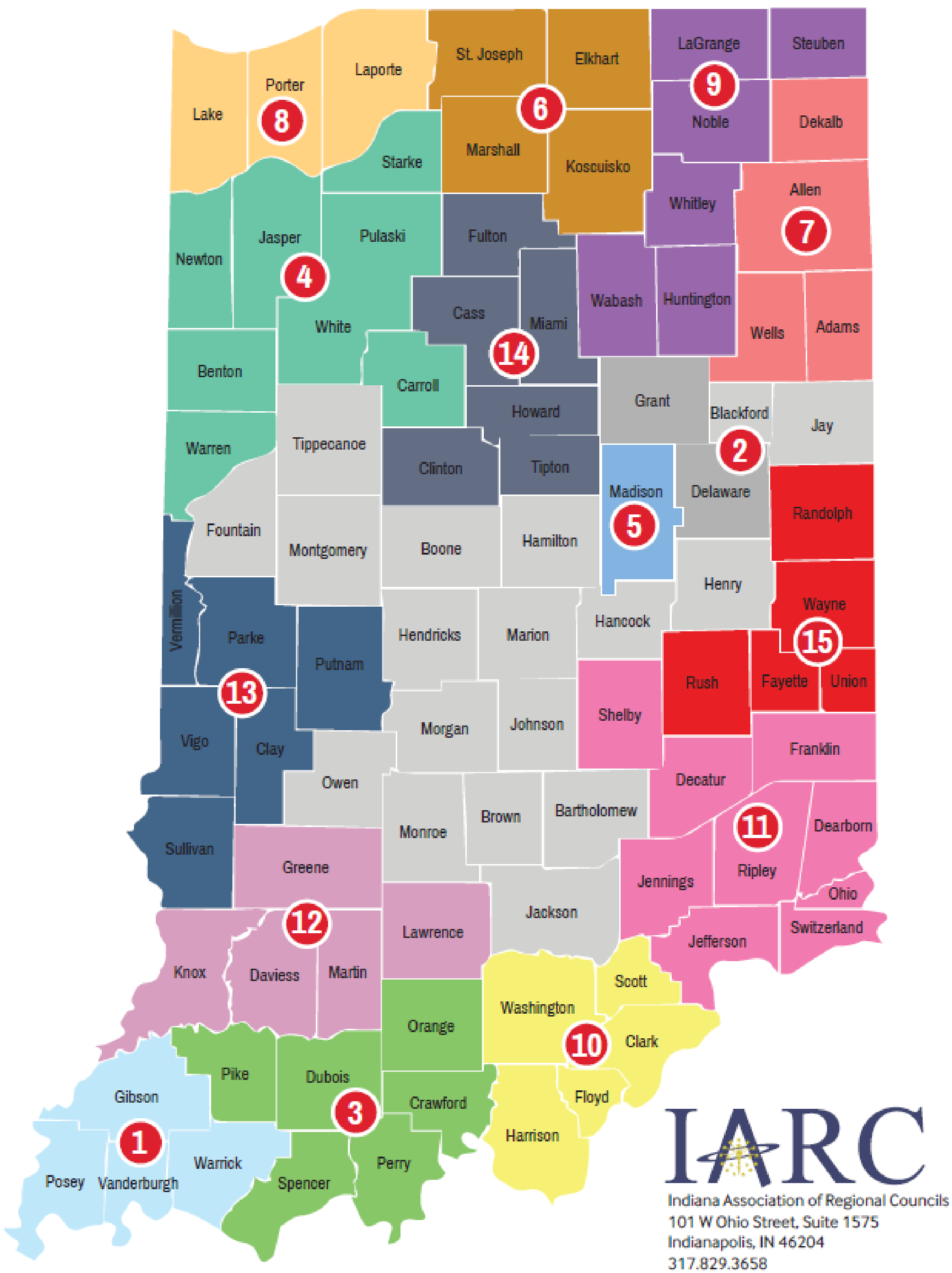


Figure 113. IARC Regions

9.2 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. One of the strategic priorities in 2020 for IDHS was expanding mitigation and resiliency in the State. This increased focus allows IDHS Mitigation to have a dedicated mitigation planner to perform the initial review of all county plans before submission to FEMA. This dedicated planner assists the counties by providing technical support, training, and act as a liaison between the counties and subject matter experts. The planner reviews local strategies to integrate into the SHMP and generates reports on an as-needed basis. One of the priorities of the IDHS Mitigation program each year is to obtain grant funding to assist local jurisdictions in their planning efforts. All 92 counties have recently received FEMA grant funding to assist them financially in updating their local plans.

During the State's Mitigation Plan Update, IDHS staff and local planning consultants reviewed all the county mitigation plans for their highest-ranked mitigation priorities and action items. During the review, the State focused on the top three mitigation strategies for each of the 92 counties. Moving forward the State will analyze local strategies on an annual basis to ensure this data helps inform the State's grant funding decisions.

Indiana's primary barrier regarding local mitigation planning is many communities feel they don't have access to the financial grant resources that connected to their County's Multi-Hazard Mitigation Plan. Many local jurisdictions can't meet the local match requirement in FEMA's Hazard Mitigation Grant Programs for a major project due to various reasons. Additionally, if they do apply, their projects rarely get chosen by FEMA to move forward in the grant process. So, these factors discourage them from spending their limited time on being a planning participant member.

9.3 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 floodplains and flood risk. It will continue to be necessary to maintain a priority to assist these communities in reducing existing risk by providing technical assistance, funding when available and working to integrating risk reduction into their comprehensive planning efforts.

These areas also have the most Repetitive Loss and Severe Repetitive Loss properties in the State, which positions them as the areas of highest vulnerability. Current prioritization is based primarily on repetitive loss status, financial status of the community (small and impoverished communities have priority), availability of funding, and federal mandates. Communities with the greatest number of Repetitive Loss and Severe Repetitive Loss properties are the first priority of the State's planning and mitigation activities. Indiana has made significant strides in acquiring and demolishing more than 750 properties since 2008.

IDHS Mitigation is increasing its focus on non-flood related hazards through the development and funding of new projects for the state. These projects include actions to minimize the damages associated with severe weather and earthquakes. Going forward, the State Hazard Mitigation Officer will assess the need for projects minimizing the effects from other hazards identified in the plan.

9.4 Jurisdictions at Greatest Risk

Table 49 identifies the top 5 counties within the state with the most flash flood, flood, tornadoes, high wind and thunderstorm wind events reported to NCEI from January 1, 2019 to December 31, 2022.

Table 49. Counties at Greatest Risk

Most Flash Floods	Most Floods	Most Tornadoes	Most High Wind & Thunderstorm Wind	Repetitive Loss	Severe Repetitive Loss
Ripley (9)	Gibson (58)	Lake (5)	Allen (98)	Marion (255)	Marion (38)
Vanderburgh (9)	Posey (44)	Ripley (5)	St. Joseph (71)	Lake (221)	Clark (25)
Dubois (8)	Pike (29)	St. Joseph (5)	Kosciusko (59)	Allen (160)	Carroll (24
Fayette (8)	Warrick (22)	Shelby (4)	Lake (57)	Carroll (110)	Allen (14)
Clark (7)	Ripley (21)	Gibson (3)	Huntington (52)	Clark (101)	Lake (12)

Counties that include census tracts identified as FEMA Disaster Resilience Zones include Bartholomew, Crawford, Jackson, Jefferson, Owen, Scott, and Vanderburgh Counties.

The State of Indiana highly prioritizes covering each county with Hazard Mitigation Assistance funding. Specifically, focusing on highly disadvantaged jurisdictions based on risk assessments, environmental justice considerations, and collaboration.

The state's Hazard Mitigation Plan outlines strategies for addressing various hazards, including floods, tornadoes, and winter storms, with a focus on building resilience in vulnerable communities throughout the state of Indiana.

Indiana's dedication to incorporating environmental justice principles into its hazard mitigation efforts is evident due to their support of prioritizing Community Disaster Resilience Zones (CDRZ) and Climate and Economic Justice Screening Tool (CEJST). On September 6, 2023, the initial CDRZ designations were announced by FEMA including seven within the state. These seven census tracts pinpoint areas at heightened risk of natural disasters such as floods, tornadoes, and winter storms. These zones are geographical and socio-economic hotspots where vulnerabilities intersect, amplifying the impact of disaster on communities. When IDHS was notified of these designations, we reached out directly to the counties in which the census tracts are located to emphasize the benefits, garner interest in hazard mitigation grant programs, promote the benefits to the communities on these designations, and supporting them throughout the application development process. By focusing efforts on these zones, resources can be allocated strategically to mitigate potential hazards and enhance resilience. This approach ensures mitigation efforts are tailored to the specific needs and challenges faced by communities in highly vulnerable areas.

CEJST also identifies socio-economic and environmental vulnerabilities. This assessment allows the state to identify marginalized and disadvantaged communities that may be disproportionately affected by disasters. The tool uses datasets that are indicators of burdens in eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. Prioritizing these communities ensures that mitigation efforts promote equity and inclusivity, directing resources to areas most in need and empowering vulnerable populations to better withstand and recover from disasters.

Collaboration with Indiana Voluntary Organizations Active in Disaster (VOAD) plays a crucial role in enhancing the effectiveness of hazard mitigation partnerships in Indiana. Indiana VOAD is composed of a diverse network of non-profit, faith-based, and community organizations that are committed to disaster preparedness, response, recovery, and mitigation efforts. Leveraging the expertise and resources of Indiana VOAD members can significantly enhance the state's mitigation efforts by utilizing community engagement and outreach. Due to preestablished relationships and trust within local communities, Indiana VOAD can effectively disseminate information about hazard mitigation strategies, preparedness initiatives, federal and nonfederal mitigation grants, and available resources for residents, particularly those in disadvantaged communities.

Through the integration of CDRZ, CEJST, and Indiana VOAD, the state's hazard mitigation plan becomes a comprehensive framework for prioritizing jurisdictions and maximizing the impact of grants to build a more resilient society.

9.5 Policies Regulating Development

Indiana's Home Rule statute grants local government units "all the powers that they need for the effective operation of government as to local affairs" (IC 36-1-3-2). These government units include townships, cities, and counties. Planning and zoning fall within the local government unit's purview. As a result, planning and zoning fall to local governments in Indiana, resulting in a lack of uniformity from one jurisdiction to the next. Indiana law does require that, if a municipality wants to exercise zoning powers, a plan commission adopt a comprehensive plan.

However, Indiana law IC 36-1-3-8 (7) states that a unit does not have the "power to regulate conduct that is regulated by a state agency, except as expressly granted by statute". 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	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.

Policy Area	Description/Applicability	Effectiveness
	and rebuilding (regardless of the nature of damage) in floodplains.	
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.
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 harm's way. Still found mostly in larger cities and to some extent as economic development plans in smaller communities.

9.6 Status of Multi-Hazard Mitigation Plans

When a County Multi-Hazard Mitigation plan is submitted to IDHS for the State Review the Planner has 60 days to review the plan and return it with notes for any needed revisions. The time frames are 60 days for the initial review and 30 days for the 2nd submission then the plan is sent to FEMA for their initial review.

Table 51 lists the status of each county Multi-Hazard Mitigation Plan in Indiana as of November 16, 2023.

Table 51. County MHMP Status (As of 12/31/2018)

Counties	Expiration	Counties	Expiration	Counties	Expiration
Adams	4/5/2028	Hendricks	3/28/2026	Pike	9/12/2023
Allen	4/19/2028	Henry	10/29/2023	Porter	10/15/2025
Bartholomew	11/3/2022	Howard	1/10/2027	Posey	1/15/2023
Benton	9/27/2025	Huntington	12/16/2023	Pulaski	6/18/2024
Blackford	4/5/2026	Jackson	4/19/2028	Putnam	2/4/2023
Boone	9/12/2023	Jasper	12/2/2026	Randolph	11/20/2022
Brown	4/14/2017	Jay	2/25/2026	Ripley	9/12/2023

Counties	Expiration	Counties	Expiration	Counties	Expiration
Carroll	1/26/2025	Jefferson	7/4/2028	Rush	1/24/2028
Cass	3/1/2017	Jennings	2/4/2023	St. Joseph	12/1/2021
Clark	10/9/2027	Johnson	6/21/2026	Scott	12/8/2022
Clay	2/6/2023	Knox	1/15/2023	Shelby	2/22/2026
Clinton	10/15/2025	Kosciusko	1/27/2024	Spencer	3/19/2015
Crawford	11/15/2025	LaGrange	10/15/2024	Starke	2/22/2026
Daviess	9/30/2025	Lake	6/18/2024	Steuben	5/30/2023
Dearborn	4/19/2028	LaPorte	8/21/2028	Sullivan	8/19/2025
Decatur	2/2/2025	Lawrence	1/4/2023	Switzerland	7/5/2022
DeKalb	2/12/2025	Madison	3/5/2023	Tippecanoe	5/10/2021
Delaware	11/13/2013	Marion	12/6/2024	Tipton	3/25/2025
Dubois	1/9/2024	Marshall	5/31/2018	Union	4/5/2028
Elkhart	6/20/2022	Martin	9/27/2025	Vanderburgh	12/27/2023
Fayette	4/19/2028	Miami	5/30/2023	Vermillion	3/23/2016
Floyd	11/27/2027	Monroe	9/12/2023	Vigo	4/5/2028
Fountain	10/15/2024	Montgomery	10/19/2027	Wabash	10/15/2024
Franklin	12/5/2024	Morgan	5/28/2028	Warren	8/4/2026
Fulton	9/30/2025	Newton	7/21/2026	Warrick	3/6/2028
Gibson	9/2/2026	Noble	7/26/2025	Washington	1/14/2024
Grant	10/17/2022	Ohio	6/17/2023	Wayne	12/8/2022
Greene	2/4/2023	Orange	10/2/2023	Wells	7/21/2026
Hamilton	12/15/2025	Owen	7/4/2028	White	4/21/2027
Hancock	12/1/2021	Parke	9/20/2023	Whitley	8/16/2026
Harrison	4/5/2028	Perry	12/20/2027		

The goal of mitigation is to protect lives and build disaster-resistant communities through minimizing disruptions to local and regional economies, reducing the future impacts of hazards including property damage, and supporting best use practices for public and private funds spent on recovery assistance.

Each county and its participating communities share a common MHMP and worked closely to develop it. These communities work together with their city councils and their Emergency Management Agency Director to ensure that the hazards and mitigation actions included in their plan are accurate and addressed in their jurisdictions. For additional information on local mitigation strategies and actions, please refer to the county's plan.

9.7 Mitigation Strategies and Actions

The goal of mitigation is to protect lives and build disaster-resistant communities through minimizing disruptions to local and regional economies, reducing the future impacts of hazards including property damage, and supporting best use practices for public and private funds spent on recovery assistance.

Each county and its participating communities share a common MHMP and worked closely to develop it. These communities work together with their city councils and their EMA Director to ensure that the hazards and mitigation actions included in their plan are accurate and addressed in their jurisdictions. The following table includes the top two to three mitigation strategies for each county with a current plan as of November 15, 2023.

The state's mitigation strategies serve as a blueprint, offering guidance and insight for local communities. Section 8 outlines the state's approach to mitigation. For example, it illustrates funding the State looks to pursue related to mitigation like funding for safe rooms. It details plans to integrate socially vulnerable communities, such as through the completion of flood equity analyses in 2024. Section 8 highlights areas of focus for the state that local communities may not have been aware of, such as the development of an earthquake plan. These are a few examples that you can see imitated in Table 52.

Table 52. Local MHMP Mitigation Strategies

County	Hazard	Mitigation Strategy
Adams	Flood	Reduce flood insurance premiums through increased participation or advancement in the NFIP's CRS program
	Flood, Dam Failure, Haz Mat	Review and update procedures to alert and evacuate populations (especially special needs populations) in known hazard areas (SFHAs, dam failure areas Tier II areas)
	Multiple	Incorporate hazard information, risk assessment and hazard mitigation practices into the Comprehensive Land Use Plan and development review to better guide future growth and development.
Allen	Dam Failure	Update IEAP for Hurshtown Reservoir Dam in NE Allen County; dated Sep 2015.
	Multiple	Develop reciprocal agreements between neighboring communities/counties for structural inspections following hazard events.
	Flood	Prepare a detailed Flood Response Plan (FRP) to improve response and reduce losses from a flood event.
Bartholomew	Flood	Educate community leaders about the effectiveness of floodgates for roads where people frequently drive around barriers and signage. Explore the possible funding mechanisms to reduce the cost for such structures.
	Multiple	Continue to work on downed trees and removal of dead trees that pose a public safety hazard (Emerald Ash Borer). Increase staffing to address tree maintenance issues as funding permits.
	Flood	Assess county drainage for repair and /or maintenance
Boone	Flood	Evaluate the homes along Prairie Creek and identify homes that may need bought out.
	Multiple	Conduct a study to determine shelter capacity in the county.
	Multiple	Increase safety education and drills at schools.
Brown	Multiple	Develop a plan for testing, maintenance, and operation of the outdoor warning sirens.
	Flood	Educate Government representatives on the importance of floodplain management procedures and permitting restrictions.
	Flood	Research the need for additional gages upstream to provide advanced warning.
Carroll	Flood	Conduct an engineering study to determine a solution for runoff/washout of roads throughout the county.
	Multiple	Institute a mass notification system to cover all communities within the county.
	Hazmat Release, Fire	Conduct a study to analyze relocation of Sheriff Department, EMA, and fire station in Delphi. All are at risk in the event of a hazmat spill at the downtown railroad crossing.
Cass	Flood	Conduct a sewer upgrade to separate stormwater and sanitary sewer lines.

County	Hazard	Mitigation Strategy
	Hazmat Release	Conduct a commodity flow study.
	Flood	Replace tiles, dredge ditches and creeks, and install permanent signage in areas vulnerable to frequent flash flooding.
Clark	Hazmat Release	Initiate a traffic flow study once the Ohio bridges are complete.
	Multiple	Provide emergency generators for essential facilities (fire houses, schools, shelters).
	Winter Storm	Re-evaluate existing snow removal plan annually.
Clay	Multiple	Examine existing weather alert sires within the county, ensure there are sirens in state/local parks and reallocate use of sirens to heavily populated areas and schools
	Multiple	Provide key structures and residents with weather radios to warn of impending hazards
	Multiple	Ensure strong fencing for Exotic Feline Center and redundant features are in place to assure the animals are safe and protect the public from the animals residing at the sanctuary.
Crawford	Multiple	Construct a safe room in Crawford County High School.
	Flood	County-wide voluntary acquisition and relocation of buildings in high hazard areas.
	Multiple	Require mobile homes to have more than adequate tie-downs.
Dearborn	Multiple	Obtain backup generators for all critical infrastructure, including some mobile generators.
	Flood	Address Bonnell Road residential flooding.
	Tornado, Severe Storm	Build safe rooms in various schools across the county.
DeKalb	Multiple	Add safe rooms and/or shelters to mobile home parks
	Flood	Maintain channels and regulated drains to prevent localized flooding
	Multiple	Prohibit construction of critical facilities in known hazard areas
Elkhart	Flood, Dams, Fluvial Erosion	Prioritize structures located in floodplains or other known hazard areas and work with facility owners to relocate, buyout, or floodproof these structures to a minimum of 500-year protection with flood-free access.
	Severe Weather	Increase awareness and participation in mass notification, social media, weather radios, etc.
	Multiple	Create a countywide event planning process to include safe area designations.
Fayette	Flood, Flash Flooding	Conduct study to investigate nature-based solutions, such as wetlands, to alleviate flooding issues.
	Tornado, Severe Storm	Obtain weather radios to distribute to residents.
	Multiple	Encourage construction of new buildings and infrastructure above code.
Floyd	Flood, Thunderstorm, Winter Storm	Study to determine mitigation options for Flood Overtopping Road at Oaks Rd and SR 64.
	Hazmat Release	Install air and water quality monitors – in particular for the City of New Albany and Rubbertown in Kentucky.
	Flood, Ground Failire	Acquire 30 acres to be used as watershed storage for Blackiston Run.
Fulton	Multiple	Purchase additional mobile electronic messaging boards and develop protocol for local interactions to provide current hazard information.

County	Hazard	Mitigation Strategy
	Multiple	Inventory needs for mobile data terminals in response vehicles and purchase and install as prioritized
	Hazmat	Review/revise transportation survey to determine typical chemicals and quantities of chemicals being transported through the county
Gibson	Tornado, Severe Storm	Create new tornado / severe thunderstorm shelters within Gibson County.
	Earthquake	For all public facilities in the county which have gas lines, add inertial shut-off valves.
	Flood	Complete a study along Highway 64 to explore potential strategies to mitigate the frequent flooding.
Grant	Dam/Levee Failure	Review regular inspection reports and maintenance records of high hazard dams/encourage Wagner Lake Dam owners to develop an IEAP
	Multiple	Encourage additional participation in Severe Weather Awareness Week; develop education and outreach campaign; post information/warning signs in local parks and gathering places explaining what to do in case of a hazard event
Greene	Multiple	Explore the ability to acquire and install outdoor warning sires near the Bloomfield South Sports Complex and Westgate locations.
	Wind and Tornado	Explore additional ordinance for mobile home tie downs. Until ordinance can be put in place encourage new and existing mobile homeowners to tie down mobile homes in accordance with manufacturer instructions. Seek funding for grants to assist mobile homeowners.
	Multiple	Explore funding for placement of community safe rooms at schools, fire stations and/or similar public facilities.
Hamilton	Dam/Levee	Management of High Hazard Dams and Levees; Ensure inspections are reported and required improvements and repairs are completed in a timely manner; Complete IEAP and inundation mapping; Inventory property owners in potential inundation areas provide annual alert of the risk associated with the dam or the levee
	Multiple	Emergency Preparedness and Warning; Purchase and utilize additional mobile message boards; Continue to provide weather radios; Appropriate mass notification system; Prepare plans for individual communities; Purchase/install outdoor warning sirens in rural areas; Adopt local ordinance requiring payment for additional outdoor warning sirens
Hancock	Flood	Continue to use of green infrastructure as feasible. Share BMPs such as dry detention with bioswales, etc.
	Multiple	Formalize a neighborhood or local campaign where community representatives familiar with the culture and language provide residents with emergency information and protocols
	Dam Failure	Encourage the development of IEAPs and Annual exercises for all High Hazard Dams
Harrison	Multiple	Work with neighboring communities to develop mutual aid agreements.
	Flood, Severe Storms	Update development standards to address street drainage issues
	Multiple	Analyze ways to improve communications throughout the County for phone/internet towers.
Henry	Multiple	Expand upon the CERT program already in place
	Multiple	Increase the range of sirens in Henry County and install new sirens in areas where they do not currently exist

County	Hazard	Mitigation Strategy
	Severe Weather	Establish a countywide tie-down ordinance that would require all new modular homes to have tie-downs
Howard	Multiple	Coordinate communications, documentation, and record keeping between communities and agencies including a database of accurate and community specific information following each hazard events
	Flood	Conduct detailed flood protection studies for problem areas and/or areas with repetitive flooding problems
	Multiple	Update and coordinate GIS layers with location and attributes of critical infrastructure
Huntington	Flood	Establish a Flood Response and Evacuation Plan
	Flood	Institute a buy-out plan for homes along the Wabash River and Little Wabash River
	Multiple	Develop a public education program to inform residents of potential hazards and emergency plans
Jackson	Multiple	Utilize a hazard broadcast system to distribute mass notifications to residents and visitors
	Flood	Conduct detailed flood protection studies for problem areas and/or areas with repetitive flooding problems
	Multiple	Inventory needs and prioritize purchases for mobile data terminals (hardware, software, updates, etc.) to emergency response vehicles
Jefferson	Dam Failure	Review regular inspection reports and maintenance records of dams regardless of ownership.
	Flood	Continue to assess need for additional gages and available funding.
	Multiple	Inventory, prioritize, and retrofit public facilities and/or all critical facilities with appropriate wiring and electrical capabilities for utilizing a large generator for power backup
Jennings	Multiple	Acquire and distribute weather radios, especially to the mobile home communities
	Fire	Promote the improvement of fire protection services by improving low water pressure by considering elevated water tanks and pumping systems.
	Multiple	Assist with and pursue a storm shelter grant for Country Squire Lakes community.
Johnson	Multiple	Continue to add sirens throughout the county and create coordinated county-wide emergency and hazard warning system
	Earthquake	Conduct public awareness and information campaign on earthquake safety and preparedness
Knox	Flood	Update Flood Maps to DFIRM
	Flood	Improve current levee systems, certification of levees
	Hazmat	Train and equip emergency personnel
LaGrange	Flood	Review finish grade requirements for building/developments and enforce on all new construction.
	Drought	Conduct a study to determine a location for a cooling center.
	Tornado, Severe Storm	Identify locations for & establish storm shelter throughout the county.
Lake	Multiple	Increase awareness and participation in the various mass notification system and various social media outlets
	Multiple	Investigate equipment needs such as snow-fight equipment, mobile sandbagging equipment and generators if needed

County	Hazard	Mitigation Strategy
	Multiple	Improve planning and coordination among event coordinators, facility owners, and emergency response teams
LaPorte	Flood	Continue to implement BMPs outlined in the SWQMP and enforce applicable stormwater ordinances
	Multiple	Prepare evacuation plans for neighborhoods and/or mobile home parks in hazard areas.
	Multiple	Update the City of LaPorte Comprehensive land use plan. Consider enhancing the level of review for M1/M2 (manufacturing) zoned structure. Find a common ground for the 2 different permitting programs.
Lawrence	Multiple	Upgrade police equipment countywide to include new radios, cameras, and new radio system with 800 trunk line system
	Flood	Address the wastewater infiltration concerns in Oolitic
	Flood	Develop an ordinance to ticket persons who drive through flood waters
Madison	Multiple	Coordinate communications and notifications between towns and agencies
	Hazmat	Ensure that current facility maps and response plans are on file for all SARA Title III Facilities
	Flood	Provide the opportunity for staff members to become a Certified Floodplain Manager (CFM)
Marshall	Multiple	Implement school-wide programs to educate students on the hazards affecting the county and preparation/mitigation plans
	Multiple	Purchase generators to provide back-up power to schools and shelters
	Flood	Continued compliance of the NFIP, for all FNIP communities
Miami	Earthquake	Conduct a study to evaluate the strength of the county's aging underground infrastructure.
	Tornado, Earthquake, Sever Storm, Winter Storm	Bury new power lines.
	Flood	Improve drainage ditches near Grissom Air Reserve Base to reduce residential flooding at the Estates at Eagle Point.
Monroe	Multiple	Continue to educate community members on the hazards which affect the county and low cost mitigation actions they can take.
	Flood	Institute a buyout program for homes and critical infrastructure. Determine which properties are eligible for grant assistance.
	Flood	Continue to reach out to homeless at feeding sites especially when storms are forecast to encourage them to leave the underground pipes before the storms begin.
Montgomery	Multiple	Establish procedures using CodeRed to alert and evacuate the populations in known hazard areas (routinely flooded areas, floodplains, dam failure areas)
	Multiple	Post information and/or warning signs in local parks and other public gathering places explaining outdoor warning sirens, what to do in case of a hazard event, and local radio stations that carry emergency information
	Flooding	Conduct detailed flood studies for problem areas and/or areas with repetitive flooding problems or poor drainage
Morgan	Flood, Ground Failure	Map flood and erosion problems along McCracken Creek, north of Patton Park Lake and along Orchard Creek.

County	Hazard	Mitigation Strategy
	Flood, Severe Storm, Winter Storm	Erosion reduction study needed as FEH is impacting waste water treatment plant and the bridge over White River at Blue Bluff Road.
	Dam Failure	Coordinate with surrounding counties to ensure any high hazard dam located in a neighboring county but with inundation in Morgan County, has an IEAP.
Newton	Multiple	Inventory, prioritize, and retrofit public facilities and/or critical facilities with appropriate wiring and electrical capabilities for utilizing a large generator for power back up
	Multiple	Improve disaster preparedness and emergency response at the local level through the CERT or similar program
	Multiple	Inventory needs for mobile data terminals and/or upgrades in prioritized response vehicles and purchase and install as feasible
Noble	Multiple	Prohibit construction of critical facilities in known hazard areas (downstream of dams and floodplains)
	Flood	Complete a Noble County Flood Mitigation Plan to set long-term strategies to mitigate flood impacts county-wide
Ohio	Multiple	Install back-up power generators at churches used as shelters and the senior citizen center. At a minimum install wiring and switches to make facilities capable to use portable generators.
	Multiple	Continued compliance of the NFIP for all NFIP communities by prohibiting future development in the special flood hazard area
	Multiple	Explore developing an app to notify community members of re-routing of traffic, power outages, and other public education.
Orange	Fire	Install back-up power generators for churches used as shelters
	Multiple	Develop long-term strategies to educate residents on the hazards affecting their county
	Flood	Install signage at low head dams to warn of hazards.
Owen	Flood	Conduct detailed flood studies for problem areas (such as stream crossing and culverts) and/or areas with poor drainage or repetitive flooding problems
	Multiple	Inventory critical facilities to determine what improvements are needed to harden against various hazards
Parke	Hazmat	Create new or revise existing plans to hazards that affect Parke County; implement county drills for hazards
	Severe Weather	Establish new or improve upon existing shelters for hazards within the county
Perry	Drought	Procure a new water tank for Tell City.
	Flood, Severe Storms	Limit the percentage of allowable impervious surface within developed areas. Encourage pervious surfaces. .
	Wildfire	Identify wildland urban interface.
Pike	Flood	Conduct a study to determine if critical facilities require relocation.
	Earthquake	Secure shelving for medical cabinets in public facilities and utilize water heater restraints.
	Dam Failure	Identify ways to protect critical facilities in Pride's Creek Dam inundation area.
Porter	Multiple	Assess current agreements (capacity) and develop any needed shelter, safe rooms, warming center agreements within the County. Equip with generators and response materials

County	Hazard	Mitigation Strategy
	Multiple	Conduct watershed studies, stormwater master plans, or coastal erosion studies to develop action strategies for mitigation and protection
	Hazmat	Review and/or revise transportation survey to determine the typical chemicals and quantities of chemicals being transported through Porter County
Posey	Severe Weather	Distribute weather radios for public buildings and mobile homes
	Flood	Protect pump station from flooding
	Multiple	Construct safe room at community center
Putnam	Flood	Flood proof Greencastle water treatment plant site.
	Hazmat Release	Develop emergency procedure updates for communities to include evacuation plans for the public and care facilities.
	Tornado, Earthquake	Re-enforcement of public infrastructure to include nursing homes.
Randolph	Flood	Establish plan to purchase repetitive loss and potentially unsafe properties
	Flood	Ensure that schools have access to emergency generators and safe rooms
	Dam/Levee	Provide educational information regarding low-head dams
Ripley	Multiple	Implement and improve communication systems for all Emergency Services within the County
	Hazardous Materials	Update Commodity Flow Study
	Flood	Continue compliance with the NFIP by restricting new development from the special flood hazard area
Rush	Human	Fund training and equipment to handle active shooter situations.
	Levee Failure	Upgrade work on Rushville levee systems.
	Tornado, Severe Storms	Establish a new development ordinance that requires a siren for every area of homes.
Scott	Severe Weather	Replace and repair damaged culverts throughout the county
	Multiple	Continue to provide the community with outreach information /education brochures
	Multiple	Continue to enhance emergency communications in Scott County, including school administrators
Shelby	Multiple	Establish a free-standing Communications Center.
	Flood, Flash Flood, Dam/Levee Failure	Purchase and set up signage directing residents to shelters and warning of flash flood areas. Enhance emergency communications through public media.
	Multiple	Establish a process to identify and communicate with vulnerable populations in the event of a disaster.
St. Joseph	Multiple	Enhance partnerships with organizations working with underserved populations such as meals on wheels by adding education messages with food deliveries.
	Multiple	Seriously consider use of the IPAWs for public notification of hazards and emergency situations.
	Flood	Acquire flood prone properties.
Steuben	Flood, Dam Failure, Earthquake, Severe Storm	Ensure mobile home are anchored to meet industry standards.
	Flood	Continue to maintain waterways and regulated drains to prevent localized flooding.

County	Hazard	Mitigation Strategy
	Multiple	Prohibit development of critical facilities in known hazard areas.
Sullivan	Multiple	Propose and adopt ordinances related to International Building Codes, Floodplain Ordinances and Zoning regulations
	Multiple	Harden critical or public facilities to withstand severe wind damages
	Flood	Conduct detailed flood protection studies for problem areas and/or areas with repetitive flooding problems
Switzerland	Erosion, Flood	Continue to focus on river bank and roadway erosion and flood protection countywide.
	Multiple	Explore funding for upgrade of 800 mHz communications software.
	Multiple	Continue to sponsor weather spotter training courses and encourage use and distribution of weather radios.
Tippecanoe	Flood	Seek grants to buy out homes located in the floodplain go help reduce risk to life and property damage for local residents
	Flood	Encourage the town of Clarks hill to join the NFIP
	Multiple	Require safe rooms in all new public facilities
Union	Flood, Ground Failure	Implement reimbursement program to agricultural farmers to plan cover crops to prevent erosion and runoff.
	Wildfire	Mitigate dead trees.
	Tornado	Increase the range of outdoor warning sirens in Union County and install new sirens in those communities where they do not currently exist.
Vanderburgh	Multiple	Develop dedicated website page for multi-hazard mitigation information
	Flood	Purchase and install stream gages and water table gages to provide flood warning
Vigo	Multiple	Replace the existing mobile EOC and update equipment as needed
	Multiple	Inventory, prioritize, and retrofit public facilities and/or critical facilities with appropriate wiring and electrical capabilities for utilizing a large generator for power back up
	Multiple	Utilize a hazard broadcast system to distribute mass notifications to residents and visitors
Wabash	Multiple	Develop county-wide GIS with address verification within Code Red to improve emergency response times
	Multiple	Inventory and prioritize listing of public facilities which may serve as effective shelters if hardened
	Flooding	Protect existing critical facilities in floodplains
Warrick	Earthquake	Add inertial shut-off valves for all public facilities and key industry buildings in the county which have gas lines
	Multiple	Secure the EOC or seek funding for a standalone hardened structure which would include a command center
	Flood	Purchase repetitive loss properties along Stromburg Ditch
Wayne	Flood	Institute a buy-out plan for repetitive loss properties
	Flood/Severe Weather	Complete a storm water drainage study for known problem areas
	Multiple	Upgrade the radio communications system throughout the county for all public safety services
Wells	Flood	Increase size of storm sewer to improve drainage
	Flood	Provide protective measures for sewage treatment plant
	Flood	Mobile home park relocation and flood insurance outreach on Eight Mile Creek located along N. 300W 90

County	Hazard	Mitigation Strategy
Whitley	Multiple	Increase interdepartmental and inter-municipality communications related to hazard awareness and planning efforts
	Multiple	Increase awareness of hazard broadcast system (such as NIXLE) to distribute mass telephone announcements to every phone number or email in the system
	Multiple	Construct a new fire station/EOC in Churubusco and new fire station in Columbia City

10 State Capabilities

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.

10.1 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.

10.1.1 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.

10.1.2 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.

Building Resilient Infrastructure and Communities (BRIC) Grant Program (Pre-Disaster): IDHS administers funds from this annual, national competitive program. BRIC 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.

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.

10.1.3 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.

Enhance Indiana's Economic Competitiveness and Quality of Life

- Improve connectivity via multiple modes of transportation.
- Increase understanding of Indiana's position as it relates to the autonomous/connected vehicle industry and undertake initiatives to advance testing and research in the state.
- Support and encourage local agencies in their efforts to develop and implement sustainable plans for their futures.

Execute a 20-Year Road and Bridge Plan

- Deliver the Next Level Roads plan to improve pavement and bridge quality, safety, and mobility.
  - Priority given to construction zone safety for workers and motorists.
  - Focus on engineering, education, enforcement, and emergency response.
- Identify continuous improvements of the Asset Management process.
  - Strive for improved collaborations with all stakeholders – internal and external.
- Convey Next Level construction projects through effective and efficient communication strategies.

Develop INDOT's 21st Century Workforce

- Provide more complete job-training capabilities across the agency.
- Provide employees with tools and information needed to succeed.
- Deliver enhanced leadership training opportunities.

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.

10.1.4 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.

10.1.5 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.

Focused research initiatives and cooperative investigations with governmental agencies, businesses and industries, and educational organizations.

Geologic sample and data collection and archiving.

Dissemination of information in many forms, including published maps, reports, databases, and educational outreach programs.

10.1.6 Indiana Department of Environmental Management (IDEM)

IDEM's mission is to implement federal and state regulations to protect human health and the environment. IDEM works with local, state, and federal entities for the protection of environmental resources.

Air Quality Programs

- The Air Monitoring Branch serves the public and IDEM by overseeing all aspects of air quality monitoring in Indiana including the maintenance of Indiana's air monitoring network that measures regulated air pollutants covered by the Clean Air Act (CAA), the collection of air monitoring samples, and the handling and sharing of data collected from Indiana's air monitoring network.
- Air Compliance and Enforcement
- Air Monitoring
- Air Operations
- Air Permits
- Air Programs

Land Quality Programs

The Indiana landscape is an essential part of our environment, economy, and community. We must use it properly and preserve it for future generations of Hoosiers. The Office of Land Quality (OLQ) is primarily responsible for protecting this valuable resource. To achieve its goal, OLQ enforces regulations to make sure businesses are managing waste in safe ways. This includes animal farms, which can create large amounts of manure. Additionally, OLQ regulates storage tanks to minimize the possibility and impact of any underground leaks. And if the environment or public health is put at risk due to contamination, OLQ ensures that cleanups are prompt and effective.

- Animal farms
- Environmental clean up
- Storage Tanks
- Auto Salvage
- Coal Combustion Residuals.
- Industrial Waste
- Solid Waste
- Waste Tire Program

Water Quality Programs

The mission of the Indiana Department of Environmental Management (IDEM) is to implement federal and state regulations to protect human health and the environment while allowing the environmentally sound operations of industrial, agricultural, commercial, and governmental activities vital to a prosperous economy. The mission of IDEM's Office of Water Quality (OWQ), under the oversight of the Assistant Commissioner of OWQ, is to concentrate on fulfilling IDEM's mission where water quality is concerned. More specifically, OWQ is responsible for protecting public health and the environment by assessing the quality of surface water and groundwater through biological and chemical testing; regulating and monitoring drinking water supplies (including wellhead protection), wastewater treatment facilities and the construction of such facilities; and, protecting wetlands for proper drainage, flood protection and wildlife habitat. OWQ serves the citizens of Indiana through fulfilling responsibilities as set forth in the Clean Water Act.

- Blue-Green Algae
- Hoosier Riverwatch
- Storm Water Permitting
- Watersheds and Nonpoint Source Water Pollution
- Wetlands, Lakes, and Streams Regulation

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 hazards to human health and the environment. Incorporates mitigation objectives whenever possible.

10.1.7 Indiana State Department of Health

The Indiana State Department of Health serves to promote, protect, and improve the health and safety of all Hoosiers through the following:

- Drug Overdose Prevention
- Emergency Preparedness
- Epidemiology Resource Center
- Health and Human Services
- Health Care Regulation
- Laboratory Services
- Tobacco Prevention and Cessation
- Women, Infants & Children (WIC)
- Center for Deaf and Hard of Hearing Education

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.

10.1.8 Indiana Economic Development Corporation (IEDC)

IEDC's programs and initiatives offer business support and expertise to companies that are investing and creating jobs in Indiana. The agency strives to improve quality of place, infrastructure, available development sites and regulatory assistance to build economic strength and opportunity that grows and attracts new business and talent.

From decreasing permitting time, to streamlining application processes, pre-certifying shovel-ready sites and increasing access to training and skills, IEDC is focused on creating new high-wage, high-skill opportunities for the next generation of Hoosiers. It places special emphasis on the automotive, life sciences, energy, and national security industry sectors, and supports companies involved in advanced manufacturing, logistics, information technology and research and development.

Indiana also provides financial assistance to qualified high-tech firms and small businesses and offers a variety of programs to support new business start-ups and business expansion and growth.

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:** Can supply matching funds to communities for acquisition/elevation projects under the Community Development Block Grant (CDBG) program. Provides technical assistance to communities through various programs.

10.1.9 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.

10.1.10 Indiana Office of Community and Rural Affairs (OCRA)

OCRA's works with local, state, and national partners to provide resources and technical assistance to aid communities in shaping and achieving their vision for community and economic development.

Its activities include the following.

> **Funding for construction of housing through its low to moderate income housing, senior citizen housing, etc.:** Provides funding for relocation of floodplain residents through purchase of new housing.
>
> **Community Development Block Grants:** Provides federal funding to help rural communities with a variety of projects to include sewer and water systems, community centers, health and safety programs, and many others. These funds help communities improve their quality of life and ensure the health and safety of their citizens.
>
> Over 40 loan, loan guarantee, and grant programs to finance housing, businesses, economic development, and community facilities and infrastructure. Eight key programs:

- **Business & Industry Loan Guarantees:** bolsters the availability of private credit by guaranteeing loans for rural businesses.
- **Water & Waste Disposal Loan & Grant Program:** provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage to households and businesses in eligible rural areas.
- **Single Family Housing Guaranteed Loan Program:** assists approved lenders in providing low- and moderate-income households the opportunity to own adequate, modest, decent, safe and sanitary dwellings as their primary residence in eligible rural areas. Eligible applicants may build, rehabilitate, improve or relocate a dwelling in an eligible rural area. The program provides a 90% loan note guarantee to approved lenders in order to reduce the risk of extending 100% loans to eligible rural homebuyers.
- **Multi-Family Housing Direct Loans:** provides competitive financing for affordable multi-family rental housing for low-income, elderly, or disabled individuals and families in eligible rural areas.
- **Community Facilities Guaranteed Loan Program:** provides loan guarantees to eligible private lenders to help build essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings.
- **Community Facilities Direct Loan & Grant Program:** provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings.
- **Single Family Housing Direct Home Loans:** assists low- and very-low-income applicants obtain decent, safe and sanitary housing in eligible rural areas by providing payment assistance to increase an applicant's repayment ability. Payment assistance is a type of subsidy that reduces the mortgage payment for a short time. The amount of assistance is determined by the adjusted family income.
- **Multi-Family Housing Loan Guarantees:** works with qualified private-sector lenders to provide financing to qualified borrowers to increase the supply of affordable rental housing for low- and moderate-income individuals and families in eligible rural areas and towns.

10.1.11 Indiana Finance Authority (IFA)

IFA's mission is to oversee State-related debt issuance and provide efficient and effective financing solutions to facilitate state, local government, and business investment in Indiana.

Flood Control Revolving Fund: Created to provide local entities loans with low interest to pursue a relevant flood control program.

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.

- 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

10.1.12 USDA Rural Development Community Programs

This is a federal community program established to 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. Programs focused on individuals include:

- Farm Labor Housing Direct Loans & Grants
- Individual Water & Wastewater Grants
- Multi-Family Housing Direct Loans
- Single Family Housing Direct Home Loans
- Single Family Housing Guaranteed Loan Program
- Single Family Housing Repair Loans & Grants
- Value Added Producer Grants

10.2 State Policy and Local 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 53. 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	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

Policy Area	Description/Applicability	Effectiveness
	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 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.
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 harm's way. Still found mostly in larger cities and to some extent as economic development plans in smaller communities.

11 Plan Maintenance, Monitoring, and Evaluation

11.1 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 2021, multiple flooding events in the northern and southwestern parts of the state—where the State focused significant mitigation funding during the 2010s—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.

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 integrate the team more directly into the planning process.

11.2 Plan Monitoring and Evaluation

The plan goes over when the evaluation of goals and the overall effectiveness will occur, but it is light on the specific criteria that will be used in the evaluation process.

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. The mitigation section, through the cooperation of the local EMA directors, State Field Coordinators, and IDNR, 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.

Each agency reviews mitigation action progress based on their respective programmatic policies and requirements. IDHS monitors most projects based on the FEMA Hazard Mitigation Assistance Program Policy Guidance and the FEMA State and Local Mitigation Planning Policy Guidance. When mitigation projects overlap agencies, such as IDHS and IDNR, each agency will collaborate with the other to ensure each agency's policies are met. As other agencies completing mitigation actions work through IDHS, these agencies would abide by the federal policies IDHS utilizes and adapt other agency-specific policies in addition to the required IDHS policies. The State also has a Programmatic Agreement among FEMA, SHPO, IDHS and Tribes, which outlines stipulations to satisfy environmental and historic preservation considerations when evaluating mitigation projects.

An important time for plan monitoring is post-event. The purpose of monitoring the plan at that time is to review and evaluate how well the overall strategies work to achieve the goals of the State and local mitigation plans.

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. The State 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. Table 54 lists the status of grant mitigation projects within the state.

Table 54. Status of Indiana Mitigation Activities

Community	Description	Federal Award Amount	Federal Funding Source	Status		
				Completed	Ongoing	Awaiting Funding
Adams County	Planning	16,738.03	PDMC 16	x		
Adams County	Planning	19,457.00	PDMC 19		x	
Allen County	Planning	16,738.03	PDMC 16	x		
Allen County	Planning	19,457.00	PDMC 19		x	
Andrews (Huntington Co)	Acquisition/ Demolition	605,271.00	HMGP 4363		x	
Auburn	Acquisition/ Demolition	134,737.50	PDMC 16		x	
Bartholomew County	Planning	19,457.00	PDMC 19		x	
Benton County	Planning	19,583.20	HMGP 4173		x	
Benton County	Planning	19,457.00	PDMC 18		x	
Blackford County	Planning	16,738.03	PDMC 16	x		
Boone County	Planning	18,457.00	BRIC 20		x	
BSA Hoosier Trails Council (Jackson Co.)	Community Safe Room	1,015,896.03	PDMC 17		x	
BSA LaSalle Council (St. Joseph Co.)	Community Safe Room	437,850.00	PDMC 18		x	
Carroll County	Planning	16,738.03	PDMC 16	x		

Community	Description	Federal Award Amount	Federal Funding Source	Status		
				Completed	Ongoing	Awaiting Funding
Cass County	Planning	16,738.03	PDMC 16		x	
Clark County	Planning	19,457.00	PDMC 18		x	
Clarksville	Acquisition/ Demolition	242,479.50	HMGP 4363		x	
Clay County	Planning	18,457.00	BRIC 20		x	
Clinton County	Planning	19,583.20	HMGP 4173		x	
Crawford County	Planning	19,564.00	PDMC 17		x	
Daviess County	Planning	16,738.03	PDMC 16	x		
Dearborn County	Planning	19,457.00	PDMC 18		x	
Decatur (City)	Acquisition/ Demolition	660,030.00	PDMC 18		x	
Decatur (City)	Acquisition/ Demolition	374,400.00	PDMC 19		x	
Decatur (City)	Acquisition/ Demolition	362,498.00	HMGP 4173	x		
Decatur (City)	Acquisition/ Demolition	428,156.25	PDMC 16		x	
Decatur (City)	Acquisition/ Demolition	1,765,812.50	PDMC 17		x	
Decatur County	Planning	16,738.03	PDMC 16		x	
DeKalb County	Planning	19,564.00	PDMC 17		x	
Delaware County	Planning	16,738.03	PDMC 16		x	
Dubois County	Planning	16,738.03	PDMC 16		x	
Elkhart (City)	Acquisition/ Demolition	359,238.00	HMGP 4363		x	
Elkhart County	Planning	19,457.00	PDMC 19		x	
Fayette County	Planning	19,457.00	PDMC 18		x	
Floyd County	Planning	19,457.00	PDMC 18		x	
Fountain County	Planning	16,738.03	PDMC 16	x		
Franklin County	Planning	19,583.20	HMGP 4173		x	
Ft. Wayne	Acquisition/ Demolition	557,644.00	HMGP 4173	x		
Ft. Wayne	Acquisition/ Demolition	248,703.75	PDMC 16		x	
Ft. Wayne	Acquisition/ Demolition	1,122,208.50	PDMC 17		x	
Ft. Wayne	Acquisition/ Demolition	347,424.00	PDMC 18		x	
Ft. Wayne	Acquisition/ Demolition	479,070.00	PDMC 19		x	
Fulton County	Planning	16,738.03	PDMC 16	x		
Gibson County	Planning	19,564.00	PDMC 17		x	
Grant County	Planning	18,457.00	BRIC 20		x	

Community	Description	Federal Award Amount	Federal Funding Source	Status		
				Completed	Ongoing	Awaiting Funding
Greene County	Planning	18,457.00	BRIC 20		x	
Greenwood	Acquisition/ Demolition	973,121.31	PDMC 16		x	
Greenwood	Acquisition/ Demolition	848,800.31	PDMC 18		x	
Hamilton County	Planning	19,564.00	PDMC 17		x	
Hancock County	Planning	19,457.00	PDMC 19		x	
Harrison County	Planning	19,457.00	PDMC 18		x	
Hendricks County	Planning	19,564.00	PDMC 17		x	
Holton (Ripley Co)	Community Safe Room	224,145.00	PDMC 19		x	
Howard County	Planning	19,564.00	PDMC 17		x	
Huntington County	Planning	16,738.03	PDMC 16		x	
IN Residential Safe Room Program (Statewide)	Residential Safe Room	189,890.21	PDMC 15	x		
Jackson County	Planning	19,457.00	PDMC 18		x	
Jasper County	Planning	19,564.00	PDMC 17		x	
Jay County	Planning	16,738.03	PDMC 16	x		
Jefferson County	Planning	19,457.00	PDMC 19		x	
Jennings County	Planning	18,457.00	BRIC 20		x	
Johnson County	Planning	19,564.00	PDMC 17		x	
Knox County	Planning	19,457.00	PDMC 19		x	
Kosciusko County	Planning	16,738.03	PDMC 16	x		
LaGrange County	Planning	16,738.03	PDMC 16	x		
Lake County	Planning	19,583.20	HMGP 4173		x	
LaPorte County	Planning	18,457.00	BRIC 20		x	
Lawrence County	Planning	19,457.00	PDMC 19		x	
Low Head Dam Initiative (Statewide)	Education/ Outreach	69,940.00	HMGP 4173		x	
Madison County	Planning	18,457.00	BRIC 20		x	
Marion County	Planning	19,564.00	PDMC 17		x	
Marshall County	Planning	18,457.00	BRIC 20		x	
Martin County	Planning	19,583.20	HMGP 4173		x	
Miami County	Planning	18,457.00	BRIC 20		x	
Monroe County	Planning	18,457.00	BRIC 20		x	
Montgomery County	Planning	19,457.00	PDMC 18		x	
Morgan County	Acquisition/ Demolition	1,423,057.58	PDMC 18		x	
Morgan County	Planning	19,457.00	PDMC 19		x	
Morgan County	Acquisition/ Demolition	100,365.00	HMGP 4363		x	

Community	Description	Federal Award Amount	Federal Funding Source	Status		
				Completed	Ongoing	Awaiting Funding
Newton County	Planning	16,738.03	PDMC 16	x		
Noble County	Planning	19,564.00	PDMC 17		x	
Ohio County	Planning	18,457.00	BRIC 20		x	
Owen County	Planning	19,457.00	PDMC 18		x	
Parke County	Planning	18,457.00	BRIC 20		x	
Perry County	Planning	19,457.00	PDMC 18		x	
Pike County	Planning	18,457.00	BRIC 20		x	
Plymouth (City)	Acquisition/ Demolition	259,950.00	HMGP 4363		x	
Porter County	Planning	16,738.03	PDMC 16	x		
Posey County	Planning	18,457.00	BRIC 20		x	
Pulaski County	Planning	16,738.03	PDMC 16	x		
Putnam County	Planning	18,457.00	BRIC 20		x	
Randolph County	Planning	19,457.00	PDMC 19		x	
Rush County	Planning	19,457.00	PDMC 19		x	
Rush County	Drainage Study	67,055.61	PDMC 19		x	
Salem Community Schools Corp. (High School)	Community Safe Room	3,870,890.44	PDMC 18		x	
Salem Community Schools Corp. (Middle School)	Community Safe Room	3,580,163.62	PDMC 18		x	
Scott County	Planning	19,457.00	PDMC 18		x	
Shelby County	Planning	19,457.00	PDMC 19		x	
Spencer County	Planning	16,738.03	PDMC 16	x		
St. Joseph County	Acquisition/ Demolition	2,162,080.49	PDMC 18		x	
St. Joseph County	Acquisition/ Demolition	549,531.80	HMGP 4363		x	
Starke County	Planning	19,457.00	PDMC 18		x	
Steuben County	Planning	19,564.00	PDMC 17		x	
Sullivan County	Planning	16,738.03	PDMC 16	x		
Switzerland County	Planning	18,457.00	BRIC 20		x	
Tippecanoe County	Planning	19,457.00	PDMC 18		x	
Tipton (City)	Acquisition/ Demolition	307,305.00	HMGP 4173	x		
Tipton County	Planning	16,738.03	PDMC 16	x		
Union County	Planning	19,457.00	PDMC 19		x	

Community	Description	Federal Award Amount	Federal Funding Source	Status		
				Completed	Ongoing	Awaiting Funding
Vanderburgh County	Planning	16,738.03	PDMC 16	x		
Vermillion County	Planning	16,738.03	PDMC 16		x	
Vigo County	Planning	19,457.00	PDMC 18		x	
Wabash County	Planning	16,738.03	PDMC 16	x		
Warren County	Planning	16,738.03	PDMC 16	x		
Warrick County	Planning	19,457.00	PDMC 19		x	
Washington County	Planning	19,564.00	PDMC 17		x	
Wayne County	Planning	19,457.00	PDMC 19		x	
Wells County	Acquisition/ Demolition	175,851.31	PDMC 16	x		
Wells County	Planning	19,564.00	PDMC 17		x	
White County	Planning	19,457.00	PDMC 18		x	
Whitley County	Planning	16,738.03	PDMC 16	x		

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Appendix A NCEI Events by County and IDHS Region

Flooding

Table 55. NCEI flood events by county and IDHS region (2018-2022)

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
IDHS DISTRICT 1					
Jasper	4	0	0	$288,000	$0
LaPorte	1	0	0	$500,000	$0
Lake	20	0	0	$0	$0
Newton	4	0	0	$0	$0
Porter	13	0	0	$3,705,000	$0
District Subtotal	**42**	**0**	**0**	**$4,493,000**	**$0**
IDHS DISTRICT 2					
Elkhart	10	0	0	$1,200,000	$0
Fulton	1	0	0	$250,000	$0
Kosciusko	1	0	0	$56,000	$0
Marshall	1	0	0	$1,200,000	$0
Pulaski	1	0	0	$38,000	$0
St. Joseph	7	0	0	$1,106,000	$0
Starke	1	0	0	$1,200,000	$0
District Subtotal	**22**	**0**	**0**	**$5,050,000**	**$0**
IDHS DISTRICT 3					
Adams	1	0	0	$0	$0
Allen	3	0	0	$5,000	$0
DeKalb	0	0	0	$0	$0
Huntington	0	0	0	$0	$0
LaGrange	1	0	0	$54,000	$0
Miami	0	0	0	$0	$0
Noble	0	0	0	$0	$0
Steuben	0	0	0	$0	$0
Wabash	1	1	0	$0	$0
Wells	1	0	0	$0	$0
Whitley	3	0	0	$325,000	$0
District Subtotal	**10**	**1**	**0**	**$384,000**	**$0**
IDHS DISTRICT 4					
Benton	0	0	0	$0	$0
Carroll	2	0	0	$15,000	$2,000
Cass	0	0	0	$0	$0
Clinton	8	0	0	$17,750	$1500

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
Fountain	2	0	0	$520,000	$0
Montgomery	5	0	0	$8,000	$2,500
District Subtotal	**17**	**0**	**0**	**$560,500**	**$6,000**
Tippecanoe	2	0	0	$101,000	$0
Warren	0	0	0	$0	$0
White	1	0	0	$230,000	$0
District Subtotal	**20**	**0**	**0**	**$891,750**	**$6,000**
IDHS DISTRICT 5					
Boone	5	0	0	$14,500	$55,500
Hamilton	8	0	0	$310,000	$0
Hancock	3	0	0	$11,000	$0
Hendricks	4	0	0	$252,000	$2,500
Johnson	2	0	0	$60,000	$0
Marion	12	0	0	$78,500	$0
Morgan	5	0	0	$155,750	$5,500
Shelby	7	0	0	$45,500	$3,000
District Subtotal	**46**	**0**	**0**	**$927,250**	**$63,500**
IDHS DISTRICT 6					
Blackford	0	0	0	$0	$0
Delaware	13	0	0	$134,000	$10,000
Fayette	15	0	0	$165,000	$0
Grant	0	0	0	$0	$0
Henry	0	0	0	$0	$0
Howard	4	0	0	$38,000	$0
Jay	0	0	0	$0	$0
Madison	3	0	0	$7,000	$0
Randolph	3	0	0	$16,000	$0
Rush	2	0	0	$265,000	$0
Tipton	1	0	0	$10,000	$0
Union	9	0	0	$20,000	$30,000
Wayne	9	0	0	$9	$0
District Subtotal	**59**	**1**	**0**	**$655,000**	**$40,000**
IDHS DISTRICT 7					
Clay	2	0	0	$6,000	$5,000
Greene	3	0	0	$16,000	$1,000
Owen	3	0	0	$20,010,500	$10,000
Parke	2	0	0	$20,500	$12,000
Putnam	1	0	0	$10,000	$0
Sullivan	3	0	0	$9,000	$25,000

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
Vermillion	3	0	0	$4,000	$2,000
Vigo	10	0	0	$106,000	$11,000
District Subtotal	**27**	**0**	**0**	**$20,182,000**	**$66,000**
IDHS DISTRICT 8					
Bartholomew	9	1	0	$245,000	$0
Brown	4	0	0	$181,000	$0
Jackson	7	0	0	$140,000	$11,000
Lawrence	6	0	0	$57,500	$1,000
Monroe	5	1	1	$27,100,000	$0
Orange	1	0	0	$0	$0
Washington	4	0	0	$0	$0
District Subtotal	**36**	**2**	**1**	**$27,723,500**	**$12,000**
IDHS DISTRICT 9					
Clark	14	0	0	$50,000	$0
Dearborn	17	0	0	$116,000	$0
Decatur	9	0	0	$62,500	$7,000
Floyd	5	0	0	$0	$0
Franklin	23	7	0	$778,000	$0
Harrison	2	0	0	$150,000	$0
Jefferson	5	1	0	$200,000	$0
Jennings	2	0	0	$28,000	$0
Ohio	5	0	0	$55,000	$0
Ripley	35	0	0	$11,000	$0
Scott	3	0	0	$0	$0
Switzerland	14	1	0	$18,054,000	$0
District Subtotal	**134**	**9**	**0**	**$19,504,500**	**$7,000**
IDHS DISTRICT 10					
Crawford	5	0	0	$2,000	$0
Daviess	6	0	0	$32,500	$2,000
Dubois	20	0	0	$15,000	$0
Gibson	83	0	0	$287,000	$230,000
Knox	16	0	0	$161,000	$21,500
Martin	3	0	0	$15,500	$0
Perry	10	0	0	$20,000	$0
Pike	42	0	0	$80,000	$180,000
Posey	58	0	0	$115,000	$65,000
Spencer	13	0	0	$370,000	$0
Vanderburgh	30	0	0	$417,000	$0
Warrick	31	0	0	$120,000	$45,000

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
District Subtotal	317	0	0	$1,635,000	$543,500
Grand Total	713	12	1	$81,446,000	$738,000

Table 56. Hazus flood results: total amount of damaged buildings by occupancy code

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
	IDHS DISTRICT 1							
Jasper	$964,527	$57,629	$15,166	$0	$0	$2,092	$0	$889,640
Lake	$18,924,301	$513,983	$349,388	$71,778	$6,362,060	$1,608,857	$119,061	$9,899,174
LaPorte	$2,268,000	$60,702	$11,582	$2,915	$243,668	$348	$13,057	$1,935,726
Newton	$1,364,754	$32,569	$17,444	$0	$560,941	$32	$0	$753,769
Porter	$4,213,420	$30,935	$265,317	$0	$97,071	$0	$944	$3,819,153
District Subtotal	**$27,735,003**	**$695,817**	**$658,898**	**$74,693**	**$7,263,740**	**$1,611,330**	**$133,061**	**$17,297,463**
	IDHS DISTRICT 2							
Elkhart	$17,274,962	$57,220	$520,230	$0	$4,974,453	$293,246	$97,777	$11,332,036
Fulton	$376,575	$2,838	$0	$0	$0	$0	$0	$373,738
Kosciusko	$7,140,135	$221,285	$68,252	$0	$1,234,565	$172,070	$9,891	$5,434,071
Marshall	$1,495,867	$114,663	$4,330	$0	$135,037	$501	$1,843	$1,239,493
Pulaski	$4,110,459	$20,297	$10,197	$0	$2,277,888	$0	$6,831	$1,795,247
St_Joseph	$15,017,953	$96,981	$7,889	$0	$371,356	$263,229	$838	$14,277,660
Starke	$1,112,181	$160,180	$6,669	$0	$694,850	$282	$0	$250,199
District Subtotal	**$46,528,132**	**$673,463**	**$617,566**	**$0**	**$9,688,149**	**$729,329**	**$117,180**	**$34,702,443**
	IDHS DISTRICT 3							
Adams	$1,276,810	$37,611	$34,162	$0	$0	$772,954	$25,437	$406,647
Allen	$39,747,808	$268,106	$630,862	$966,075	$3,925,165	$17,230,417	$92,603	$16,634,580
Dekalb	$2,840,599	$98,770	$766	$0	$1,317,132	$77,058	$107,426	$1,239,447
Huntington	$2,478,578	$173,517	$54,122	$0	$417,805	$14,408	$2,972	$1,815,754
LaGrange	$3,835,535	$94,473	$19,131	$0	$2,037	$0	$0	$3,719,894
Miami	$5,517,245	$2,819	$169,464	$0	$4,722,128	$119,280	$1,595	$501,960
Noble	$3,092,550	$79,401	$1,217	$0	$9,806	$3,932	$0	$2,998,193
Steuben	$3,064,093	$44,068	$8,250	$0	$1,990	$0	$23,679	$2,986,106
Wabash	$1,621,057	$3,800	$109,057	$0	$226,300	$66,554	$22,664	$1,192,681

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
Wells	$1,654,225	$153,910	$378	$0	$847,638	$0	$0	$652,299
Whitley	$3,224,129	$84,183	$529,741	$171,341	$1,334,333	$6,503	$322	$1,097,707
District Subtotal	**$68,352,630**	**$1,040,658**	**$1,557,151**	**$1,137,415**	**$12,804,334**	**$18,291,105**	**$276,699**	**$33,245,267**
	IDHS DISTRICT 4							
Benton	$273,541	$0	$0	$0	$0	$0	$0	$273,541
Carroll	$24,709,362	$1,953,105	$130,812	$0	$5,794,347	$2,359	$51,292	$16,777,447
Cass	$1,841,569	$23,531	$54	$0	$643,231	$4$0,313	$65,072	$1,105,369
Clinton	$1,334,088	$145,703	$27,426	$0	$284,755	$0	$21,022	$855,183
Fountain	$999,052	$716,510	$0	$0	$25,689	$0	$0	$256,853
Montgomery	$2,755,471	$124,074	$378,420	$0	$76,623	$14,950	$0	$2,161,404
Tippecanoe	$21,295,082	$1,648,715	$698,346	$0	$4,823,143	$13,902	$436,689	$13,674,286
Warren	$5,999,135	$5,602,163	$0	$0	$0	$0	$0	$396,972
White	$13,567,286	$56,774	$3,903	$0	$220,148	$62	$86	$13,286,314
District Subtotal	**$72,774,586**	**$10,270,575**	**$1,238,960**	**$0**	**$11,867,936**	**$35,586**	**$574,161**	**$48,787,368**
	IDHS DISTRICT 5							
Boone	$5,816,911	$267,376	$1,399,072	$0	$905,094	$1,695,266	$7,200	$1,542,904
Hamilton	$17,546,111	$69,831	$782,323	$0	$5,374,534	$107,497	$14,233	$11,197,694
Hancock	$3,471,780	$91,421	$323,240	$0	$147,790	$511	$95,151	$2,813,668
Hendricks	$2,291,150	$20,641	$37,983	$0	$395,403	$5,994	$6,607	$1,824,522
Johnson	$10,239,315	$166,735	$281,877	$685	$1,344,372	$167,814	$65,310	$8,212,521
Marion	$285,800,132	$481,992	$20,753,145	$154,503	$161,532	$7,308,496	$1,940,864	$254,999,600
Morgan	$4,805,700	$768,610	$265,546	$21,357	$584,481	$105,763	$57,348	$3,002,595
Shelby	$9,681,341	$1,358,134	$32,455	$0	$1,862,378	$198,160	$85,922	$6,144,292
District Subtotal	**$339,652,440**	**$3,224,740**	**$23,875,641**	**$176,546**	**$10,775,583**	**$9,589,501**	**$2,272,635**	**$289,737,796**
	IDHS DISTRICT 6							
Blackford	$577,808	$0	$88,091	$0	$335,789	$29,156	$0	$124,771
Delaware	$18,820,511	$19,749	$177,836	$0	$14,091,635	$1,071,589	$60,972	$3,398,731

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
Fayette	$3,151,566	$654,221	$28,846	$0	$825,821	$1,289	$2,556	$1,638,832
Grant	$9,026,819	$94,653	$183,050	$0	$4,387,223	$54,014	$130,997	$4,176,882
Henry	$1,266,350	$68,945	$3,365	$0	$589,804	$2,436	$7,660	$594,141
Howard	$5,681,283	$32,274	$87,188	$355,759	$1,253,798	$166,242	$129,062	$3,656,960
Jay	$260,712	$43,040	$3,493	$63	$17,285	$1	$0	$196,829
Madison	$11,808,460	$378,318	$303,820	$0	$4,199,685	$993,829	$10,733	$5,922,075
Randolph	$2,281,346	$26,006	$66,660	$0	$316,300	$59,178	$40,494	$1,772,709
Rush	$3,573,306	$68,935	$5,799	$1,545,436	$527,981	$1,245,926	$22,394	$156,836
Tipton	$8,845,988	$66,226	$304,709	$314,179	$7,035,824	$4,343	$6,946	$1,113,761
Union	$503,175	$190,317	$0	$0	$0	$0	$0	$312,858
Wayne	$23,868,921	$61,505	$669,807	$6,873,325	$11,683,301	$1,328,051	$114,292	$3,138,640
District Subtotal	**$89,666,246**	**$1,704,188**	**$1,922,664**	**$9,088,762**	**$45,264,447**	**$4,956,054**	**$526,106**	**$26,204,025**
	IDHS DISTRICT 7							
Clay	$2,467,533	$1,260,421	$0	$0	$0	$126	$0	$1,206,986
Greene	$2,508,313	$1,305,835	$149,656	$0	$26,627	$22,694	$34,105	$969,396
Owen	$1,766,716	$307,496	$6,071	$0	$0	$0	$85,627	$1,367,522
Parke	$11,455,343	$4,658,964	$5,470	$0	$4,449,968	$1,997	$8,115	$2,330,828
Putnam	$5,603,020	$1,521,786	$26,478	$0	$1,165,948	$0	$250	$2,888,558
Sullivan	$250,502	$84,937	$5,658	$0	$107,478	$0	$0	$52,430
Vermillion	$3,356,075	$86,745	$8,400	$0	$180,173	$1,126,556	$34,436	$1,919,765
Vigo	$19,624,765	$241,961	$5,287,033	$0	$303,574	$55,839	$231,333	$13,505,024
District Subtotal	**$47,032,268**	**$9,468,145**	**$5,488,766**	**$0**	**$6,233,768**	**$1,207,213**	**$393,867**	**$24,240,509**
	IDHS DISTRICT 8							
Bartholomew	$18,506,818	$608,303	$883,541	$0	$8,919,819	$1,474,414	$41,716	$6,579,025
Brown	$11,903,910	$406,759	$1,103,348	$0	$6,460,970	$5,488	$13,648	$3,913,698
Jackson	$3,405,982	$752,186	$229,517	$0	$629,122	$248,034	$18,270	$1,528,853
Lawrence	$7,308,450	$1,840,080	$48,611	$0	$3,208,158	$0	$89,041	$2,122,560

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
Monroe	$9,400,448	$839,679	$453,854	$0	$781,622	$7,957	$65,111	$7,252,226
Orange	$7,502,346	$178,371	$1,304,253	$3,008	$3,706,166	$693,901	$105,649	$1,510,998
Washington	$1,942,328	$154,602	$24,195	$0	$600,352	$64,709	$5,269	$1,093,201
District Subtotal	**$59,970,282**	**$4,779,981**	**$4,047,319**	**$3,008**	**$24,306,207**	**$2,494,503**	**$338,704**	**$24,000,559**
	IDHS DISTRICT 9							
Clark	$67,494,321	$1,231,785	$1,458,889	$0	$23,685,550	$2,195,362	$269,268	$38,653,466
Dearborn	$33,255,500	$1,206,142	$2,401,748	$0	$26,716,296	$585,685	$116,520	$2,229,109
Decatur	$939,012	$181,019	$15,040	$3,930	$395,012	$27,006	$2,784	$314,221
Floyd	$17,169,719	$1,673,247	$1,862,774	$48,397	$10,078,015	$380,636	$304,228	$2,822,423
Franklin	$4,105,553	$1,423,095	$30,238	$0	$59,774	$149,778	$4,105	$2,438,564
Harrison	$12,068,766	$328,413	$906,443	$0	$6,899,589	$992,867	$235,026	$2,706,428
Jefferson	$14,867,486	$103,556	$2,002,072	$26,040	$7,134,235	$1,881	$15,679	$5,584,023
Jennings	$2,915,971	$1,467,766	$0	$0	$0	$0	$10,192	$1,438,014
Ohio	$1,194,592	$160,731	$14,510	$0	$0	$0	$0	$1,019,351
Ripley	$1,479,771	$518,067	$184,764	$0	$51,783	$0	$22,897	$702,260
Scott	$312,190	$76,776	$9,658	$0	$1,197	$1,789	$0	$222,769
Switzerland	$20,538,066	$263,458	$263,528	$0	$15,537,101	$0	$20,544	$4,453,435
District Subtotal	**$176,340,947**	**$8,634,054**	**$9,149,664**	**$78,367**	**$90,558,553**	**$4,335,004**	**$1,001,243**	**$62,584,062**
	IDHS DISTRICT 10							
Crawford	$3,531,181	$75,146	$149,117	$0	$1,450	$0	$49,715	$3,255,753
Davies	$3,266,867	$341,539	$17,353	$0	$0	$0	$12,296	$2,895,680
Dubois	$3,945,091	$208,999	$214,252	$0	$2,516	$610,691	$0	$2,908,634
Gibson	$8,406,785	$473,480	$53,168	$0	$4,983,778	$156,682	$91,022	$2,648,656
Kno	$12,209,636	$1,193,540	$104,512	$3,526,702	$1,917,363	$221,825	$151,215	$5,094,479
Martin	$4,731,559	$607,917	$115,517	$0	$1,830,218	$58,791	$27,298	$2,091,818
Perry	$2,637,422	$298,204	$56,076	$0	$24,807	$71,183	$3,085	$2,184,067
Pike	$449,905	$79,798	$113,929	$0	$232,177	$17,137	$3,289	$3,575

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
Posey	$8,954,124	$2,101,586	$75,757	$0	$3,454,911	$34,014	$51,407	$3,236,448
Spencer	$4,715,736	$261,805	$130,531	$0	$219,704	$1,372,469	$8,827	$2,722,401
Vanderburgh	$14,326,899	$384,366	$1,101,349	$0	$2,726,868	$2,444,716	$38,786	$7,630,814
Warrick	$7,155,303	$680,912	$196,033	$290,713	$2,074,809	$184,723	$156,419	$3,571,694
District Subtotal	**$74,330,509**	**$6,707,291**	**$2,327,593**	**$3,817,415**	**$17,468,602**	**$5,172,230**	**$593,359**	**$38,244,019**
Grand Total	$1,002,383,043	$47,198,913	$50,884,223	$14,376,206	$236,231,319	$48,421,856	$6,227,016	$599,043,511

Table 57. Hazus flood results: number of damaged buildings by occupancy code

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
	IDHS DISTRICT 1							
Jasper	614	121	47	0	0	6	2	438
Lake	3,156	303	247	3	143	368	32	2,060
LaPorte	773	320	16	1	40	6	8	382
Newton	569	65	23	0	18	1	0	462
Porter	455	56	23	0	13	0	4	359
District Subtotal	**455**	**56**	**23**	**0**	**13**	**0**	**4**	**359**
	IDHS DISTRICT 2							
Elkhart	1,065	74	96	0	125	36	14	720
Fulton	260	15	0	0	6	0	0	239
Kosciusko	3,019	159	150	0	41	32	14	2,623
Marshall	420	84	34	0	46	4	13	239
Pulaski	937	75	16	0	26	0	2	818
St_Joseph	920	152	41	1	19	67	12	628
Starke	652	323	13	0	19	2	0	295
District Subtotal	**7,273**	**882**	**350**	**1**	**282**	**141**	**55**	**5,562**

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
	IDHS DISTRICT 3							
Adams	493	191	18	0	1	109	4	170
Allen	3,640	247	291	11	101	128	56	2,806
Dekalb	383	60	9	0	38	15	24	237
Huntington	279	15	31	0	15	15	4	199
LaGrange	1,590	219	23	0	2	0	0	1,346
Miami	572	25	33	7	114	29	1	363
Noble	1,547	52	10	0	3	19	1	1,462
Steuben	1,017	35	10	0	1	0	8	963
Wabash	553	60	53	0	13	12	20	395
Wells	193	39	2	0	29	0	0	123
Whitley	481	50	19	4	27	6	4	371
District Subtotal	**10,748**	**993**	**499**	**22**	**344**	**333**	**122**	**8,435**
	IDHS DISTRICT 4							
Benton	28	7	0	0	0	0	0	21
Carroll	2,129	141	43	0	29	20	25	1,871
Cass	675	43	14	0	28	8	22	560
Clinton	301	66	21	0	5	0	2	207
Fountain	110	36	0	0	9	0	0	65
Montgomery	416	86	36	0	17	12	0	265
Tippecanoe	1,139	137	40	0	13	6	20	923
Warren	116	80	0	0	0	0	0	36
White	1,628	18	28	0	18	2	1	1,561
District Subtotal	**6,542**	**614**	**182**	**0**	**119**	**48**	**70**	**5,509**
	IDHS DISTRICT 5							
Boone	892	82	64	0	20	7	15	704
Hamilton	1,804	128	121	0	96	30	22	1,407

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
Hancock	994	152	128	5	27	10	17	655
Hendricks	481	67	36	0	25	10	3	340
Johnson	1,975	138	113	1	22	29	47	1,625
Marion	18,215	26	1,326	13	9	417	143	16,281
Morgan	1,266	202	150	10	39	61	13	791
Shelby	1,563	334	27	0	29	48	15	1,110
District Subtotal	**27,190**	**1,129**	**1,965**	**29**	**267**	**612**	**275**	**22,913**
	IDHS DISTRICT 6							
Blackford	107	19	18	0	5	15	0	50
Delaware	1,512	52	100	0	113	77	17	1,153
Fayette	853	304	90	0	9	5	13	432
Grant	753	70	83	0	39	13	18	530
Henry	625	182	33	0	34	3	20	353
Howard	784	125	53	1	45	34	9	517
Jay	291	16	22	3	3	1	8	238
Madison	1,930	178	140	0	68	37	7	1,500
Randolph	788	164	33	0	20	16	18	537
Rush	479	201	17	16	29	2	14	200
Tipton	839	181	61	1	47	6	7	536
Union	81	31	0	0	0	0	0	50
Wayne	1,134	154	151	11	106	64	29	619
District Subtotal	**10,176**	**1,677**	**801**	**32**	**518**	**273**	**160**	**6,715**
	IDHS DISTRICT 7							
Clay	645	370	3	0	0	1	0	271
Greene	909	493	56	0	3	10	19	328
Owen	526	102	20	0	2	0	24	378
Parke	393	145	9	0	4	3	3	229

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
Putnam	620	213	4	0	13	0	7	383
Sullivan	151	111	1	0	2	0	0	37
Vermillion	569	33	10	0	9	25	24	468
Vigo	4,301	136	492	0	9	19	107	3,538
District Subtotal	**8,114**	**1,603**	**595**	**0**	**42**	**58**	**184**	**5,632**
	IDHS DISTRICT 8							
Bartholomew	2,532	391	163	0	31	109	32	1,806
Brown	897	242	67	0	25	9	9	545
Jackson	2,058	482	116	4	23	81	27	1,325
Lawrence	608	228	20	0	4	0	46	310
Monroe	916	106	189	0	39	6	17	559
Orange	868	98	185	1	36	43	21	484
Washington	430	111	45	0	15	9	2	248
District Subtotal	**8,309**	**1,658**	**785**	**5**	**173**	**257**	**154**	**5,277**
	IDHS DISTRICT 9							
Clark	3,650	203	314	0	82	19	71	2,961
Dearborn	930	242	318	0	60	36	23	251
Decatur	302	73	43	2	11	7	4	162
Floyd	921	134	111	2	41	49	32	552
Franklin	758	304	102	0	2	14	10	326
Harrison	1,060	157	253	0	73	37	53	487
Jefferson	547	40	58	2	37	1	16	393
Jennings	404	136	1	0	2	0	3	262
Ohio	282	83	12	0	0	0	0	187
Ripley	300	79	48	0	5	0	18	150
Scott	121	8	7	0	3	1	2	100
Switzerland	761	70	64	0	50	0	8	569

County Name	Total Building Losses	Building Occupancy Class						
		Agriculture	Commercial	Education	Government	Industrial	Religious	Residential
District Subtotal	**10,036**	**1,529**	**1,331**	**6**	**366**	**164**	**240**	**6,400**
	IDHS DISTRICT 10							
Crawford	694	74	55	0	1	0	20	544
Davies	1,068	363	31	0	0	0	26	648
Dubois	600	88	140	0	4	129	0	239
Gibson	692	167	19	0	13	16	30	447
Kno	1,165	313	82	11	19	37	16	687
Martin	654	168	40	0	19	16	8	403
Perry	756	189	43	0	2	52	4	466
Pike	56	9	10	0	4	18	6	9
Posey	1,572	501	25	0	9	14	35	988
Spencer	1,576	374	106	0	18	132	34	912
Vanderburgh	2,877	254	308	0	34	279	56	1,946
Warrick	1,266	295	111	11	66	69	27	687
District Subtotal	**12,976**	**2,795**	**970**	**22**	**189**	**762**	**262**	**7,976**
Grand Total	106,931	13,745	7,834	121	2,514	3,029	1,568	78,120

Severe Weather

Table 58. NCEI Reported High Wind, Lightning, and Thunderstorm Wind Events by County (2018-2022)

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
IDHS DISTRICT 1					
Jasper	37	0	1	$0	$0
LaPorte	29	0	1	$31,000	$0
Lake	71	0	2	$0	$0
Newton	27	0	0	$0	$0
Porter	62	0	0	$15,000	$0
District Subtotal	**226**	**0**	**4**	**$46,000**	**$0**
IDHS DISTRICT 2					
Elkhart	68	0	0	$65,500	$0
Fulton	23	0	1	$46,000	$0
Kosciusko	73	0	2	$318,000	$0
Marshall	43	2	0	$126,000	$0
Pulaski	8	0	0	$45,000	$0
St. Joseph	88	0	0	$86,800	$0
Starke	24	1	1	$147,000	$0
District Subtotal	**327**	**3**	**4**	**$834,300**	**$0**
IDHS DISTRICT 3					
Adams	11	2	0	$0	$0
Allen	110	2	2	$404,000	$0
DeKalb	23	0	0	$312,500	$0
Huntington	57	0	3	$11,500	$0
LaGrange	28	0	0	$1,000	$0
Miami	21	0	0	$17,000	$0
Noble	28	0	0	$10,000	$0
Steuben	30	0	1	$45,000	$0
Wabash	15	0	0	$40,000	$0
Wells	11	0	0	$9,000	$0
Whitley	42	0	0	$122,200	$0
District Subtotal	**376**	**4**	**6**	**$972,200**	**$0**
IDHS DISTRICT 4					
Benton	18	0	0	$25,000	$0
Carroll	20	0	0	$196,000	$0
Cass	20	0	0	$18,500	$0
Clinton	14	0	0	$117,500	$0
Fountain	21	0	1	$648,000	$0
Montgomery	10	0	0	$69,000	$0
Tippecanoe	54	0	0	$280,950	$0

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
Warren	12	0	0	$48,500	$0
White	19	0	0	$0	$0
District Subtotal	**188**	**0**	**1**	**$1,403,450**	**$0**
IDHS DISTRICT 5					
Boone	19	1	0	$267,000	$0
Hamilton	40	1	0	$601,500	$0
Hancock	28	0	0	$314,750	$0
Hendricks	42	1	3	$729,250	$0
Johnson	22	0	2	$361,250	$0
Marion	61	0	1	$1,924,700	$0
Morgan	14	0	0	$226,000	$0
Shelby	32	0	1	$381,200	$0
District Subtotal	**258**	**3**	**7**	**$4,805,650**	**$0**
IDHS DISTRICT 6					
Blackford	5	0	0	$0	$0
Delaware	34	0	0	$378,500	$0
Fayette	16	0	0	$57,000	$0
Grant	17	0	0	$13,000	$0
Henry	14	0	0	$123,250	$0
Howard	30	0	0	$170,250	$0
Jay	11	0	0	$6,000	$0
Madison	34	0	0	$589,500	$5,000
Randolph	11	0	0	$116,500	$0
Rush	39	0	0	$970,000	$125,000
Tipton	8	0	0	$42,750	$0
Union	10	0	0	$41,000	$0
Wayne	30	0	0	$107,500	$0
District Subtotal	**259**	**0**	**0**	**$2,615,250**	**$130,000**
IDHS DISTRICT 7					
Clay	13	0	0	$79,500	$0
Greene	11	0	0	$62,000	$0
Owen	12	0	0	$198,000	$0
Parke	15	0	0	$73,000	$0
Putnam	24	0	0	$211,000	$3,000
Sullivan	12	0	0	$138,000	$0
Vermillion	10	0	0	$53,000	$0
Vigo	25	0	0	$245,000	$0
District Subtotal	**122**	**0**	**0**	**$1,059,500**	**$3,000**
IDHS DISTRICT 8					

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
Bartholomew	26	0	0	$366,200	$0
Brown	16	0	0	$138,200	$0
Jackson	12	0	0	$194,000	$0
Lawrence	14	0	0	$141,000	$0
Monroe	22	1	0	$248,000	$3,000
Orange	15	0	0	$45,000	$0
Washington	15	0	0	$188,000	$0
District Subtotal	**120**	**1**	**0**	**$1,320,400**	**$3,000**
IDHS DISTRICT 9					
Clark	36	0	0	$220,000	$0
Dearborn	37	0	0	$215,500	$0
Decatur	28	0	1	$314,550	$0
Floyd	14	0	0	$77,000	$0
Franklin	12	0	0	$31,500	$0
Harrison	26	0	0	$20,500	$0
Jefferson	21	0	0	$26,000	$0
Jennings	8	0	0	$172,000	$0
Ohio	11	0	0	$30,000	$0
Ripley	56	0	0	$336,500	$0
Scott	14	0	0	$85,000	$0
Switzerland	23	0	0	$93,350	$0
District Subtotal	**286**	**0**	**1**	**$1,621,900**	**$0**
IDHS DISTRICT 10					
Crawford	25	0	0	$116,000	$0
Daviess	11	0	0	$23,500	$0
Dubois	49	0	0	$180,000	$0
Gibson	18	0	0	$491,000	$0
Knox	42	0	0	$906,250	$0
Martin	14	0	0	$137,000	$0
Perry	12	0	0	$0	$0
Pike	6	0	0	$72,000	$0
Posey	8	0	0	$344,000	$0
Spencer	18	0	0	$229,000	$0
Vanderburgh	22	1	0	$439,000	$0
Warrick	12	0	0	$137,000	$0
District Subtotal	**237**	**1**	**0**	**$3,074,750**	**$0**
Grand Total	2399	12	23	$17,753,400	$136,000

Tornado

Table 59. NCEI Reported Tornadoes by County (2018-2022)

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
IDHS DISTRICT 1					
Jasper	0	0	0	$0	$0
LaPorte	0	0	0	$0	$0
Lake	5	0	0	$0	$0
Newton	3	0	0	$0	$0
Porter	1	0	0	$0	$0
District Subtotal	**9**	**0**	**0**	**$0**	**$0**
IDHS DISTRICT 2					
Elkhart	0	0	0	$0	$0
Fulton	1	0	0	$0	$0
Kosciusko	3	0	0	$0	$0
Marshall	1	0	0	$0	$0
Pulaski	0	0	0	$0	$0
St. Joseph	5	0	0	$20,000	$0
Starke	0	0	0	$0	$0
District Subtotal	**10**	**0**	**0**	**$20,000**	**$0**
IDHS DISTRICT 3					
Adams	0	0	0	$0	$0
Allen	0	0	0	$0	$0
DeKalb	0	0	0	$0	$0
Huntington	0	0	0	$0	$0
LaGrange	0	0	0	$0	$0
Miami	2	0	0	$0	$0
Noble	0	0	0	$0	$0
Steuben	3	0	0	$0	$0
Wabash	2	0	0	$0	$0
Wells	1	0	2	$0	$0
Whitley	0	0	0	$0	$0
District Subtotal	**8**	**0**	**2**	**$0**	**$0**
IDHS DISTRICT 4					
Benton	0	0	0	$0	$0
Carroll	2	0	0	$1,000,000	$0
Cass	1	0	0	$15,000	$0
Clinton	0	0	0	$0	$0
Fountain	1	0	0	$1,000	$5,000
Montgomery	1	0	0	$0	$0
Tippecanoe	2	0	0	$43,000	$0

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
Warren	0	0	0	$0	$0
White	1	0	0	$0	$0
District Subtotal	**8**	**0**	**0**	**$1,059,000**	**$5,000**
IDHS DISTRICT 5					
Boone	0	0	0	$0	$0
Hamilton	0	0	0	$0	$0
Hancock	0	0	0	$0	$0
Hendricks	0	0	0	$0	$0
Johnson	1	0	0	$40,000	$0
Marion	2	0	0	$1,110,000	$0
Morgan	1	0	0	$500,000	$0
Shelby	4	0	0	$228,000	$5,500
District Subtotal	**8**	**0**	**0**	**$1,878,000**	**$5,500**
IDHS DISTRICT 6					
Blackford	0	0	0	$0	$0
Delaware	0	0	0	$0	$0
Fayette	1	0	0	$50,000	$0
Grant	2	0	0	$0	$0
Henry	2	0	0	$60,000	$0
Howard	0	0	0	$0	$0
Jay	1	0	0	$0	$0
Madison	3	0	1	$295,000	$500
Randolph	1	0	0	$15,000	$0
Rush	2	0	0	$460,000	$0
Tipton	0	0	0	$0	$0
Union	1	0	0	$35,000	$0
Wayne	1	0	2	$225,000	$0
District Subtotal	**14**	**0**	**3**	**$1,140,000**	**$500**
IDHS DISTRICT 7					
Clay	0	0	0	$0	$0
Greene	1	0	0	$250,000	$0
Owen	1	0	0	$100,000	$0
Parke	0	0	0	$0	$0
Putnam	0	0	0	$0	$0
Sullivan	1	0	0	$5,000	$10,000
Vermillion	0	0	0	$0	$0
Vigo	0	0	0	$0	$0
District Subtotal	**3**	**0**	**0**	**$355,000**	**$10,000**
IDHS DISTRICT 8					

County	# of Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage
Bartholomew	0	0	0	$0	$0
Brown	2	0	0	$31,000	$0
Jackson	2	0	0	$80,000	$0
Lawrence	0	0	0	$0	$0
Monroe	1	0	0	$110,000	$0
Orange	0	0	0	$0	$0
Washington	4	0	0	$80,000	$0
District Subtotal	**9**	**0**	**0**	**$301,000**	**$0**
IDHS DISTRICT 9					
Clark	0	0	0	$0	$0
Dearborn	2	0	0	$90,000	$0
Decatur	1	0	0	$15,000	$0
Floyd	0	0	0	$0	$0
Franklin	0	0	0	$0	$0
Harrison	2	0	0	$620,000	$0
Jefferson	0	0	0	$0	$0
Jennings	2	0	0	$53,000	$0
Ohio	3	0	0	$90,000	$0
Ripley	5	0	0	$320,000	$0
Scott	1	0	0	$0	$0
Switzerland	0	0	0	$0	$0
District Subtotal	**16**	**0**	**0**	**$1,188,000**	**$0**
IDHS DISTRICT 10					
Crawford	0	0	0	$0	$0
Daviess	0	0	0	$0	$0
Dubois	0	0	0	$0	$0
Gibson	3	0	1	$175,000	$8,000
Knox	2	0	0	$215,000	$0
Martin	0	0	0	$0	$0
Perry	1	0	0	$80,000	$0
Pike	2	0	0	$3,000	$0
Posey	2	0	0	$80,000	$10,000
Spencer	4	0	0	$95,000	$5,000
Vanderburgh	2	0	0	$25,000	$0
Warrick	1	0	2	$2,000,000	$0
District Subtotal	**17**	**0**	**3**	**$2,673,000**	**$23,000**
Grand Total	102	0	8	$8,614,000	$44,000

Appendix B Potential Essential Facility Damage from 100-year Flood

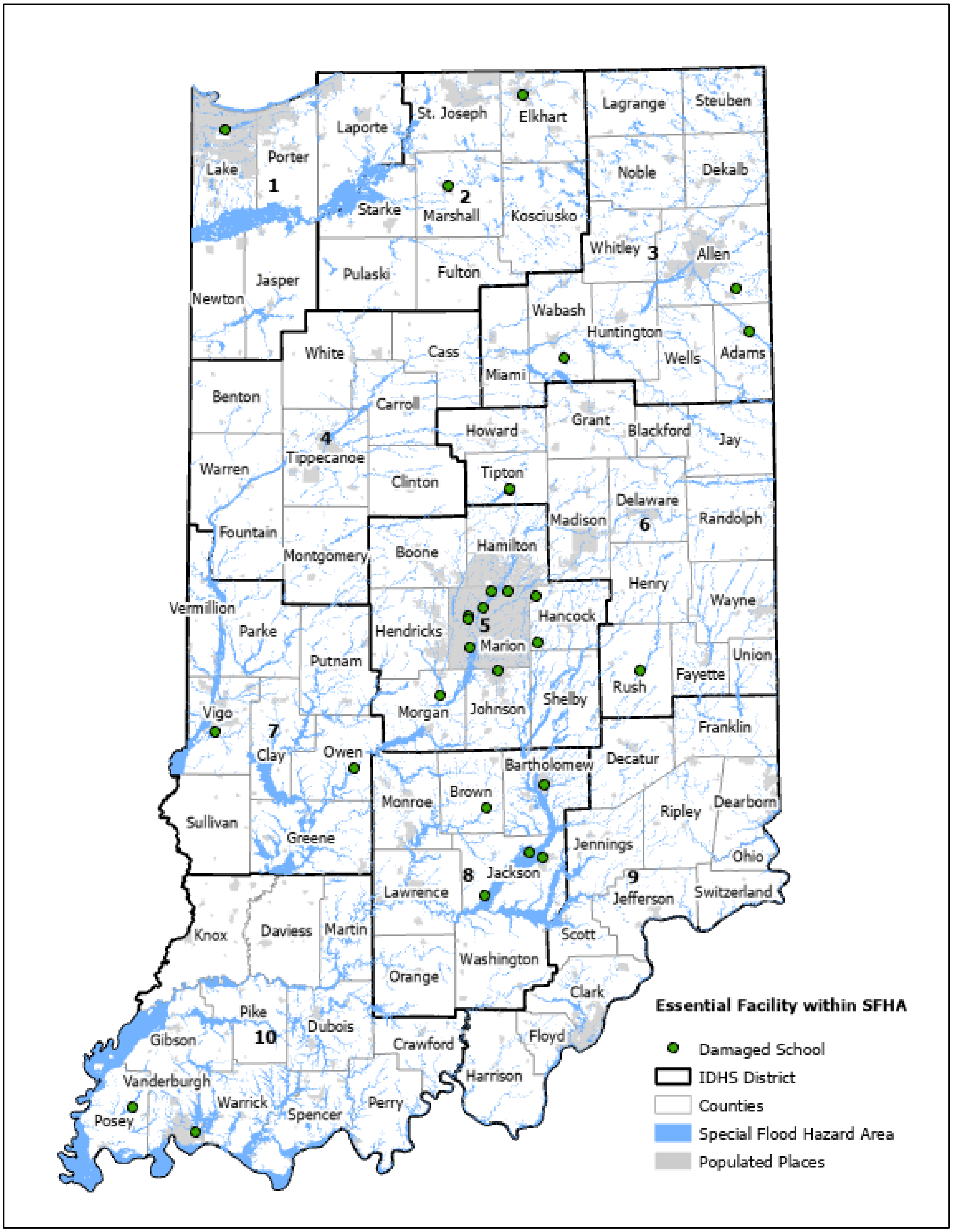


Figure 114. Projected Damaged Schools during a 100-Year Flood

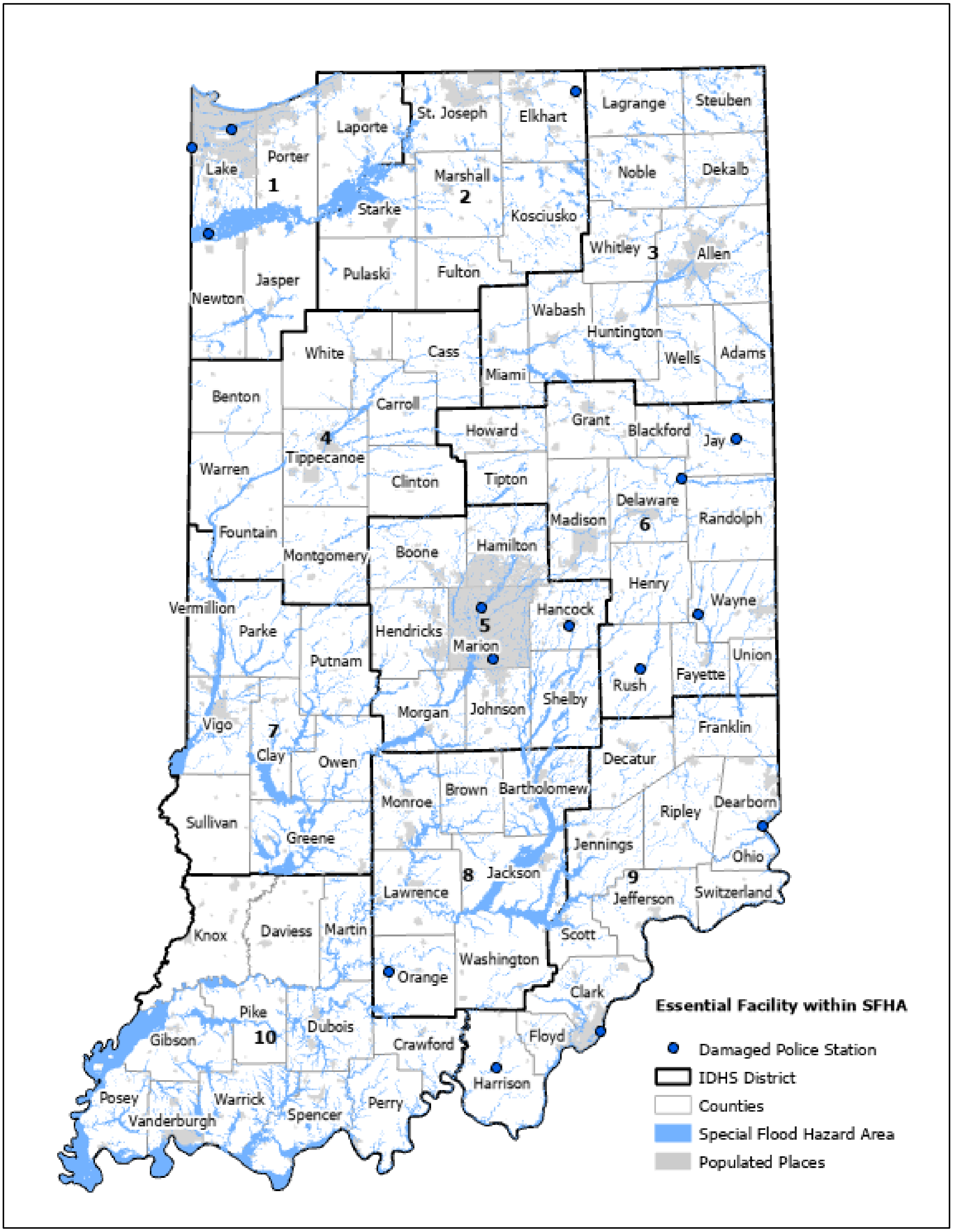


Figure 115. Projected Damaged Police Stations during a 100-Year Flood

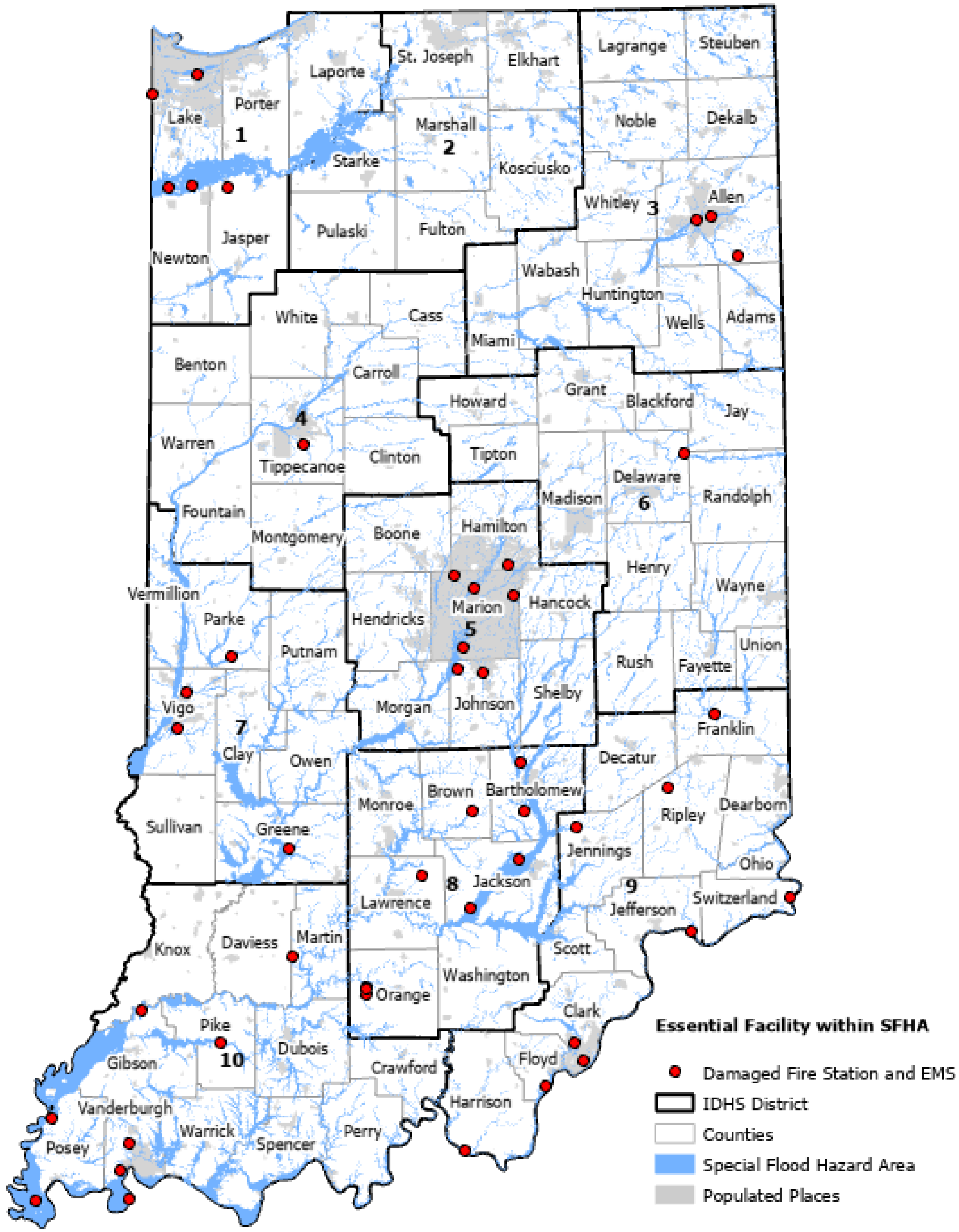


Figure 116. Projected Damaged Fire Stations & EMS during a 100-Year Flood

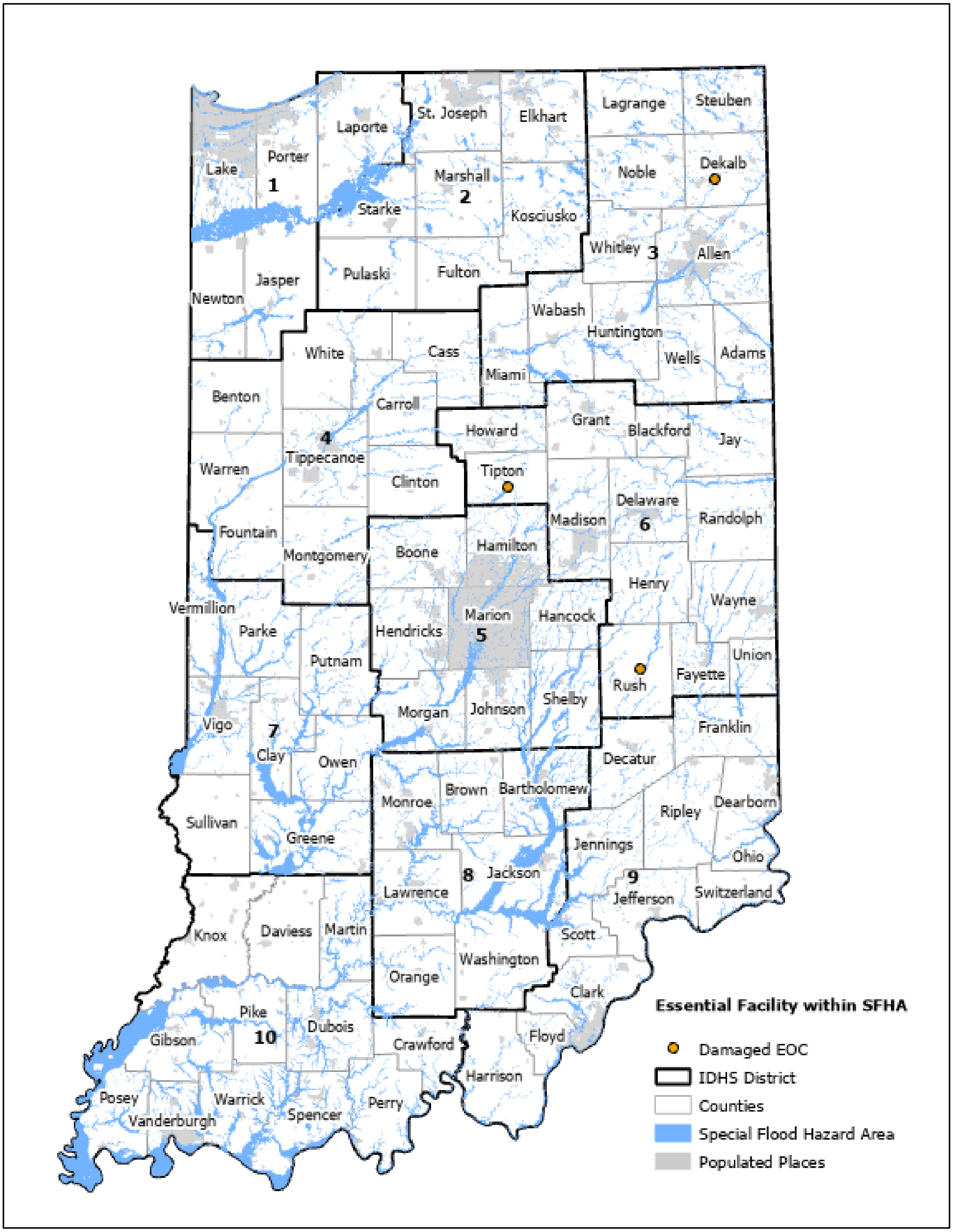


Figure 117. Projected Damaged EOC during a 100-Year Flood

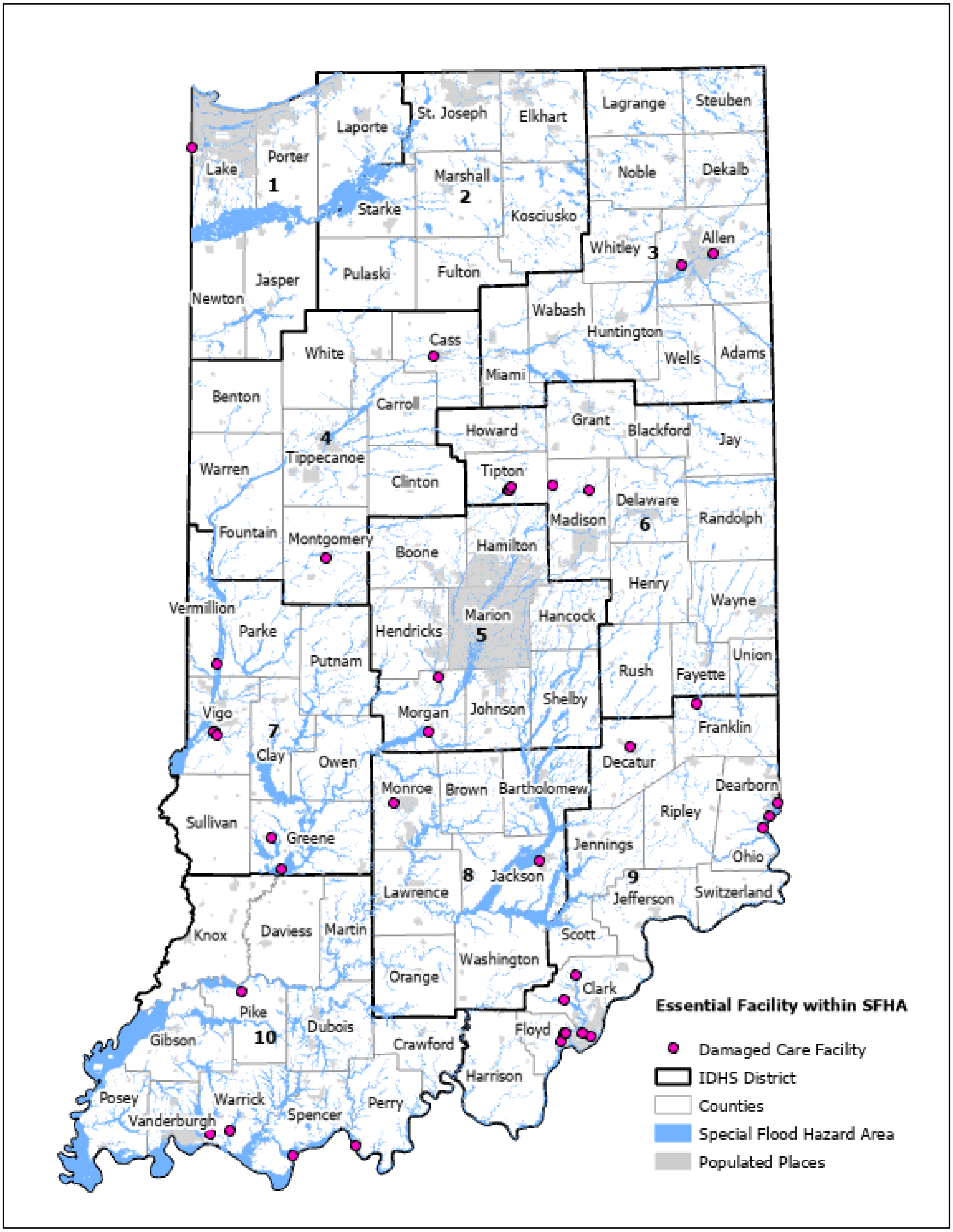
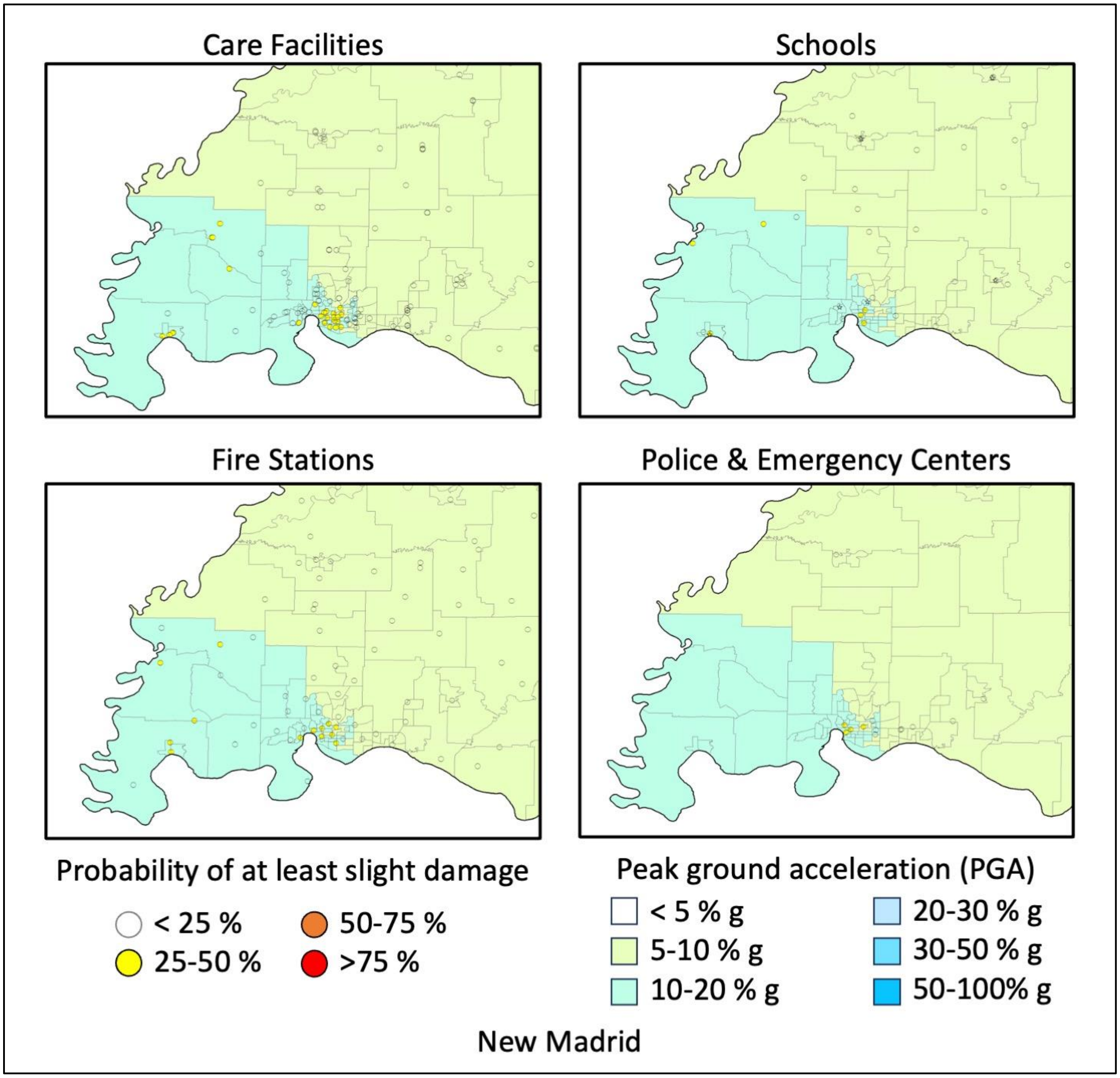
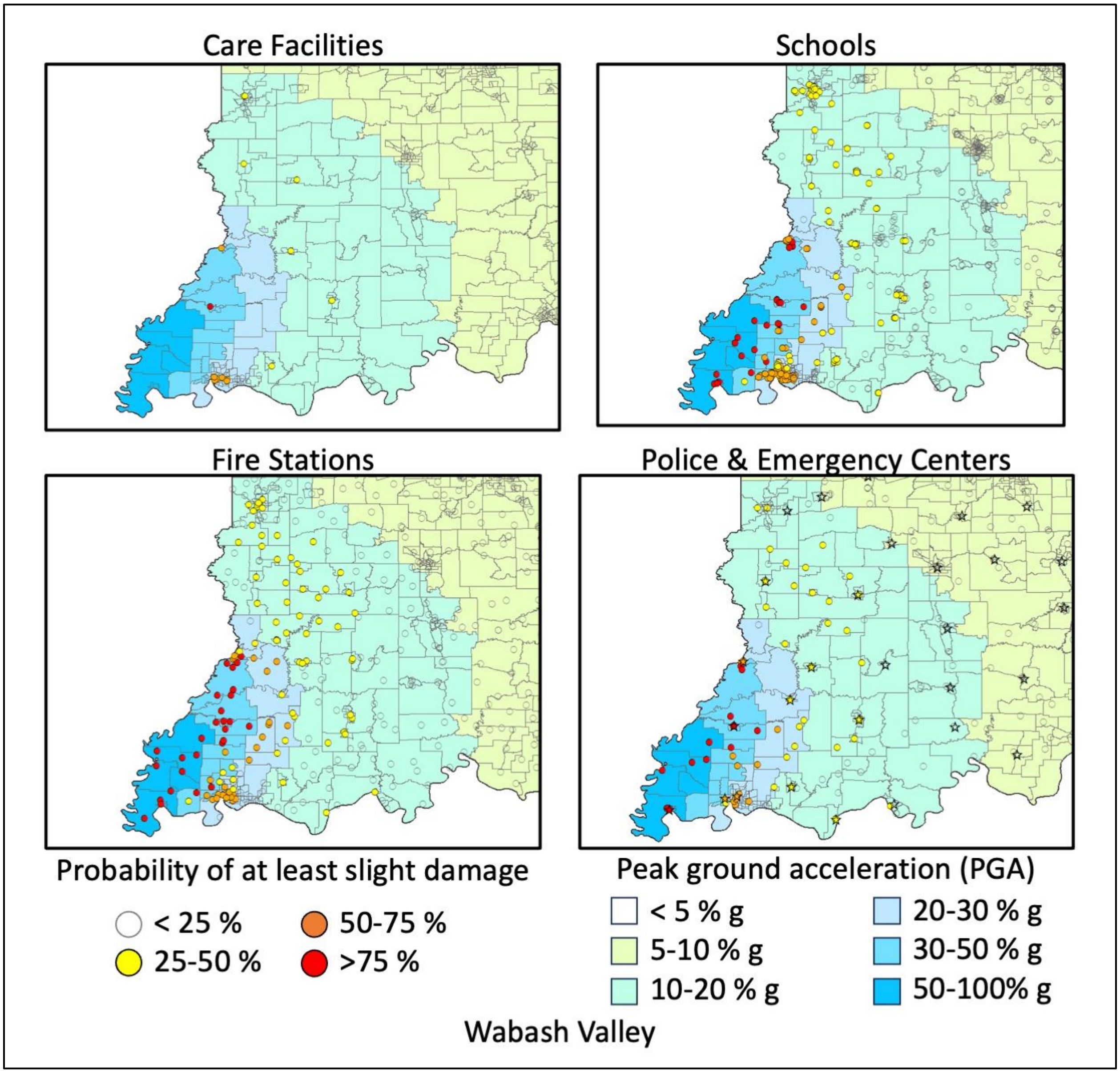
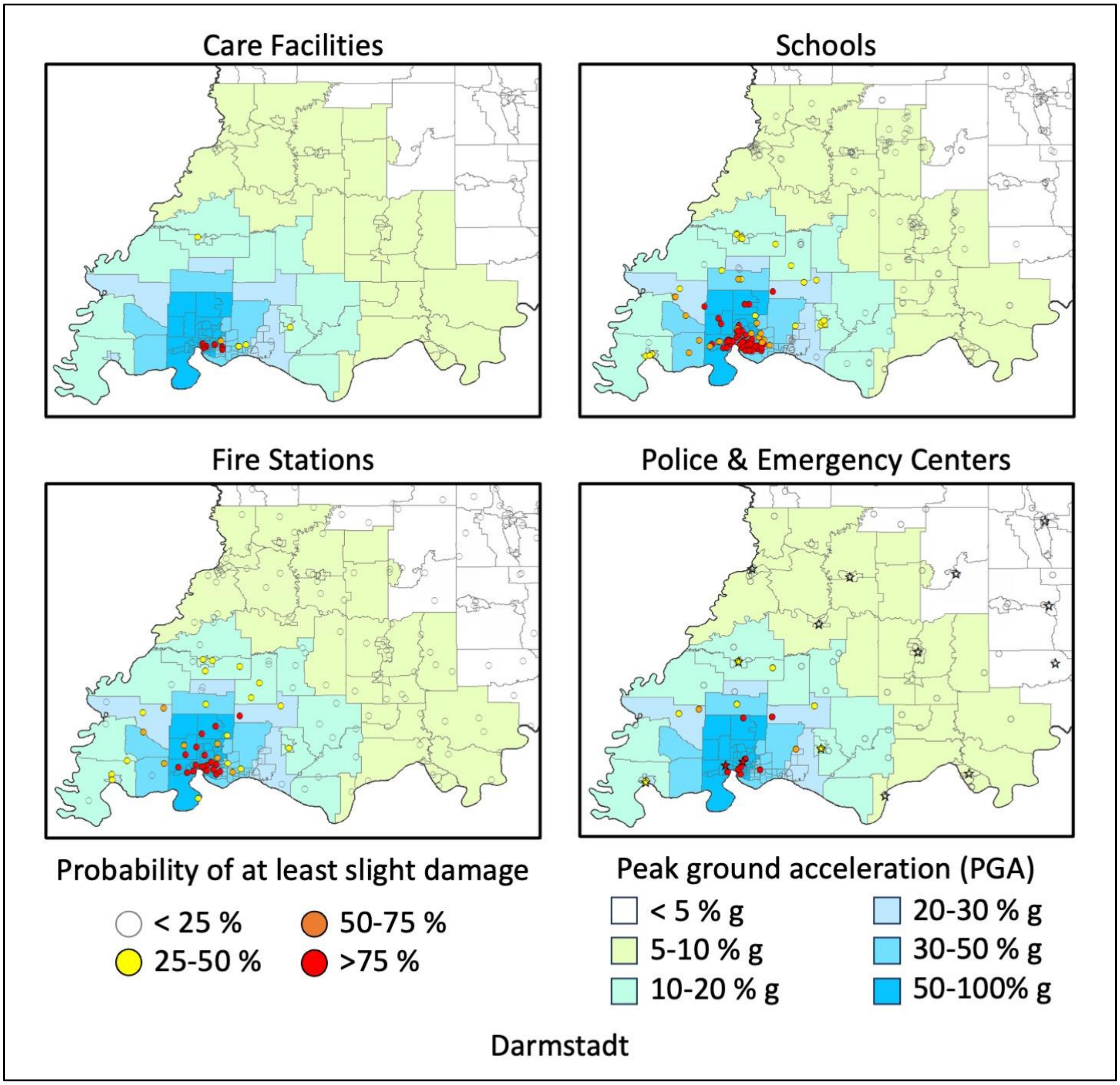
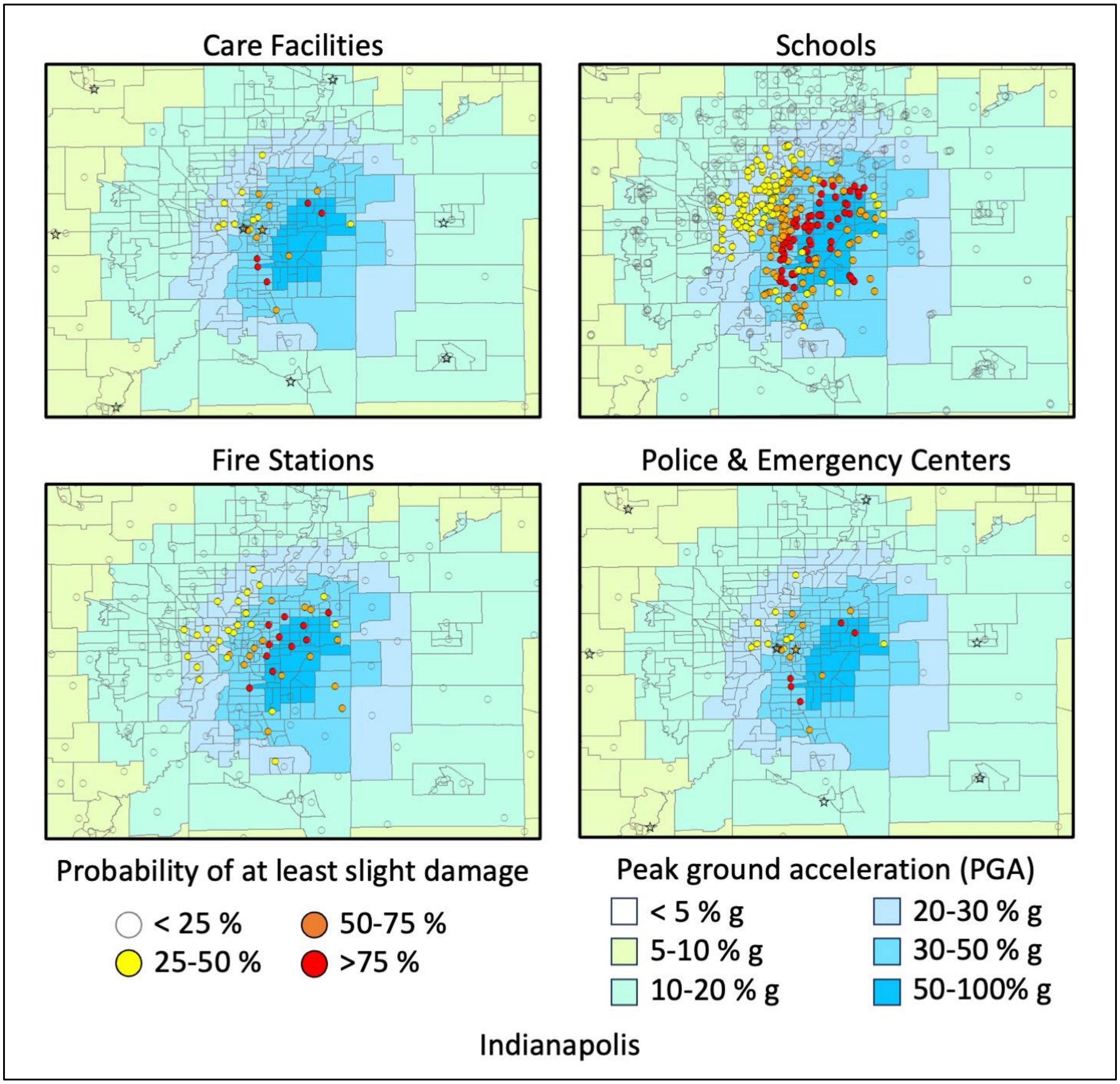


Figure 118. Projected Damaged Care Facility during a 100-Year Flood


Care Facilities
Schools
Fire Stations
Police & Emergency Centers
Probability of at least slight damage
< 25 %
25-50 %
50-75 %
>75 %
Peak ground acceleration (PGA)
< 5 % g
5-10 % g
10-20 % g
20-30 % g
30-50 % g
50-100% g
New Madrid


Care Facilities
Schools
Fire Stations
Police & Emergency Centers
Probability of at least slight damage
< 25 %
50-75 %
25-50 %
>75 %
Peak ground acceleration (PGA)
< 5 % g
20-30 % g
5-10 % g
30-50 % g
10-20 % g
50-100% g
Wabash Valley


Care Facilities
Schools
Fire Stations
Police & Emergency Centers
Probability of at least slight damage
< 25 %
50-75 %
25-50 %
>75 %
Peak ground acceleration (PGA)
< 5 % g
20-30 % g
5-10 % g
30-50 % g
10-20 % g
50-100% g
Darmstadt



Care Facilities
Schools
Fire Stations
Police & Emergency Centers
Probability of at least slight damage
< 25 %
50-75 %
25-50 %
>75 %
Peak ground acceleration (PGA)
< 5 % g
5-10 % g
10-20 % g
20-30 % g
30-50 % g
50-100% g
Indianapolis

Appendix D 2022 HIRA

Table 60. 2022 HIRA

Plan Year	IDHS Region	County	Category	Hazard	Severe	High	Moderate	Low	CPRI
2022	North	Allen	Man-Made Threats	Hostage Situation	0.00	2.80	0.00	0.00	2.80
2022	North	Allen	Man-Made Threats	Hostage Situation	0.00	2.80	0.00	0.00	2.80
2022	North	Allen	Man-Made Threats	Riot	3.30	0.00	0.00	0.00	3.30
2022	North	Carroll	Man-Made Threats	Active Attacker (Kinetic)	0.00	2.80	0.00	0.00	2.80
2022	North	Carroll	Natural Hazards	Animal Disease Outbreak	3.25	0.00	0.00	0.00	3.25
2022	North	Carroll	Man-Made Threats	Arson	0.00	0.00	2.40	0.00	2.40
2022	North	Carroll	Man-Made Threats	Biological Attack	0.00	2.70	0.00	0.00	2.70
2022	North	Carroll	Man-Made Threats	Chemical Attack	0.00	0.00	2.40	0.00	2.40
2022	North	Carroll	Technological Hazards	Communication Failure	0.00	2.80	0.00	0.00	2.80
2022	North	Carroll	Man-Made Threats	Conventional Attack	0.00	2.70	0.00	0.00	2.70
2022	North	Carroll	Man-Made Threats	Cyber Attack	3.70	0.00	0.00	0.00	3.70
2022	North	Carroll	Natural Hazards	Derecho	0.00	0.00	2.40	0.00	2.40
2022	North	Carroll	Man-Made Threats	Domestic Terrorism	0.00	0.00	2.50	0.00	2.50
2022	North	Carroll	Natural Hazards	Drought	0.00	2.80	0.00	0.00	2.80
2022	North	Carroll	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	0.00	1.90	1.90
2022	North	Carroll	Man-Made Threats	Electromagnetic (EMP) Attack	0.00	2.65	0.00	0.00	2.65
2022	North	Carroll	Technological Hazards	Explosion	0.00	2.70	0.00	0.00	2.70
2022	North	Carroll	Man-Made Threats	Explosive Attack	0.00	0.00	2.50	0.00	2.50
2022	North	Carroll	Natural Hazards	Extreme Temperatures	0.00	2.55	0.00	0.00	2.55
2022	North	Carroll	Natural Hazards	Flash Flood	0.00	0.00	2.30	0.00	2.30
2022	North	Carroll	Natural Hazards	Ground Failure	0.00	0.00	0.00	1.90	1.90
2022	North	Carroll	Technological Hazards	Hazardous Material - Fixed Facility	3.15	0.00	0.00	0.00	3.15
2022	North	Carroll	Technological Hazards	Hazardous Material - Transportation Incident	0.00	2.70	0.00	0.00	2.70

2022	North	Carroll	Technological Hazards	High Hazard Dam - (Federally owned)	0.00	0.00	2.50	0.00	2.50
2022	North	Carroll	Technological Hazards	High Hazard Dam - (Privately/locally owned)	0.00	2.65	0.00	0.00	2.65
2022	North	Carroll	Technological Hazards	Highway Transportation Incident	3.15	0.00	0.00	0.00	3.15
2022	North	Carroll	Technological Hazards	Highway Transportation Incident	3.15	0.00	0.00	0.00	3.15
2022	North	Carroll	Technological Hazards	Highway Transportation Incident	0.00	0.00	2.00	0.00	2.00
2022	North	Carroll	Man-Made Threats	Hostage Situation	0.00	0.00	2.20	0.00	2.20
2022	North	Carroll	Natural Hazards	Human Disease Outbreak	3.55	0.00	0.00	0.00	3.55
2022	North	Carroll	Natural Hazards	Ice Storms	0.00	2.85	0.00	0.00	2.85
2022	North	Carroll	Man-Made Threats	International Terrorism	0.00	0.00	2.35	0.00	2.35
2022	North	Carroll	Natural Hazards	Invasive Species - Animal	3.25	0.00	0.00	0.00	3.25
2022	North	Carroll	Natural Hazards	Invasive Species - Animal	2.95	0.00	0.00	0.00	2.95
2022	North	Carroll	Natural Hazards	Invasive Species - Insect	2.95	0.00	0.00	0.00	2.95
2022	North	Carroll	Technological Hazards	Large Fire/Conflagration	0.00	2.70	0.00	0.00	2.70
2022	North	Carroll	Natural Hazards	Major Flood	2.95	0.00	0.00	0.00	2.95
2022	North	Carroll	Technological Hazards	Major Levee Failure - (Accredited)	0.00	0.00	2.25	0.00	2.25
2022	North	Carroll	Man-Made Threats	Nuclear Attack	0.00	2.65	0.00	0.00	2.65
2022	North	Carroll	Man-Made Threats	Other Violent Offenders	0.00	0.00	0.00	1.90	1.90
2022	North	Carroll	Technological Hazards	Pipeline Transportation Incident	0.00	2.75	0.00	0.00	2.75
2022	North	Carroll	Technological Hazards	Public Utility Failure	0.00	2.70	0.00	0.00	2.70
2022	North	Carroll	Man-Made Threats	Radiological Attack	0.00	2.65	0.00	0.00	2.65
2022	North	Carroll	Technological Hazards	Rail Transportation Incident	3.15	0.00	0.00	0.00	3.15
2022	North	Carroll	Technological Hazards	Rail Transportation Incident	3.15	0.00	0.00	0.00	3.15
2022	North	Carroll	Man-Made Threats	Riot	0.00	0.00	0.00	1.85	1.85
2022	North	Carroll	Natural Hazards	Severe Thunderstorm	3.30	0.00	0.00	0.00	3.30
2022	North	Carroll	Technological Hazards	Structural Collapse	0.00	0.00	2.30	0.00	2.30
2022	North	Carroll	Natural Hazards	Tornado EF0 - EF2	0.00	2.80	0.00	0.00	2.80
2022	North	Carroll	Natural Hazards	Tornado EF3 - EF5	0.00	0.00	2.50	0.00	2.50

2022	North	Carroll	Natural Hazards	Wild Fire	0.00	2.75	0.00	0.00	2.75
2022	North	Carroll	Natural Hazards	Winter Storms	0.00	2.85	0.00	0.00	2.85
2022	North	Carroll	Natural Hazards	Winter Storms	0.00	2.85	0.00	0.00	2.85
2022	South	Dubois	Man-Made Threats	Active Attacker (Kinetic)	0.00	0.00	2.30	0.00	2.30
2022	South	Dubois	Natural Hazards	Animal Disease Outbreak	3.10	0.00	0.00	0.00	3.10
2022	South	Dubois	Man-Made Threats	Arson	0.00	0.00	2.30	0.00	2.30
2022	South	Dubois	Technological Hazards	Communication Failure	0.00	2.60	0.00	0.00	2.60
2022	South	Dubois	Man-Made Threats	Cyber Attack	4.00	0.00	0.00	0.00	4.00
2022	South	Dubois	Natural Hazards	Derecho	3.70	0.00	0.00	0.00	3.70
2022	South	Dubois	Man-Made Threats	Domestic Terrorism	3.25	0.00	0.00	0.00	3.25
2022	South	Dubois	Man-Made Threats	Domestic Terrorism	3.25	0.00	0.00	0.00	3.25
2022	South	Dubois	Natural Hazards	Drought	0.00	0.00	2.35	0.00	2.35
2022	South	Dubois	Natural Hazards	Earthquake MMI I to IV	3.55	0.00	0.00	0.00	3.55
2022	South	Dubois	Natural Hazards	Extreme Temperatures	0.00	0.00	2.20	0.00	2.20
2022	South	Dubois	Natural Hazards	Flash Flood	3.50	0.00	0.00	0.00	3.50
2022	South	Dubois	Technological Hazards	Hazardous Material - Fixed Facility	3.60	0.00	0.00	0.00	3.60
2022	South	Dubois	Technological Hazards	Hazardous Material - Transportation Incident	3.60	0.00	0.00	0.00	3.60
2022	South	Dubois	Technological Hazards	High Hazard Dam - (Federally owned)	0.00	0.00	2.20	0.00	2.20
2022	South	Dubois	Technological Hazards	High Hazard Dam - (Privately/locally owned)	0.00	0.00	2.20	0.00	2.20
2022	South	Dubois	Man-Made Threats	Hostage Situation	0.00	2.75	0.00	0.00	2.75
2022	South	Dubois	Natural Hazards	Human Disease Outbreak	3.25	0.00	0.00	0.00	3.25
2022	South	Dubois	Natural Hazards	Ice Storms	0.00	2.70	0.00	0.00	2.70
2022	South	Dubois	Technological Hazards	Large Fire/Conflagration	0.00	2.80	0.00	0.00	2.80
2022	South	Dubois	Natural Hazards	Major Flood	0.00	0.00	2.35	0.00	2.35
2022	South	Dubois	Technological Hazards	Pipeline Transportation Incident	0.00	0.00	2.30	0.00	2.30
2022	South	Dubois	Natural Hazards	Severe Thunderstorm	3.70	0.00	0.00	0.00	3.70
2022	South	Dubois	Natural Hazards	Tornado EF0 - EF2	3.70	0.00	0.00	0.00	3.70

2022	South	Dubois	Natural Hazards	Tornado EF3 - EF5	3.55	0.00	0.00	0.00	3.55
2022	South	Dubois	Natural Hazards	Winter Storms	3.15	0.00	0.00	0.00	3.15
2022	Central	Howard	Man-Made Threats	Active Attacker (Kinetic)	3.15	0.00	0.00	0.00	3.15
2022	Central	Howard	Natural Hazards	Animal Disease Outbreak	0.00	0.00	2.35	0.00	2.35
2022	Central	Howard	Man-Made Threats	Arson	0.00	0.00	2.20	0.00	2.20
2022	Central	Howard	Man-Made Threats	Biological Attack	3.10	0.00	0.00	0.00	3.10
2022	Central	Howard	Man-Made Threats	Chemical Attack	2.95	0.00	0.00	0.00	2.95
2022	Central	Howard	Technological Hazards	Commercial Air Transportation Incident	0.00	2.85	0.00	0.00	2.85
2022	Central	Howard	Man-Made Threats	Conventional Attack	0.00	2.80	0.00	0.00	2.80
2022	Central	Howard	Man-Made Threats	Cyber Attack	3.25	0.00	0.00	0.00	3.25
2022	Central	Howard	Natural Hazards	Derecho	0.00	0.00	2.35	0.00	2.35
2022	Central	Howard	Man-Made Threats	Domestic Terrorism	3.25	0.00	0.00	0.00	3.25
2022	Central	Howard	Natural Hazards	Drought	0.00	0.00	2.35	0.00	2.35
2022	Central	Howard	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	2.40	0.00	2.40
2022	Central	Howard	Man-Made Threats	Electromagnetic (EMP) Attack	0.00	2.80	0.00	0.00	2.80
2022	Central	Howard	Technological Hazards	Explosion	0.00	2.80	0.00	0.00	2.80
2022	Central	Howard	Man-Made Threats	Explosive Attack	0.00	2.80	0.00	0.00	2.80
2022	Central	Howard	Natural Hazards	Extreme Temperatures	0.00	2.55	0.00	0.00	2.55
2022	Central	Howard	Technological Hazards	Hazardous Material - Fixed Facility	0.00	2.70	0.00	0.00	2.70
2022	Central	Howard	Technological Hazards	Hazardous Material - Transportation Incident	0.00	2.75	0.00	0.00	2.75
2022	Central	Howard	Technological Hazards	High Hazard Dam - (Federally owned)	4.00	0.00	0.00	0.00	4.00
2022	Central	Howard	Technological Hazards	High Hazard Dam - (State owned)	0.00	0.00	2.30	0.00	2.30
2022	Central	Howard	Technological Hazards	Highway Transportation Incident	0.00	2.85	0.00	0.00	2.85
2022	Central	Howard	Man-Made Threats	Hostage Situation	0.00	0.00	2.20	0.00	2.20
2022	Central	Howard	Natural Hazards	Human Disease Outbreak	0.00	2.80	0.00	0.00	2.80
2022	Central	Howard	Natural Hazards	Ice Storms	3.10	0.00	0.00	0.00	3.10
2022	Central	Howard	Man-Made Threats	International Terrorism	0.00	0.00	0.00	1.90	1.90

2022	Central	Howard	Technological Hazards	Large Fire/Conflagration	0.00	0.00	2.40	0.00	2.40
2022	Central	Howard	Natural Hazards	Major Flood	0.00	0.00	2.40	0.00	2.40
2022	Central	Howard	Man-Made Threats	Nuclear Attack	2.95	0.00	0.00	0.00	2.95
2022	Central	Howard	Man-Made Threats	Other Violent Offenders	0.00	2.65	0.00	0.00	2.65
2022	Central	Howard	Technological Hazards	Public Utility Failure	0.00	2.80	0.00	0.00	2.80
2022	Central	Howard	Man-Made Threats	Riot	0.00	0.00	2.30	0.00	2.30
2022	Central	Howard	Natural Hazards	Severe Thunderstorm	3.20	0.00	0.00	0.00	3.20
2022	Central	Howard	Technological Hazards	Structural Collapse	0.00	0.00	2.50	0.00	2.50
2022	Central	Howard	Natural Hazards	Tornado EF0 - EF2	3.25	0.00	0.00	0.00	3.25
2022	Central	Howard	Natural Hazards	Tornado EF3 - EF5	3.55	0.00	0.00	0.00	3.55
2022	Central	Howard	Natural Hazards	Winter Storms	3.15	0.00	0.00	0.00	3.15
2022	North	Huntington	Man-Made Threats	Active Attacker (Kinetic)	3.10	0.00	0.00	0.00	3.10
2022	North	Huntington	Man-Made Threats	Arson	0.00	2.80	0.00	0.00	2.80
2022	North	Huntington	Technological Hazards	Communication Failure	0.00	2.70	0.00	0.00	2.70
2022	North	Huntington	Man-Made Threats	Cyber Attack	3.45	0.00	0.00	0.00	3.45
2022	North	Huntington	Natural Hazards	Derecho	0.00	0.00	2.25	0.00	2.25
2022	North	Huntington	Man-Made Threats	Domestic Terrorism	0.00	0.00	2.40	0.00	2.40
2022	North	Huntington	Natural Hazards	Drought	0.00	0.00	2.05	0.00	2.05
2022	North	Huntington	Technological Hazards	Explosion	4.00	0.00	0.00	0.00	4.00
2022	North	Huntington	Technological Hazards	Explosion	0.00	2.80	0.00	0.00	2.80
2022	North	Huntington	Natural Hazards	Flash Flood	0.00	0.00	2.30	0.00	2.30
2022	North	Huntington	Technological Hazards	Hazardous Material - Fixed Facility	0.00	2.80	0.00	0.00	2.80
2022	North	Huntington	Technological Hazards	Hazardous Material - Transportation Incident	0.00	2.70	0.00	0.00	2.70
2022	North	Huntington	Technological Hazards	High Hazard Dam - (Federally owned)	2.95	0.00	0.00	0.00	2.95
2022	North	Huntington	Technological Hazards	Highway Transportation Incident	4.00	0.00	0.00	0.00	4.00
2022	North	Huntington	Technological Hazards	Highway Transportation Incident	0.00	0.00	2.40	0.00	2.40
2022	North	Huntington	Man-Made Threats	International Terrorism	0.00	0.00	2.40	0.00	2.40

2022	North	Huntington	Technological Hazards	Large Fire/Conflagration	4.00	0.00	0.00	0.00	4.00
2022	North	Huntington	Technological Hazards	Large Fire/Conflagration	0.00	2.80	0.00	0.00	2.80
2022	North	Huntington	Technological Hazards	Pipeline Transportation Incident	0.00	2.80	0.00	0.00	2.80
2022	North	Huntington	Technological Hazards	Public Utility Failure	0.00	2.70	0.00	0.00	2.70
2022	North	Huntington	Technological Hazards	Rail Transportation Incident	4.00	0.00	0.00	0.00	4.00
2022	North	Huntington	Technological Hazards	Rail Transportation Incident	0.00	2.80	0.00	0.00	2.80
2022	North	Huntington	Natural Hazards	Severe Thunderstorm	0.00	0.00	2.00	0.00	2.00
2022	North	Huntington	Technological Hazards	Structural Collapse	0.00	2.80	0.00	0.00	2.80
2022	North	Huntington	Natural Hazards	Winter Storms	0.00	0.00	2.40	0.00	2.40
2022	North	Huntington	Natural Hazards	Winter Storms	0.00	0.00	0.00	1.95	1.95
2022	South	Jackson	Natural Hazards	Animal Disease Outbreak	3.00	0.00	0.00	0.00	3.00
2022	South	Jackson	Man-Made Threats	Arson	0.00	0.00	2.35	0.00	2.35
2022	South	Jackson	Man-Made Threats	Biological Attack	0.00	2.80	0.00	0.00	2.80
2022	South	Jackson	Man-Made Threats	Chemical Attack	0.00	2.80	0.00	0.00	2.80
2022	South	Jackson	Technological Hazards	Communication Failure	0.00	0.00	2.30	0.00	2.30
2022	South	Jackson	Man-Made Threats	Cyber Attack	3.70	0.00	0.00	0.00	3.70
2022	South	Jackson	Natural Hazards	Derecho	0.00	0.00	2.30	0.00	2.30
2022	South	Jackson	Man-Made Threats	Domestic Terrorism	3.90	0.00	0.00	0.00	3.90
2022	South	Jackson	Man-Made Threats	Domestic Terrorism	0.00	2.70	0.00	0.00	2.70
2022	South	Jackson	Natural Hazards	Drought	0.00	0.00	0.00	1.30	1.30
2022	South	Jackson	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	2.30	0.00	2.30
2022	South	Jackson	Natural Hazards	Earthquake MMI V to VI	0.00	0.00	2.40	0.00	2.40
2022	South	Jackson	Natural Hazards	Earthquake MMI VII to X	3.10	0.00	0.00	0.00	3.10
2022	South	Jackson	Man-Made Threats	Electromagnetic (EMP) Attack	3.10	0.00	0.00	0.00	3.10
2022	South	Jackson	Natural Hazards	Extreme Temperatures	0.00	0.00	0.00	1.65	1.65
2022	South	Jackson	Natural Hazards	Flash Flood	3.20	0.00	0.00	0.00	3.20
2022	South	Jackson	Natural Hazards	Geomagnetic Storm	0.00	2.80	0.00	0.00	2.80

2022	South	Jackson	Technological Hazards	Hazardous Material - Fixed Facility	0.00	0.00	2.30	0.00	2.30
2022	South	Jackson	Technological Hazards	Hazardous Material - Transportation Incident	0.00	0.00	2.30	0.00	2.30
2022	South	Jackson	Technological Hazards	Highway Transportation Incident	3.10	0.00	0.00	0.00	3.10
2022	South	Jackson	Natural Hazards	Human Disease Outbreak	0.00	2.65	0.00	0.00	2.65
2022	South	Jackson	Natural Hazards	Ice Storms	0.00	2.55	0.00	0.00	2.55
2022	South	Jackson	Man-Made Threats	International Terrorism	0.00	2.80	0.00	0.00	2.80
2022	South	Jackson	Technological Hazards	Large Fire/Conflagration	0.00	2.60	0.00	0.00	2.60
2022	South	Jackson	Natural Hazards	Major Flood	3.15	0.00	0.00	0.00	3.15
2022	South	Jackson	Man-Made Threats	Nuclear Attack	0.00	2.65	0.00	0.00	2.65
2022	South	Jackson	Technological Hazards	Pipeline Transportation Incident	0.00	2.70	0.00	0.00	2.70
2022	South	Jackson	Technological Hazards	Public Utility Failure	0.00	2.75	0.00	0.00	2.75
2022	South	Jackson	Technological Hazards	Rail Transportation Incident	0.00	0.00	0.00	1.70	1.70
2022	South	Jackson	Man-Made Threats	Riot	0.00	0.00	2.15	0.00	2.15
2022	South	Jackson	Natural Hazards	Severe Thunderstorm	3.10	0.00	0.00	0.00	3.10
2022	South	Jackson	Technological Hazards	Structural Collapse	0.00	2.60	0.00	0.00	2.60
2022	South	Jackson	Natural Hazards	Tornado EF0 - EF2	0.00	0.00	2.50	0.00	2.50
2022	South	Jackson	Natural Hazards	Tornado EF3 - EF5	2.95	0.00	0.00	0.00	2.95
2022	South	Jackson	Natural Hazards	Wild Fire	0.00	0.00	0.00	1.90	1.90
2022	South	Jackson	Natural Hazards	Winter Storms	3.30	0.00	0.00	0.00	3.30
2022	Central	Marion	Man-Made Threats	Active Attacker (Kinetic)	3.20	0.00	0.00	0.00	3.20
2022	Central	Marion	Man-Made Threats	Arson	3.20	0.00	0.00	0.00	3.20
2022	Central	Marion	Technological Hazards	Commercial Air Transportation Incident	0.00	0.00	2.40	0.00	2.40
2022	Central	Marion	Man-Made Threats	Domestic Terrorism	0.00	0.00	2.50	0.00	2.50
2022	Central	Marion	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	2.40	0.00	2.40
2022	Central	Marion	Technological Hazards	Explosion	0.00	2.70	0.00	0.00	2.70
2022	Central	Marion	Natural Hazards	Extreme Temperatures	3.00	0.00	0.00	0.00	3.00
2022	Central	Marion	Technological Hazards	Hazardous Material - Fixed Facility	3.25	0.00	0.00	0.00	3.25

2022	Central	Marion	Technological Hazards	Hazardous Material - Transportation Incident	3.20	0.00	0.00	0.00	3.20
2022	Central	Marion	Technological Hazards	High Hazard Dam - (Privately/locally owned)	3.10	0.00	0.00	0.00	3.10
2022	Central	Marion	Technological Hazards	Highway Transportation Incident	0.00	2.75	0.00	0.00	2.75
2022	Central	Marion	Man-Made Threats	Hostage Situation	0.00	2.90	0.00	0.00	2.90
2022	Central	Marion	Natural Hazards	Human Disease Outbreak	2.95	0.00	0.00	0.00	2.95
2022	Central	Marion	Natural Hazards	Ice Storms	0.00	2.55	0.00	0.00	2.55
2022	Central	Marion	Technological Hazards	Large Fire/Conflagration	3.15	0.00	0.00	0.00	3.15
2022	Central	Marion	Technological Hazards	Pipeline Transportation Incident	0.00	0.00	2.40	0.00	2.40
2022	Central	Marion	Technological Hazards	Public Utility Failure	0.00	0.00	2.40	0.00	2.40
2022	Central	Marion	Technological Hazards	Rail Transportation Incident	0.00	2.70	0.00	0.00	2.70
2022	Central	Marion	Man-Made Threats	Riot	0.00	2.55	0.00	0.00	2.55
2022	Central	Marion	Technological Hazards	Structural Collapse	0.00	2.80	0.00	0.00	2.80
2022	Central	Marion	Natural Hazards	Tornado EF0 - EF2	3.55	0.00	0.00	0.00	3.55
2022	North	Marshall	Man-Made Threats	Active Attacker (Kinetic)	3.25	0.00	0.00	0.00	3.25
2022	North	Marshall	Natural Hazards	Animal Disease Outbreak	3.25	0.00	0.00	0.00	3.25
2022	North	Marshall	Man-Made Threats	Arson	0.00	0.00	2.40	0.00	2.40
2022	North	Marshall	Man-Made Threats	Biological Attack	0.00	2.65	0.00	0.00	2.65
2022	North	Marshall	Man-Made Threats	Chemical Attack	0.00	0.00	2.35	0.00	2.35
2022	North	Marshall	Technological Hazards	Commercial Air Transportation Incident	0.00	2.80	0.00	0.00	2.80
2022	North	Marshall	Technological Hazards	Communication Failure	0.00	2.70	0.00	0.00	2.70
2022	North	Marshall	Man-Made Threats	Conventional Attack	3.70	0.00	0.00	0.00	3.70
2022	North	Marshall	Man-Made Threats	Cyber Attack	3.70	0.00	0.00	0.00	3.70
2022	North	Marshall	Natural Hazards	Derecho	0.00	2.70	0.00	0.00	2.70
2022	North	Marshall	Man-Made Threats	Domestic Terrorism	4.00	0.00	0.00	0.00	4.00
2022	North	Marshall	Man-Made Threats	Domestic Terrorism	4.00	0.00	0.00	0.00	4.00
2022	North	Marshall	Man-Made Threats	Domestic Terrorism	0.00	0.00	2.50	0.00	2.50
2022	North	Marshall	Natural Hazards	Drought	0.00	2.80	0.00	0.00	2.80

2022	North	Marshall	Natural Hazards	Earthquake MMI I to IV	0.00	2.80	0.00	0.00	2.80
2022	North	Marshall	Natural Hazards	Earthquake MMI I to IV	0.00	2.65	0.00	0.00	2.65
2022	North	Marshall	Natural Hazards	Earthquake MMI V to VI	0.00	2.65	0.00	0.00	2.65
2022	North	Marshall	Man-Made Threats	Electromagnetic (EMP) Attack	3.10	0.00	0.00	0.00	3.10
2022	North	Marshall	Technological Hazards	Explosion	0.00	2.60	0.00	0.00	2.60
2022	North	Marshall	Man-Made Threats	Explosive Attack	0.00	2.80	0.00	0.00	2.80
2022	North	Marshall	Natural Hazards	Extreme Temperatures	0.00	2.85	0.00	0.00	2.85
2022	North	Marshall	Natural Hazards	Flash Flood	2.95	0.00	0.00	0.00	2.95
2022	North	Marshall	Natural Hazards	Geomagnetic Storm	0.00	2.65	0.00	0.00	2.65
2022	North	Marshall	Natural Hazards	Ground Failure	0.00	0.00	0.00	1.95	1.95
2022	North	Marshall	Technological Hazards	Hazardous Material - Fixed Facility	0.00	2.70	0.00	0.00	2.70
2022	North	Marshall	Technological Hazards	Hazardous Material - Transportation Incident	3.60	0.00	0.00	0.00	3.60
2022	North	Marshall	Technological Hazards	High Hazard Dam - (Federally owned)	0.00	0.00	0.00	1.00	1.00
2022	North	Marshall	Technological Hazards	High Hazard Dam - (non-regulated state owned)	0.00	0.00	0.00	1.00	1.00
2022	North	Marshall	Technological Hazards	High Hazard Dam - (Privately/locally owned)	0.00	0.00	2.50	0.00	2.50
2022	North	Marshall	Technological Hazards	High Hazard Dam - (State owned)	0.00	0.00	0.00	1.00	1.00
2022	North	Marshall	Technological Hazards	Highway Transportation Incident	0.00	2.75	0.00	0.00	2.75
2022	North	Marshall	Man-Made Threats	Hostage Situation	0.00	0.00	2.40	0.00	2.40
2022	North	Marshall	Natural Hazards	Human Disease Outbreak	3.25	0.00	0.00	0.00	3.25
2022	North	Marshall	Natural Hazards	Ice Storms	0.00	2.80	0.00	0.00	2.80
2022	North	Marshall	Man-Made Threats	International Terrorism	0.00	2.65	0.00	0.00	2.65
2022	North	Marshall	Man-Made Threats	International Terrorism	0.00	2.65	0.00	0.00	2.65
2022	North	Marshall	Natural Hazards	Invasive Species - Animal	0.00	0.00	2.05	0.00	2.05
2022	North	Marshall	Natural Hazards	Invasive Species - Aquatic	2.95	0.00	0.00	0.00	2.95
2022	North	Marshall	Natural Hazards	Invasive Species - Insect	3.25	0.00	0.00	0.00	3.25
2022	North	Marshall	Natural Hazards	Invasive Species - Plant	3.40	0.00	0.00	0.00	3.40

2022	North	Marshall	Technological Hazards	Large Fire/Conflagration	0.00	2.70	0.00	0.00	2.70
2022	North	Marshall	Natural Hazards	Major Flood	3.25	0.00	0.00	0.00	3.25
2022	North	Marshall	Technological Hazards	Major Levee Failure - (Accredited)	4.00	0.00	0.00	0.00	4.00
2022	North	Marshall	Technological Hazards	Major Levee Failure - (Accredited)	0.00	0.00	0.00	1.00	1.00
2022	North	Marshall	Technological Hazards	Major Levee Failure - (Non-accredited)	0.00	0.00	0.00	1.00	1.00
2022	North	Marshall	Technological Hazards	Marine Transportation Incident	0.00	0.00	0.00	1.00	1.00
2022	North	Marshall	Man-Made Threats	Nuclear Attack	0.00	2.65	0.00	0.00	2.65
2022	North	Marshall	Man-Made Threats	Other Violent Offenders	0.00	0.00	2.20	0.00	2.20
2022	North	Marshall	Technological Hazards	Pipeline Transportation Incident	0.00	0.00	2.40	0.00	2.40
2022	North	Marshall	Technological Hazards	Public Utility Failure	0.00	2.70	0.00	0.00	2.70
2022	North	Marshall	Man-Made Threats	Radiological Attack	0.00	2.65	0.00	0.00	2.65
2022	North	Marshall	Technological Hazards	Rail Transportation Incident	3.10	0.00	0.00	0.00	3.10
2022	North	Marshall	Man-Made Threats	Riot	0.00	0.00	2.40	0.00	2.40
2022	North	Marshall	Natural Hazards	Seiche	0.00	0.00	2.30	0.00	2.30
2022	North	Marshall	Natural Hazards	Severe Thunderstorm	3.00	0.00	0.00	0.00	3.00
2022	North	Marshall	Technological Hazards	Structural Collapse	0.00	2.80	0.00	0.00	2.80
2022	North	Marshall	Natural Hazards	Tornado EF0 - EF2	3.30	0.00	0.00	0.00	3.30
2022	North	Marshall	Natural Hazards	Tornado EF3 - EF5	3.10	0.00	0.00	0.00	3.10
2022	North	Marshall	Natural Hazards	Tropical Cyclone Remnants	0.00	0.00	2.05	0.00	2.05
2022	North	Marshall	Natural Hazards	Wild Fire	3.15	0.00	0.00	0.00	3.15
2022	North	Marshall	Natural Hazards	Winter Storms	3.30	0.00	0.00	0.00	3.30
2022	North	Noble	Natural Hazards	Drought	0.00	0.00	0.00	1.60	1.60
2022	North	Noble	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	2.35	0.00	2.35
2022	North	Noble	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	2.05	0.00	2.05
2022	North	Noble	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	2.05	0.00	2.05
2022	North	Noble	Technological Hazards	Hazardous Material - Fixed Facility	0.00	2.80	0.00	0.00	2.80
2022	North	Noble	Technological Hazards	High Hazard Dam - (Privately/locally owned)	0.00	0.00	2.20	0.00	2.20

2022	North	Noble	Technological Hazards	Highway Transportation Incident	0.00	2.70	0.00	0.00	2.70
2022	North	Noble	Natural Hazards	Major Flood	0.00	0.00	2.20	0.00	2.20
2022	North	Noble	Natural Hazards	Major Flood	0.00	0.00	0.00	1.90	1.90
2022	North	Noble	Natural Hazards	Major Flood	0.00	0.00	0.00	1.90	1.90
2022	North	Noble	Technological Hazards	Rail Transportation Incident	3.10	0.00	0.00	0.00	3.10
2022	North	Noble	Natural Hazards	Severe Thunderstorm	0.00	2.85	0.00	0.00	2.85
2022	North	Noble	Natural Hazards	Severe Thunderstorm	0.00	0.00	2.50	0.00	2.50
2022	North	Noble	Natural Hazards	Severe Thunderstorm	0.00	0.00	2.50	0.00	2.50
2022	North	Noble	Natural Hazards	Tornado EF0 - EF2	0.00	0.00	2.35	0.00	2.35
2022	North	Noble	Natural Hazards	Winter Storms	0.00	2.80	0.00	0.00	2.80
2022	Central	Randolph	Man-Made Threats	Active Attacker (Kinetic)	0.00	0.00	2.10	0.00	2.10
2022	Central	Randolph	Man-Made Threats	Arson	0.00	0.00	0.00	1.90	1.90
2022	Central	Randolph	Man-Made Threats	Biological Attack	0.00	0.00	2.05	0.00	2.05
2022	Central	Randolph	Man-Made Threats	Chemical Attack	0.00	0.00	0.00	1.95	1.95
2022	Central	Randolph	Man-Made Threats	Conventional Attack	0.00	0.00	0.00	1.85	1.85
2022	Central	Randolph	Man-Made Threats	Cyber Attack	3.30	0.00	0.00	0.00	3.30
2022	Central	Randolph	Man-Made Threats	Domestic Terrorism	0.00	2.55	0.00	0.00	2.55
2022	Central	Randolph	Man-Made Threats	Domestic Terrorism	0.00	2.55	0.00	0.00	2.55
2022	Central	Randolph	Natural Hazards	Drought	0.00	0.00	2.35	0.00	2.35
2022	Central	Randolph	Man-Made Threats	Electromagnetic (EMP) Attack	0.00	0.00	2.25	0.00	2.25
2022	Central	Randolph	Man-Made Threats	Explosive Attack	0.00	0.00	2.25	0.00	2.25
2022	Central	Randolph	Natural Hazards	Extreme Temperatures	2.95	0.00	0.00	0.00	2.95
2022	Central	Randolph	Natural Hazards	Flash Flood	0.00	2.55	0.00	0.00	2.55
2022	Central	Randolph	Man-Made Threats	Hostage Situation	0.00	0.00	2.00	0.00	2.00
2022	Central	Randolph	Man-Made Threats	International Terrorism	0.00	0.00	2.35	0.00	2.35
2022	Central	Randolph	Natural Hazards	Major Flood	0.00	0.00	2.40	0.00	2.40
2022	Central	Randolph	Man-Made Threats	Nuclear Attack	0.00	0.00	2.35	0.00	2.35

2022	Central	Randolph	Man-Made Threats	Other Violent Offenders	0.00	2.65	0.00	0.00	2.65
2022	Central	Randolph	Man-Made Threats	Radiological Attack	0.00	0.00	2.05	0.00	2.05
2022	Central	Randolph	Man-Made Threats	Riot	0.00	0.00	0.00	1.65	1.65
2022	Central	Rush	Man-Made Threats	Active Attacker (Kinetic)	4.00	0.00	0.00	0.00	4.00
2022	Central	Rush	Man-Made Threats	Active Attacker (Kinetic)	3.60	0.00	0.00	0.00	3.60
2022	Central	Rush	Man-Made Threats	Active Attacker (Kinetic)	3.60	0.00	0.00	0.00	3.60
2022	Central	Rush	Natural Hazards	Animal Disease Outbreak	0.00	2.85	0.00	0.00	2.85
2022	Central	Rush	Man-Made Threats	Arson	0.00	0.00	2.30	0.00	2.30
2022	Central	Rush	Man-Made Threats	Biological Attack	0.00	0.00	2.50	0.00	2.50
2022	Central	Rush	Man-Made Threats	Chemical Attack	3.10	0.00	0.00	0.00	3.10
2022	Central	Rush	Technological Hazards	Commercial Air Transportation Incident	0.00	2.80	0.00	0.00	2.80
2022	Central	Rush	Technological Hazards	Communication Failure	3.25	0.00	0.00	0.00	3.25
2022	Central	Rush	Man-Made Threats	Conventional Attack	0.00	2.80	0.00	0.00	2.80
2022	Central	Rush	Man-Made Threats	Cyber Attack	3.25	0.00	0.00	0.00	3.25
2022	Central	Rush	Natural Hazards	Derecho	0.00	0.00	2.40	0.00	2.40
2022	Central	Rush	Man-Made Threats	Domestic Terrorism	3.05	0.00	0.00	0.00	3.05
2022	Central	Rush	Man-Made Threats	Domestic Terrorism	3.05	0.00	0.00	0.00	3.05
2022	Central	Rush	Natural Hazards	Drought	0.00	2.80	0.00	0.00	2.80
2022	Central	Rush	Natural Hazards	Earthquake MMI I to IV	0.00	2.65	0.00	0.00	2.65
2022	Central	Rush	Natural Hazards	Earthquake MMI V to VI	0.00	2.70	0.00	0.00	2.70
2022	Central	Rush	Natural Hazards	Earthquake MMI VII to X	3.10	0.00	0.00	0.00	3.10
2022	Central	Rush	Man-Made Threats	Electromagnetic (EMP) Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Rush	Technological Hazards	Explosion	0.00	2.60	0.00	0.00	2.60
2022	Central	Rush	Man-Made Threats	Explosive Attack	0.00	2.80	0.00	0.00	2.80
2022	Central	Rush	Natural Hazards	Extreme Temperatures	0.00	2.55	0.00	0.00	2.55
2022	Central	Rush	Natural Hazards	Flash Flood	0.00	2.85	0.00	0.00	2.85
2022	Central	Rush	Natural Hazards	Flash Flood	0.00	2.85	0.00	0.00	2.85

2022	Central	Rush	Natural Hazards	Geomagnetic Storm	0.00	0.00	2.35	0.00	2.35
2022	Central	Rush	Natural Hazards	Ground Failure	0.00	0.00	2.30	0.00	2.30
2022	Central	Rush	Technological Hazards	Hazardous Material - Fixed Facility	0.00	0.00	2.30	0.00	2.30
2022	Central	Rush	Technological Hazards	Hazardous Material - Transportation Incident	0.00	2.75	0.00	0.00	2.75
2022	Central	Rush	Technological Hazards	High Hazard Dam - (Privately/locally owned)	0.00	0.00	2.30	0.00	2.30
2022	Central	Rush	Technological Hazards	Highway Transportation Incident	0.00	2.65	0.00	0.00	2.65
2022	Central	Rush	Man-Made Threats	Hostage Situation	0.00	0.00	2.50	0.00	2.50
2022	Central	Rush	Natural Hazards	Human Disease Outbreak	3.25	0.00	0.00	0.00	3.25
2022	Central	Rush	Natural Hazards	Ice Storms	0.00	2.85	0.00	0.00	2.85
2022	Central	Rush	Man-Made Threats	International Terrorism	0.00	0.00	0.00	1.85	1.85
2022	Central	Rush	Natural Hazards	Invasive Species - Animal	0.00	0.00	2.05	0.00	2.05
2022	Central	Rush	Natural Hazards	Invasive Species - Insect	3.40	0.00	0.00	0.00	3.40
2022	Central	Rush	Technological Hazards	Large Fire/Conflagration	0.00	2.70	0.00	0.00	2.70
2022	Central	Rush	Natural Hazards	Major Flood	3.00	0.00	0.00	0.00	3.00
2022	Central	Rush	Technological Hazards	Major Levee Failure - (Accredited)	0.00	2.70	0.00	0.00	2.70
2022	Central	Rush	Man-Made Threats	Nuclear Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Rush	Man-Made Threats	Other Violent Offenders	3.20	0.00	0.00	0.00	3.20
2022	Central	Rush	Man-Made Threats	Other Violent Offenders	3.20	0.00	0.00	0.00	3.20
2022	Central	Rush	Man-Made Threats	Other Violent Offenders	3.20	0.00	0.00	0.00	3.20
2022	Central	Rush	Technological Hazards	Pipeline Transportation Incident	0.00	0.00	2.30	0.00	2.30
2022	Central	Rush	Technological Hazards	Public Utility Failure	3.15	0.00	0.00	0.00	3.15
2022	Central	Rush	Man-Made Threats	Radiological Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Rush	Technological Hazards	Rail Transportation Incident	0.00	0.00	2.30	0.00	2.30
2022	Central	Rush	Man-Made Threats	Riot	0.00	0.00	2.40	0.00	2.40
2022	Central	Rush	Man-Made Threats	Riot	0.00	0.00	2.40	0.00	2.40
2022	Central	Rush	Natural Hazards	Severe Thunderstorm	3.05	0.00	0.00	0.00	3.05
2022	Central	Rush	Natural Hazards	Severe Thunderstorm	3.05	0.00	0.00	0.00	3.05

2022	Central	Rush	Technological Hazards	Structural Collapse	0.00	0.00	2.30	0.00	2.30
2022	Central	Rush	Natural Hazards	Tornado EF0 - EF2	3.15	0.00	0.00	0.00	3.15
2022	Central	Rush	Natural Hazards	Tornado EF3 - EF5	3.10	0.00	0.00	0.00	3.10
2022	Central	Rush	Natural Hazards	Tropical Cyclone Remnants	0.00	0.00	2.10	0.00	2.10
2022	Central	Rush	Natural Hazards	Wild Fire	0.00	2.65	0.00	0.00	2.65
2022	Central	Rush	Natural Hazards	Winter Storms	3.15	0.00	0.00	0.00	3.15
2022	Central	Union	Man-Made Threats	Active Attacker (Kinetic)	3.05	0.00	0.00	0.00	3.05
2022	Central	Union	Natural Hazards	Animal Disease Outbreak	0.00	0.00	2.10	0.00	2.10
2022	Central	Union	Man-Made Threats	Arson	0.00	0.00	2.30	0.00	2.30
2022	Central	Union	Man-Made Threats	Biological Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Union	Man-Made Threats	Chemical Attack	0.00	2.80	0.00	0.00	2.80
2022	Central	Union	Technological Hazards	Commercial Air Transportation Incident	0.00	2.70	0.00	0.00	2.70
2022	Central	Union	Technological Hazards	Communication Failure	3.25	0.00	0.00	0.00	3.25
2022	Central	Union	Man-Made Threats	Cyber Attack	3.25	0.00	0.00	0.00	3.25
2022	Central	Union	Natural Hazards	Derecho	0.00	0.00	2.40	0.00	2.40
2022	Central	Union	Man-Made Threats	Domestic Terrorism	0.00	0.00	2.40	0.00	2.40
2022	Central	Union	Natural Hazards	Drought	0.00	2.80	0.00	0.00	2.80
2022	Central	Union	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	2.50	0.00	2.50
2022	Central	Union	Natural Hazards	Earthquake MMI V to VI	0.00	2.80	0.00	0.00	2.80
2022	Central	Union	Natural Hazards	Earthquake MMI VII to X	3.10	0.00	0.00	0.00	3.10
2022	Central	Union	Man-Made Threats	Electromagnetic (EMP) Attack	0.00	2.80	0.00	0.00	2.80
2022	Central	Union	Technological Hazards	Explosion	0.00	2.70	0.00	0.00	2.70
2022	Central	Union	Man-Made Threats	Explosive Attack	0.00	2.70	0.00	0.00	2.70
2022	Central	Union	Natural Hazards	Extreme Temperatures	4.00	0.00	0.00	0.00	4.00
2022	Central	Union	Natural Hazards	Flash Flood	0.00	2.85	0.00	0.00	2.85
2022	Central	Union	Natural Hazards	Flash Flood	0.00	2.85	0.00	0.00	2.85
2022	Central	Union	Natural Hazards	Ground Failure	0.00	0.00	2.40	0.00	2.40

2022	Central	Union	Technological Hazards	Hazardous Material - Fixed Facility	0.00	0.00	2.40	0.00	2.40
2022	Central	Union	Technological Hazards	Hazardous Material - Transportation Incident	0.00	0.00	2.40	0.00	2.40
2022	Central	Union	Technological Hazards	High Hazard Dam - (Privately/locally owned)	0.00	0.00	2.25	0.00	2.25
2022	Central	Union	Technological Hazards	High Hazard Dam - (State owned)	0.00	0.00	2.40	0.00	2.40
2022	Central	Union	Technological Hazards	Highway Transportation Incident	0.00	2.85	0.00	0.00	2.85
2022	Central	Union	Man-Made Threats	Hostage Situation	0.00	0.00	2.20	0.00	2.20
2022	Central	Union	Natural Hazards	Human Disease Outbreak	3.25	0.00	0.00	0.00	3.25
2022	Central	Union	Natural Hazards	Ice Storms	3.15	0.00	0.00	0.00	3.15
2022	Central	Union	Man-Made Threats	International Terrorism	0.00	0.00	0.00	1.95	1.95
2022	Central	Union	Technological Hazards	Large Fire/Conflagration	0.00	2.70	0.00	0.00	2.70
2022	Central	Union	Natural Hazards	Major Flood	0.00	0.00	2.40	0.00	2.40
2022	Central	Union	Man-Made Threats	Nuclear Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Union	Man-Made Threats	Other Violent Offenders	0.00	0.00	2.30	0.00	2.30
2022	Central	Union	Technological Hazards	Pipeline Transportation Incident	4.00	0.00	0.00	0.00	4.00
2022	Central	Union	Technological Hazards	Public Utility Failure	3.15	0.00	0.00	0.00	3.15
2022	Central	Union	Man-Made Threats	Radiological Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Union	Technological Hazards	Rail Transportation Incident	4.00	0.00	0.00	0.00	4.00
2022	Central	Union	Man-Made Threats	Riot	0.00	0.00	2.30	0.00	2.30
2022	Central	Union	Natural Hazards	Severe Thunderstorm	3.70	0.00	0.00	0.00	3.70
2022	Central	Union	Technological Hazards	Structural Collapse	0.00	2.70	0.00	0.00	2.70
2022	Central	Union	Natural Hazards	Tornado EF0 - EF2	3.25	0.00	0.00	0.00	3.25
2022	Central	Union	Natural Hazards	Tornado EF3 - EF5	0.00	2.80	0.00	0.00	2.80
2022	Central	Union	Natural Hazards	Tropical Cyclone Remnants	0.00	0.00	2.40	0.00	2.40
2022	Central	Union	Natural Hazards	Wild Fire	0.00	2.85	0.00	0.00	2.85
2022	Central	Union	Natural Hazards	Winter Storms	3.45	0.00	0.00	0.00	3.45
2022	Central	Vigo	Man-Made Threats	Active Attacker (Kinetic)	0.00	0.00	2.40	0.00	2.40
2022	Central	Vigo	Natural Hazards	Animal Disease Outbreak	0.00	0.00	2.05	0.00	2.05

2022	Central	Vigo	Man-Made Threats	Arson	0.00	2.90	0.00	0.00	2.90
2022	Central	Vigo	Man-Made Threats	Biological Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Vigo	Man-Made Threats	Chemical Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Vigo	Technological Hazards	Commercial Air Transportation Incident	0.00	2.80	0.00	0.00	2.80
2022	Central	Vigo	Technological Hazards	Communication Failure	0.00	2.85	0.00	0.00	2.85
2022	Central	Vigo	Man-Made Threats	Conventional Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Vigo	Man-Made Threats	Cyber Attack	3.25	0.00	0.00	0.00	3.25
2022	Central	Vigo	Natural Hazards	Derecho	0.00	0.00	2.25	0.00	2.25
2022	Central	Vigo	Man-Made Threats	Domestic Terrorism	3.15	0.00	0.00	0.00	3.15
2022	Central	Vigo	Natural Hazards	Drought	0.00	0.00	2.50	0.00	2.50
2022	Central	Vigo	Natural Hazards	Earthquake MMI I to IV	0.00	0.00	2.45	0.00	2.45
2022	Central	Vigo	Natural Hazards	Earthquake MMI V to VI	0.00	0.00	2.50	0.00	2.50
2022	Central	Vigo	Natural Hazards	Earthquake MMI VII to X	3.10	0.00	0.00	0.00	3.10
2022	Central	Vigo	Man-Made Threats	Electromagnetic (EMP) Attack	0.00	2.65	0.00	0.00	2.65
2022	Central	Vigo	Technological Hazards	Explosion	0.00	2.85	0.00	0.00	2.85
2022	Central	Vigo	Technological Hazards	Explosion	0.00	0.00	2.50	0.00	2.50
2022	Central	Vigo	Man-Made Threats	Explosive Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Vigo	Natural Hazards	Extreme Temperatures	0.00	2.85	0.00	0.00	2.85
2022	Central	Vigo	Natural Hazards	Flash Flood	3.40	0.00	0.00	0.00	3.40
2022	Central	Vigo	Natural Hazards	Geomagnetic Storm	0.00	0.00	2.05	0.00	2.05
2022	Central	Vigo	Natural Hazards	Ground Failure	0.00	0.00	2.40	0.00	2.40
2022	Central	Vigo	Technological Hazards	Hazardous Material - Fixed Facility	0.00	0.00	2.40	0.00	2.40
2022	Central	Vigo	Technological Hazards	Hazardous Material - Transportation Incident	3.30	0.00	0.00	0.00	3.30
2022	Central	Vigo	Technological Hazards	High Hazard Dam - (Federally owned)	0.00	0.00	2.50	0.00	2.50
2022	Central	Vigo	Technological Hazards	High Hazard Dam - (Privately/locally owned)	2.95	0.00	0.00	0.00	2.95
2022	Central	Vigo	Technological Hazards	High Hazard Dam - (State owned)	0.00	0.00	2.50	0.00	2.50
2022	Central	Vigo	Technological Hazards	Highway Transportation Incident	3.30	0.00	0.00	0.00	3.30

2022	Central	Vigo	Man-Made Threats	Hostage Situation	3.20	0.00	0.00	0.00	3.20
2022	Central	Vigo	Natural Hazards	Human Disease Outbreak	2.95	0.00	0.00	0.00	2.95
2022	Central	Vigo	Natural Hazards	Ice Storms	0.00	2.85	0.00	0.00	2.85
2022	Central	Vigo	Man-Made Threats	International Terrorism	0.00	0.00	2.25	0.00	2.25
2022	Central	Vigo	Natural Hazards	Invasive Species - Plant	0.00	0.00	2.10	0.00	2.10
2022	Central	Vigo	Technological Hazards	Large Fire/Conflagration	0.00	0.00	2.40	0.00	2.40
2022	Central	Vigo	Natural Hazards	Major Flood	3.70	0.00	0.00	0.00	3.70
2022	Central	Vigo	Technological Hazards	Major Levee Failure - (Accredited)	0.00	0.00	2.50	0.00	2.50
2022	Central	Vigo	Technological Hazards	Major Levee Failure - (Non-accredited)	3.25	0.00	0.00	0.00	3.25
2022	Central	Vigo	Man-Made Threats	Nuclear Attack	0.00	2.65	0.00	0.00	2.65
2022	Central	Vigo	Man-Made Threats	Other Violent Offenders	0.00	2.75	0.00	0.00	2.75
2022	Central	Vigo	Technological Hazards	Pipeline Transportation Incident	0.00	0.00	2.40	0.00	2.40
2022	Central	Vigo	Technological Hazards	Public Utility Failure	3.30	0.00	0.00	0.00	3.30
2022	Central	Vigo	Man-Made Threats	Radiological Attack	0.00	0.00	2.35	0.00	2.35
2022	Central	Vigo	Technological Hazards	Rail Transportation Incident	2.95	0.00	0.00	0.00	2.95
2022	Central	Vigo	Technological Hazards	Rail Transportation Incident	0.00	2.85	0.00	0.00	2.85
2022	Central	Vigo	Man-Made Threats	Riot	0.00	2.80	0.00	0.00	2.80
2022	Central	Vigo	Natural Hazards	Severe Thunderstorm	3.00	0.00	0.00	0.00	3.00
2022	Central	Vigo	Technological Hazards	Structural Collapse	0.00	0.00	2.50	0.00	2.50
2022	Central	Vigo	Technological Hazards	Structural Collapse	0.00	0.00	2.50	0.00	2.50
2022	Central	Vigo	Natural Hazards	Tornado EF0 - EF2	3.30	0.00	0.00	0.00	3.30
2022	Central	Vigo	Natural Hazards	Tornado EF3 - EF5	3.25	0.00	0.00	0.00	3.25
2022	Central	Vigo	Natural Hazards	Tropical Cyclone Remnants	0.00	0.00	0.00	1.95	1.95
2022	Central	Vigo	Natural Hazards	Winter Storms	3.00	0.00	0.00	0.00	3.00

Appendix E Meeting Minutes

Earthquake Team Meeting Minutes

Tuesday, June 6, 2023

Present: Michael Hamburger (IU Bloomington), Victoria Leffel (Indiana Geological & Water Survey), Anna Jessee (IUPUI), Elizabeth Sherill (IU Bloomington), Carter Dills (IU Bloomington), Ashley Steeb, Ben Biberdorf & Danielle Lafever

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<u>Agenda:</u>

- Introductions
- Review how earthquake section was completed for 2019 Plan
- Discuss updates, changes, additions, and removals for 2023 plan
- Discuss who can complete proposed changes
- Schedule follow up dates, if needed

<u>2019 Plan discussion:</u>

- Polis ran Hazus
- Created 5 scenarios, 5 specific earthquakes, including probabilistic
  - National seismic hazard map and using as input into Hazus
    - Takes likelihood of shaking
- Anna helped with landslide and liquefaction writing. Not incorporated into damage tolls from Hazus

<u>2024 Plan discussion:</u>

- The actual science in Shake Map have been updated. And Polis has updated building inventory.
  - They provide Shake Map input (.xml)
    - In this step, liquefaction and landslide are turned on and select .xml
    - Landslide needs to be created (time for IU)
    - Liquefaction is still close
- Scenarios are still relevant
- USGS probabilistic ground motion as of 2018 for contiguous US

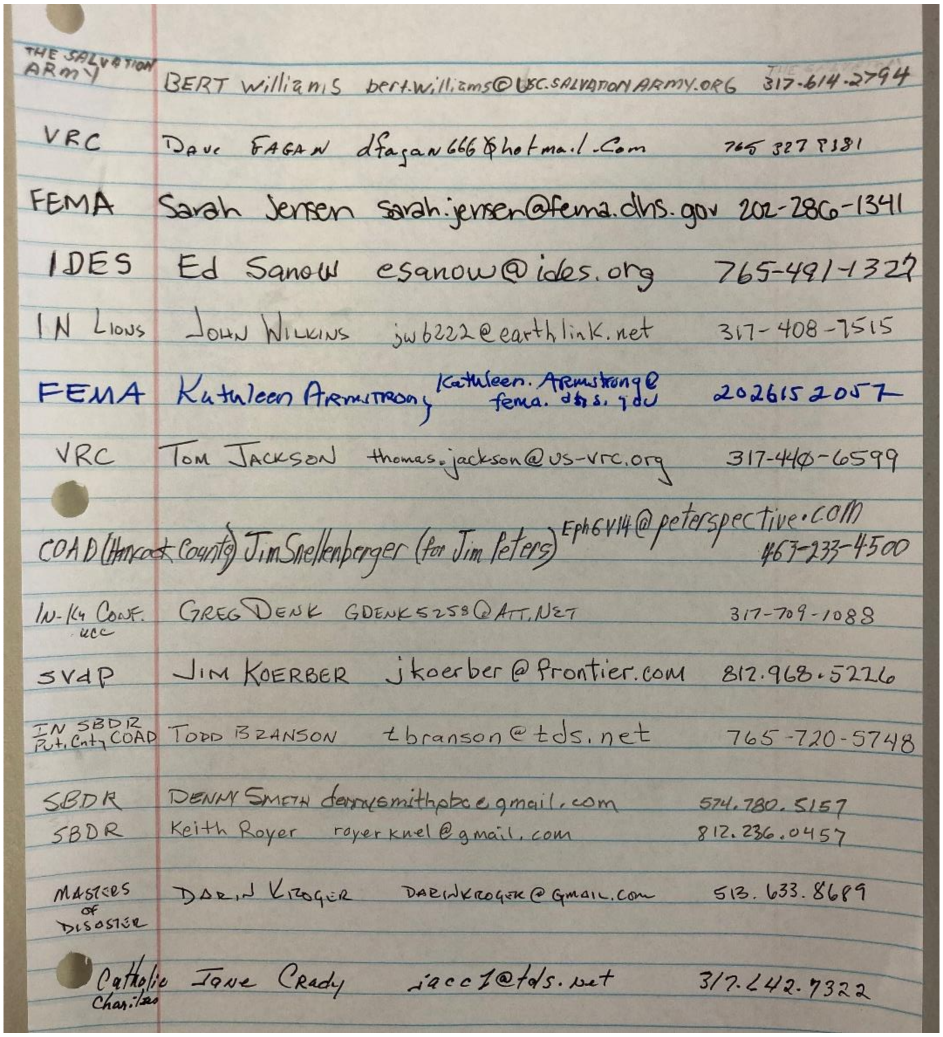
<u>Meeting summary and to-do's:</u>

- I will remove the Ohio scenario and 500 year probabilistic scenarios from the report. As a sidenote, it would be best to discuss ideals behind the 500 year probabilistic for future uses
- Elizabeth will re-run the Hazus models used for her publication, but with the updated Hazus 6.0 application
- The results from Hazus can be sent to Danielle for additional data comparison—ie: essential facilities, vulnerable populations, etc.
  - Danielle can provide ideal additional comparison to Elizabeth to help determine which data to provide
  - Danielle will create maps for the report

- Michael will look at updating Induced Seismicity section
- Anna will work with Elizabeth to better include landslide and liquefaction in the results

Indiana Voluntary Organizations Active in Disaster Meeting Minutes

Present: Ashley Steeb, Ben Biberdorf, Danielle Lafever, and:



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INVOAD suggestions:

- Consider Air Quality as part of wildfire sections.
- How are we addressing immigrants that are being spread across the US, dealing with the influx? Is there a National Plan for that?
    - IDHS: the State HMP is more focused on natural hazards, some of the human hazards.
    - Immigrants may be considered a vulnerable population. Data may not be readily available.
    - Jane: Long-term recovery groups are responsible for looking at this need. Catholic Charities works a lot with undocumented immigrants, data is difficult if not impossible to track

- United Nations might have some data to look into for immigration.
- Homeless population in Indiana should also be considered a vulnerable population.
- Look into Food Deserts.
    - Midwest food bank
    - Gleaners Food Bank
- Urban-rural disparity

- When a disaster happens, impacts the established social support systems as well, have a lack of access to basic needs that may already be difficult to obtain when not being affected by disaster.
- EMPower – electricity use.
- Office of Refugee Resettlement.

What are common resources needed during/after disasters?

- Medication: If a tornado takes out a home, that might completely destroy all available medication, other essential medical care equipment.
    - Salvation Army can try to help coordinate with pharmacy's to replace lost prescription medication.
    - Prosthetics
    - Oxygen tanks
- Personal identification
    - MARCs (One Stop Shops)
    - IDs
    - Birth Certificates
    - Insurance
    - SSC
    - Getting mail delivered (If a mail box gets destroyed, USPS might not deliver).
- Muck and Gut/Mud Out support services (Help to clean up disaster-struck)

If the County Emergency Manager doesn't have a relationship with the various VOADs, may need IDHS to help establish the connection. Networking and relationship-building is a primary goal of INVOAD.

- Success Story: Sullivan Co Mayor was panicked, Co EMA Director was OOS. INVOAD worked with IDHS, advise Sullivan Co to not turn away INVOAD.

COAD (Community Organizations Active in Disaster).

Datasets

- Working through the local churches, working with emergency management.
    - Jane: Shelby Co. Churches were using GIS data to map their population, to know where their vulnerable communities (Starting with their congregation, expanding out to their local communities as well. Might not capture all of the vulnerable populations).
- Point in Time – Run by Indiana Housing and Community Development Board.

    IHCDB Might be good to add as a planning partner.
- Continuum of Care

How do we refer to these vulnerable populations?

FEMA has a new term, per the Justice40 Initiative. 'Disadvantaged Communities' that are marginalized, underserved, and overburdened.

Additional FEMA terminology: Access and Functional Needs

Health Department Meeting Minutes

Thursday, June 15, 2023
Present: Derek Sebold (IDOH), Robert Davis (IDOH), Eric Hawkins (IDOH), Ashley Steeb, & Danielle Lafever

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Agenda:

- Are we missing major viruses or diseases to outline?
- Is there more recent data to include?
- General thoughts on outline and tone to our approach that should change?

Meeting summary and to dos:

- Include mitigation actions and steps IDOH takes toward mitigation
- Reorganize plan to:
  - Air borne
  - Vector borne (include ticks and mosquitoes)
  - Biological
  - Special pathogens
  - Antibody resistant
  - Respiratory (look at CDC respiratory dashboard)
  - Food borne
  - Environmental (include water)
  - STDs (include Mpox)
- Specify what's affect by climate change and seasonal differences

Proposed timeline:

- Send draft back to IDOH in about two weeks (by June 30th)
- Comments back to Polis by July 14th

Hazmat, CBRNE, and Radiation Meeting Minutes

Monday, June 26, 2023
Present: Courtney Eckstein (Radiation Program Director), Ashley Steeb, & Danielle Lafever

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Nuclear plants:

- 4 near Indiana. Courtney sending map of locations
- There is a test reactor at Purdue where they have their own response and protocol.

Courtney will send information on radioactive transport through Indiana.

Thursday, June 29, 2023
Mike White—Chemical, Ashley Steeb, & Danielle Lafever

Tier 2 system:

- Facilites with EHS (Extremely Hazardous Substances) chemical, required to file a tier 2 report with the State.
  - 7,359 facilities total

- Working with tier 2 manager to create reports. How many per county and what chemicals.
- No historical occurrences provided in previous annual-type reports
- Reported releases (those that have been reported)
- IDEM Office of Land Quality Emergency Response program. Operational Spill Expert? (OSE).
    - Myra McShane

Meeting Minutes with Tribal EMA Director

Tuesday, July 11, 2023
Present: Angelia Ramos (Emergency Manager), Ashley Steeb, & Danielle Lafever

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- EMA is a one-person show for the entire tribe.
- Most Native Americans live in Michigan reservation, but lands extend into Indiana.
    - Counties in Indiana: Laporte, Starke, Marshall, Elkhart, and St. Joe
- EMA works with the counties as they complete their MHMP update. The Tribal EMA has a great working relationship with the county EMA Directors. They "cohabitate" well
- Angie is the first EMA Director. Previously EMA activities were completed "within".
- Tribal EMA is currently updating Hazard Plan. Last one was completed in 2011.
- Casinos are not at risk, in general, except if something were to happen at with the nuclear plants
- When considering tribes and native lands in plans, most important items to consider are spots of cultural significance (ie: burial spots). Indiana does not have many.
    - Others are wildlife and casinos.

Public Infrastructure Meeting Minutes

Tuesday, June 6, 2023
Present: Jake Carrico (Electricity Program Manager, Indiana Office of Energy Development), Ashley Steeb, Ben Biberdorf & Danielle Lafever

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Mitigation items:

- Creating grant program for locals to write their own energy plan

Items to include:

- Man-made effect of infrastructure
- Cybersecurity (cyberattack on the colonial pipeline)
- Info from Energy Sector State Profile
- IURC Indiana Utility Regulatory Commission Regulate public utilities

Economic Development and Associated Land Use Meeting Minutes

Tuesday, February 13, 2024
Present: Matthew Jaworowski (Chief of Staff, Indiana Economic Development Corporation), Ben Biberdorf, & Danielle Lafever

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- IEDC.IN.gov --> 5E strategy. Programs (READY initiative). Provides focus of IEDC.

- The IEDC asked counties to work with neighboring counties to put forth proposals to improve quality of life or quality of place. Regions were created to submit the proposals.
- Local Economic Development officials are very responsive to IEDC. Responsiveness varies from county to county and region to region, but generally very strong working relationship. Indiana Economic Development Association, many of the local leaders are a part of.

- $80 billion of potential projects at a time.
- Lately, key target industries: IRA and CHIPS Act
- Ie:
  - Onshoring and development of supply chain
  - Semi-conductor application
  - EV battery fabrication
  - Solar cell
  - Life Sciences – ie: Elli Lily. Going to build newest facility in Lebanon
  - Solar and data centers are huge. Data centers have been including data scientists to study AI and efficiency.
  - Carbon sequestration:
    - UIC, Underground injection control. Permitting is through the US EPA. In 2021 or 2022, established bill with DNR to oversee inserting pipelines for carbon sequestration. Utility, natural gas, and hydrogen for possible pipeline work. Six hydrogen hubs located in Whiting at BP refiner. Include hydrogen development. Looking to development across the state.
    - Terre Haute project is class 6.
    - Hydrogen can be used for heat, to create electricity and energy, sprinkle into natural gas to reduce footprint of natural gas.
- Working toward "Economy of the future"-Clark County near Jeffersonville. See 5E Strategies.

Key locations of economic development recently:

- Kokomo, EV battery facility. Samsung SDI and Stalantis
- St. Joe, building EV battery outside
- Lebanon, Leed district
- River Ridge, Clark, data center, EV battery
- All ports, Mount Vernon, Burns Harbor, Jeffersonville. Each port has good land and having great
- Vigo
- Kosciusko, orthopedic corridors, possibly the largest in the world. Manufacturing for life science industry.
- Northwest generally looked at as known for industry.
- Fort Wayne, up to the Michigan border to Jay County and east Huntington, in general.

Possible mitigation action:

- Ensure infrastructure related to energy development is resilient that the grid stays up should a hazard occur.