3.6: Flood Risk Assessment

Hazard Description

Floods are the most frequently occurring natural disaster and occur when an overflow of water submerges land that is usually dry. Floods and the associated water-born debris have the potential to cause injury, death, and damage to the built and natural environments.

A flood is any general or temporary condition of partial or complete inundation of normally dry land from the overflow of inland or tidal waters or the unusual and rapid accumulation or run-off of surface waters from any source.

Flooding is a natural and inevitable occurrence. Floods occur seasonally with general or torrential rains associated with tropical storms that later drain into river basins and fill them with an abundance of water. Rivers, lakes, and other water bodies have always overflowed their normal beds to inundate nearby land. The land adjacent to these bodies of water is called the floodplain. The more serious effect of flooding occurs at the intersection of the floodplain and the built environment. When the floodplain contains manmade structures and either temporary or permanent habitation, the results can be devastating. There are generally four leading causes/ types of flooding. Mississippi is vulnerable to each as explained in the following section.

River (Riverine or Stream) Flooding:

Riverine floods occur along rivers, streams, or channels primarily when there is heavy or prolonged rainfall. Other contributing factors include (1) the elimination of ground cover on drainage slopes as a result of tree cutting or wildfires, land development, or overgrazing; (2) the simultaneous arrival of flood crests from major tributaries; and (3) blocked drainage by items such as debris; dams or inadequately sized drainage structures. Floods from these sources can be “flash” or rapid but are usually more gradual and have a longer duration than flash floods. Riverine floods occur in all nine major drainage basins in Mississippi.

Flash Flooding (Rapid):

Flash floods are a result of heavy, localized rainfall, possibly from slow-moving intense thunderstorms that cause small creeks, streams, and rivers to overflow. They are most common when rain falls on areas with steep slopes or built-up areas where impervious surfaces, gutters, and storm sewers speed up the flow of run-off. The torrential nature of flash floods makes this hazard particularly lethal, especially in or near rivers and streambeds, city streets, coastal areas, and narrow valleys which contribute to the development of rapid water movement. Rapid or flash flooding occurs in all nine major drainage basins in Mississippi.

Coastal (Tidal) Flooding:

All waterbodies and waterways bordering the Mississippi Sound, such as bays, and estuaries, lakes, rivers, and streams are prone to tidal effects/flooding. Coastal lands, such as sand bars, barrier islands, and deltas provide a buffer zone to help protect human life and real property relative to the sea. These natural features function very similarly to floodplains and provide a buffer zone along rivers or other bodies of water. Coastal floods usually occur as a result of abnormally high tides or tidal waves, storm surge, and heavy rains in combination with high winds, tropical storms, or hurricanes.

Storm surge is caused by high water from the wind and the low air pressure differences that accompany a storm. Storm surge is not a tidal wave or sudden rush of water; rather it is more of a gradual increase in water surface elevation. A surge can be as high as 20 feet above normal water levels, flooding normally dry

areas far inland. A storm surge is generally associated with a tropical storm or hurricane. Most of the fatalities and damage caused by a tropical storm or hurricane are the result of surge and their associated flooding, not high winds. The effects of coastal flooding can be worsened due to erosion. Coastal dunes and beaches provide natural protection by causing waves to break close to the shore, but these features can be worn down, exposing areas farther inland to storm damage. Tidal flooding occurs within three basins in Mississippi the Lower Pearl River, Coast Streams, and Pascagoula River Basins.

Drainage

Drainage flooding occurs primarily in urban or developed areas when the volume of run-off exceeds the capacity of drainage systems. Flooding of this nature can be the result of increased development, inadequate drainage, riverine flooding, flash flooding, or a combination of these. The potential for drainage flooding is directly proportional to the percentage of impervious surfaces in a given area. Drainage flooding occurs in all nine major drainage basins in Mississippi.

Hazard Profile

Mississippi is situated in a region where water is a bountiful natural resource, coming in third behind Hawaii and Louisiana as the "wettest" state in the union considering the average amount of precipitation over the State's area. The statewide average of above 59 inches over nearly 31 million acres produces a volume greater than 144 million acre-feet of water delivered to the state annually, providing both surface water and groundwater in abundance. Though Mississippi has no natural large inland lakes, flood control dams in the Yazoo-Tallahatchie basin and water supply reservoirs at Jackson and Meridian have formed large lakes in the north, and these have added to the fishing and recreational resources of the State.

Flood season in Mississippi is considered to occur primarily from November through June (the period of greatest rainfall), while March and April are the months of greatest flood frequency. The first six months of the year is the season of high flows in the Mississippi River. Seasonal flooding along the Mississippi River and its tributaries often occur in the late winter and early spring as melting snow makes its way south from the northernmost reaches of the Mississippi River. In other rivers and streams, flooding sometimes occurs during the summer from persistent thunderstorms, or in the late summer and early fall from the heavy rains associated with tropical storms originating in the Gulf of Mexico.

Local overflows occur on many streams three or four times a year in association with extended rainy periods and associated saturated soil conditions. Severe general flooding occurs about once in two years from upstream runoff. The only important contribution to the Mississippi River within the state is from the Yazoo Basin. A system of levees prevents major damage from Mississippi River floods.

Flash flooding and heavy rain events have posed significant threats to many communities throughout the state. The aging drainage infrastructure and increases in development in urban areas have increased the amount of runoff into area drainage systems. Natural conveyances that were once narrow enough to jump over are now wider creating exit points for water to drain out of its banks and into developed areas. As road and bridge improvements are made and larger culverts and catch basins are engineered, a more comprehensive look downstream is necessary to ensure that those improvements will not contribute to flooding in downstream regions that have not benefited from drainage improvements.

Education and Outreach

Flood Awareness Week occurs in March. For more information on flood awareness call the MEMA Public Information number (866-519-6362) between 8 a.m. and 5 p.m. on weekdays.

Mississippi's Coastal Hazard Outreach Strategy Team (C-HOST) is a regional outreach team that was established on March 5, 2008. The Team strives to deliver the general floodplain management messaging so that residents are educated about flood hazards, flood insurance, flood protection measures, and the National Flood Insurance Program (NFIP). Education and outreach information is provided at http://chost.stormsmart.org.

Severe Storms and Flooding, Clarksdale 2016

Mississippi River Flooding, Vicksburg 2011

Hurricane Isaac Flooding, 2012

Location - River Basins

The state of Mississippi is located within the Gulf of Mexico drainage area. The nine river basins within the state include the:

- Big Black River Basin
- North Independent Streams
- South Independent Streams
- Coastal Streams Basin
- Pascagoula River Basin
- Tennessee River Basin
- Lower Pearl River Basin
- Yazoo River Basin
- Tombigbee River Basin

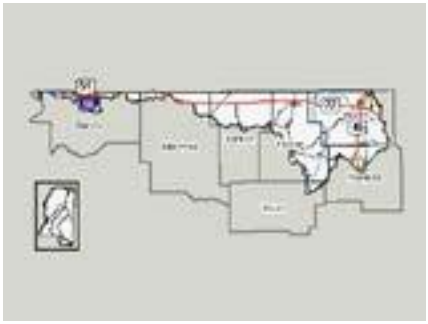
The state is primarily concerned with the risk associated with the floodplains found within the basins listed above. Local governments focus their risk assessments on the tributaries and secondary streams associated with the primary rivers located within their respective jurisdictions.

The state recognizes the importance of watershed planning and regional planning when implementing flood mitigation solutions. The identified basins and their member counties are listed on the subsequent pages. The assignment of a county to a basin was based solely upon the placement of the majority of the county's landmass within the appropriate basin boundary.

North Independent River Basin

The North Independent Basin encompasses portions of Alcorn and Tippah counties. Flood losses associated with this basin are due primarily to the Hatchie, Tuscumbia, and Little Hatchie Rivers, Muddy Creek, South Tippah Creek, and their tributaries.

County	Total Area in Square Miles
Alcorn	401.3
Tippah	459.9
Totals	**861.2**



Tennessee River Basin

The Tennessee River Basin encompasses portions of Tishomingo County. Flood losses associated with this basin are due primarily to the Tennessee and Tombigbee Rivers, Bear Creek, Yellow Creek, and their tributaries.

County	Total Area in Square Miles
Tishomingo	444.6

Yazoo River Basin

The Yazoo River Basin encompasses portions of the twenty-five counties listed below. Flood losses associated with this basin are due primarily to the Yazoo, Sunflower, Coldwater, and Tallahatchie Rivers and their associated tributaries.

County	Total Area Sq Miles
Benton	408.5
Bolivar	905.7
Calhoun	587.8
Carroll	634.3
Coahoma	583
Desoto	496.6
Grenada	449.2
Holmes	764
Humphreys	431.1
Issaquena	441.4
Lafayette	679.1
Leflore	606.2

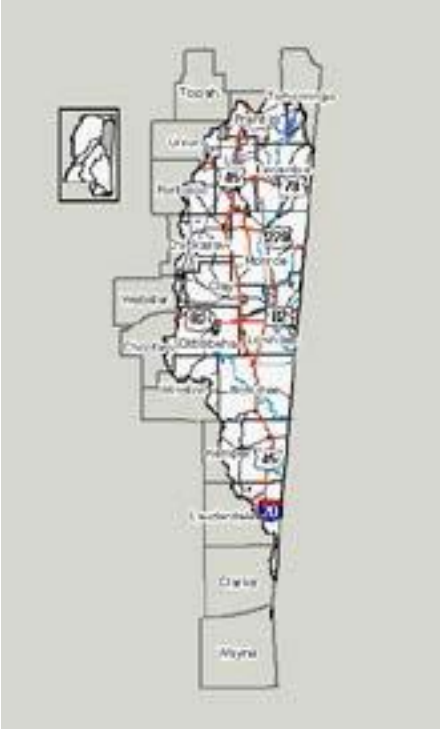
County	Total Area Sq Miles
Marshall	709.6
Panola	704.9
Pontotoc	500.9
Quitman	406.4
Sharkey	434.8
Sunflower	707.1
Tallahatchie	651.9
Tate	410.8
Tunica	480.7
Union	416.8
Washington	761.2
Yalobusha	494.8
Yazoo	933.9
Totals	**12,773**

Tombigbee River Basin

The Tombigbee River Basin encompasses portions of the ten counties listed below. Flood losses associated with this basin are due primarily to the Tombigbee, Luxpalila, and the Buttahatchee Rivers, the Bull Mountain, Mattubby, and Yellow Creeks and their associated tributaries.

County	Total Area in Square Miles
Chickasaw	504.2
Clay	416
Itawamba	540.5
Kemper	767.01
Lee	453.1

County	Total Area in Square Miles
Lowndes	516.5
Monroe	772.1
Noxubee	700
Oktibbeh	461.8
Prentiss	418.2
Totals	**55,49.4**



Big Black River Basin

The Big Black River Basin encompasses portions of the seven counties listed below. Flood losses associated with this basin are due primarily to the Big Black and the Bogue Chitto Rivers, the Deer, Black Poplar, and Mulberry Creeks and their associated tributaries.

County	Total Area in Square Miles
Attala	736.9
Choctaw	419.7
Hinds	877.1
Madison	741.7
Montgomery	407.1
Warren	618.7
Webster	423.2
Totals	**4224.4**

Pearl River Basin

The Pearl River Basin encompasses portions of the eleven counties listed below and the Pearl River Valley Water Supply District. Flood losses associated with this basin are due primarily to the Pearl, Strong, and Yockanookany Rivers and the Hobolochitta, Little, Richland, Pelahatchie, Culley, Bogue Chitto, Nanih Waiya, and Big Slough Creeks and their associated tributaries.

County	Total Area in Square
Jefferson Davis	409
Lawrence	435.6
Leake	585.2
Lincoln	588
Marion	548.4
Neshoba	571.5

County	Total Area in Square Miles
Rankin	805.9
Scott	610.2
Simpson	590.3
Walthall	404.3
Winston	610
Totals	**6,158.4**

South Independent River Basin

The South Independent Basin encompasses portions of the eight counties listed below. Flood losses associated with this basin are due primarily to the Mississippi, Buffalo, Homochitto Rivers, Bayou Pierre, and the Second and St. Catherine Creeks and their associated tributaries.

County	Total Area in Square Miles
Adams	486.4
Amite	731.6
Claiborne	501.4
Copiah	779.2

County	Total Area in Square Miles
Franklin	566.7
Jefferson	527.2
Pike	410.7
Wilkinson	687.8
Totals	**4691**

Pascagoula River Basin

The Pascagoula River Basin encompasses portions of the 15
counties listed below. Flood losses associated with this basin are due primarily to the Pascagoula, Escatawpa, Chickasawhay, and Leaf Rivers, the Bogue Homa, Thompson, Tallahala, Tallahoma, Okatoma, Long, Okatibbee, and Sowashee Creeks and their associated tributaries.

County	Total Area in Square
Clarke	693.4
Covington	414.8
Forrest	470
George	483.6
Greene	718.7
Jackson	1,043.3
Jasper	677.3
Jones	699.6

County	Total Area in Square
Lamar	500.3
Lauderdale	715.2
Newton	579.4
Perry	650.1
Smith	637.1
Stone	448
Wayne	813.4
Totals	**9544.2**

Coastal River Basin

The Coastal River Basin encompasses portions of Hancock, Harrison, and Pearl River Counties. Flood losses associated with this basin are due primarily to the Wolf, Jourdan, Biloxi, Little Biloxi, and Tchautacabouffa Rivers, Rotten Bayou, Bayou La Croix, Bernard Bayou, Brickyard Bayou, Turkey, and Tuxachanie Creeks, and their associated tributaries.

County	Total Area in Square Miles
Hancock	552.4
Harrison	975.9
Pearl River	818.7
Totals	**2,347**

Mississippi River Basin

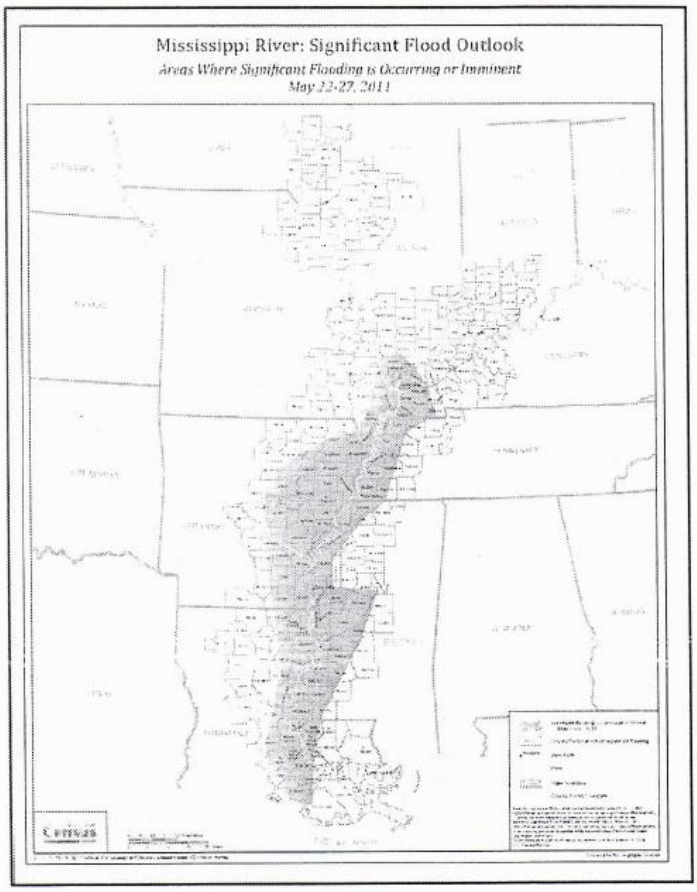
The Mississippi River Basin encompasses small portions of the eleven counties listed in the table below. The flood losses associated with this slice of terrain adjacent to the Mississippi River are often structures known as “fish camps.” These structures are secondary homes or weekend homes. A large percentage of the state’s repetitive loss structures are thought to consist of such structures, which are constructed on the “wet side” of the levee system. The analyses of the counties will be included in the appropriate basin that contains the largest landmass as indicated.

County	River Basin
Adams	South Independent River
Bolivar	Yazoo River
Claiborne	South Independent River
Coahoma	Yazoo River
Desoto	Yazoo River
Issaquena	Yazoo River
Jefferson	South Independent River
Tunica	Yazoo River
Warren	Big Black River
Washington	Yazoo River
Wilkinson	South Independent River

Historic Flood Events

Mississippi River Flood 2011

The Mississippi River floods in April and May of 2011 were among the largest and most damaging recorded along the U.S. waterway in the past century, comparable in extent to the major floods of 1927 and 1993. In April 2011, two major storm systems deposited record levels of rainfall on the Mississippi River watershed. When that additional water combined with the springtime snowmelt, the river and many of its tributaries began to swell to record levels. Areas along the Mississippi River experiencing flooding included Illinois, Missouri, Kentucky, Tennessee, Arkansas, Mississippi, and Louisiana. President Barack Obama declared the western counties of Kentucky, Tennessee, and Mississippi federal disaster areas. On May 14, the Morganza Spillway was opened for the first time in 37 years. This action deliberately flooded 4,600 square miles (12,000 km2) of rural Louisiana to minimize the flood's impacts on Baton Rouge and New Orleans.



The flood event resulted in nearly 400 deaths across seven states. Thousands of homes were ordered evacuated, including over 1,300 in Memphis, Tennessee, and more than 24,500 in Louisiana and Mississippi, though some people disregarded mandatory evacuation orders. The flood crested in Memphis on May 10 and artificially crested in southern Louisiana on May 15, a week earlier than it would have if spillways had not been opened. The United States Army Corps of Engineers stated that an area in Louisiana between Simmesport and Baton Rouge was expected to be inundated with 20-30 feet (6.1- 9.1 m) of water. Baton Rouge, New Orleans, and many other river towns were threatened, but officials stressed that they expected to avoid catastrophic flooding in those major cities.

The storm system continued through the second half of April and spawned was responsible for one of the largest tornado outbreaks in U.S. history. The unprecedented rainfall from these four storms, combined with springtime snow melt from the Upper Midwest created the perfect situation for a 500-year flood along the Mississippi.

Mississippi Summary:

In Tunica County, nine casinos located on stationary river barges were closed for most of May. The hotel portions of the casinos are located on the adjacent, low-lying land, and began to flood with the rising waters with inundation levels reaching 6 feet in surrounding areas. Near Vicksburg, Highway 465 in Warren and Issaquena counties was closed on May 3 due to high flood waters. North-south access to and from Vicksburg was cut off for more than two weeks. U.S. Highway 61 between Vicksburg and Port Gibson was closed due to backwater flooding along the Big Black River on May 12; it reopened on June 1. Another portion of U.S. Highway 61 near Redwood was closed due to backwater flooding along the Yazoo River on May 13 and was closed until June 3.

In anticipation of major flooding, the U.S. federal government issued disaster declarations for 14 counties along the Mississippi River including Adams, Bolivar, Claiborne, Coahoma, Desoto, Humphreys, Issaquena, Jefferson, Sharkey, Tunica, Warren, Washington, Wilkinson, and Yazoo. Mississippi Governor Haley Barbour urged holdouts to head for higher ground, saying "The biggest danger is that they choose not to evacuate assuming there'll be someone to rescue them," noting that emergency teams could be endangered as well. "More than anything else save your life and don't put other people at risk who might have to come in and save your lives."

The Flood of 2011 set new record stages at Vicksburg and Natchez. The peak streamflow at Vicksburg, 2,310,000 cubic feet per second (65,000 m3/s), exceeded the estimated peak streamflow of the Great Mississippi Flood of 1927, 2,278,000 cu ft/s (64,500 m3/s), and the measured peak streamflow of the 1937 flood, 2,080,000 cu ft/s (59,000 m3/s). The Project Design Flood predicts that a flowrate at Vicksburg of 2,710,000 cubic feet per second (77,000 m3/s) would still be within the limits of the downstream capacities, meaning that the May 17 - May 18 peak flow was about 85% of the acceptable flowrate for Vicksburg.

Hurricane Katrina 2005

On August 29, 2005, Hurricane Katrina made landfall resulting in widespread flash flooding across the state. The 26 counties impacted by this event included: Newton, Scott, Neshoba, Leake, Kemper, Winston, Attala, Noxubee, Oktibbeha, Choctaw, Lowndes, Clay, Forrest, George, Greene, Lamar, Perry, Stone, Wayne, Marion, Prentiss, Covington, Jefferson Davis, Jones, Jasper, and Smith. This storm dropped five to eight inches of rain over a six to ten-hour period. This rainfall event caused many county roads and other secondary roads to remain flooded for some time with several forced road closures. Additionally, several roads had small sections washed out due to their locations in low-lying areas near creeks and creek bottoms.

125-year event Central Mississippi 2003

On April 6, 2003, many counties in Mississippi experienced a 125-year rainfall event. Much of Mississippi north of Interstate 20 and extending west and east across the entire state were impacted. The 16 counties impacted included: Hinds, Scott, Rankin, Yazoo, Grenada, Leflore, Lee, Warren, Choctaw, Madison, Leake, Winston, Newton, Neshoba, Lauderdale, and Kemper. Rainfall totals averaged 7 to 12 inches in 18 hours. River flooding quickly became a major issue. Pelahatchie Creek experienced a 100-year flood event. The Chunky River at Chunky set a new record. This river flooded a portion of Interstate 20 which had to be closed for a few hours. The Chickasawhay River at Enterprise also set a record. In addition to the flash flooding, river flooding caused major damage to homes and numerous roads.

Easter Flood on the Pearl River 1979

The flood of record on the Pearl River in 1979 affected about 500 people, contributed to the deaths of four people, and resulted in an estimated $400 million in property damages. A worst-case scenario today would equal or double those numbers.

Mississippi River Flood 1927

The flood of record within the state occurred on the Mississippi River in 1927. At that time, the flood resulted in 246 deaths, left 650,000 homeless, and caused $284.1 million in property damages.

Other Flood Events

- 2014 – Severe Storms, Tornadoes, and Flooding
- 2012 - Hurricane Isaac
- 1973 - Mississippi River
- 1969 - Hurricane Camille
- 1961 - Pearl River
- 1948 - Tombigbee River
- 1892 - Tombigbee River

Under provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, (PL 93 – 288 as amended) and its predecessor, the Disaster Relief Act of 1970 (PL 91-606), 29 floods have resulted in federally declared "Major Disasters" since 1984. (**See Table 3.6.1**).

Table 3.6.1
Federal Disaster Declarations Flooding 1987 – 2017

Date Declared	Description	Disaster Declaration	Funds Extended	
			Public Assistance (Dollars Obligated)	Individual Assistance Dollars Approved)
Nov 2017	Hurricane Nate	DR-4350	$171,409	Not Available
May 2017	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-4314	$14,859,529	Not Available
Jan 2017	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-4295	$8,910,037	$3,336,215
Mar 2016	Severe Storms and Flooding	DR-4268	$8,833,631	$8,144,330
Jan 2016	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-4248	$5,548,643	$2,903,900
Apr 2014	Severe Storms, Tornadoes, Flooding	DR-4175	$90,521,861	$5,899,175
Feb 2013	Severe Storms, Tornadoes, Flooding	DR-4101	$606,727	$2,974,219
Aug 2012	Hurricane Isaac	DR-4081	$29,319,162	$17,315,143
May 2011	Mississippi Flooding	DR-1983	$7,933,540	$13,724,525

Date Declared	Description	Disaster Declaration	Funds Extended	
			Public Assistance (Dollars Obligated)	Individual Assistance Dollars Approved)
May 2010	Severe Storms, Tornadoes, and Flooding	DR-1916	$11,262,731	$1,320,029
April 2010	Severe Storms, Tornadoes, and Flooding	DR-1906	$5,913,852	$4,302,971
May 2009	Severe Storms, Floods	DR-1837	$2,721,893	$0
Sept 2008	Hurricane Gustav	DR-1794	$33,693,136	$7,176,481
April 2008	Severe Storms	DR-1764	$4,713,231	$549,481
March 2008	Severe Storms	DR-1753	$0	$1,598,082
Aug 2005	Hurricane Katrina	DR-1604	$3,243,443,388	$1,296,454,555
July 2005	Hurricane Dennis	DR-1594	$1,735,639	$0
Sept 2004	Hurricane Ivan	DR-1550	$14,403,029	$8,514,433
April 2003	Severe Storms	DR-1459	$6,031,462	$18,270,709
Oct 2002	Tropical Storm Isidore and Hurricane	DR-1436	$6,784,617	$0
Nov 2001	Severe Storms	DR-1398	$5,519,322	Not available
June 2001	Tropical Storm Allison	DR-1382	$1,804,361	Not available
April 2001	Severe Storms	DR-1365	$2,855,253	Not available
Sept 1998	Hurricane Georges	DR-1251	$32,124,060	Not available
June 1997	Mississippi River Floods	DR-1178	$264,979	Not available
May 1995	Response 1995	DR-1051	$996,257	Not available
May 1991	April – May Floods	DR-906	$7,390,442	Not available
Feb 1990	January – March Floods	DR-859	$7,901,304	Not available
March 1987	Severe Storms, Floods	DR-7687	Not available	Not available

Source: Federal Emergency Management Agency
Total dollars for PA and IA through December 2017

There are 82 counties within the state; all of which suffered at least one event since 1950. The number of instances for each of the counties by MEMA Region is indicated in Table 3.6.2.

Table 3.6.2
Mississippi Flood History January 1950 – October 2022 By County/MEMA Region

MEMA Region	County	Number of Events	Deaths	Injuries	Property Damage
MEMA Region 1	Coahoma	23	0	0	$2,088,000
	Desoto	77	2	0	$11,084,000
	Grenada	64	0	0	$4,721,000
	Panola	30	1	1	$1,565,000
	Quitman	7	0	2	$2,762,000
	Tallahatchie	19	0	0	$3,246,000
	Tate	26	2	7	$478,000
	Tunica	14	2	0	$1,002,000,000
	Yalobusha	11	0	0	$258,000
Total Region 1 Totals		271	7	10	**$1,028,202,000**
MEMA Region 2	Alcorn	38	1	0	$5,671,000
	Benton	6	0	0	$762,000
	Itawamba	17	0	0	$295,000
	Lafayette	28	0	0	$1,620,000
	Lee	59	0	0	$1,359,000
	Marshall	20	1	0	$1,142,000
	Pontotoc	29	0	0	$370,000
	Prentiss	24	0	0	$423,000
	Tippah	20	0	0	$1,587,000
	Tishomingo	16	3	0	$1,054,000
	Union	31	0	0	$1,417,000
Total Region 2 Totals		288	5	0	**$15,700,000**
MEMA Region 3	Attala	29	0	0	$2,738,000
	Bolivar	52	0	0	$6,452,000
	Carroll	29	0	0	$1,336,000
	Holmes	27	0	0	$13,579,000
	Humphreys	22	0	0	$2,139,000
	Leflore	38	0	0	$3,417,000
	Montgomery	27	0	1	$1,057,000
	Sunflower	45	0	0	$3,373,000
	Washington	61	0	0	$18,863,000
Total Region 3 Totals		330	0	1	**$52,954,000**
MEMA Region 4	Calhoun	25	0	0	$326,000

MEMA Region	County	Number of Events	Deaths	Injuries	Property Damage
	Chickasaw	15	0	0	$318,000
	Choctaw	21	0	0	$1,222,000
	Clay	23	0	0	$1,274,000
	Lowndes	54	0	0	$7,255,000
	Monroe	29	0	0	$1,751,000
	Noxubee	24	0	0	$646,000
	Oktibbeha	45	0	0	$2,121,000
	Webster	24	0	1	$2,046,000
	Winston	32	0	0	$1,354,000
Total Region 4 Totals		292	0	1	**$18,313,000**
MEMA Region 5	Claiborne	19	0	0	$1,284,000
	Copiah	31	0	0	$2,489,000
	Hinds	178	0	0	$32,604,000
	Issaquena	10	0	0	$2,163,000
	Madison	104	0	0	$54,947,000
	Rankin	217	1	0	$44,341,000
	Sharkey	20	0	0	$1,748,000
	Simpson	38	0	0	$563,000
	Warren	72	0	0	$22,069,000
	Yazoo	59	1	0	$20,319,000
Total Region 5 Totals		748	1	0	**$182,527,000**
MEMA Region 6	Clarke	41	0	0	$4,735,000
	Jasper	40	0	0	$4,042,000
	Kemper	16	0	0	$1,605,000
	Lauderdale	83	0	0	$56,048,000
	Leake	41	0	0	$11,179,000
	Neshoba	44	0	0	$2,222,000
	Newton	54	0	0	$32,361,000
	Scott	55	1	0	$53,384,000
	Smith	41	0	0	$692,000
Total Region 6 Totals		415	1	0	**$166,268,000**
MEMA Region 7	Adams	42	0	0	$4,231,000
	Amite	8	0	0	$990,000
	Franklin	29	0	0	$2,860,000
	Jefferson	18	0	0	$3,865,000

MEMA Region	County	Number of Events	Deaths	Injuries	Property Damage
	Lawrence	32	0	0	$2,360,000
	Lincoln	44	0	0	$6,795,000
	Pike	13	0	0	$985,000
	Walthall	8	0	0	$1,260,000
	Wilkinson	12	0	0	$7,265,000
Total Region 7 Totals		206	0	0	**$30,611,000**
MEMA Region 8	Covington	52	0	0	$3,181,000
	Forrest	136	1	0	$9,502,000
	Greene	31	0	0	$659,000
	Jefferson	18	0	0	$3,865,000
	Jones	130	0	0	$10,874,000
	Lamar	90	0	0	$12,616,000
	Marion	79	0	0	$25,502,000
	Perry	34	0	0	$1,993,000
	Wayne	31	0	0	$1,241,000
Total Region 8 Totals		601	1	0	**$69,433,000**
MEMA Region 9	George	35	3	7	$2,342,000
	Hancock	56	0	0	$3,396,000,000
	Harrison	90	2	0	$5,647,000,000
	Jackson	51	0	0	$2,257,000,000
	Pearl River	23	0	0	$4,035,000
	Stone	43	0	0	$223,000
Total Region 9 Totals		298	5	7	**$11,306,600,000**
Total		3,449	21	19	**$12,870,608,000**

Source: NCEI Database with the following parameters: coastal flood, flash flood, flood, heavy rain, lakeshore flood, storm surge/tide

Probability of Future Flood Events

Based on available historical data, floods occur within the state of Mississippi multiple times per year resulting in a calculated probability of reoccurrence of 3.21 annually. Approximately one in six acres in Mississippi is found within the FEMA-designated floodplain.

The Flood Insurance Studies (FIS) and their accompanying Flood Insurance Rate Maps (FIRMs) provide a means to identify the probability of future flood events. The utilization of the flood profiles for each river and stream, a summary of discharge tables, and floodway data tables allow each community's future event probability to be identified. The flood levels that can be predicted consist of the 10-year, 50-year, 100-year, and 500-year Base Flood Elevation (BFE) depths.

Another means of prediction of future events is the examination of past events, as this also establishes a

probability of recurring floods or repetitive flooding. There have been 29 federally declared disasters in Mississippi since 1987 (Table 3.6.1) and 19 Small Business Administration (Table 3.6.3) flood declarations. Each event contained some measure of the four types of flooding identified in the flood hazard description of this plan. These statistics place the state of Mississippi within the top tier of disaster-prone states.

Table 3.6.3
Number of Counties Designated in SBA Declared Flood Events Since 1998

Disaster Designation	Initial Date of Declaration	Number of Counties
SBA MS-00130	December 2020	4
SBA MS-00134	December 2020	8
SBA AL-00115	December 2020	4
SBA AL-00111	September 2020	3
SBA TN-00124	August 2020	1
SBA MS-00129	July 2020	11
SBA MS-00126	May 2020	5
SBA MS-00127	May 2020	29
SBA MS-00125	April 2020	15
SBA MS-00124	April 2020	24
SBA MS-00121	March 2020	10
SBA MS-00123	March 2020	13
SBA MS-00120	February 2020	3
SBA MS-00118	January 2020	6
SBA MS-00116	December 2019	3
SBA MS-00117	December 2019	19
SBA MS-00113	November 2019	7
SBA MS-00110	September 2019	14
SBA TN-00107	June 2019	2
SBA MS-00112	June 2019	9
SBA AR-00104	June 2019	2
SBA MS-00111	April 2019	29
SBA MS-00109	February 2019	11
SBA MS-00108	January 2019	10
SBA LA-00087*	January 2019	4
SBA TN-00106*	May 2017	6
SBA MS-00102*	May 2017	8
SBA MS-13543	April 2013	5
SBA MS-13492	February 2013	10
SBA MS-13439	January 2013	7
SBA MS-13273	September 2013	22
SBA MS-12938	November 2011	7

Disaster Designation	Initial Date of Declaration	Number of Counties
SBA MS-00029	May 2009	7
SBA MS-00033	April 2009	18
SBA MS-00034	March 2009	82
SBA MS-00028	March 2009	4
SBA MS-00026	August 2008	63
SBA MS-00020	May 2008	9
SBA MS-00021	March 2008	12
SBA MS-00009	November 2006	13
SBA (Flooding)	April 2005	18
SBA (Flooding)	August 2004	2
SBA (Flooding)	August 2003	7
SBA (Flooding)	August 2001	1

Source: U.S. Small Business Administration.

*Included counties in neighboring states

FEMA RiskMAP Program in Mississippi

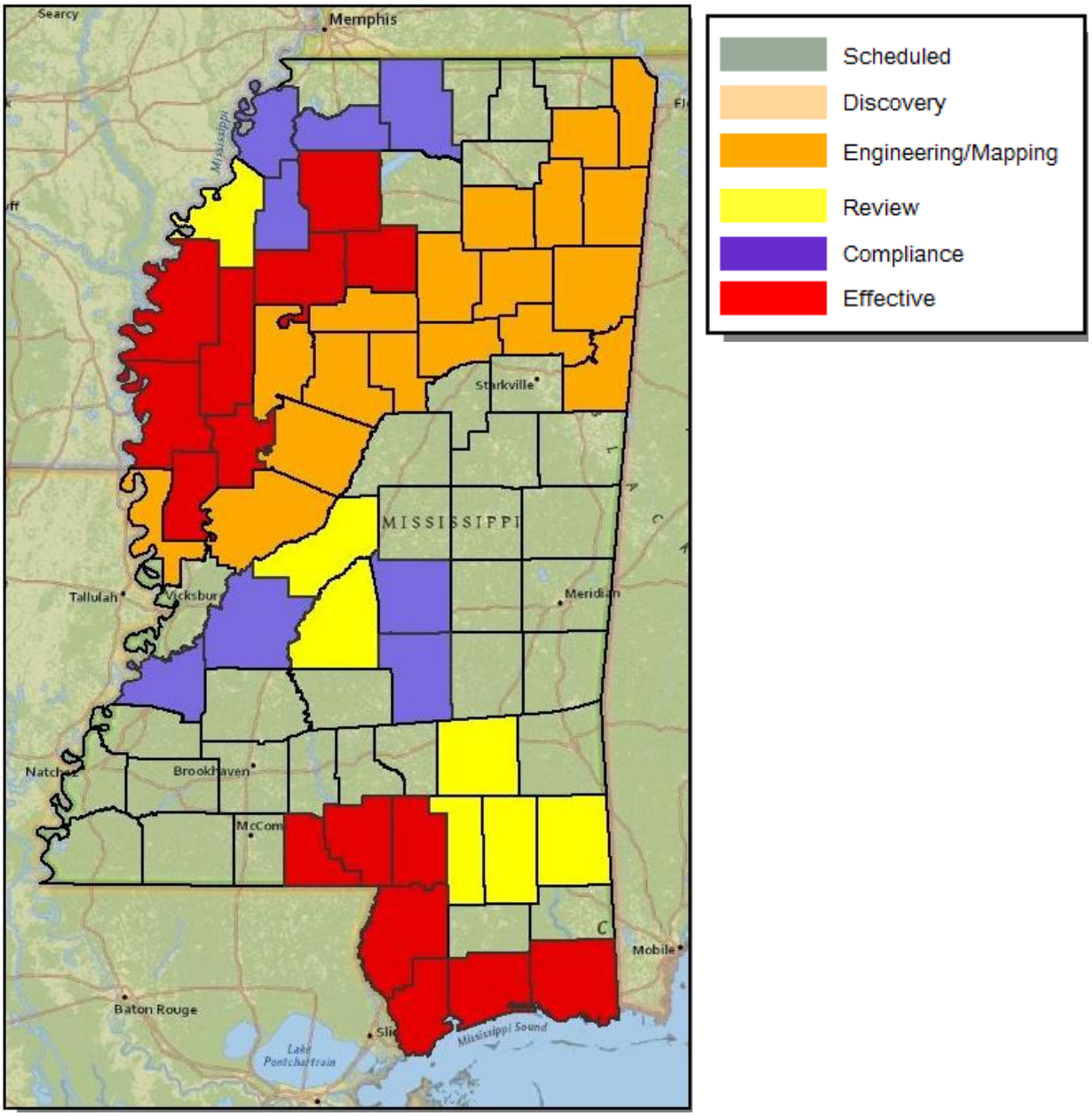
Beginning with FEMA FY2010 funding, the state of Mississippi and FEMA flood mapping shifted from the original FEMA Map Modification Program where DFIRM work was based on county-wide projects to the new RiskMAP Program. The primary difference between the RiskMap and Map Mod programs is that DFIRM work is now based on HUC-8 basins (for example Big Sunflower Basin) which include all or parts of multiple counties under RiskMAP. In addition to the regulatory products (Flood Insurance Study (FIS), DFIRM, and DFIRM GIS Database), communities in a studied basin will receive new non-regulatory products which will include the following; Watershed Flood Risk Report, Watershed Risk Map, and Flood Risk GIS Database with Changes Since Last FIRM data, Multi-Frequency Flood Depth Grids, Percent Annual Chance of Flooding data, Percent Chance of Flooding over 30-Years and new HAZUS Annualized Risk data. This data can be used in day-to-day floodplain management, and mitigation work and can be incorporated into hazard planning. All new DFIRM work will use Lidar elevation data where available.

New preliminary FIRMs and Flood Insurance Study (FIS) reports were completed for several counties since the last plan update:

County	Year	County	Year
• Hancock	2019	• Desoto	2021
• Pearl River	2019	• Marshall	2021
• Lamar	2019	• Quitman	2021
• Marion	2019	• Tate	2021
• Walthall	2019	• Tunica	2021
• Itawamba	2019	• Panola	2021
• Monroe	2019	• Tallahatchie	2021
• Scott	2021	• Yalabusha	2021

County	Year	County	Year
• Smith	2021	• Bolivar	2021
• Claiborne	2021	• Humphreys	2021
• Hinds	2021	• Sharkey	2021
• Benton	2021	• Sunflower	2021
• Coahoma	2021	• Washington	2021

The following map shows the status of the Mississippi Flood Risk Mapping, Assessment, and Planning status as of April 22, 2021.



Source: https://geology.deq.ms.gov/floodmaps/Projects/RiskMAP/

National Flood Insurance Program (NFIP)

Mississippi has 363 communities that have federally identified Special Flood Hazard Areas (SFHA) or floodplains. These areas indicate the water surface elevation resulting from a flood that has a one percent or greater chance of being equaled or exceeded in any given year.

330 Mississippi communities are members of the National Flood Insurance Program (NFIP), including 4 communities (Carrollton, Coahoma, Courtland, and Renova) that are in the emergency plan. Additionally, 32 communities also participate in the Community Rating System (CRS). Details on the communities that participate in the program are found in Appendix 7.3.6-A. To show the forward progress being made by communities, **Table 3.6.4** provides a summary of the community participation in the NFIP and CRS communities since the 2007 State of Mississippi Standard Hazard Mitigation Plan.

Table 3.6.4
NFIP and CRS Community Participation

State Plan Year	NFIP Communities	Emergency Plan	CRS Communities
2023	391		33
2018	330	4	32
2013	329	4	31
2010	305	15	23
2007	276	4	19

Mississippi continues to rank high in the nation for NFIP claims payments. **Table 3.6.5** details the ten Mississippi counties with the greatest total NFIP claims payments through February 2018. Details on flood insurance policies by county can be referenced in **Appendix 7.3.6-B**. Data current through 2022 is redacted and does not accurately reflect a true update for the period from 2019-2022.

Table 3.6.5
NFIP Loss Statistics Top 10 Counties January 1978 to February 2018

County	Total Losses	Closed Losses	Open Losses	Closed w/o Payment Losses	Total Payments
Harrison	11,395	12,777	12	2,376	$1,281,229,535
Hancock	9,646	8,572	14	1,060	$737,684,695
Jackson	10,650	9,121	26	1,503	$703,296,088
Hinds	4,195	3,399	32	764	$59,269,645.97
Washington	1,849	1,515	25	309	$33,696,394
Warren	2,765	2,418	1	346	$30,876,258
Bolivar	1,300	1,135	4	161	$22,411,146
Wilkinson	1,871	1,592	1	278	$20,595,214
Pearl River	730	568	1	161	$13,509,714
Forrest	1,746	1,379	1	366	$9,754,712.47

Source: bsa.nfipstats.html (NFIP Policy and Loss by Community February 2018)

The State's Floodplain Manager and local jurisdictions maintain detailed data on properties classified as repetitive flood loss properties or severe repetitive loss properties that include specific addresses and homeowner information. This information is protected under the Privacy Act of 1974 and is not included as an appendix item with this plan update (contact the State Floodplain Manager for details).

Repetitive Loss Property Analysis

The reduction of losses related to repetitive loss structures is a high priority for Mississippi and for the U.S. Repetitive loss properties strain the National Flood Insurance (NFIP) Fund. They increase the NFIP's annual losses and the need for borrowing and, more importantly, they drain resources needed to prepare for catastrophic events. The NFIP defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. At least two of the claims must be more than ten days apart.

A repetitive loss property is also defined by the following when considering the Pre-Disaster Mitigation Program (PDM):

- A property covered under a contract for flood insurance made available under the NFIP; and has incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and
- At the time of the second incidence of flood-related damage, the contract for flood insurance contains an increased cost of compliance coverage.

Table 3.6.6 illustrates the number of properties and payments received for Mississippi's top 10 repetitive loss counties. The table ranks counties by repetitive loss dollars paid between 1978 and February 2016 and is sorted by the highest total payments received. The top three counties with repetitive losses continue to be the coastal counties of Harrison, Hancock, and Jackson. Figure 3.6.5 illustrates the number of properties by county. Additional details by county are also provided by MEMA Region later in this section.

Table 3.6.6
Repetitive Loss (RL) Flood Claims by County (1978-2016)

County	No. of RL Properties	No. of Insured Properties	No. of Mitigated Properties	Flood Claims	Total Property Value	Total Payments
Harrison	1,290	427	674	222	$11,203,151,307*	$197,852,894
Jackson	1,260	509	379	3,144	$233,383,062*	$175,661,475
Hancock	1,036	442	428	2,683	$166,055,374*	$121,615,790
Hinds	443	190	18	1,117	$64,181,531*	$24,239,035
Warren	393	18	247	1,418	$79,757,122*	$21,019,934
Washington	191	29	26	631	$21,485,272*	$15,307,508
Wilkinson	190	15	94	774	$34,089,945*	$12,893,255
Pearl River	82	23	18	260	$13,881,972*	$5,921,890
Rankin	94	32	26	237	$21,464,455*	$5,324,565
Forrest	205	26	130	551	$18,920,148*	$4,322,726

Source: State Floodplain Manager NFIP List as of February 2016

*Property values listed for condominiums were removed due to inaccuracy.

Below is a series of figures, which show the repetitive loss and severe repetitive loss structures located within the special flood hazard area (SHFA) per MEMA Region.

Figure 3.6-1 MEMA Region 1 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

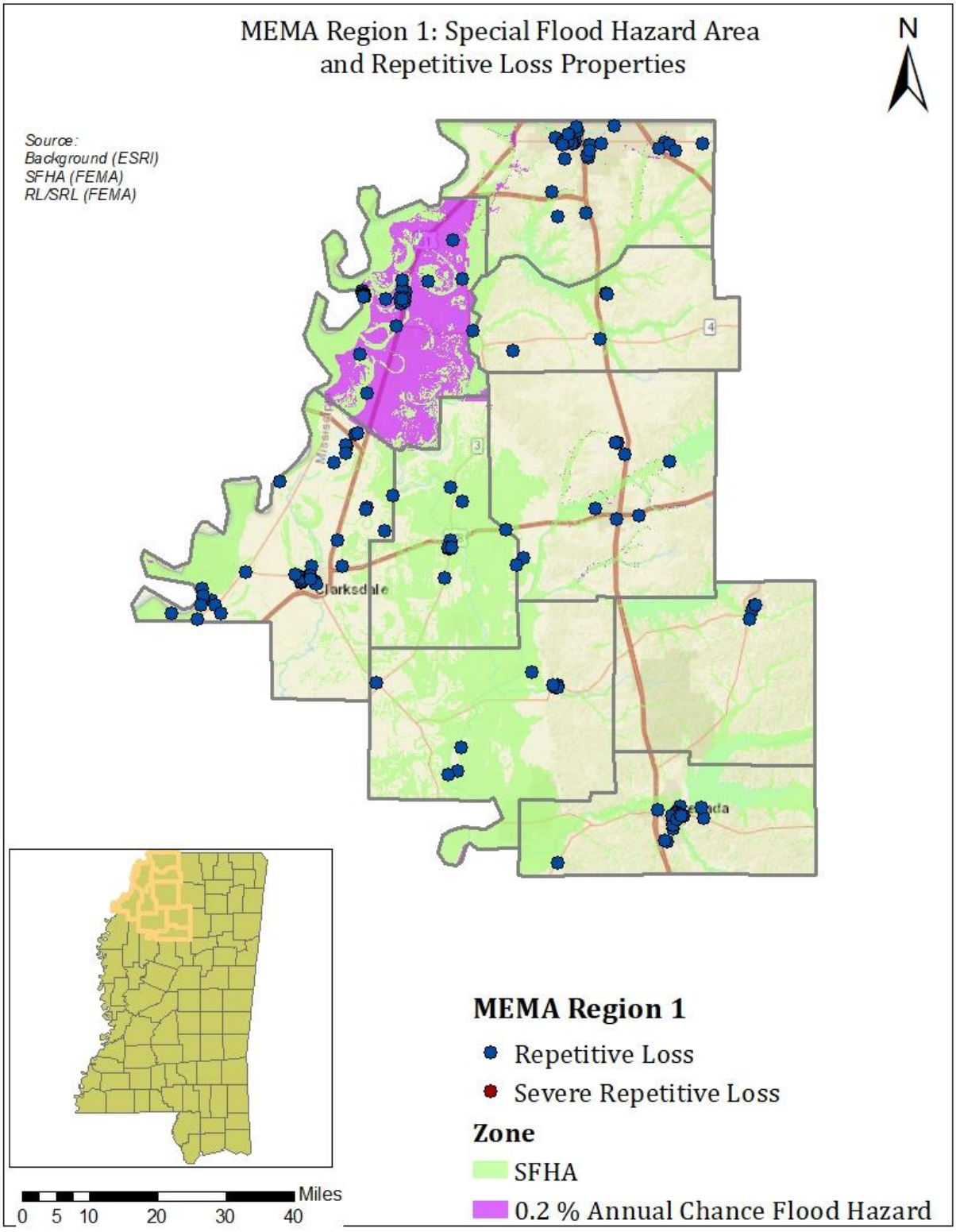


Figure 3.6-2 MEMA Region 2 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

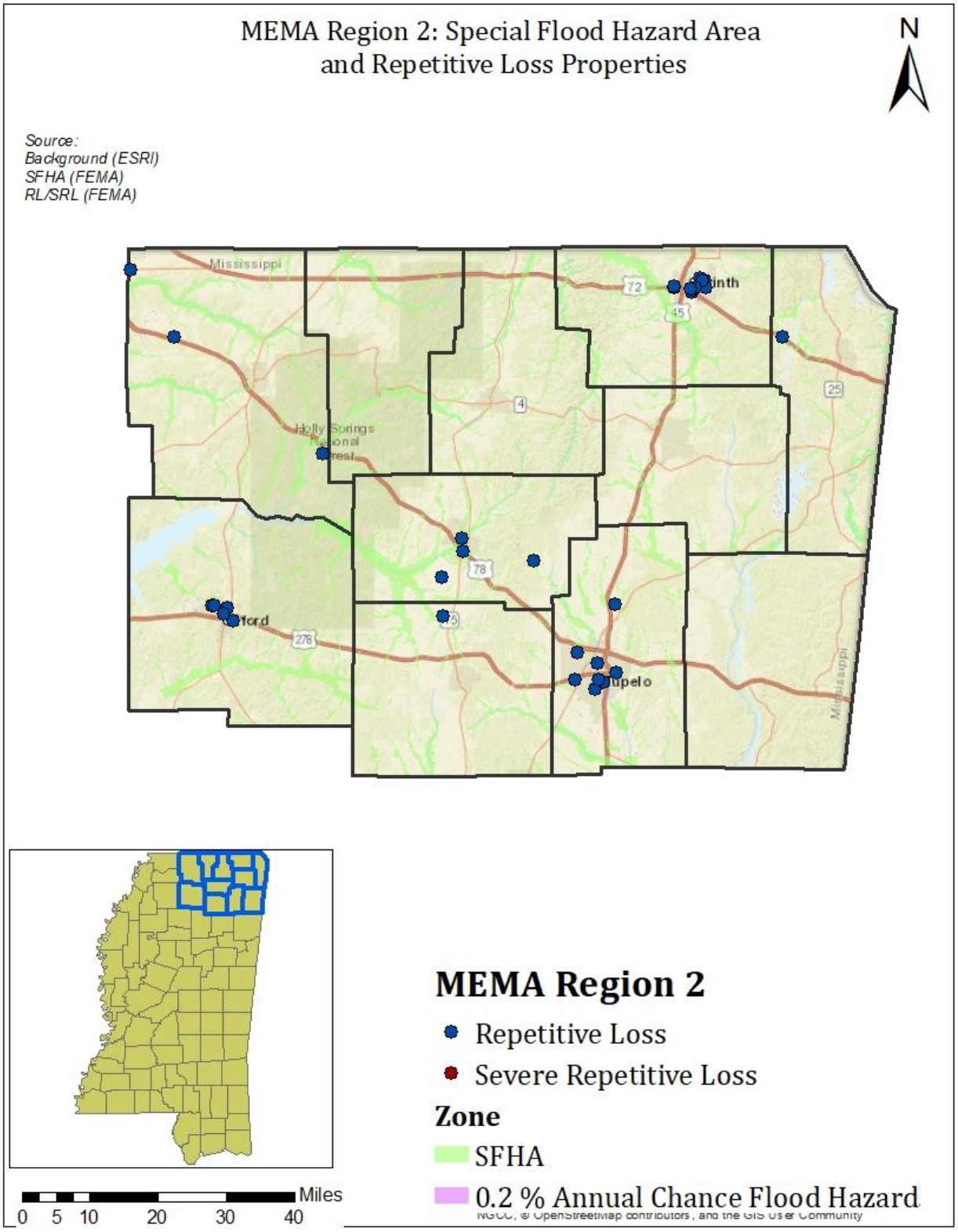


Figure 3.6-3 MEMA Region 3 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

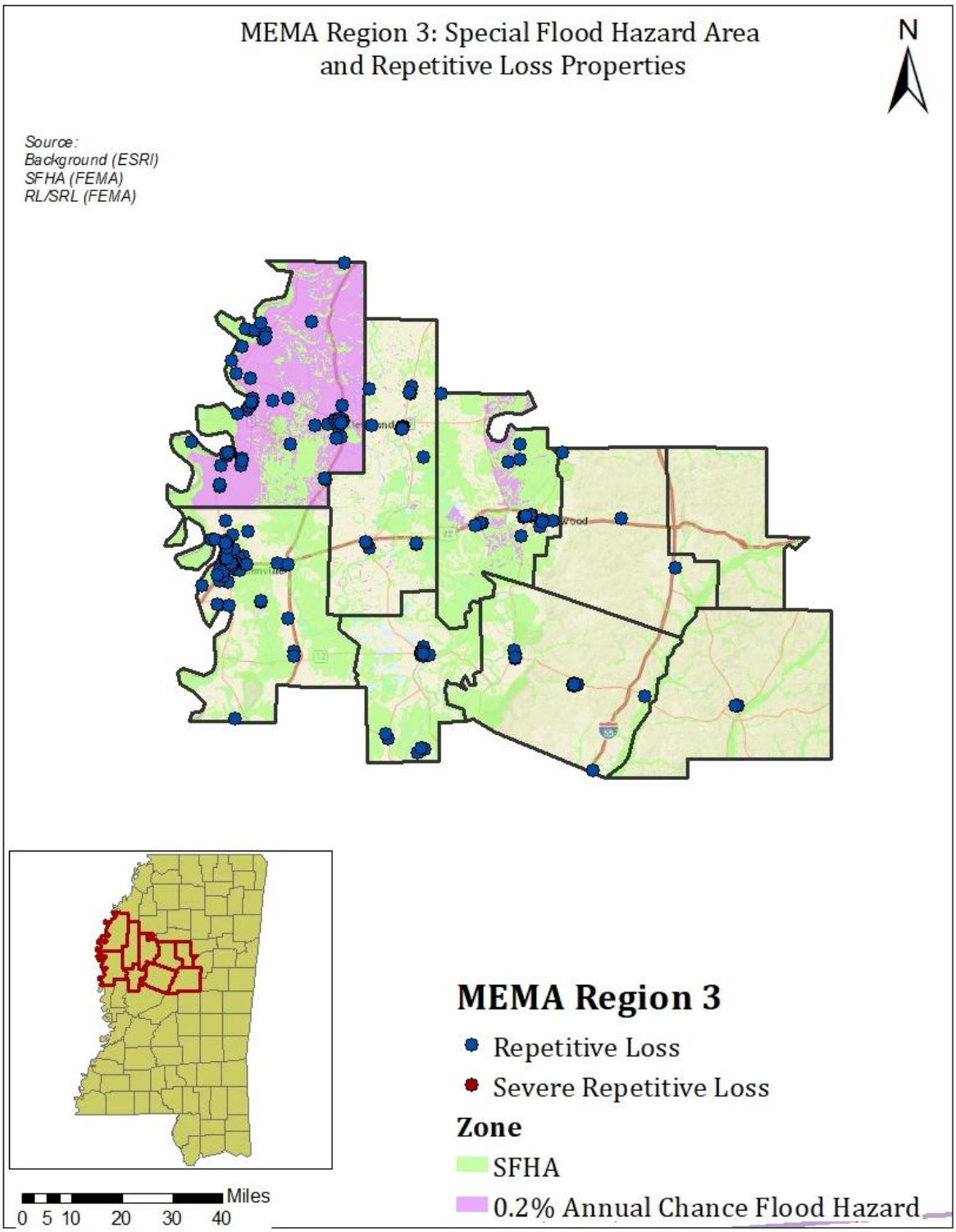


Figure 3.6-4 MEMA Region 4 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

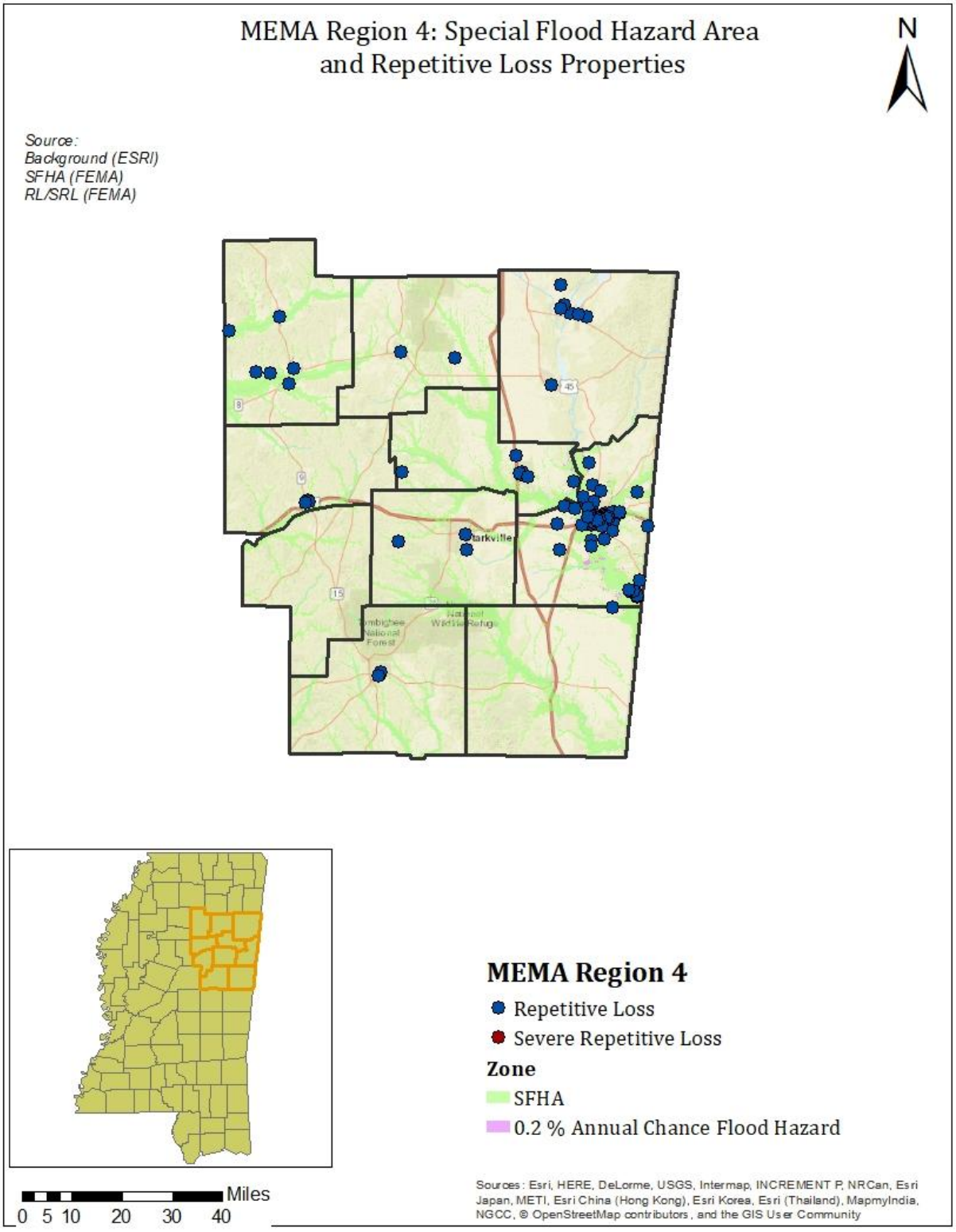


Figure 3.6-5 MEMA Region 5 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

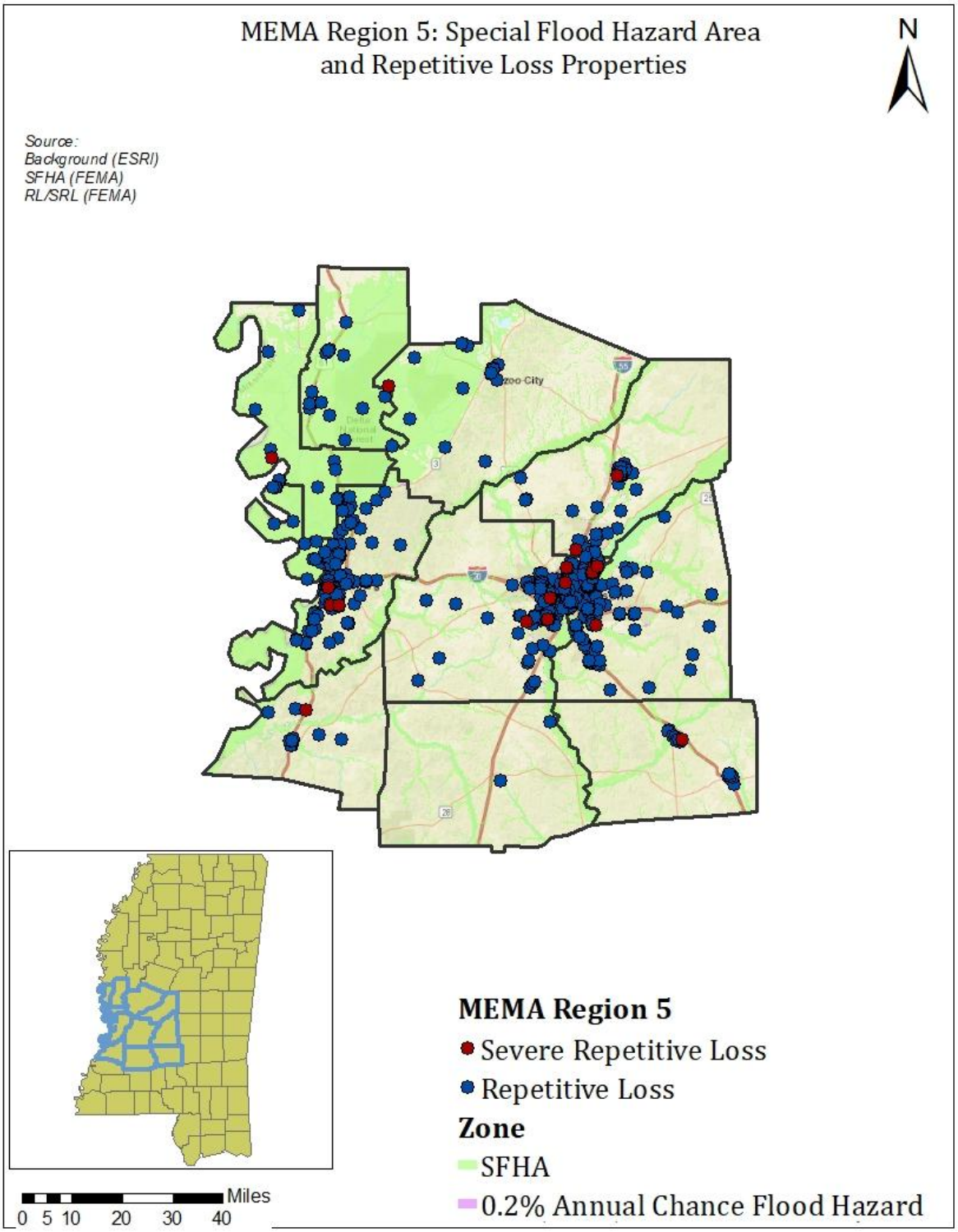


Figure 3.6-6 MEMA Region 6 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

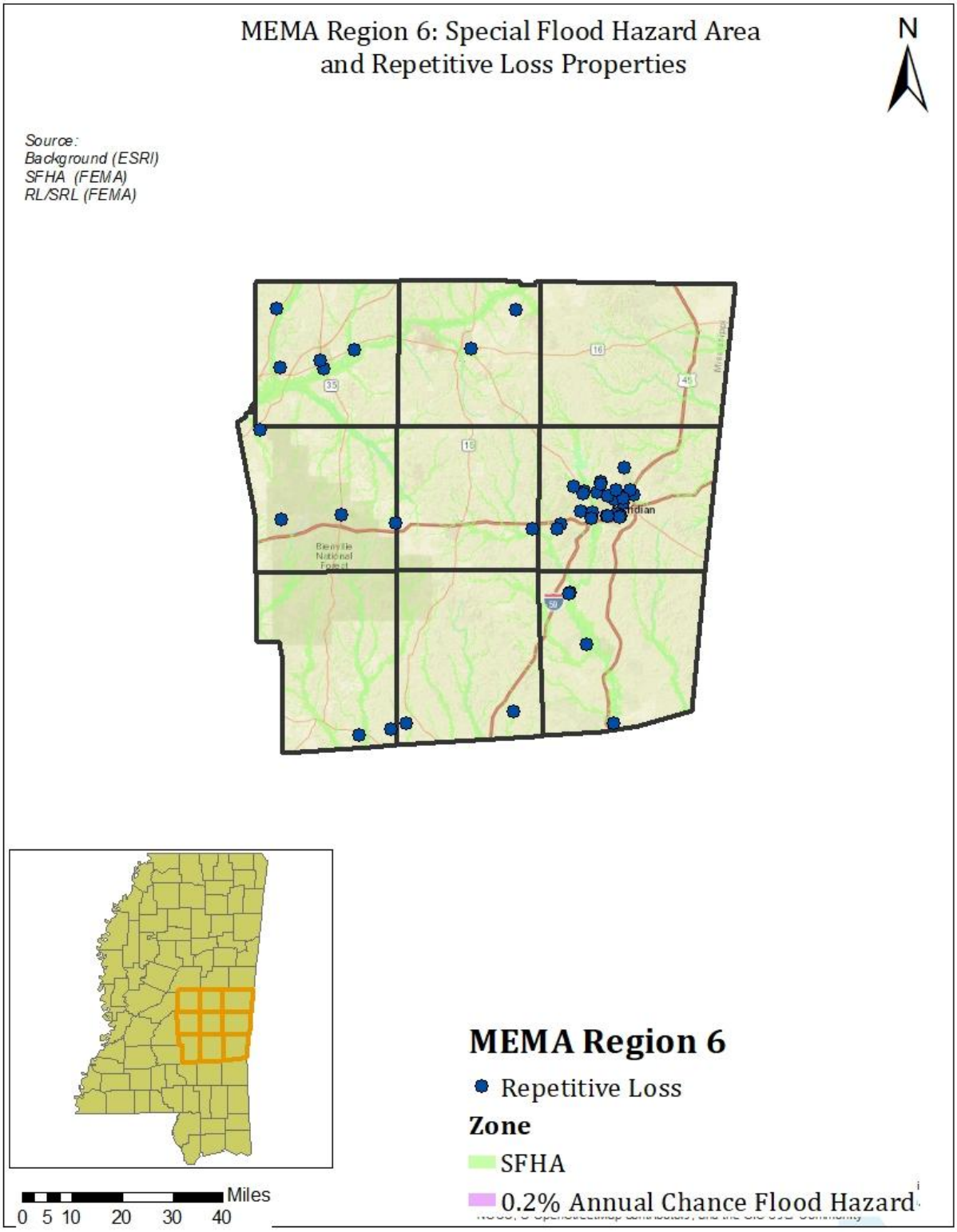


Figure 3.6-7 MEMA Region 7 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

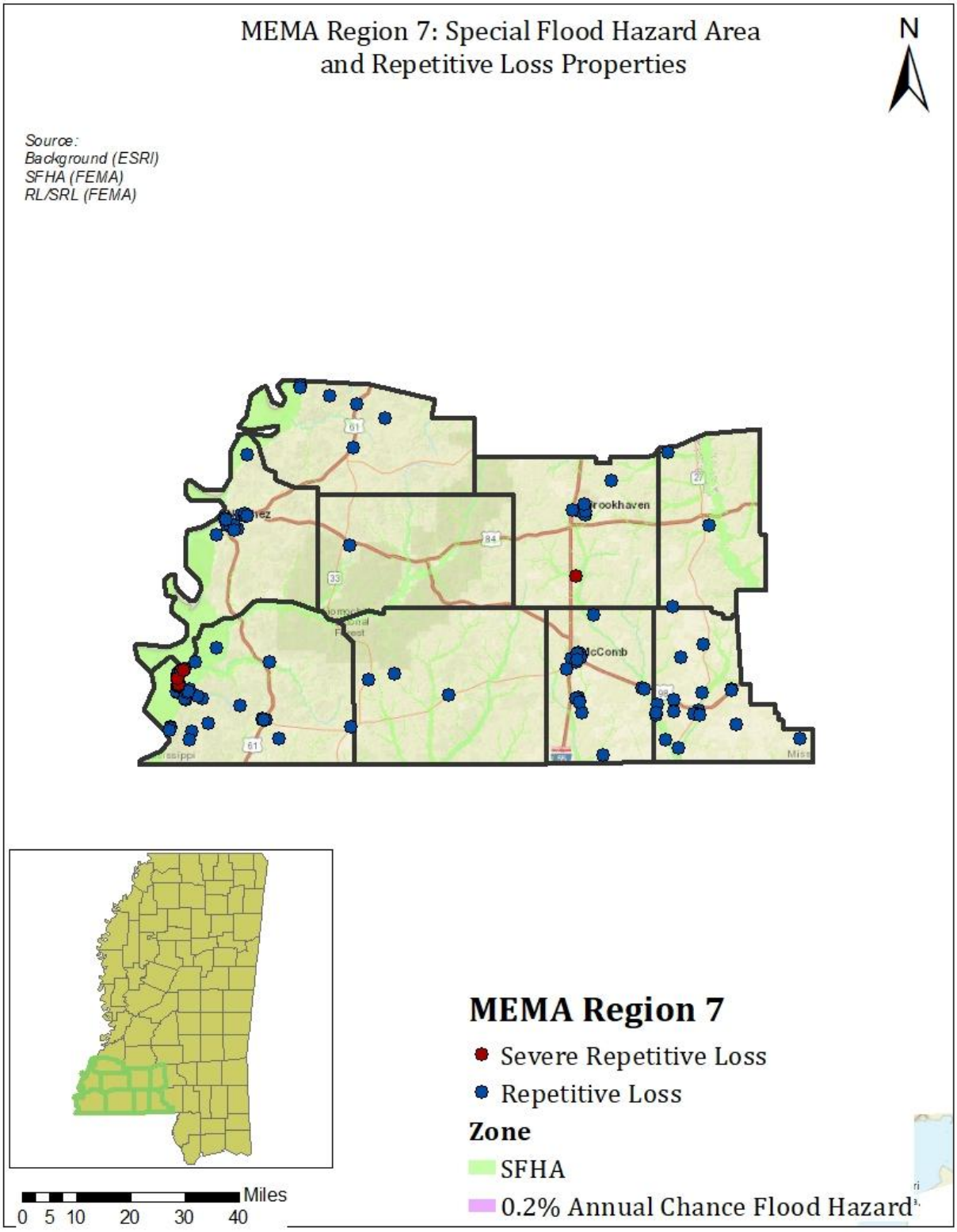


Figure 3.6-8 MEMA Region 8 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

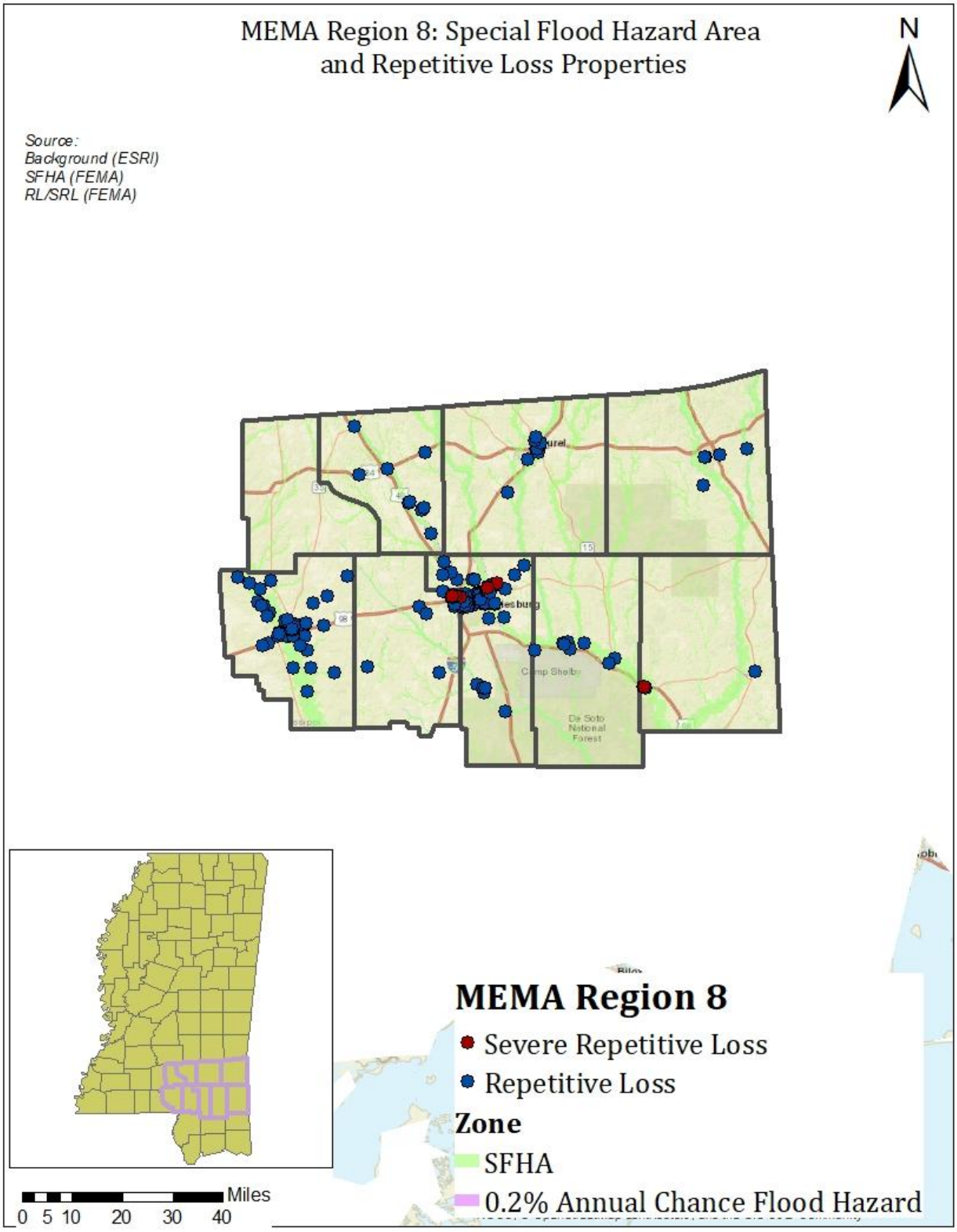
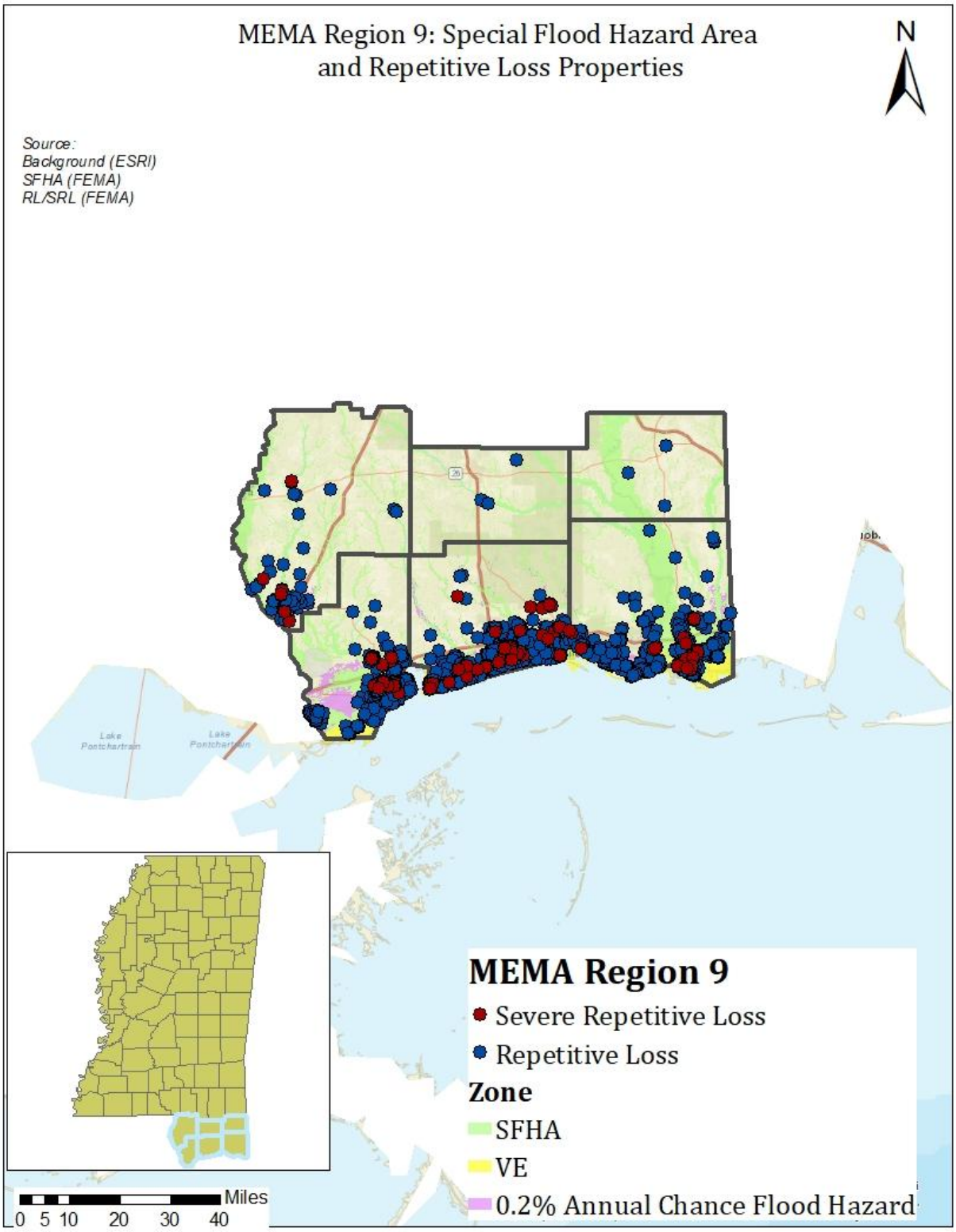


Figure 3.6-9 MEMA Region 9 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures



Severe Repetitive Loss Property Analysis

The Flood Insurance Reform Act of 2004 identified another category of repetitive loss. Severe repetitive loss (SRL) is defined as "

A property covered under a contract for flood insurance made available under the NFIP; and

Has incurred flood-related damage

- For which four or more separate claims payments (including building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or
- For which at least two separate claims payments (including only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Table 3.6.7 illustrates the number of properties and the payments received for Mississippi's top 10 severe repetitive loss counties. The table ranks counties by severe repetitive loss dollars paid between 1978 and February 2016 and is sorted by the highest total payments received. The top three counties with repetitive losses continue to be the coastal counties of Harrison, Hancock, and Jackson. and Figure 3.6.6 illustrates the number of properties by county. Additional details by county are also provided by MEMA Region later in this section.

Table 3.6.7
Mississippi's Severe Repetitive Loss Summary by County
(Ranked by Total Payment)

County	No. of SRL Properties	No. of Insured Properties	Flood Claims	Total Property Value	Total Payments (Bldg and Contents)
Harrison	51	1*	222	$9,844,971	$11,635,104
Jackson	31	4*	194	$6,057,105	$5,393,976
Hancock	27	0*	93	$4,237,655	$5,368,404
Hinds	15	0*	53	$1,446,339	$1,418,565
Washington	5	2*	22	$806,287	$1,232,560
Lamar	8	0*	48	$1,177,548	$969,758
Wilkinson	6	1*	32	$669,905	$814,558
Warren	2	1*	9	$341,911	$217,869
Bolivar	2	0*	7	$40,876	$84,548

County	No. of SRL Properties	No. of Insured Properties	Flood Claims	Total Property Value	Total Payments (Bldg and Contents)
Claiborne	1	0*	10	$25,603	$80,549

Source: State Floodplain Manager NFIP List as of February 2016
*All other structures listed as SDF

MEMA Region Repetitive Loss/Severe Repetitive Loss Summary

Added to this section in 2013, and updated in 2018, is a summary of the repetitive and severe repetitive loss properties by MEMA Region. As shown in the tables, a comparison of the 2009, 2011, and 2016 NFIP reports is provided to show progress made - including the number of mitigated properties to date. A summary of the number of NFIP communities is displayed. The counties that have added communities are highlighted in bold font.

MEMA Region 1

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Coahoma	15	42	51	133	0	5	0	18
Desoto	14	0	40	107	0	0	1	8
Grenada	14	49	63	153	0	13	0	32
Panola	7	7	8	19	0	0	0	0
Quitman	21	20	22	62	0	1	0	4
Tallahatchi	9	9	11	24	0	0	0	0
Tate	1	2	6	12	0	0	0	0
Tunica	77	65	79	206	1	10	0	43
Yalobusha	8	8	9	17	0	0	0	0
Totals	**166**	**202**	**289**	**733**	**1**	**29**	**1**	**105**

County	No. of NFIP Communities	No. of Mitigated Properties
Coahoma	7	13
Desoto	6	0
Grenada	2	9

County	No. of NFIP Communities	No. of Mitigated Properties
Tallahatchie	6	0
Tate	3	0
Tunica	2	14

County	No. of NFIP Communities	No. of Mitigated Properties
Panola	7	3
Quitman	6	1

County	No. of NFIP Communities	No. of Mitigated Properties
Yalobusha	4	0
Totals	**43**	**40**

MEMA Region 2

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Alcorn	0	7	0	14	0	0	0	0
Benton	0	0	0	0	0	0	0	0
Itawamba	0	0	0	0	0	0	0	0
Lafayette	0	3	6	11	0	0	0	0
Lee	4	7	10	28	0	1	1	5
Marshall	1	1	1	3	0	0	0	0
Pontotoc	1	1	1	2	0	0	0	0
Prentiss	0	0	0	0	3	0	0	0
Tippah	0	0	0	0	0	0	0	0
Tishomingo	1	1	1	2	0	0	0	0
Union	3	2	5	8	0	1	0	2
Totals	**10**	**22**	**24**	**68**	**3**	**2**	**1**	**7**

County	No. of NFIP Communities	No. of Mitigated Properties
Alcorn	5	0
Benton	3	0
Itawamba	3	0
Lafayette	4	0
Lee	10	3
Marshall	4	0

County	No. of NFIP Communities	No. of Mitigated Properties
Pontotoc	7	0
Prentiss	2	0
Tippah	6	0
Tishomingo	7	0
Union	4	0
Totals	**55**	**3**

MEMA Region 3

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Attala	0	0	1	2	0	0	0	0
Bolivar	155	108	210	631	2	48	2	228
Carroll	4	4	4	8	0	0	0	0
Holmes	11	12	12	27	0	0	0	0
Humphreys	40	31	46	161	2	10	1	61
LeFlore	29	27	27	71	0	2	0	8
Montgomer	0	0	0	0	0	0	0	0
Sunflower	19	16	20	72	1	4	0	21
Washington	152	115	191	631	14	48	8	250
Totals	**410**	**313**	**511**	**1,603**	**19**	**112**	**11**	**568**

County	No. of NFIP Communities	No. of Mitigated Properties
Attala	5	0
Bolivar	16	20
Carroll	4	0
Holmes	8	0
Humphreys	5	1

County	No. of NFIP Communities	No. of Mitigated Properties
Leflore	6	1
Montgomery	4	0
Sunflower	8	4
Washington	6	26
Totals	**62**	**52**

MEMA Region 4

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Calhoun	5	4	5	15	0	1	0	7
Chickasaw	1	1	1	2	0	0	0	0
Choctaw	0	0	0	0	0	0	0	0
Clay	8	8	9	26	0	0	0	0
Lowndes	125	109	123	389	2	14	2	79
Monroe	12	9	11	33	1	3	1	11
Noxubee	0	0	0	0	0	0	0	0
Oktibbeha	2	2	2	7	0	0	0	0
Webster	5	4	5	16	0	1	0	6
Winston	2	2	2	4	0	0	0	0
Totals	**160**	**139**	**158**	**474**	**3**	**19**	**3**	**103**

County	No. of NFIP Communities	No. of Mitigated Properties
Calhoun	7	0
Chickasaw	5	0
Choctaw	5	0
Clay	2	0
Lowndes	4	18

County	No. of NFIP Communities	No. of Mitigated Properties
Monroe	6	0
Noxubee	4	0
Oktibbeha	3	0
Webster	2	0
Winston	2	0
Totals	**40**	**18**

MEMA Region 5

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Claiborne	79	48	82	294	7	32	1	162
Copiah	2	2	3	6	0	0	0	0
Hinds	388	365	438	1,102	15	46	15	157
Issaquena	128	93	134	402	3	39	1	137
Madison	40	64	72	351	0	6	3	46
Rankin	47	68	93	237	0	0	0	0
Sharkey	20	16	25	68	2	9	2	25
Simpson	27	26	30	108	0	4	1	38
Warren	191	321	393	1,418	6	60	3	299
Yazoo	9	15	25	64	0	0	0	0
Totals	**931**	**1,018**	**1,295**	**4,050**	**33**	**196**	**26**	**864**

County	No. of NFIP Communities	No. of Mitigated Properties
Claiborne	2	14
Copiah	5	1
Hinds	11	18
Issaquena	2	16
Madison	7	34

County	No. of NFIP Communities	No. of Mitigated Properties
Rankin	10	25
Sharkey	4	0
Simpson	5	3
Warren	2	247
Yazoo	5	6
Totals	**53**	**364**

MEMA Region 6

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Clarke	3	4	17	49	0	0	0	0
Jasper	1	0	3	7	0	1	0	3
Kemper	0	0	0	0	0	0	0	0
Lauderdale	24	26	26	73	0	1	0	4
Leake	4	4	4	8	0	0	0	0
Neshoba	0	0	0	0	0	0	0	0
Newton	1	1	1	2	0	0	0	0
Scott	3	3	2	4	0	0	0	0
Smith	0	0	0	0	0	0	0	0
Totals	**36**	**38**	**53**	**143**	**0**	**2**	**0**	**7**

County	No. of NFIP Communities	No. of Mitigated Properties
Clarke	6	2
Jasper	5	0
Kemper	3	0
Lauderdale	3	11
Leake	5	0

County	No. of NFIP Communities	No. of Mitigated Properties
Neshoba	4	0
Newton	6	0
Scott	6	0
Smith	3	0
Totals	**41**	**13**

MEMA Region 7

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Adams	11	16	29	72	0	0	0	0
Amite	0	0	3	8	0	0	0	0
Franklin	0	0	2	3	0	0	0	0
Jefferson	9	6	12	40	0	3	0	17
Lawrence	2	1	14	53	1	1	0	11
Lincoln	3	3	2	6	0	0	0	0
Pike	10	12	2	4	0	3	1	16
Walthall	19	16	2	5	0	3	0	8
Wilkinson	204	116	189	774	3	86	6	440
Totals	**258**	**170**	**255**	**965**	**4**	**96**	**7**	**492**

County	No. of NFIP Communities	No. of Mitigated Properties
Adams	2	5
Amite	3	0
Franklin	4	0
Jefferson	2	6
Lawrence	4	6

County	No. of NFIP Communities	No. of Mitigated Properties
Lincoln	2	2
Pike	4	2
Walthall	2	2
Wilkinson	4	93
Totals	**27**	**116**

MEMA Region 8

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Covington	11	11	11	27	0	0	0	0
Forrest	71	191	204	551	2	6	4	43
Greene	0	2	1	2	0	0	0	0
Jefferson Davis	0	0	0	0	0	0	0	0
Jones	12	12	13	36	0	0	0	0
Lamar	36	19	39	198	6	19	8	128
Marion	83	77	91	288	2	14	0	73
Perry	11	9	12	29	0	2	0	6
Wayne	3	3	5	19	0	0	0	0
Totals	**227**	**324**	**376**	**1,150**	**10**	**41**	**12**	**250**

County	No. of NFIP Communities	No. of Mitigated Properties
Covington	4	0
Forrest	3	129
Greene	4	0
Jefferson Davis	3	0
Jones	5	0

County	No. of NFIP Communities	No. of Mitigated Properties
Lamar	5	2
Marion	2	10
Perry	4	1
Wayne	3	0
Totals	**33**	**142**

MEMA Region 9

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
George	1	1	3	7	0	0	0	0
Hancock	727	818	1,036	2,683	39	70	28	231
Harrison	724	1,085	1,290	3,985	72	125	51	557
Jackson	947	965	1,260	3,144	26	95	33	394
Pearl River	61	61	82	260	6	10	7	44
Stone	1	1	2	4	0	0	0	0
Totals	**2,461**	**2,931**	**3,674**	**10,083**	**143**	**300**	**119**	**1,226**

County	No. of NFIP Communities	No. of Mitigated Properties
George	2	0
Hancock	4	428
Harrison	6	674

County	No. of NFIP Communities	No. of Mitigated Properties
Jackson	5	379
Pearl River	4	17
Stone	2	0
Totals	**23**	**1,498**

Assessing Vulnerability by Jurisdiction / Estimating Potential Losses

Methodology

This plan updated the HAZUS runs for flood from the 2013 plan, using the most recent version of the program available. All HAZUS runs were generated by MEMA Region for the applicable hazards.

The HAZUS-MH flood analysis was a significant undertaking for the state. Producing a HAZUS-MH flood run is very computer-resource intensive. Processing a MEMA Region takes a significant amount of time from start to finish, depending on the size of the counties, density of the stream network, and density of census blocks. In some cases, the Regions had to be divided into separate runs and then analyzed on a regional level once complete.

HAZUS-MH produces a flood polygon and flood depth grid that represents the base flood. While not as accurate as official flood maps, such as digital flood insurance rate maps, these floodplain boundaries are available for use in GIS and could be valuable to communities that have not been mapped by the National Flood Insurance Program.

Flood damage is directly related to the depth of flooding. For example, a two-foot-deep flood generally results

in about 20 percent damage to the structure (which translates to 20 percent of the structure's replacement value). HAZUS-MH takes into account flood depth when modeling damage (based on FEMA's depth-damage functions). The HAZUS-MH reports capture damage by occupancy class (in terms of square footage impacted) by damage percent classes. Occupancy classes in HAZUS-MH include agriculture, commercial, education, government, industrial, religion, and residential. Damage percent classes are grouped by ten percent increments: 1-10 percent, 11-20 percent, etc., up to 50 percent. Buildings that sustain more than 50 percent damage are considered to be "substantially" damaged

The HAZUS-MH methodology provides the number of buildings impacted, estimates of the building repair costs, and the associated loss of building contents and business inventory. Building damage can also cause additional losses to a community as a whole by restricting the building's ability to function properly. Income loss data accounts for losses such as business interruption and rental income losses as well as the resources associated with damage repair and job and housing losses. These losses are calculated by HAZUS-MH using a methodology based on the building damage estimates.

Data Limitations

Default HAZUS-MH data was used to develop the loss estimates. Thus, the potential losses derived from HAZUS-MH, the best available data, may contain some inaccuracies. The state facility list contained an insufficient number of attributes to be fully integrated into HAZUS-MH.

The damaged building counts generated by HAZUS-MH are susceptible to rounding errors and are likely the weakest output of the model due to the use of census blocks for analysis. The HAZUS-MH "Building Damage Count by General Building Type" report includes this disclaimer:

> "Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduce uncertainty into the building count results. Please use these results with suitable caution."

The counts of buildings at risk collected from flood insurance policy data and biennial reports could potentially provide a more realistic estimate of the actual numbers of buildings in the base-flood hazard areas (see the Flood Insurance Claims Analysis that follows), but the information in the biennial reports could contain errors as well.

HAZUS-MH can analyze additional impacts, including what type of infrastructure could be affected and how severely. Project files for each county are available for use by local governments and the state if more details on the impacts discussed here, or information about other impacts, such as vehicle losses, agricultural losses, utility system losses, essential facility impacts, and transportation impacts, are desired.

Vulnerable Jurisdictions

This analysis is intended to enable the state to estimate where flood losses could occur and the degree of severity, regionally, using a consistent methodology. The computer modeling helps quantify risk along known flood hazard corridors such as along the Mississippi and Pearl rivers. In addition, flood losses are estimated for certain lesser streams and rivers where the flood hazard may not have been previously studied.

HAZUS-MH impact analyses were run for direct economic losses for buildings and societal impacts (displaced people and shelter needs) to see which regions ranked the highest on these risk indicators (these losses and impacts are illustrated in the maps and tables that follow). Using GIS, HAZUS-MH flood results were mapped to show flood loss potential and how it varies across the state. The primary indicators used to assess flood losses were:

- direct building losses combined with income losses,
- loss ratio of the direct building losses compared to overall building inventory, and
- population displaced by the flood and shelter needs.

Figure 3.6-10 Mississippi Assets Located in the MEMA Region 1 Special Flood Hazard Area (SHFA)

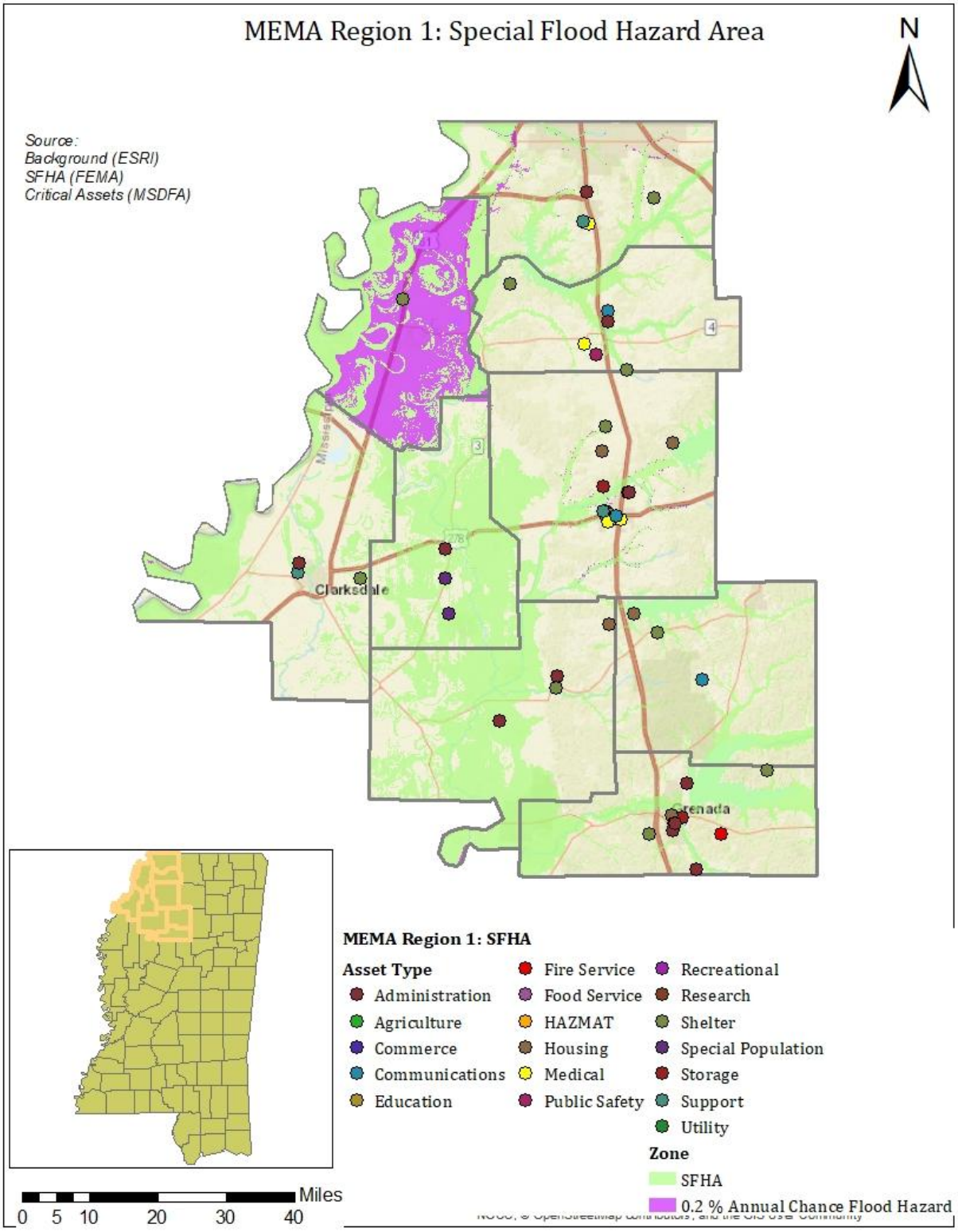


Figure 3.6-11 Mississippi Assets Located in the MEMA Region 2 Special Flood Hazard Area (SHFA)

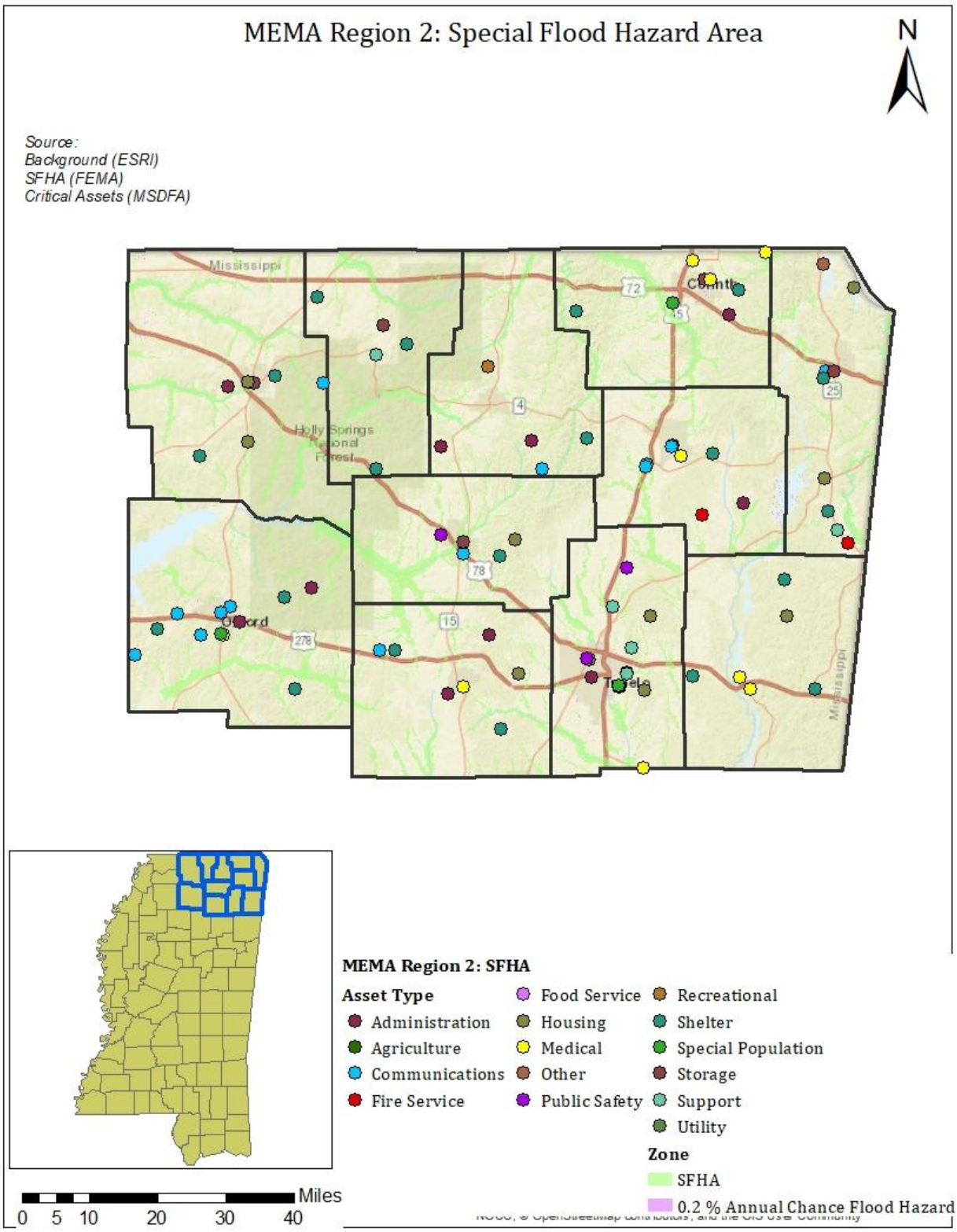


Figure 3.6-12 Mississippi Assets Located in the MEMA Region 3 Special Flood Hazard Area (SHFA)

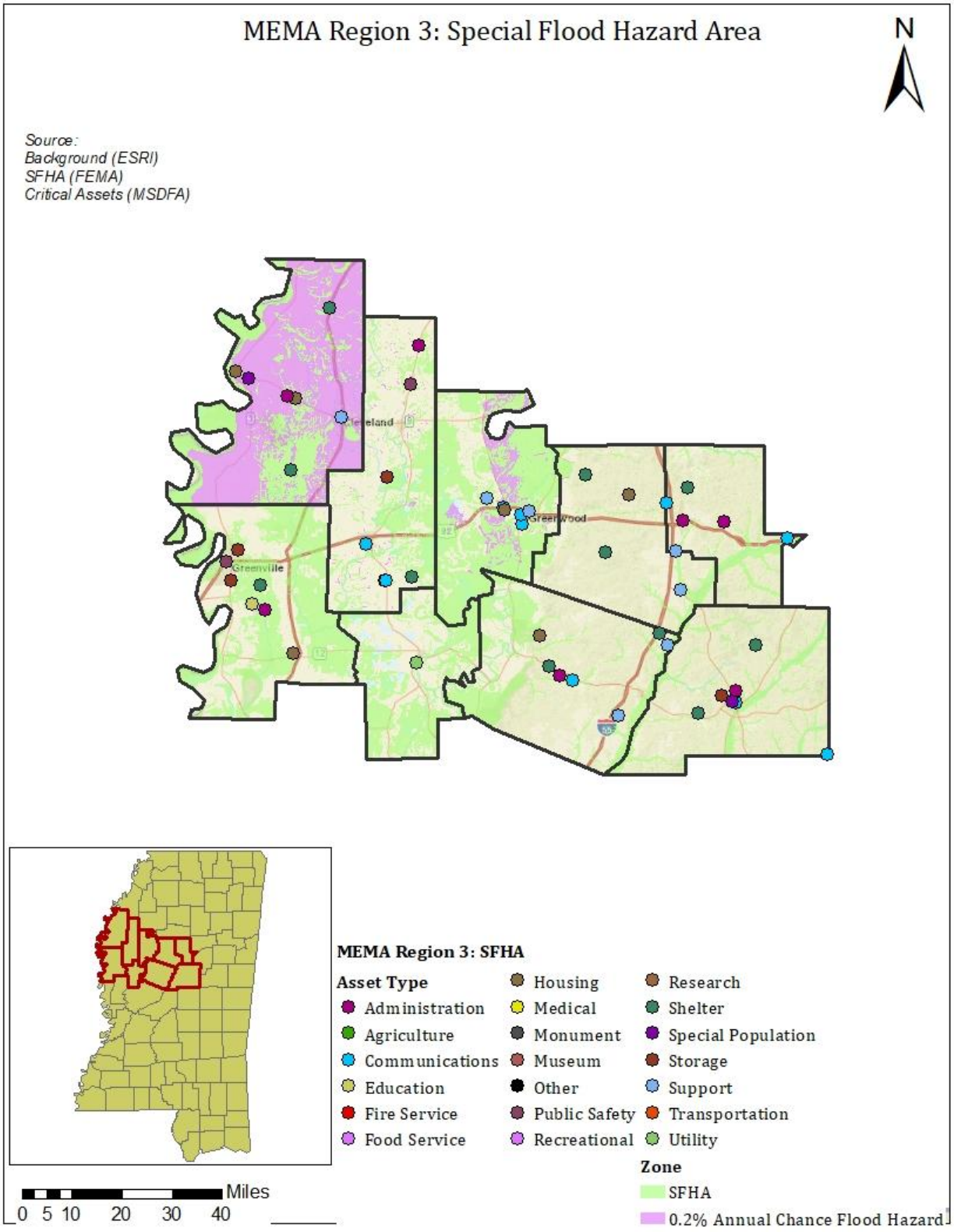


Figure 3.6-13 Mississippi Assets Located in the MEMA Region 4 Special Flood Hazard Area (SHFA)

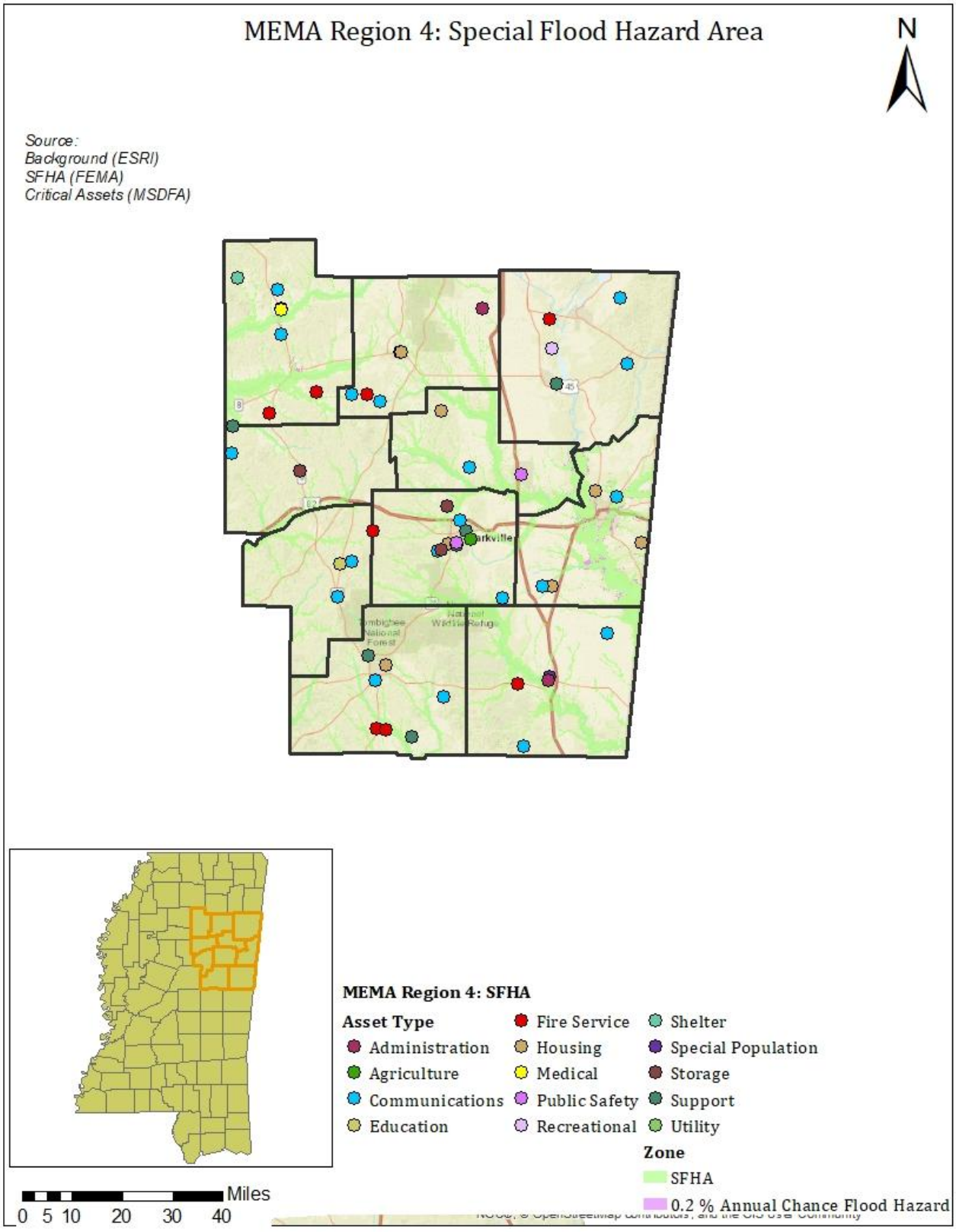


Figure 3.6-14 Mississippi Assets Located in the MEMA Region 5 Special Flood Hazard Area (SHFA)

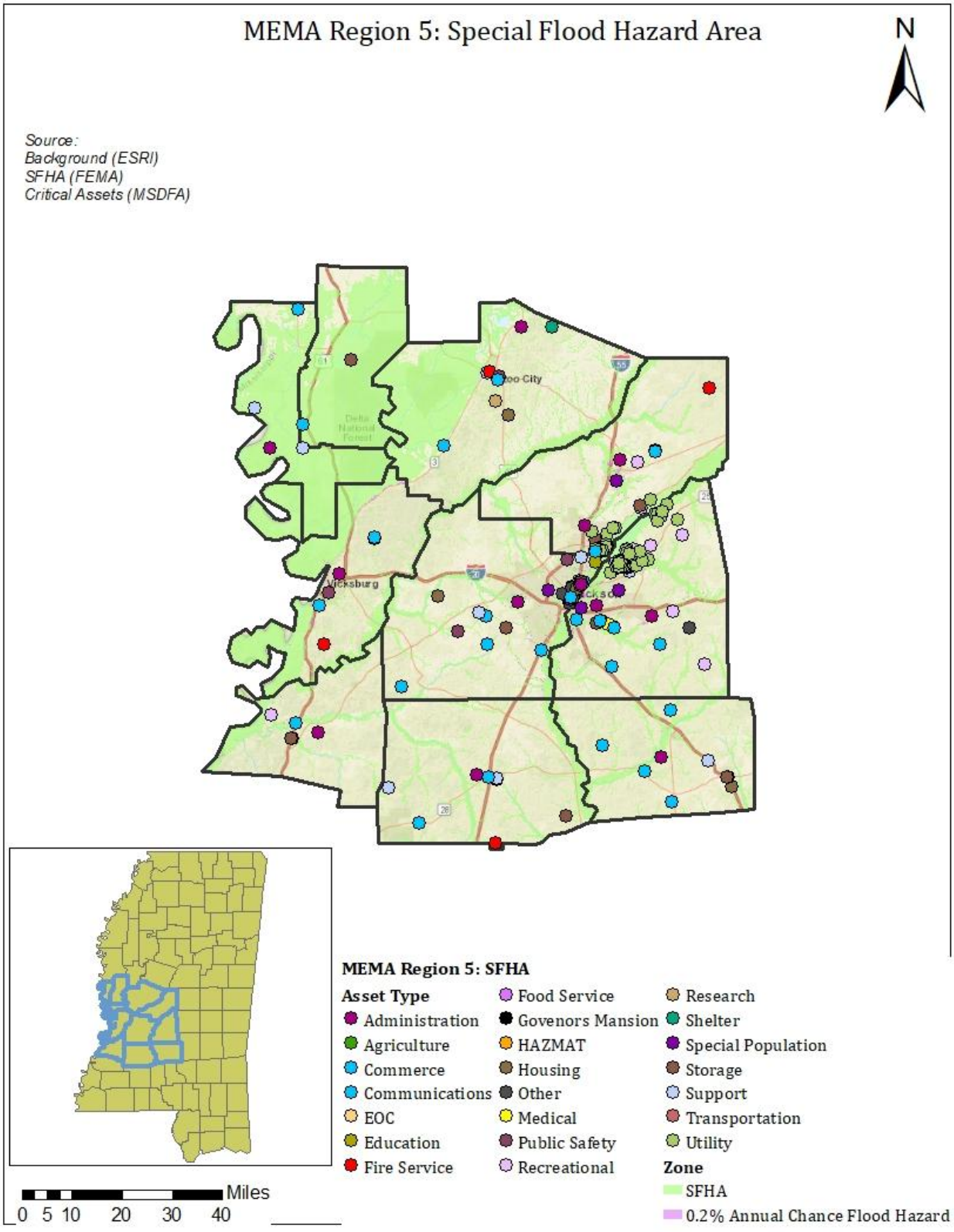


Figure 3.6-15 Mississippi Assets Located in the MEMA Region 6 Special Flood Hazard Area (SHFA)

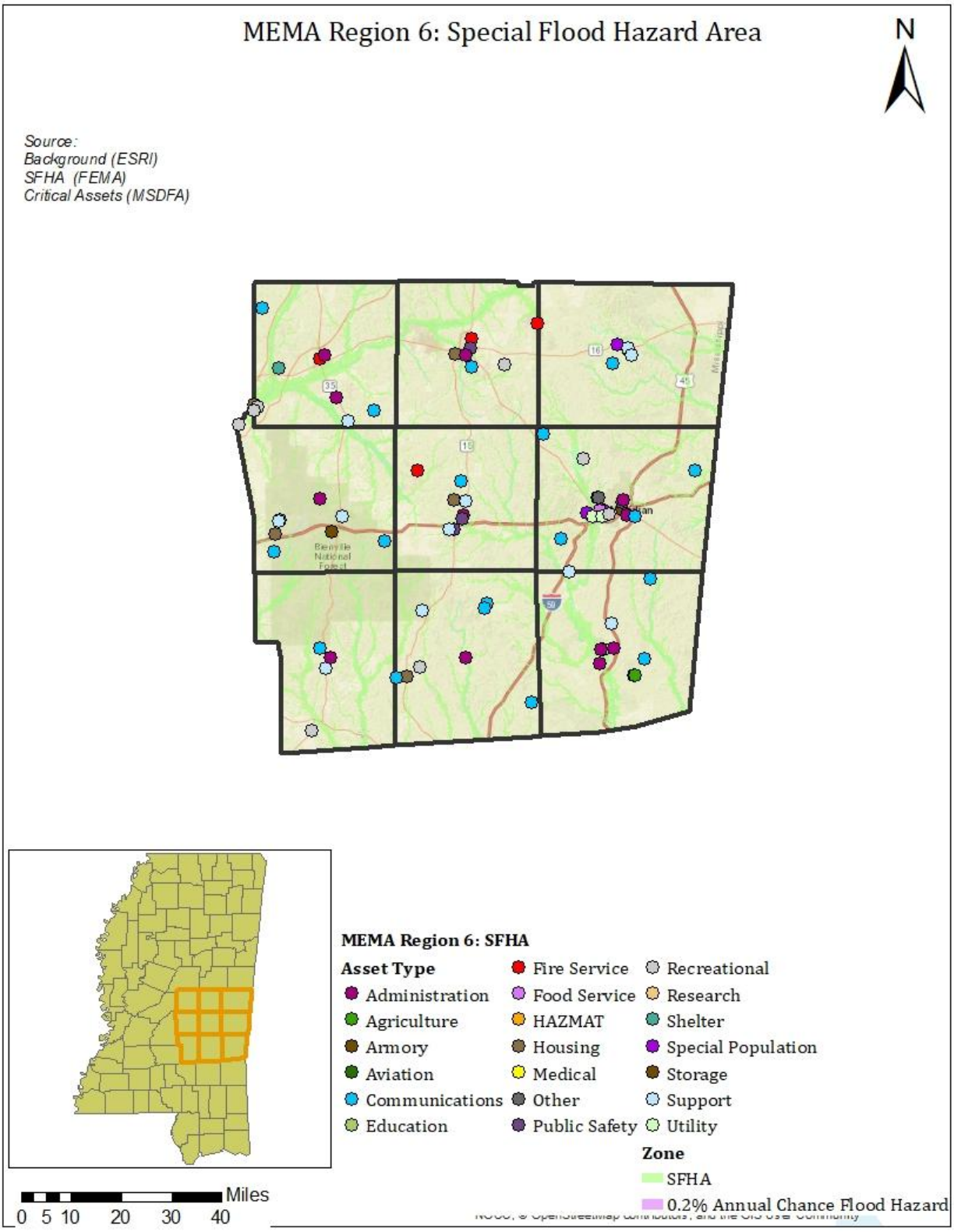


Figure 3.6-16 Mississippi Assets Located in the MEMA Region 7 Special Flood Hazard Area (SHFA)

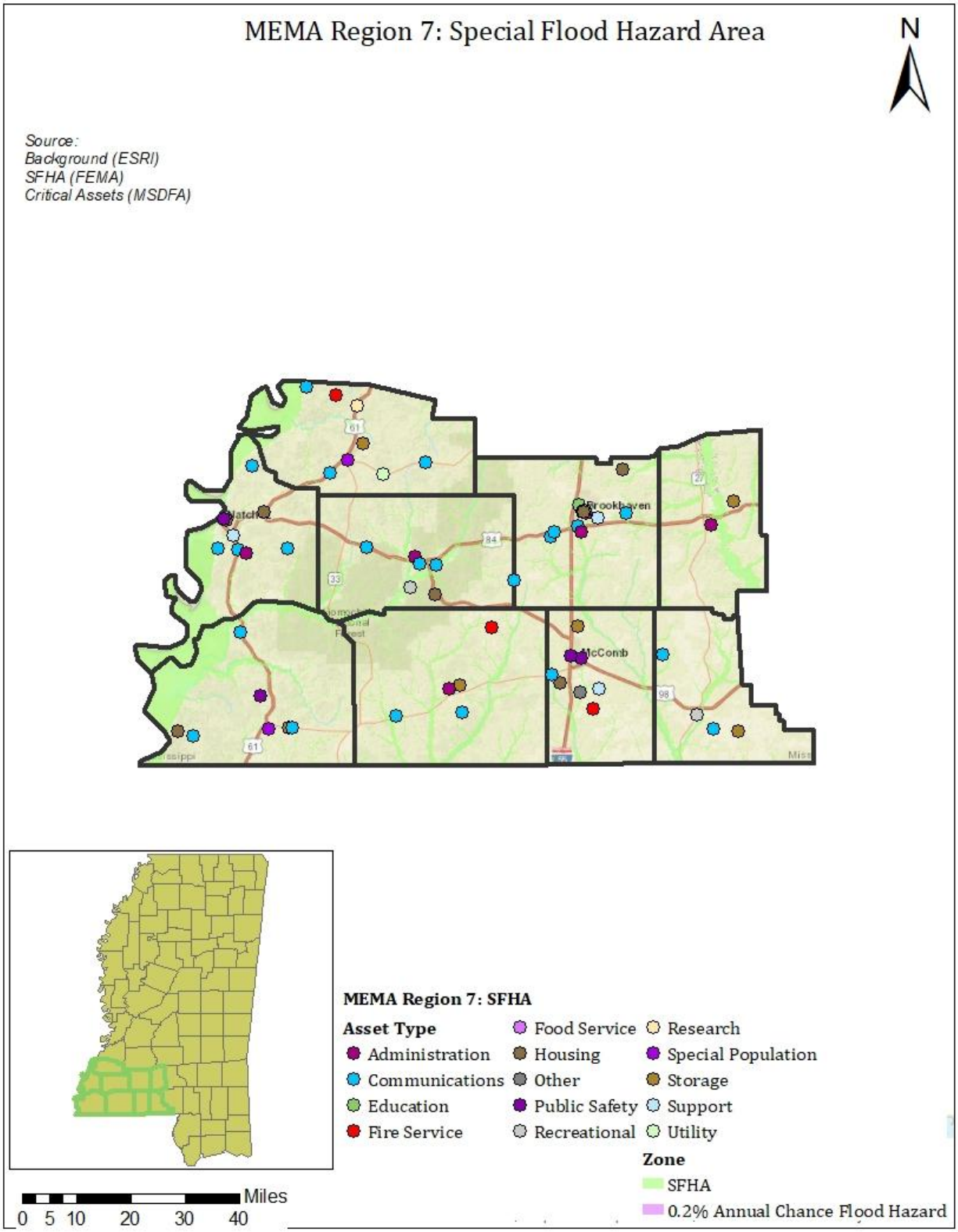


Figure 3.6-17 Mississippi Assets Located in the MEMA Region 8 Special Flood Hazard Area (SHFA)

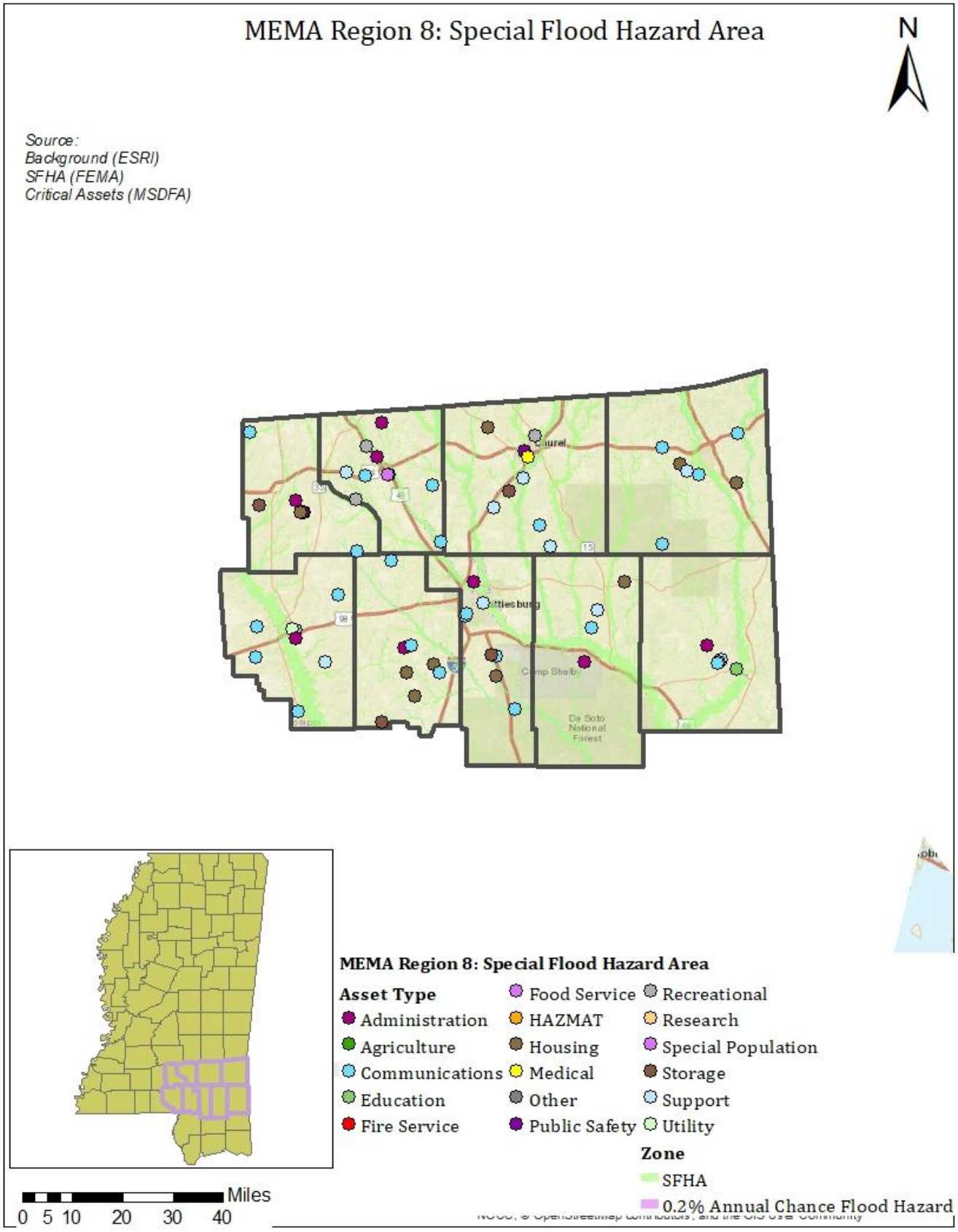


Figure 3.6-18 Mississippi Assets Located in the MEMA Region 9 Special Flood Hazard Area (SHFA)

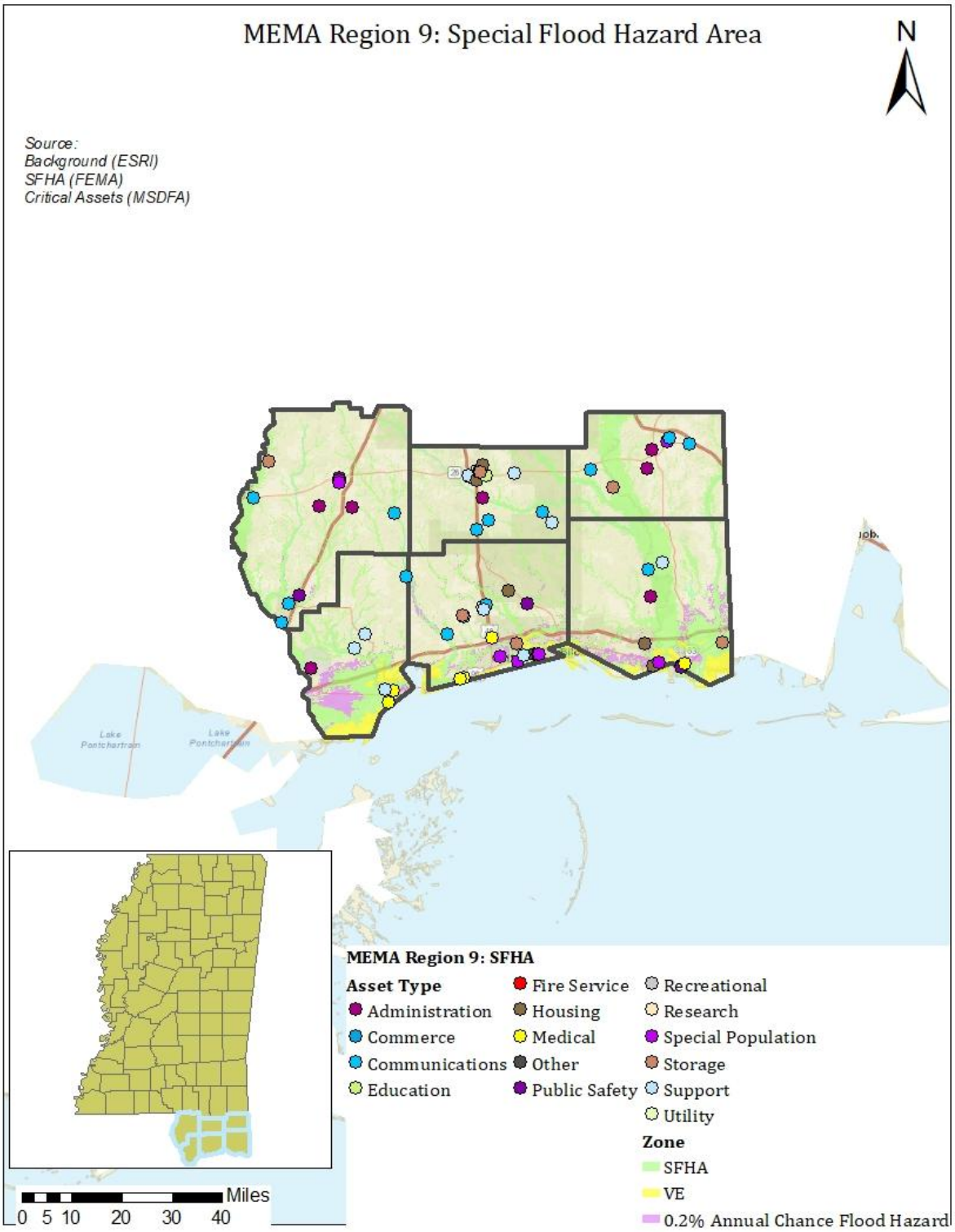


Table 3.6.8
HAZUS-MH 100-Year Flood Loss Estimation
Results: Building and Income Loss by Region

Region	Total Building Loss	Total Business Interruption	Total Building Related Economic Loss
Region 1	$2.239B	$2.408B	$4.647B
Region 2	$4.463B	$4.375B	$8.838B
Region 3	$454.83M	$461.70M	$916.53M
Region 4	$1.32B	$878.36M	$2.200B
Region 5	$2.681B	$3.334B	$6.016B
Region 6	$846.46M	$722.62M	$1.569B
Region 7	$769.26M	$457M	$1.226B
Region 8	$981.64M	$770.5M	$1.752B
Region 9	$1.368B	$953.88M	$2.322B

The displaced population is based on the inundation area. Individuals and households will be displaced from their homes even when the home has suffered little or no damage either because they were evacuated (i.e., a warning was issued) or there was no physical access to the property because of flooded roadways. Displaced people using shelters will most likely be individuals with lower incomes and those who do not have family and friends within the immediate area. Age plays a secondary role in shelter use in that some individuals will go to a public shelter even if they have the financial means to go elsewhere. These will usually be younger, less established families, and elderly families (HAZUS-MH User's Manual). HAZUS-MH does not model flood casualties given that flood-related deaths and injuries typically do not have the same significant impact on the medical infrastructure as those associated with earthquakes. **Table 3.6.9** compares the potential impacts of floods on Mississippi citizens in the MEMA Regions. Detailed results for all regions can be referenced in **Appendix 7.3.6-C**.

Table 3.6.9
Flooding Impacts on Populations
(Ranked by Displaced People)

County	Number of households	Number of people needing shelter
Region 1	3,193	379
Region 2	3,615	305
Region 3	2,383	390
Region 4	3,289	555

County	Number of households	Number of people needing shelter
Region 5	5,345	1,219
Region 6	2,255	123
Region 7	1,413	84
Region 8	2,506	178
Region 9	4,281	465

Local Critical Facility Floodplain Analysis

Critical facilities have been inventoried and geolocated where possible by region and are presented in **Appendix 7.3.2-D**. Information regarding the facility type and location was available, but valuations were not. The statewide HAZUS-MH-derived base-flood layer was overlaid, using GIS, on the geolocated critical facilities. The number and types of facilities located in a possible flood hazard area were summarized by Region in **Table 3.6.10**. Critical facilities included are emergency operations centers, fire stations, hospitals, police stations, and schools. These results are for general planning purposes only as there could be errors in the location of critical facilities as well as errors in HAZUS-MH modeled flood hazard boundaries noted previously.

Table 3.6.10
Critical Facilities Potentially Within a Base-Flood Hazard Area

Region	Number of Facilities at Risk
Region 1	217
Region 2	272
Region 3	233
Region 4	218
Region 5	404
Region 6	201
Region 7	153
Region 8	210
Region 9	295

Flood Insurance Claims Analysis

As previously stated in the flood profile section, Mississippi is rich in water resources that contribute to flooding issues for residential, commercial, and essential facilities. With more than 5.2 million acres of floodplain (of a total landmass of 30,989,376 acres), Mississippi has the 5th largest floodplain in the United States.

A summary of the residential and other facilities building replacement values at risk by region is provided in **Table 3.6.11**.

Table 3.6.11
Summary of At-Risk Properties by Region

Region	Residential Building Replacement Value at Risk	Other Building Replacement Value at Risk	Regional Building Exposure
MEMA Region 1	$2,665,644	$721,734	$3,387,378
MEMA Region 2	$4,136,077	$1,455,228	$5,591,305
MEMA Region 3	$2,054,352	$696,868	$2,751,220
MEMA Region 4	$2,877,659	$858,361	$3,736,020
MEMA Region 5	$6,362,345	$3,016,825	$9,379,170
MEMA Region 6	$2,970,405	$905,737	$3,876,142
MEMA Region 7	$2,017,177	$503,921	$2,521,098
MEMA Region 8	$9,127,035	$3,202,774	$12,329,809
MEMA Region 9	$18,096,969	$3,742,043	$21,839,012
Totals	$50,307,663	$15,103,491	$65,411,154

Local Plan Risk Assessment Summary

Below is a summary of the risk classification identified in the individual local mitigation plans by MEMA Region.

MEMA Region	Low	Medium	High
1	-	-	1
2	1	1	-
3	1	1	-
4	-	1	1
5	-	5	12

MEMA Region	Low	Medium	High
6	-	-	1
7	-	-	1
8	-	-	4
9	-	-	1

*The Town of Pelahatchie, in Region 5, only stated that flood was a hazard but did not provide a ranking. This plan was not included in the table above.

Assessing Vulnerability of State Facilities / Estimating Potential Losses

Methodology

The state of Mississippi Department of Finance and Administration's Bureau of Buildings, Grounds, and Real Property provided the number and value of state-owned buildings located in floodplains. Plan developers know of no building located in a floodplain that is operated, but not owned, by the state.

Specific data on building elevation, location, and vulnerability to flooding of varying depths were not available. Without such data, it was not possible to accurately determine any degree of building damage and potential loss. Theoretically, each building has the potential for total loss. The same data from the 2010 plan was used since the statewide inventory project is not completed. A percentage of loss, instead of total exposure, was applied to estimate potential losses. Damage is directly related to the depth of the flooding. Based on FEMA's depth-damage curves used in their benefit-cost models it can be inferred that a two-foot flood equates to roughly 20 percent loss of the structure value. For purposes of this plan, the value of 20 percent of the building value is the estimate of the potential loss.

Data Limitations

HAZUS-MH does not distinguish between federal, state, or local ownership or operation in its inventory data on bridges. Therefore, all bridges regardless of ownership are included in the assessment. At this time the state of Mississippi does not have a comprehensive list of state-owned or operated infrastructure, including bridges, sorted by region and keyed to a location in floodplains. Without such data, plan developers determined that the HAZUS-MH default inventory data was the "best available data" even though all facilities are represented in the data, not just state-owned or operated infrastructure.

Because of their potential vulnerability, bridges were chosen to represent infrastructure in the loss estimates. Due to time constraints only bridges, not all state-owned infrastructure, were addressed using HAZUS-MH inventory data. Additionally, the estimate of potential losses to bridges was limited to the top ten of the fifty most vulnerable communities. Vulnerable highways were noted but not included in the loss estimates.

The state has developed an ongoing strategy to address these data limitations for plan updates. That strategy is included in the mitigation strategy section of the plan.

Table 3.6.12 serves as a summary of the potential losses to state-owned structures within the state of Mississippi. Details by region are provided in Appendix 7.3.2-E. This analysis was completed based on information provided by MEMA and outside of the HAZUS-MH model.

Table 3.6.12
Summary of Potential Losses to State-Owned Facilities

Region	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	Number in Special Flood Hazard Area (SFHA)	Value in Special Flood Hazard Area (SHFA)	Estimated Flood loss (value x 20%)
MEMA Region 1	171	$57,356,843	2	$1,850,051	$35,636,281
MEMA Region 2	331	$156,546,716	0	$0	$0
MEMA Region 3	552	$256,299,605	55	$6,518,567	$1,303,713
MEMA Region 4	134	$27,175,900	0	$0	$0
MEMA Region 5	1,335	$2,648,653,307	52	$182,070,707	$36,414,141
MEMA Region 6	918	$813,681,823	12	$3,351,986	$670,397
MEMA Region 7	247	$79,618,031	0	$0	$0
MEMA Region 8	455	$286,676,990	17	$2,412,581	$482,516
MEMA Region 9	268	$215,287,139	16	$13,410,827	$2,682,165

Table 3.6.13 serves as a summary of the potential losses to state-owned bridges. The bridges are located along state highways that serve as important transportation and evacuation routes. These bridges transverse portions of the state's delineated floodplains and are susceptible to flood damage. Additionally, portions of the roadways themselves are subject to inundation and 'overtopping' by events greater than a 100-year flood.

Included with HAZUS-MH is a database of bridges called the National Bridge Inventory, which was developed by the Federal Highway Administration. One of the database items includes a "scour index" that is used to quantify the vulnerability of bridges to scour during a flood. Bridges with a scour index between 1 and 3 are considered "scour critical," or a bridge with a foundation element determined to be unstable for the observed or evaluated scour condition. A query of the database was performed that identified the scour critical bridges. Out of 4,037 state-owned bridges in Mississippi, 225 met these criteria. The potential loss could include the replacement value of the structure if flooding resulted in a bridge collapse. These are bridges that could benefit from mitigation projects or be thoroughly inspected following a flood event. There were no changes to this table for the 2013 or 2018 plan update.

Table 3.6.13
Exposure and Flood Vulnerability of State Bridges by County (Values in thousands of dollars)

County	Bridge Count	Value	Scour Critical
Adams	16	$59,354.35	0
Alcorn	72	$99,883.86	0
Amite	41	$33,621.93	1
Attala	46	$39,324.78	11
Benton	54	$60,391.36	4
Bolivar	28	$22,534.88	2
Calhoun	63	$45,618.08	4
Carroll	43	$43,183.27	7
Chickasaw	51	$36,397.28	9
Choctaw	20	$14,146.20	2
Claiborne	19	$55,342.46	1
Clarke	70	$65,280.27	12
Clay	25	$54,115.41	3
Coahoma	28	$29,869.61	0
Copiah	49	$43,717.27	0
Covington	40	$39,545.24	7
Desoto	72	$119,180.45	1
Forrest	56	$80,733.65	2
Franklin	35	$52,053.90	0
George	27	$55,277.87	2
Greene	28	$101,453.50	1
Grenada	48	$51,207.33	4
Hancock	26	$145,699.13	0
Harrison	82	$460,275.88	1
Hinds	185	$399,360.16	6
Holmes	79	$84,795.11	9
Humphreys	8	$23,971.50	0
Pearl River	70	$90,247.62	3
Perry	36	$64,396.78	3
Pike	54	$58,800.65	3

County	Bridge Count	Value	Scour Critical
Issaquena	8	$12,409.80	0
Itawamba	74	$152,459.10	9
Jackson	56	$649,903.65	2
Jasper	42	$28,508.17	1
Jefferson	11	$6,913.09	0
Jeff. Davis	21	$20,112.19	2
Jones	91	$135,897.51	8
Kemper	48	$61,903.86	0
Lafayette	72	$64,338.53	1
Lamar	34	$38,973.09	2
Lauderdale	141	$208,051.89	1
Lawrence	17	$22,141.20	2
Leake	54	$79,850.72	3
Lee	131	$204,006.54	23
Leflore	32	$45,578.98	0
Lincoln	60	$61,895.46	1
Lowndes	90	$191,660.50	6
Madison	82	$101,987.37	4
Marion	51	$67,208.34	2
Marshall	85	$117,323.02	4
Monroe	76	$188,235.90	1
Montgomery	57	$53,470.84	1
Neshoba	41	$34,011.07	1
Newton	70	$64,145.34	3
Noxubee	24	$39,135.99	3
Oktibbeha	35	$34,457.36	2
Panola	75	$78,814.52	1
Tate	39	$53,338.10	2
Tippah	26	$25,323.31	2
Tishomingo	33	$78,274.19	3

Exposure and Flood Vulnerability of State Bridges by County
(Values in thousands of dollars)

County	Bridge Count	Value	Scour Critical
Pontotoc	54	$42,949.87	6
Prentiss	45	$49,366.41	3
Quitman	29	$21,578.69	0
Rankin	112	$212,858.86	3
Scott	42	$35,451.42	2
Sharkey	16	$14,459.88	0
Simpson	38	$29,888.20	3
Smith	25	$26,402.18	4
Stone	22	$31,987.16	2
Sunflower	23	$29,934.05	0
Tallahatchie	29	$27,133.10	0
Totals			

County	Bridge Count	Value	Scour Critical
Tunica	17	$11,849.09	0
Union	65	$73,748.68	3
Walthall	27	$26,061.52	1
Warren	61	$122,148.99	1
Washington	35	$35,864.93	1
Wayne	30	$42,152.86	2
Webster	29	$31,583.84	1
Wilkinson	19	$65,158.54	0
Winston	40	$33,227.70	0
Yalobusha	67	$54,624.90	5
Yazoo	65	$111,103.38	0
	4037	**$6,579,643.64**	**225**

Twenty state-owned or -operated (maintained) highways are important to the movement of people and freight and are potentially at risk of flooding because all of them have segments that traverse floodplains. These highways are:

Interstate 55	U.S. Highway 98
Interstate10	U.S. Highway 84
Interstate 20	State Highway 18
Interstate 59	State Highway 80
U.S. Highway 90	State Highway 1
U.S. Highway 45	State Highway 302
U.S. Highway 82	State Highway 25
U.S. Highway 61	State Highway 49
U.S. Highway 72	State Highway 63
U.S. Highway 78	State Highway 11