2.2 FLOOD

Floods are natural and beneficial functions of stream and lacustrine systems. Floods occur when streams or lakes overflow their banks and spill onto the adjoining land area, which is called a floodplain. Loss of life and property can result when people build structures and develop in flood hazard areas. Numerous factors can cause or exacerbate flooding in Ohio including: heavy and/or prolonged periods of rainfall, snowmelt, soil saturation, ground freeze, severe wind events, and inadequate drainage systems. Floods damage private and public property and infrastructure in Ohio every year. Flooding is the most frequently occurring natural disaster in Ohio and the United States.

The two major drainage basins in Ohio are the Lake Erie and Ohio River basins. Streams in the northern third of the state flow into Lake Erie and eventually into the Atlantic Ocean. Streams in the southern two-thirds of the state flow into the Ohio River and eventually into the Gulf of Mexico.

There are many types of flooding that occur in Ohio including: riverine, flash flooding, coastal flooding, and shallow flooding. Riverine flooding is generally characterized by slower rising water, which allows for increased warning time, but has the potential to last for longer periods of time. Ohio communities experience riverine flooding on both large basins and smaller tributary streams throughout the state. Major sources of riverine flooding in Ohio include the Ohio River, Scioto River, Great Miami River, Muskingum River, Hocking River, Maumee River, Blanchard River, Sandusky River, Cuyahoga River, Grand River, Little Miami River, the Mahoning River and their larger tributaries.

Flash flooding can occur when a severe storm produces large amounts of rainfall in a short time. Flash flooding is generally characterized by high-velocity water that rises and recedes quickly allowing little or no warning time to evacuate. Ohio's Appalachian Region is particularly vulnerable to flash flooding because of the steep terrain and narrow stream valleys. Ohio's urban areas also experience flash flooding that may be attributed to inadequate or poorly maintained stormwater infrastructure, increased impervious area, and lost wetland areas. The U.S. Geological Survey (USGS) has concluded that urbanization generally increases the size and frequency of floods and may increase a community's flood risk.

Coastal flooding generally occurs in the counties that border Lake Erie. Flooding in coastal areas can be caused by stream overflow, wave run-up caused by strong winds, and higher than normal lake levels. Annual fluctuations in Lake Erie water levels are the result of seasonal changes and the amount of water flowing into and out of the lake. In-flow for Lake Erie includes drainage from the upper portion of the Great Lakes basin through the Detroit River, water from streams flowing directly into the lake, groundwater, and precipitation falling directly into the lake. Out-flow includes discharge into Lake Ontario through the Niagara River, evaporation, and any diversion or other withdrawals. Lake Erie levels also exhibit a wide range of long-term fluctuations that are the result of prolonged and persistent deviation from average climatic conditions.

Shallow flooding occurs in flat areas with inadequate channels that prevent water from draining easily. There are four types of shallow flooding: sheet flow, ponding, urban drainage, and rural drainage. Sheet flow flooding occurs in areas where channels are not defined. Sheet flow flooding moves downhill and covers a large area under a relatively uniform depth.

Ponding occurs in flat areas where runoff collects in depressions and cannot drain. Ponding can occur where glaciers carved out depressions in the landscape, and where man-made features such as roads have blocked drainage outlets.

Urban drainage systems can include combinations of ditches, storm sewers, detention ponds, house gutters, and yard swales. When a rainfall event exceeds the design capacity of the drainage system, it can result in the system's back-up and overflowing ditches. Basements are highly susceptible to flood damage caused by overloaded sewer and drainage systems. Urban drainage flooding can also occur behind levees when rainfall amounts exceed the capacity of pumps or other man-made systems designed to drain the landward side of the levees.

Rural drainage flooding in northwest Ohio is similar to urban drainage flooding in Ohio's cities and villages. Most of northwest Ohio was covered by a large swamp prior to European settlement that was subsequently drained for agriculture. The flat topography of this area is drained by an extensive system of ditches, swales, and small meandering streams. Rural drainage flooding occurs when rainfall exceeds the design capacity of the drainage system.

Ohio's river systems offer many benefits that have contributed to the development of the state such as: transportation, waste disposal, energy, commerce, recreation, and water supply. As a result, most major communities include development in flood hazard areas. Wetland areas have been developed, streamside forests have been removed, and streams have been straightened and channelized resulting in faster and increased runoff. After two centuries, these development patterns have drastically changed Ohio's riparian ecosystems, and resulted in escalating flood damages.

Historically, efforts to manage flooding can be divided into three major eras according to the Federal Interagency Floodplain Management Task Force. The Frontier Era (Pre-1917) is characterized by limited federal involvement in flood control or relief. During this time, many federal policies and programs encouraged land development with the common goal being "to conquer the wild landscape and to promote productive use of the land." Flood hazards were the problem of the individual property owner or dealt with cooperatively at the local level.

The Structural Era (1917-1959) is characterized by attempts to modify and control floodwater and move water off the land as quickly as possible. The federal government began assuming the costs to construct dams, levees, reservoirs, and other large structural flood control projects. As this era came to an end, resource managers began to realize that flood control projects were not eliminating flood damage and may be harming the environment.

During the Stewardship Era (1960-present), people began to recognize the important benefits and natural functions provided by floodplain areas such as natural flood and erosion control, water quality maintenance, groundwater recharge, recreation, wildlife habitat, agricultural production, and many others. The responsibility of floodplain management began to shift from the federal government to the local level again. The federal government began to focus on providing financial assistance to reduce and recover from the impacts of flooding. Congress created the National Flood Insurance Program (NFIP) in 1968 as a response to mounting flood losses and increasing disaster relief costs. The intent of the program is to reduce future flood damage through community floodplain management regulations, and provide a federally-subsidized insurance alternative to federal disaster relief.

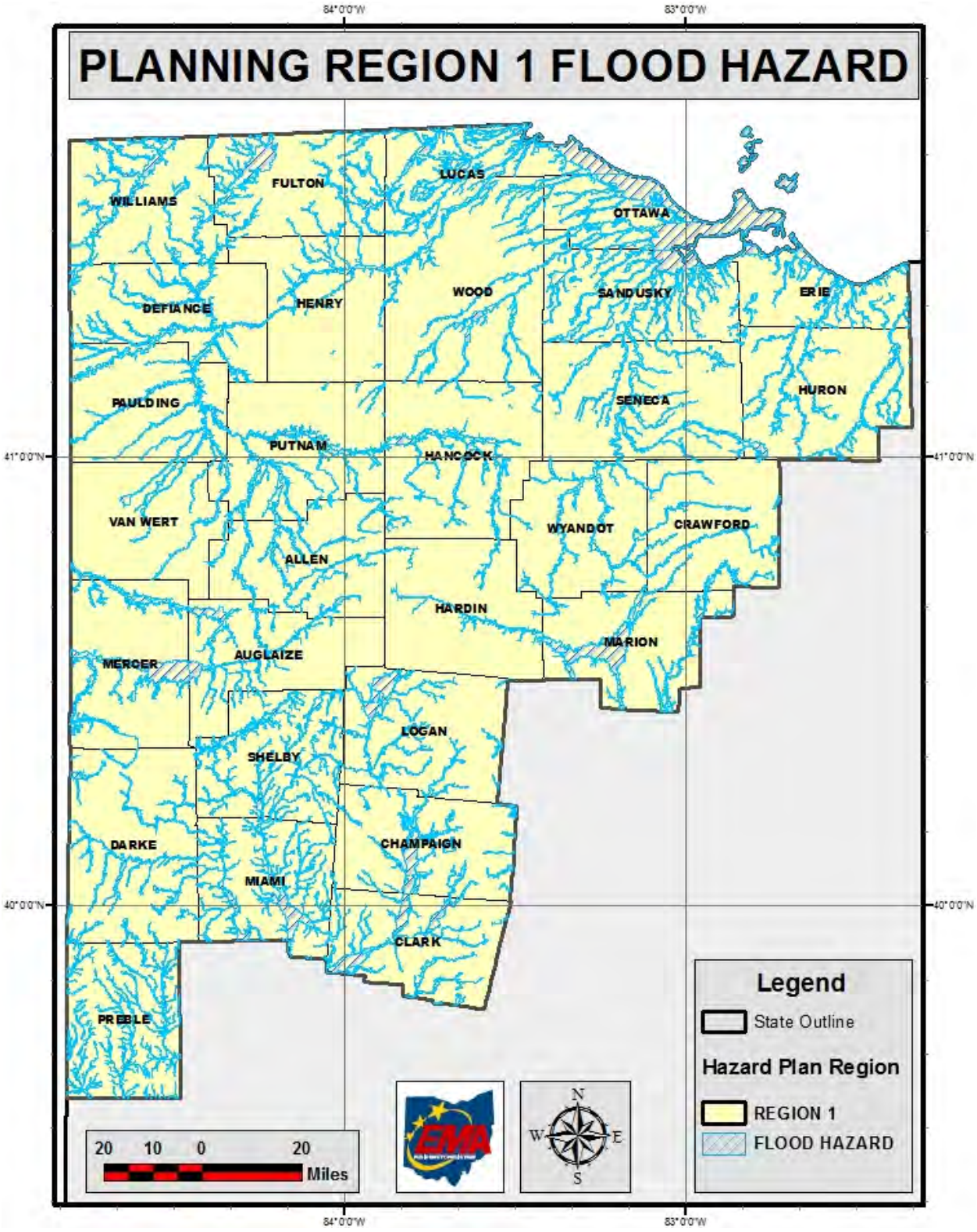
The political jurisdictions in Ohio that are eligible to participate in the NFIP include cities, villages, and unincorporated areas (through the county government). As of the 2020 Census, there are 250 cities, 676 villages, and 88 counties in Ohio. There are 754 Ohio communities that participate in the NFIP. FEMA has identified flood hazard areas in every county in the state. As of January 18, 2023, there were 23,661 flood insurance policies in effect for $4,446,946,000 in coverage statewide. Since 1978, the NFIP has paid 27,756 claims totaling $355,169,727.

LOCATION

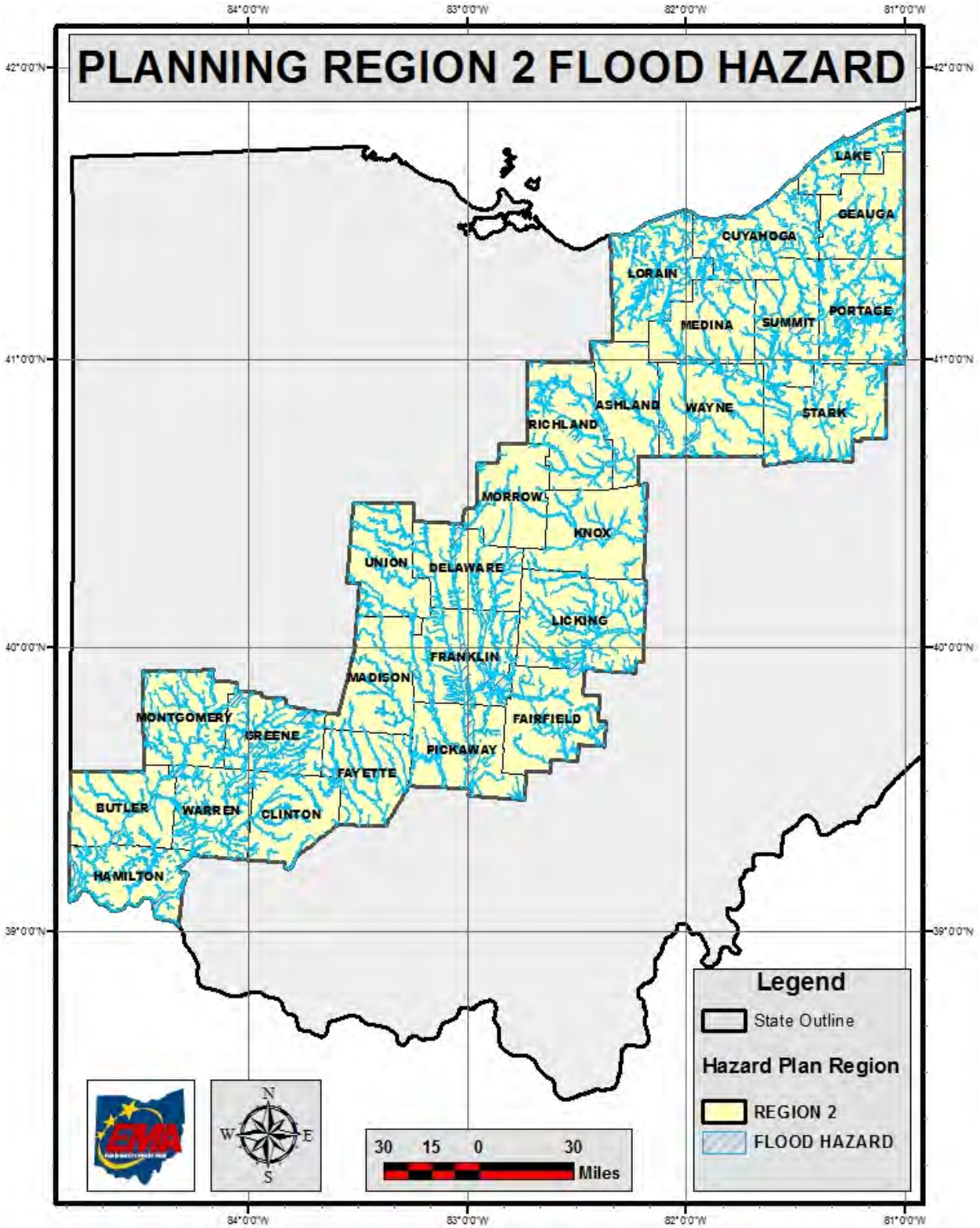
The four sources of information used to determine the location of flooding in Ohio are: FEMA flood maps and studies, NOAA data, information provided by the Ohio Department of Natural Resources - Division of Water Resources, and HAZUS analyses. Flood maps generated by FEMA to support the NFIP are the primary source of information on the location of special flood hazard areas (SFHAs) in the state. There are two main types of flood maps: the Flood Hazard Boundary Map (FHBM) and the Flood Insurance Rate Map (FIRM). The FHBM identifies approximate SFHAs based on the best available data at the time the map was created.

Generally, Flood Insurance Studies (FISs) and FIRMs are issued by FEMA following a detailed engineering analysis of flood hazard areas in participating communities. The FIS and FIRM identify 1%-annual-chance flood elevations and boundaries for selected stream reaches in the community. The FIRM will contain flood elevation information for various flood frequencies and may also delineate floodway boundaries. Flooding occurs in every county in Ohio. There are over 60,000 miles of named, unnamed, and intermittent streams in Ohio. FEMA has mapped approximately 2,777 square miles of flood hazard area in the state. Maps 2.2.a -2.2.c display FEMAs identified SFHAs in the State of Ohio for the designated Regions.

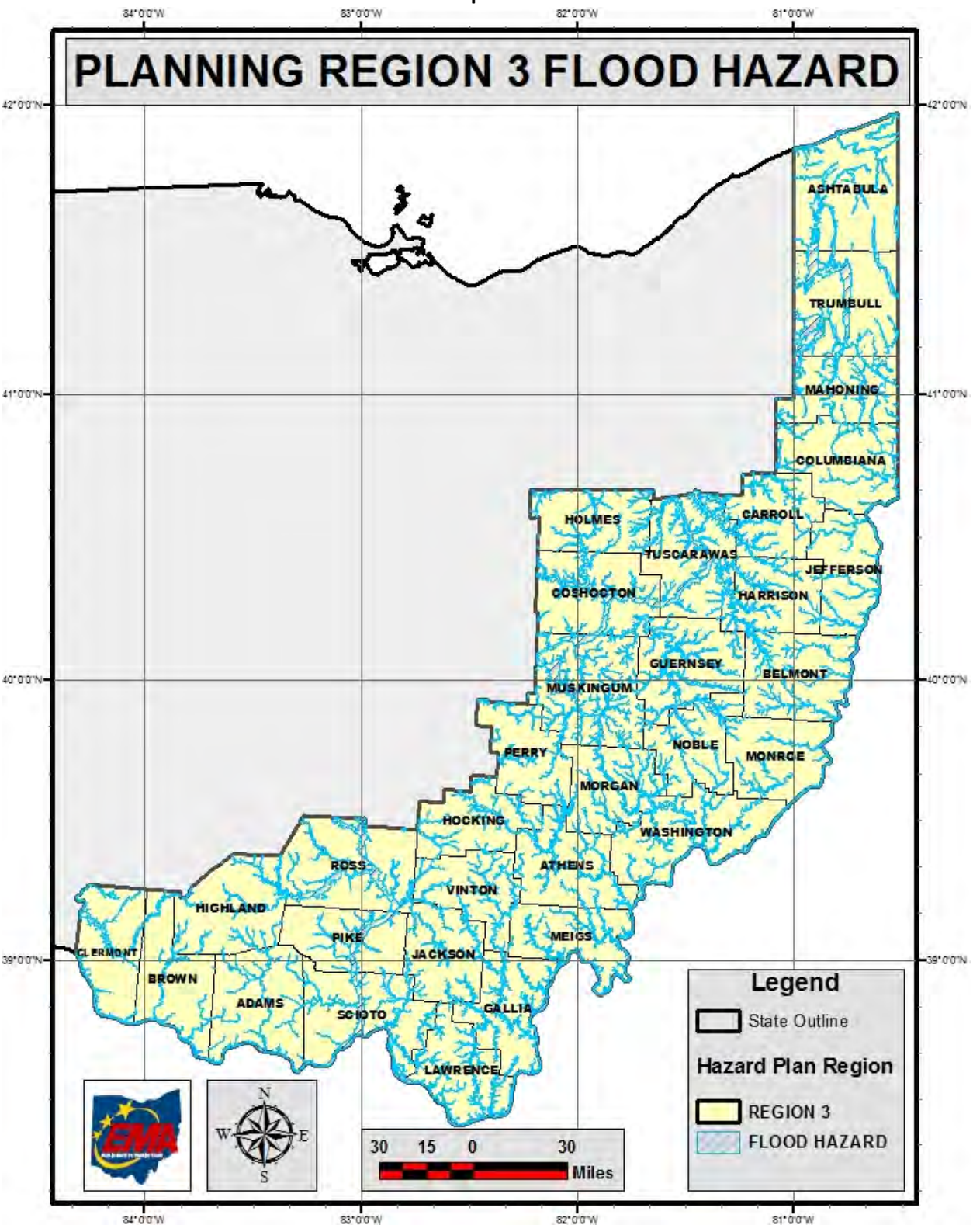
Map 2.2.a


PLANNING REGION 1 FLOOD HAZARD
84°0'0"W
83°0'0"W
41°0'0"N
40°0'0"N
WILLIAMS
FULTON
LUCAS
OTTAWA
DEFIANCE
HENRY
WOOD
SANDUSKY
ERIE
PAULDING
PUTNAM
HANCOCK
SENECA
HURON
VAN WERT
ALLEN
WYANDOT
CRAWFORD
HARDIN
MARION
MERCER
AUGLAIZE
LOGAN
SHELBY
DARKE
CHAMPAIGN
MIAMI
CLARK
PREBLE
20 10 0 20
Miles
N
W
E
S
Legend
State Outline
Hazard Plan Region
REGION 1
FLOOD HAZARD

Map 2.2.b


PLANNING REGION 2 FLOOD HAZARD
84°0'0"W
83°0'0"W
82°0'0"W
81°0'0"W
42°0'0"N
41°0'0"N
40°0'0"N
39°0'0"N
LAKE
GEAUGA
CUYAHOGA
LORAIN
MEDINA
SUMMIT
PORTAGE
ASHLAND
WAYNE
STARK
RICHLAND
MORROW
KNOX
UNION
DELAWARE
LICKING
FRANKLIN
MADISON
MONTGOMERY
GREENE
FAIRFIELD
PICKAWAY
FAYETTE
BUTLER
WARREN
CLINTON
HAMILTON
Legend
State Outline
Hazard Plan Region
REGION 2
FLOOD HAZARD
N
W
E
S
30 15 0 30
Miles

Map 2.2.c


PLANNING REGION 3 FLOOD HAZARD
84°0'0"W
83°0'0"W
82°0'0"W
81°0'0"W
42°0'0"N
41°0'0"N
40°0'0"N
39°0'0"N
ASHTABULA
TRUMBULL
MAHONING
COLUMBIANA
CARROLL
HOLMES
TUSCARAWAS
JEFFERSON
COSHOCTON
HARRISON
GUERNSEY
BELMONT
MUSKINGUM
NOBLE
MONROE
PERRY
MORGAN
WASHINGTON
HOCKING
ATHENS
ROSS
VINTON
HIGHLAND
MEIGS
PIKE
JACKSON
CLERMONT
BROWN
ADAMS
SCIOTO
GALLIA
LAWRENCE
N
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E
S
30 15 0 30
Miles
Legend
State Outline
Hazard Plan Region
REGION 3
FLOOD HAZARD

The NOAA's National Climate Data Center (NCDC) Storm Events Database contains information on the location of flood events in Ohio. The database can be searched by county and includes a written description of the location of flood events reported in the state. The database also contains latitude and longitude values for some events and contains information on reported deaths, injuries, and estimated property and crop damage. The database can be found on the NCDC website.

The Ohio Department of Natural Resources, Division of Water Resources is mandated to be a state repository for flood hazard information (Ohio Revised Code Section 1521.13(C)(2)). The Floodplain Management Program maintains copies of flood hazard data generated by various federal, state, local, and private entities.

PAST OCCURRENCES

Profiling past occurrences of flooding at the state level involves gathering and compiling data from many different sources. The data sources used to profile the past occurrences of flooding include FEMA, the ODNR, the Ohio EMA, the NOAA, and the book Thunder in the Heartland by Thomas W. and Jeanne Applehans-Schmidlin, 1996. Table 2.2.a displays a summary of historic flooding information from 1860 to 1990 based on the chronicle Thunder in the Heartland: A Chronicle of Outstanding Weather Events in Ohio. More specific information on these events as well as events post 1990 can be found in the narrative of this section.

Table 2.2.a

Summary of Historic Flood Events 1860-1990			
Date of Event	**Affected Area(s)**	**Water Bodies Affected**	**Event Description**
8/12/1861	Columbiana County, Elkton, Lisbon	Beaver Creek, Elk Run	Every home in Elkton was damaged and four persons drowned when one home was washed off its foundation.
2/17/1867	Toledo, Maumee	N/A	Ice jams destroyed one bridge and damaged several others. Flooding in downtown Toledo.
2/11/1881	Toledo, Grand Rapids, Columbus, Findlay	Maumee River, Scioto River, Blanchard River	Four bridges were damaged by ice jams and debris in Toledo. Flooding in downtown Toledo.
2/1883	Statewide	Auglaize, Blanchard, Maumee, Portage, and Sandusky Rivers	A combination of snowmelt, ice jams, frozen ground and heavy rains caused flooding statewide.
2/14/1884	Statewide	Ohio, Hocking, Maumee, and Muskingum Rivers	Second highest stage on the Ohio River in Cincinnati. Thousands were evacuated and 3000 buildings were submerged.
5/12/1886	Xenia	Shawnee Creek	Flash flooding washed away several homes killing 21 people and destroying one bridge.
1/23/1904	Lorain, Toledo, Waverly	Black, Scioto, Mahoning and Maumee Rivers	Ships, bridges, and structures were damaged by ice jams and flooding.
3/14-18/1907	Ohio River Watershed	Southern 2/3 of Ohio	Large scale flooding in the Ohio River Watershed resulted in 32 casualties, hundreds of flooded structures, utility and infrastructure damage.
3/23-27/1913	Statewide	Statewide	Described as "Ohio's Greatest Weather Disaster". Four days of heavy rain on saturated soils resulted in 467 casualties, over 2,200 homes destroyed, over 40,000 damaged, and over $2.5 Billion damage in 2003 dollars.
7/16/1914	Cambridge	Wills Creek Watershed	Over 7.09 inches of rain in 1.5 hours causing flash flooding.
8/16/1920	Toledo	Maumee River	Flash flooding in downtown Toledo damaged homes, businesses and infrastructure.
2/26/1929	Cleveland, Dayton, Mt. Vernon, Bridgeport, Springfield	Little Miami, Maumee, Miami, Rocky, Mad, and Kokosing Rivers, Wheeling and Buck Creeks	Two to three inches of rain, melting snow, and ice jams caused widespread flooding.
3/21/1933	Cincinnati and Southern Ohio	Ohio River	Two periods of heavy rain cause widespread minor flooding.
8/7/1935	Coshocton and surrounding counties	Tuscarawas Watershed	Heavy rain on saturated soils saturated soils caused flash flooding.
3/19/1936	Ohio River Communities from Pittsburgh to Steubenville	Upper Ohio River	Snowmelt and heavy rains in Penn. and W. Virginia caused the Ohio River to rise 20 feet in two days.

Table 2.2.a (Continued)

Summary of Historic Flood Events 1860-1990			
Date of Event	**Affected Area(s)**	**Water Bodies Affected**	**Event Description**
1/26/1937	All Ohio River Communities	Ohio River	Described as the "Greatest Flood on the Ohio River". Record levels on the Ohio River from Gallipolis to the confluence with the Mississippi.
7/7/1943	Akron and Steubenville	Cuyahoga River, Cross and Wills Creeks	Six to seven inches of rain in several hours caused flash flooding and landslides.
6/16/1946	Wayne and Holmes Counties	Killbuck and Salt Creeks	Heavy rain caused flash flooding resulting in one death, a train wreck destroying 5 bridges and seriously damaging 55 others.
6/8/1947	Adams, Lawrence and Scioto Counties	South Fork of Scioto Brush Creek and other small tributaries to the south emptying into the Ohio River	Flash flooding damaged many homes, bridges, roads, and crops.
3/21/1948	Counties in the Lake Erie Watershed	Lake Erie Watershed	The most severe damage was reported in along the Chagrin River in Cleveland. Twenty buildings were destroyed and 153 were damaged.
6/16/1950	Crooksville, Roseville	Moxahala Creek Watershed	One of the most intense rainfalls ever known in Ohio caused severe flood damages to homes and businesses.
1/21/1959	Statewide	Statewide	Rainfall in January 1959 ranging from 3-6 inches on snow-covered, frozen ground caused the most severe statewide flooding since 1913. Streams reached flood stage from January 21-24 killing 16 people, forcing 49,000 people from their homes, and causing extensive damage to homes, businesses and infrastructure.
6/5/1963	Guernsey County	Wills Creek Watershed	Official records indicate 7.95 inches of rainfall in 16- hours in Cambridge. One railroad bridge was destroyed, all major highways were inundated, and water supplies were polluted.
3/10/1964	Southern and Central Ohio	All Streams in Southern and Central Ohio	Two periods of heavy rain cause widespread flooding resulting in eight deaths, thousands evacuated, 84 homes destroyed, and 8,200 damaged.
7/21/1964	Akron	Ohio Canal and Little Cuyahoga River	Official records indicate 3.05 inches of rain in 75 minutes, but rain distribution was variable. The resulting flooding caused a sewer line to collapse a large section of road killing 3 people.
4/27/1966	Communities Along Lake Erie's Western Basin	Lake Erie's Western Basin	Several hours of winds up to 55 mph from the northeast pushed the western end of Lake Erie to flood stage. Fifteen hundred were evacuated, hundreds of homes were damaged, and utility services were interrupted.
7/12/1966	Erie, Ottawa, and Huron Counties	Sandusky and Huron River Watersheds	Rainfall totals ranging from 9-12 inches of rainfall over and approximately one-day period. Total damages exceed $27 million in 2003 dollars, including damages to 12,000 homes and businesses in Sandusky.
5/23-27/1968	Central and Southern Ohio	Hocking, Scioto, Little Miami	Two periods of heavy rain within 5 days on already saturated soils caused flooding on many streams. Four deaths have been attributed to this event.
7/4/1969	Northern Ohio	Lake Erie Watershed	Severe thunderstorms moved from Lake Erie into Ohio's coastal communities on July 4, 1969. Flooding combined with strong wind and tornadoes caused 41 deaths and injured 559 people. Loss estimates for this event totaled $65 million dollars in 1969, or over $328 billion in 2003 dollars.
11/14/1972	Coastal communities from Toledo to Cedar Point	Lake Erie	Northeast wind setup caused Lake Erie to rise 3 feet at Toledo and fall 4 feet at Buffalo resulting in coastal flooding. Total damages were estimated at $22 million in 1972 dollars.
4/9/1973	Coastal communities from Toledo to Port Clinton	Lake Erie	Northeast winds caused 8 to 10 foot waves and flooding.
9/14/1979	Southeastern half of the state	N/A	The remains of Hurricane Frederic brought six inches of rain in a band from Cincinnati to Youngstown causing widespread flooding.
3/12/1982	Communities in the Maumee River Watershed	Maumee River Watershed	Two inches of rainfall on snow covered, frozen ground caused flooding. Loss estimates totaled $11 million in 1982 dollars with Defiance County being the hardest hit.
6/14/1990	Shadyside in Belmont County	Pipe Creek and Wegee Creek	Twenty-six people died in a flash flood near Shadyside. Approximately 80 homes were destroyed and 250 were damaged. An estimated that 3-4 inches of rain fell in a little over an hour.
12/31/1990	Widespread	Widespread	The wettest year on record ended with extensive flooding on New Year's Eve causing $50 million (1990 dollars) in damages.

Historically, significant floods in Ohio occurred in 1913, 1937, 1959, and 1969. Heavy rain on saturated soils caused flooding throughout Ohio during March 23rd to 27th, 1913, killing 467 people, destroying 2,200 homes, and flooding 40,637 residences. Losses were totaled at $113 million in 1913 (approximately $3.5 billion in 2023 dollars), including: $78 million to buildings and personal property, $12 million to roads and bridges, $12 million to railroad property, which includes lost profit, $6 million to the agricultural industry, and $4 million dollars to machinery. This flood set record water levels on many Ohio streams. The Miami River Watershed experienced the highest casualties and damages during this event.

The flood of record for the Ohio River occurred the last two weeks in January 1937. Normal January precipitation in Ohio is 2-3 inches. The statewide average rainfall in January 1937 was 9.57 inches, with some stations recording over 14 inches. Ohio River levels on January 26th and 27th were the highest ever recorded from Gallipolis, Ohio to the confluence with the Mississippi River. Every Ohio community along the river was flooded resulting in 10 casualties, 16 injuries, thousands of damaged structures, and over 54,000 evacuations statewide.

Rainfall in January 1959, ranging from 3-6 inches on snow-covered, frozen ground, caused the most severe statewide flooding since 1913. Streams reached flood stage from January 21-24, killing 16 people, forcing 49,000 people from their homes, and causing extensive damage to homes, businesses, and infrastructure. Loss estimates for this event totaled $100 million in 1959, or over $1.04 billion in 2023 dollars. Some of the factors that reduced casualties and damages from the 1913 flood include: less intense rainfall amounts, the construction of flood-control reservoirs built after 1913, and improved emergency management procedures and capabilities.

Severe thunderstorms moved from Lake Erie into Ohio's coastal communities on July 4th, 1969. This line of storms became nearly stationary for more than eight hours, aligned from Toledo southeast to Wooster. Official records indicate over 10 inches of precipitation lasting over a two-day period. Flooding combined with strong winds and tornadoes caused 41 deaths and injured 559 people. Loss estimates for this event totaled $65 million dollars in 1969, or over $539 million in 2023 dollars. This flood caused extensive damage to homes, businesses, infrastructure, utilities, boats, and automobiles.

Twenty-six people died in a flash flood near Shadyside, Ohio on June 14th, 1990. The National Weather Service estimated that 3-4 inches of rain fell in a little over an hour near Pipe Creek and Wegee Creek. Total rainfall is estimated at 5.5 inches in three hours. The saturated soils and narrow, steep-sided valleys caused the water to drain quickly into the creeks. Flash flooding began at 9:30 PM and was over in 30 minutes. During that time, a wall of water six feet high (reported to be 20 feet in some areas) rushed through the valley at seven to ten miles-per-hour. Approximately 80 homes were destroyed and 250 were damaged.

Storms that produced heavy rains during March 1st and 2nd, 1997, resulted in severe flooding in southern Ohio. The largest accumulations of rainfall were recorded in southern Adams and Brown Counties and ranged from 10-12 inches over the two-day period. Generally, rainfall amounts of four or more inches fell on most of the counties along or near the southern border of Ohio. Widespread damages to private and public property occurred throughout the area. Preliminary loss estimates totaled nearly $180 million in 1997, or over $341 million in 2023 dollars. Approximately 20,000 people were evacuated and 6,500 residences and 833 businesses were affected. Five deaths were attributed to flooding; all of the fatalities were the result of attempts to drive through flooded roads.

Storms during June 26th through 30th, 1998, resulted in flooding and widespread damage throughout much of central, east-central and southeastern Ohio. More than 10 inches of rain fell during a four-day period in parts of southeast Ohio. Twelve storm or flood-related fatalities were reported and infrastructure and utilities were heavily impacted. Loss estimates totaled nearly $178 million in 1998, or over $446 million in 2023 dollars.

PRESIDENTIAL DISASTER DECLARATION DATA

Flood vulnerability can also be expressed as historic expenditures on disaster recovery for flood events. Total expenditures for programs triggered by a Presidential Disaster Declarations are tracked and summarized by Ohio EMA (Appendix A). Between the 2005 and 2024 plan updates, eight flood events resulted in Presidential disaster declarations.

DR-1651-OH declared July 2, 2006: Severe thunderstorms and tornado touchdowns caused two deaths and widespread damage in northern Ohio from June 21st and 23rd, 2006. The primary causes of damage in this event were flash flooding, which overwhelmed urban stormwater infrastructure, and riverine flooding. Huron County and the City of Brecksville were especially impacted. The communities of Toledo, Norwalk, Valley View, and Independence also experienced significant flooding. The USGS estimated flood recurrence intervals for gaged streams based on flood stage for this event. The flooding on the Vermilion River was estimated to be a 50-year event. The flooding on the Cuyahoga River and Tinkers Creek were estimated to be 25 to 50-year events.

DR-1656-OH declared August 1, 2006: Two separate weather systems produced storms resulting in more than 11 inches of rain in parts of Lake County, Ohio on July 27th and 28th, 2006. As a result of the storms and ensuing flooding, the counties of Lake, Geauga, and Ashtabula were declared Federal Disaster Areas. The flooding caused one fatality and 600 evacuations in Lake County. Over all of Lake County, 100 homes and businesses were destroyed and an additional 731 homes and businesses were damaged. Flooding destroyed five bridges in Lake County and closed 13 roads. The City of Painesville experienced heavy damages. The USGS streamflow-gaging station at the Grand River near Painesville, Ohio had record peak stream flow and peak stage. The recurrence interval for this event was estimated to be 500 years (Ebner, A.D.; Sherwood, J.M.; Astifan, Brian; and Lombardy, Kirk, 2007, Flood of July 27-31, 2006, on the Grand River near Painesville, Ohio: U.S. Geological Survey Open-File Report 2007-1164).

DR-1720-OH declared August 26, 2007: Heavy rainfall inundated multiple communities across northern Ohio during a two-day period. The rain developed along a nearly stationary frontal boundary that was oriented from west to east across north central Ohio. Moisture from the Gulf of Mexico, as well as the remnants of Tropical Depression Erin, was drawn northward resulting in tropical downpours. The heaviest rains redeveloped each night, starting Sunday night August 19th, 2007, into Monday morning and then again on Monday night into the early morning hours of Tuesday, August 21st, 2007.
Stream gage reports from four locations in the affected area indicated that 24-hour rainfall totals ending at 8 AM on August 21st, 2007, exceeded the 1,000 year/24-hour rainfall frequency. Peak flood stage of the Blanchard River in the City of Findlay was 0.04 less than the flood of record in 1913 (National Weather Service Forecast Office in Cleveland, Ohio). Communities in the Blanchard, Sandusky, and Mohican River watersheds were heavily impacted. There were approximately 2,500 flooded structures in the City of Findlay. The communities of Ottawa, Bucyrus, Shelby, Lima, Carey, and Bluffton also had many flooded structures.

DR-4002-OH declared July 13, 2011: Heavy rains and thunderstorms moved through the state on February 27th, 2011, as 3-4 inches of rain accumulated over a 24-hour period in already saturated areas across northern Ohio. This system exited the state and a second wave of precipitation moved through Southern Ohio. Warm temperatures, heavy snow pack, and snow melt resulted in moderate to major flooding in many areas of the state. The State monitored river crests and falling temperatures over a 48-hour period for impacts, including potential issues with debris, wastewater, sewage, and shelters. Major to moderate flood river levels were recorded in Northern Ohio. The Cuyahoga River reached near-record flood levels.

In March and April, much of Ohio continued to experience heavy rain, severe storms, flooding, and flash flooding across the southern portion of the state. The cumulative effect of these conditions, coupled with flooding in neighboring states along the Ohio and Mississippi Rivers, resulted in dangerous conditions and damages which affected the health, safety, and welfare in 21 southern Ohio counties. More severe storms moved across the south-central part of the state in May, producing heavy rain and high winds. These conditions further intensified the previously affected citizens in Gallia, Jackson, Lawrence, Pike, Ross, Scioto, and Vinton Counties. During this time, the Governor had issued two proclamations and requested a Presidentially-declared disaster for 13 counties along the Ohio River and 8 adjacent counties.

DR-4098-OH declared January 3, 2013: Hurricane Sandy brought heavy rainfall and significant flooding to northern portions of Ohio on October 29th and 30th, 2012. The flooding was the result of three consecutive weather events; a cold front, hurricane Sandy remnants, and lake enhanced showers. Rain started on October 26th as a slow-moving cold front moved into the Ohio Valley. This front brought widespread 0.75 to 2.0 inches of rainfall to northern Ohio, highest near the lake. By Monday, the remnants of Hurricane Sandy moved into Pennsylvania, and the pressure gradient between it and high pressure over Missouri produced storm force winds over Lake Erie. Moisture from Sandy moved into the region producing an additional rainfall of 2 to 3 inches by Tuesday the 30th. Rain continued at a rate averaging 0.10 inches per hour for the day, but increased to 0.75 inches per hour overnight and early Wednesday morning. This band of heavier rain caused the rivers which were receding to once again rise. Areal flooding was limited to more northern counties; however, some small streams and creeks came out of their banks as far south as Ashland County. Numerous roads were closed due to flooding in Cuyahoga, Lake, and Medina Counties. In Ashtabula County, docks were damaged at the Port of Ashtabula due to severe wind and violent wave actions on Lake Erie, and marinas had to be dredged at the Port Authority of Conneaut. A flood watch was in effect for the lakefront counties and flood advisories were issued during the event.

A few dozen homes and businesses were impacted as water inundated basements or first floors. A number of homes affected were located in the floodplain of the rivers or along the shoreline where the raised lake level combined with the increased stream flows to produce flooding in areas not typically affected. Two rivers along the lakeshore reached major flood stage (based on NWS stage categories), the Cuyahoga and the Huron Rivers. The rest of the Lake Erie tributaries saw minor or moderate flooding. Many basements flooded further inland as sump pumps failed due to power outages. As the result of Hurricane Sandy, an estimated $17.8 Million in public assistance funds has been awarded to this point.

DR-4360-OH declared April 17, 2018: Beginning on February 14, 2018, and continuing through February 25, 2018, a persistent band of moderate to severe storms moved across Region V impacting Illinois, Indiana, Michigan, Ohio, and Wisconsin. While precipitation levels and storm-related damages varied, Ohio experienced a significant amount of flooding and subsequent damage along the southern portion of the state. The snowmelt and continued rain throughout the incident period, combined with the frozen soils, led to flooding along area streams, rivers, and low-lying areas. Numerous flood gauges in this area

rose to moderate flood stage, and rainfall totals in the impacted areas during the incident period ranged from a total of five to nine inches. Following these storms, there were several road closures as well as reports of inaccessible areas throughout southern Ohio due to standing water. Widespread flooding culminated February 26, 2018, when the Ohio River at Cincinnati rain gauge showed a crest of 60.53 feet, 8 feet above flood stage and the highest crest since 1997. Communities near the river and its tributaries incurred damages to roads, bridges, and public buildings, as well as basement flooding and sewage backup. According to the Governor, preventative steps on the part of state and local agencies, such as Ohio EMA, shielded the area from the worst possible damage. The SEOC was partially activated with Emergency Support Functions (ESFs). A FEMA Region V Liaison Officer was deployed to the SEOC from February 25, 2018, through February 27, 2018, and the SEOC returned to normal operations on February 27, 2018.

There were several local evacuations due to flooding and the American Red Cross opened three shelters in the impacted areas. There was one confirmed fatality (Shelby County) as a result of this event, and at its peak, there were 10,449 customers without power statewide. On March 6, the Governor requested a joint preliminary damage assessment (PDA) conducted by local, state, and federal emergency management officials. The joint PDA resulted in documentation of approximately $44 million worth of damages to county, village and township roads, bridges, and public buildings. On March 26, the Governor requested a Presidential Disaster Declaration. On April 17, 2018, a disaster was declared for the State of Ohio, due to severe storms, flooding, and landslides that occurred during the incident period of February 14, 2018, through February 25, 2018. As a result of that declaration, Public Assistance has been made available for Adams, Athens, Belmont, Brown, Columbiana, Gallia, Hamilton, Jackson, Lawrence, Meigs, Monroe, Muskingum, Noble, Perry, Pike, Scioto, Vinton, and Washington Counties. The Disaster impact data is fluid as only half of the Public Assistance projects have been awarded as of January 2019.

DR-4424-OH declared April 8, 2019: Beginning February 5 and lasting through February 13, severe storms and excessive rainfall created dangerous and damaging conditions affecting the health, safety and welfare of the citizens of Ohio. Ohio Governor Mike DeWine declared a state of emergency on March 11, 2019 for 20 Ohio counties including: Adams, Athens, Brown, Gallia, Guernsey, Hocking, Jackson, Jefferson, Lawrence, Meigs, Monroe, Morgan, Muskingum, Noble, Perry, Pike, Ross, Scioto, Vinton and Washington. The counties suffered from significant infrastructure damage as heavy rains poured down on already-saturated soils, damaging public infrastructure like roads and culverts. On April 8, 2019, A Presidential Disaster Declaration was made that ordered Federal assistance to supplement State and local recovery efforts in the areas affected by severe storms, flooding, and landslides. Joint preliminary damage assessments conducted by local, state, and federal emergency management officials during the second week of March documented damages to critical infrastructure, such as county roads, bridges, culverts, and public buildings totaling $41.4 million.

DR-4447-OH declared June 18, 2019: Following the Memorial Day tornadoes that touched down in parts of western Ohio and brought rain and flooding impact across the state, the federal government declared a federal major disaster on June 18, 2019. Officially, this is the Ohio Severe Storms, Straight-line Winds, Tornadoes, Flooding, Landslides, and Mudslide (DR-4447). The federal disaster area includes households and business owners in Auglaize, Darke, Greene, Hocking, Mercer, Miami, Montgomery, Muskingum, Perry, and Pickaway counties. This list later included Mahoning and Columbiana counties in the eastern part of the state. In the June 27 request to the FEMA, Ohio Emergency Management Agency Executive Director Sima Merick included a preliminary damage assessment of about $18.1 million in eligible costs, of which two-thirds, or about $12 million, was debris removal.

NOAA DATA SUMMARY

Table 2.2.b lists the number of reported floods in Ohio since the year 1996, and associated loss totals according to the NOAA's NCDC Storm Events Database. The information in this database comes from NWS, who receives their data from a variety of sources including: county, state, and federal emergency management officials, local law enforcement officials, weather spotters, NWS damage surveys, newspaper clipping service, and the insurance industry and the public. An effort is made to use the best available information, but because of time and resource constraints, information from these sources may be unverified by the NWS.

Table 2.2.b

Ohio Flood Data Summary from the National Climatic Data Center [1]					
Year	**Number of Reported Flood Events [2]**	**Deaths [3]**	**Injuries [4]**	**Recorded Property Damage [5]**	**Recorded Crop Damage [5]**
1996	71	3	None Reported	$43,412,850	$863,850
1997	51	5	5	$125,449,400	$1,862,000
1998	50	9	None Reported	$204,678,980	$134,593,250
1999	30	2	1	$1,644,040	None Reported
2000	45	4	2	$16,113,580	None Reported
2001	35	3	1	$21,850,880	None Reported
2002	38	1	None Reported	$3,848,800	None Reported
2003	64	4	None Reported	$526,955,380	$4,399,000
2004	44	2	None Reported	$205,637,540	$1,450,700
2005	41	3	None Reported	$96,869,800	None Reported
2006	34	4	1	$835,633,376	$57,532,000
2007	23	None Reported	None Reported	$374,280,550	$24,587,980
2008	26	2	None Reported	$7,883,590	$64,350
2009	20	1	None Reported	$6,467,890	$75,790
2010	23	5	4	$18,827,550	$1,390
2011	51	3	None Reported	$61,623,285	$239,750
2012	22	1	2	$1,875,300	None Reported
2013	36	2	None Reported	$55,264,970	$131,000
2014	31	None Reported	None Reported	$90,021,360	$98,040
2015	37	5	3	$34,532,010	$354,750
2016	26	None Reported	None Reported	$5,887,720	None Reported
2017	39	None Reported	None Reported	$23,264,880	$1,860,000
2018	70	2	None Reported	$7,014,390	$1,220
2019	62	3	2	$106,447,020	$182,400
2020	45	4	None Reported	$22,293,765	$2,340
2021	36	None Reported	None Reported	$2,940,550	None Reported
2022	36	None Reported	None Reported	$8,736,604	None Reported
Total:	1086	68	21	$2,909,456,060	$228,299,810

1 - Figures include Flood and Flash Flooding events as recorded on the NOAA Storm Events Database.
2 - Figures of Flood and Flash Flood events were calculated as days with events.
3 - Figures include both direct and indirect deaths.
4 - Figures include both direct and indirect injuries.
5 - Damage figures were converted to 2023 U.S. Dollars from the amount recorded of year.

PROBABILITY OF FUTURE EVENTS

The probability of occurrence of flooding is the likelihood that a specific event will happen. The likelihood of a flood event happening is usually expressed in terms of frequency. The NFIP provides maps and studies that use the 1 percent annual chance floodplain area (area inundated during a 100-year flood) as the national standard for regulating floodplain development. It is critical to establish the probability of occurrence for flooding so that the state and local communities can make informed decisions about the sustainability of future development, and determine the feasibility of proposed mitigation projects.

The primary sources of data for determining the probability of occurrence of flooding are the FEMA FISs and FIRMs. Nearly every community that participates in the NFIP has a map that identifies at least some area of flood hazard in the community that has a 1 percent annual chance of being equaled or exceeded in any given year. This area is referred to as the 1%-annual-chance floodplain, or the 100-year floodplain, and is graphically represented on a FIRM or FHBM.

Communities that do not have FISs, usually have an FHBM or FIRM that shows the approximate area that would be inundated by the 1%-annual-chance flood. An FHBM was intended for interim use in most communities, until a FIS could be completed. FHBMs are still being used in some Ohio communities where a detailed FIS has yet to be produced.

Approximately 81 percent of Ohio communities that participate in the NFIP have a portion of their flood hazard areas identified in a FIS. The purpose of a FIS is to investigate the existence and severity of flood hazards in a certain geographic area. The information in a FIS is used to establish actuarial flood insurance rates and assist the community in its efforts to regulate flood hazard areas. A FIS contains data on: historical flood events, the area and flood sources studied, and the engineering methods employed to generate the flood hazard data. A FIS will have flood elevation profiles for the 100-year recurrence probability flood, and usually the 10-, 50-, and/or 500-year floods. It may also contain tables summarizing floodway data and other flood hazard information; however, it does not usually contain data for every flood hazard area in a community. The remaining areas may have approximate flood hazard data, or none at all.

There are several other possible data sources for determining the area affected by a particular probability flood event. The Ohio Department of Natural Resources, Division of Water Resources, is the state repository for flood hazard information and has copies of flood hazard information generated by various federal, state, local and private entities. The Floodplain Management Program maintains current copies of all FEMA FIS and flood maps in the state.

Probability by County								
Region 1			Region 2			Region 3		
County	Days with Event	Annual Probability	County	Days with Event	Annual Probability	County	Days with Event	Annual Probability
Allen	13	49%	Ashland	43	161%	Adams	82	304%
Auglaize	52	193%	Butler	71	263%	Ashtabula	41	152%
Champaign	39	146%	Clinton	47	176%	Athens	85	315%
Clark	57	214%	Cuyahoga	73	273%	Belmont	94	349%
Crawford	30	112%	Delaware	48	178%	Brown	67	248%
Darke	57	223%	Fairfield	54	203%	Carroll	49	182%
Defiance	14	55%	Fayette	33	129%	Clermont	97	360%
Erie	48	179%	Franklin	95	352%	Columbiana	53	197%
Fulton	11	41%	Geauga	27	101%	Coshocton	81	300%
Hancock	39	146%	Greene	59	221%	Gallia	81	300%
Hardin	38	154%	Hamilton	141	523%	Guernsey	58	215%
Henry	14	54%	Knox	26	97%	Harrison	38	141%
Huron	29	109%	Lake	37	137%	Highland	49	182%
Logan	58	227%	Licking	71	277%	Hocking	68	256%
Lucas	40	150%	Lorain	60	225%	Holmes	36	135%
Marion	56	208%	Madison	27	105%	Jackson	44	163%
Mercer	62	230%	Medina	43	161%	Jefferson	39	145%
Miami	44	165%	Montgomery	67	248%	Lawrence	76	282%
Ottawa	18	67%	Morrow	22	82%	Mahoning	32	119%
Paulding	16	60%	Pickaway	53	196%	Meigs	85	315%
Preble	45	169%	Portage	28	105%	Monroe	52	193%
Putnam	17	66%	Richland	45	168%	Morgan	36	139%
Sandusky	32	119%	Stark	61	229%	Muskingum	55	204%
Seneca	27	101%	Summit	39	146%	Noble	60	222%
Shelby	53	214%	Union	41	154%	Perry	45	169%
Van Wert	17	63%	Warren	85	318%	Pike	59	219%
Williams	6	23%	Wayne	26	97%	Ross	66	245%
Wood	33	124%				Scioto	97	360%
Wyandot	29	109%				Trumbull	60	224%
						Tuscarawas	65	241%
						Vinton	66	245%
						Washington	106	393%

LHMP DATA

As stated at the beginning of Section 2, integration of LHMP data into the state HIRA is an ongoing effort. As local plans continue to expire and jurisdictions update their plans, vulnerability information and loss estimation are collected and assembled. Highlighted below is some of the more notable jurisdictional plan information that has been assembled and integrated into the state flood risk analysis.

Cuyahoga County - The 2022 Cuyahoga County Hazard Mitigation Plan utilized two methodologies to estimate potential losses to flooding. In the first approach, they estimated the number of structures within the Special Flood Hazard Area. In which, it was estimated that there were 647 structures within the SFHA, and 9 critical facilities. Of which, the village of Valley View had the most with 161 structures, and the City of North Olmstead had the second most with 145 structures. The second methodology utilized HAZUS-MH to estimate that their flood vulnerabilities. In a 100-year flood assessment, they estimated that there are $33,789,380,000 in building exposure to a potential 100-year flood event. There were 977 essential facilities (fire stations, hospitals, police stations, and schools) at risk with three schools and one fire station expected to be damaged in the scenario event. The scenario also estimated that there would be $302 million in building losses, $490 million in content losses, and $19.73 million in inventory loss.

Hancock County - The 2019 Hancock County Hazard Mitigation Plan utilize GIS Mapping to estimate their vulnerabilities to flooding. The plan assessed the properties within the City of Findlay and assigned damage curves to whether they were situated within the floodway (75% damage curve) or the floodplain (25% damage curve). It was estimated that there were 414 properties within the floodway that would potentially have $75 million dollars in damages according to the damage curves. In the floodplain, there were 2,295 properties that would potentially have $50 million dollars in damages

Washington County - The Washington County 2021 Hazard Mitigation Plan used HAZUS-MH to estimate that their flood vulnerabilities. In a 100-year flood assessment, they estimated that there are $2,134,385,000 in building exposure to a potential 100-year flood event. There were 34 essential facilities (fire stations, hospitals, police stations, and schools) at risk with none expected to be damaged in the scenario event. The scenario also estimated that there would be $115 million in building losses, $106 million in content losses, and $3.34 million in inventory loss.

MIP LHMP HIRA ASSESSMENT

Flood ranks highly amongst local hazard mitigation plans. It ranks first in frequency, response time, and impact on business and property. Overall, it ranks first in cumulative scoring.

FLOOD MIP LHMP HIRA ASSESSMENT								
Ranking	**1**	**1**	**7**	**4**	**1**	**2**	**1**	**1**
Criteria Score	**5.41**	**4.8**	**3.18**	**2.35**	**2.12**	**1.97**	**2.3**	**22.13**
[redacted]	Hazard Frequency	Response Time	Onset Time	Magnitude	Impact on Business	Impact on Humans	Impact on Property	Cumulative Score

VULNERABILITY ANALYSIS

Flooding vulnerability is the likelihood of something to be damaged in a flood. A vulnerability analysis is a measurement of a community's flood risk. Vulnerability can be measured using many different methods. The method selected is highly dependent on the type and format of available data. If site-specific information on flood elevation, lowest floor elevation, structure type, and replacement value exist, a detailed vulnerability analysis can be performed using flood damage curves. The State of Ohio, and most communities in the state lack all or a component of the data required for a detailed analysis and must use more simplified methods. Several different data sources are utilized in this discussion to help develop a clearer picture of Ohio's flood vulnerability including: HAZUS-MH analyses, the statewide Structure Inventory, NFIP repetitive loss data, and local data uploaded into Mitigation Information Portal (MIP).

NFIP REPETITIVE LOSS PROPERTIES

The NFIP has identified a subset of structures covered by flood insurance policies that are referred to as "repetitive loss" and "severe repetitive loss" (see Appendix B). For this analysis, a repetitive loss (RL) structure is any property covered under an NFIP flood insurance policy with two or more losses of more than $1,000 each, in any 10-year rolling period, and at least two losses that are more than 10 days apart.

Severe repetitive loss (SRL) structures are defined as residential structures that are covered under an NFIP flood insurance policy and a) that have at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amounts of such claims payments exceed $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 of such claims exceeding the market value of the building. For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.

NFIP repetitive loss data can be used to identify some of the structures vulnerable to flooding throughout the state. In Ohio, the number of NFIP flood insurance policies are declining. The two main reasons for this include the rising costs of flood insurance, and the increasing availability of private flood insurance. Other reasons include: misinformation about flood insurance as a mitigation option; no requirement for structures to be covered by flood insurance if there is no current mortgage; lack of resources to purchase coverage; and lack of enforcement by the mortgage holder.

Recent legislation is focused on reducing the number of repetitive loss structures by offering mitigation options to the owners. FEMA mitigation grant programs have also prioritized the mitigation of repetitive loss structures including: HMGP and FMA. The repetitive loss data should be used to identify areas that are repetitively flooded in a community. Given the current prioritization of repetitive loss structures, these structures should be considered when developing mitigation projects that utilize FEMA funding. As part of the State mitigation strategy, Goal #4 includes the elimination of repetitive loss flood-prone structures. One of the three objectives under this Goal is to prioritize repetitive loss properties for available funds from FEMA mitigation programs. As opportunities for mitigation funding have developed, Ohio has worked with local jurisdictions, counties and FEMA to address repetitive loss and other issues to reduce loss or disaster impact. Ohio continues to be very active in accomplishing the objectives set forth in the mitigation strategy regarding repetitive loss structures. Still, there are counties where there have been few or no mitigated repetitive loss structures. Ultimately, mitigation occurs at the local level. There are many reasons why a particular community has not yet addressed identified repetitive loss structures

including: lack of property owner interest, the targeted structure cannot meet benefit-cost analysis requirements, lack of grant match dollars, etc. As demonstrated by the number of successful mitigation projects, the Ohio EMA Mitigation Branch is committed to working with Ohio communities to overcome these obstacles and support local mitigation efforts.

The State of Ohio strives to promote sustainable communities and development (Goal #2, Objective 4). The ODNR Floodplain Management Program's effort to promote sound floodplain management statewide is one example of the state's commitment. Ohio EMA's promotion of mitigation planning through the Mitigation Information Portal (MIP) also demonstrates the state's commitment to promoting community sustainability principles. The mitigation priorities identified in the State of Ohio Hazard Mitigation Plan align well with the identified risk in the state. In partnership with the Federal government and local communities, the State of Ohio will continue to develop, implement and administer mitigation grant programs that reduce risk to repetitive loss properties. These mitigation planning and project activities will continue to decrease the burden of repetitively flood damaged structures on the Disaster Relief Fund and the National Flood Insurance Fund.

The Ohio EMA Mitigation Branch examined repetitive flood loss data for all 88 counties and their affected communities. Data was compiled and analyzed for the entire state. The 15 counties with the greatest number of total losses are summarized in Table 2.2.c. The "Total Paid" column is the sum of building and content payments. Appendix B lists the RL/SRL properties for the entire state. As of November 2023, there are 2,573 repetitive and severe repetitive loss (RL/SRL) structures in Ohio with a total of 7,283 losses and $152,478,285 dollars paid. This estimate does not include structures and losses from properties that have already been mitigated. For a list of RL/SRL properties summarized for each county, refer to Appendix B.

Table 2.2.c

Repetitive and Severe Repetitive Loss Structures in Ohio as of November 2023 [1]						
County	**OEMA Region**	**Repetitive Loss Structures**	**Severe Repetitive Loss Structures**	**Total RL/SRL Structures**	**Total Losses**	**Total Paid**
HANCOCK COUNTY	1	161	25	186	550	$ 11,832,474.94
OTTAWA COUNTY	1	130	4	134	403	$ 4,023,889.67
ERIE COUNTY	1	76	16	92	322	$ 3,446,452.25
LUCAS COUNTY	1	76	8	84	239	$ 2,975,499.14
REGION 1 TOTAL		**443**	**53**	**496**	**1,514**	**$ 22,278,316.00**
CUYAHOGA COUNTY	2	112	25	137	470	$ 21,647,739.63
HAMILTON COUNTY	2	129	25	154	489	$ 16,721,206.78
SUMMIT COUNTY	2	83	10	93	242	$ 6,019,187.69
LAKE COUNTY	2	76	7	83	245	$ 3,926,915.81
FRANKLIN COUNTY	2	99	5	104	273	$ 3,727,765.50
LORAIN COUNTY	2	54	6	60	166	$ 3,417,320.08
REGION 2 TOTAL		**553**	**78**	**631**	**1,885**	**$ 55,460,135.49**
WASHINGTON COUNTY	3	174	24	198	513	$ 12,069,519.87
BELMONT COUNTY	3	63	2	65	161	$ 2,914,188.51
TRUMBULL COUNTY	3	40	4	44	125	$ 2,181,164.46
ATHENS COUNTY	3	45	5	50	151	$ 2,166,791.99
LAWRENCE COUNTY	3	36	7	43	131	$ 1,664,408.60
REGION 3 TOTAL		**358**	**42**	**400**	**1,081**	**$ 20,996,073.43**
STATEWIDE TOTAL		**1,354**	**173**	**1,527**	**4,480**	**$ 98,734,524.92**

1 – Does not include already mitigated properties.

Region 1 is identified as having the second highest number of RL/SRL structures in the State. As a whole Region 1 has 496 RL/SRL structures identified, with the total of contents replacements and total payments equaling $22,278,316 in paid claims. Within Region 1 the most significant concentration of repetitive loss structures is located in the City of Findlay (Hancock County), which is along the Blanchard River. In total, Findlay has 168 RL/SRL structures identified with 505 losses, which have paid a total of $11,053,618 for structure repairs and content replacement.

Region 2 has the highest number of RL/SRL structures identified in the state at 631 structures, including 78 severe repetitive loss structures. The amount paid out for repair of these structures through November 2023 is $55,460,135 for structure repairs and contents replacement. There are two areas of significant loss identified within the region: The City of Independence (Cuyahoga County) has 21 identified repetitive loss structures with 130 claims for a total of $14,020,812. The second area is the City of Cincinnati (Hamilton County) is located in the southwestern portion of the state on the Ohio River and have 60 repetitive loss structures with 198 claims for $10,110,024.

Region 3 is third in the state for all statistics regarding repetitive loss structures. In total, there are 358 RL/SRL structures with 1,081 losses totaling $20,996,073 in repairs and contents paid. The City of Marietta (Washington County) has 121 repetitive loss structures with 306 reported claims representing $8,228,525 in repairs and contents replacements.

NFIP COMMUNITY RATING SYSTEMS (CRS) PROGRAM

According to the October 2018 NFIP Flood Insurance Manual, the Community Rating System (CRS) is a voluntary program for communities participating in the National Flood Insurance Program (NFIP). The CRS offers flood insurance policy premium discounts in communities that develop and execute extra measures beyond minimum floodplain management requirements to provide protection from flooding. A community's eligibility for the CRS depends upon participating in the Regular Program and maintaining full compliance with the NFIP. CRS flood insurance policy premium discounts range from 0 percent to 45 percent depending on the community's floodplain management measures and activities.

The CRS recognizes measures for flood protection and flood loss reduction. The four main activity categories include Public Information, Mapping and Regulation, Flood Damage Reduction, and Flood Preparedness.

In order to participate in the CRS, a community must complete and submit an application to FEMA. Subsequently, FEMA reviews the community's floodplain management efforts and assigns the appropriate CRS classification based on credit points earned for various activities. A community's classification may change depending on the level of continued floodplain management efforts. Classifications range from one to ten and determine the premium discount for eligible flood insurance policies. All community assignments begin at Class 10 with no premium discount. Communities with a Class 1 designation receive the maximum 45 percent premium discount.

The table below highlights the available CRS premium discounts organized by class and flood zone. In addition to the Rate Class of the, the discount amount also varies depending on whether the insured property is in a Special Flood Hazard Area (SFHA), or not.

CRS Premium Discounts by Class and Flood Zone

Rate Class	Discount for SFHA*	Discount for Non-SFHA**	Credit Points Required
1	45%	10%	4,500 +
2	40%	10%	4,000–4,499
3	35%	10%	3,500–3,999
4	30%	10%	3,500–3,499
5	25%	10%	3,000–2,999
6	20%	10%	2,500–2,499
7	15%	5%	1,500–1,999
8	10%	5%	1,000–1,499
9	5%	5%	500–999
10	0	0	0–499

* Special Flood Hazard Area

** Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage. The Preferred Risk Policy does not receive premium rate credits under the CRS because it already has a lower premium than other policies. Although they are in SFHAs, Zones AR and A99 are limited to a 5% discount. Premium reductions are subject to change.

Source: 2018 National Flood Insurance Program (NFIP) Community Rating System (CRS): A Local Official's Guide to Saving Lives, Preventing Property Damage, Reducing the Cost of Flood Insurance

Table 2.2.d: CRS Eligible Communities in Ohio, October 1, 2023 Effective Date

Community Number	Community Name	CRS Entry Date	Current Effective Date	Class	% Discount
390412	Kettering, City of	10/1/1995	10/1/2000	8	10%
390328	Licking County	10/1/1993	5/1/2009	7	15%
390378	Medina County	5/1/2007	4/1/2023	9	5%
390432	Ottawa County	10/1/1992	10/1/1992	9	5%
390472	Ottawa, Village of	10/1/1995	10/1/1995	9	5%
390460	Preble County	10/1/1998	10/1/1998	9	5%
390479	Shelby, City of	10/1/1992	4/1/2023	7	15%
390419	West Carrollton, City of	5/1/2002	4/1/2023	7	15%

As of October 2023, only eight communities in Ohio participate in the CRS program. This is a decrease from October 2018, where there were 13 communities that participated in NFIP. In addition, Medina County was lowered to Class 8, a 5% discount, whereas before they were at Class 9, qualifying for a 10% discount. There was one improvement, where the City of West Carrollton was upgraded to a Class 7, now qualifying a 15% discount on flood insurance premiums. Ohio community participation in the CRS has been declining due to numerous factors:

1. The amount of time/work necessary to apply for and maintain CRS certification
    a. Most communities want to see a cost savings from CRS that would equate to or exceed the cost to maintain a local CRS program.
    b. There is an overall decline in NFIP flood insurance policies, therefore the cost/benefit to the community is reduced.
2. To be eligible for CRS participation, communities must complete a Community Assistance Visit (CAV) with no known violations (even from decades ago). Many communities do not want to invite an audit of their floodplain management program since the process may reveal floodplain development permitting violations from the past that the community will be required to remedy.

3. Ohio communities are not required to adopt/enforce floodplain management standards that exceed the minimum NFIP criteria.
4. Most communities are operating on reduced staffing resources and do not want to assume additional responsibilities.

To encourage and support CRS participation in Ohio, the FMP responds to requests for information about the program, participates in community educational events, and promotes the program to communities when possible. To increase FMP capabilities, FMP staff acquired additional training in CRS requirements, activities, and procedures in 2024. In the upcoming year, staff will be performing quarterly webinars and other outreach in an effort to generate community interest in the program. The FMP also works with CRS-participating communities to ensure locally adopted floodplain management regulations and higher standards are aligned with community goals and meet NFIP/CRS requirements. These actions to support CRS participation around the state is listed in the mitigation strategy as actions #22, 40, and 71.

Substantial Damage (SD) Assessment

Communities that are participating in the National Flood Insurance Program (NFIP) are required to adopt and enforce regulations and codes that apply to new development in Special Flood Hazard Areas (SFHAs). These local floodplain management regulations must contain, at a minimum, NFIP requirements and standards that apply not only to new structures, but also to existing structures which are Substantially Improved (SI), or Substantially Damaged (SD) from any cause, whether natural or human-induced hazards.

According to 44 CFR 59.1, Substantial improvement means any reconstruction, rehabilitation, addition or other improvement to a structure, the total cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement. Likewise, substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred. SI/SD requirements are also triggered when any combination of costs to repair and improvements to a structure in an SFHA equals or exceeds 50 percent of the structure's market value (excluding land value).

$$\frac{(Cost\ to\ Repair) + (Cost\ of\ Improvements)}{Market\ Value\ of\ Structure} \quad \geq \quad 50\ Percent$$

Enforcing the SI/SD requirements is a very important part of a community's floodplain management responsibilities. The purpose of the SI/SD requirements is to protect the property owner's investment and safety, and, over time, to reduce the total number of buildings that are exposed to flood damage, thus reducing the burden on taxpayers through the payment of disaster assistance. SD/SI requirements are enforced by the local floodplain administrator and monitored by the Ohio Department of Natural Resources (ODNR) Floodplain Management Program during Community Assistance Visits. If a local floodplain administrator is overwhelmed by the number of SD/SI inspections after a large event, ODNR has developed a network of building code officials that are trained in conducting SD/SI field determinations. Help with SD/SI inspections can be requested through the county emergency management agency director.

ODNR's Floodplain Management Program (FMP) monitors and seeks information about communities experiencing structural damage from severe weather events. When impacted communities are identified, the FMP performs outreach to communities, responds to requests for assistance, provides guidance on substantial damage requirements, interpretation and application of locally adopted floodplain management regulations as well as tools and other potential resources for damage assessment. The FMP also participates in briefings, agency coordination, and reporting.

When communities request assistance with damage assessment, the FMP can provide training or assist in coordinating skilled help from the Ohio Building Officials Association (OBOA) Damage Assessment Response Team (DART). ODNR will monitor progress on damage assessment and share information with the County and State EMA accordingly. This is listed in the mitigation strategy as action #62.

Risk MAP

Not only is flooding one of the most common and costly disasters, flood risk can also change over time because of new building and development, weather patterns and other factors. Although the frequency or severity of impacts cannot be changed, FEMA is working with federal, state, and local partners across the nation to identify flood risk and promote informed planning and development practices to help reduce that risk through the Risk Mapping, Assessment and Planning (Risk MAP) program

Risk MAP provides high quality flood maps and information, tools to better assess the risk from flooding and planning and outreach support to communities to help them take action to reduce or mitigate flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services.

Risk MAP outreach and discovery meetings in Ohio

FEMA, ODNR, Ohio EMA and the Strategic Alliance for Risk Reduction hosted outreach and discovery meetings with local officials and the public to discuss floodplain mapping needs and potential mitigation projects on the following dates.

County Name	Date
Fairfield County (Rush and Raccoon Creek PMR) CCO	6/26/2018
Scioto County (Portsmouth and New Boston PMR)	6/26/2018
Paulding, Van Wert, and Defiance Counties Workmap meeting	6/28/2018
Lucas County (Lake Erie) CCO and Open House	9/20/2018
Defiance County CCO	10/1/2019
Clinton County (Little Miami Watershed) CCO and Open House	11/19/2019
Highland County (Little Miami Watershed) CCO and Open House	11/19/2019
Greene County CCO and Open House	11/20/2019
Erie County (Lake Erie) CCO	1/15/2020
Upper Scioto Workmap Meetings	8/5 to 8/14/2020
Lower Great Miami Flood Risk Review Meetings	11/16 to 11/20/2020
Van Wert County CCO Meeting	1/21/2021
Montgomery County (Little Miami Watershed) CCO	2/4/2021
Van Wert County Open House Meeting	3/4/2021
Paulding County CCO	3/9/2021
Allen County CCO	3/10/2021
Montgomery County (Little Miami Watershed) Open House	3/16/2021
Ottawa County CCO	3/23/2021
Allen County Open House	3/24/2021
Warren County (Little Miami Watershed) Open House	4/20/2021
Ottawa County Open House	4/22/2021
Paulding County Open House	5/5/2021
Warren County (Little Miami Watershed) CCO	6/9/2021
Hamilton County (Little Miami Watershed) CCO	6/10/2021
Hamilton County (Little Miami Watershed) Open House	6/30/2021
Athens County (Hocking River PMR)- Revised PMR CCO	2/28/2022
Port Clinton- Lake Erie Tabletop Exercise	4/5/2022
Athens County (Hocking River PMR)- Revised PMR Open House	4/9/2022
Crawford County (Upper Scioto Watershed) CCO and Open House	4/26/2022
Union County (Upper Scioto Watershed) CCO	5/6/2022
Preble County (Lower Great Miami Watershed) Meetings	5/9 to 5/10/2022
Madison County (Upper Scioto Watershed) CCO	5/24/2022
Union County (Upper Scioto Watershed) Open House	6/1/2022
Delaware County (Upper Scioto Watershed) CCO	6/7/2022
Marion County (Upper Scioto Watershed) CCO	6/7/2022
Madison County (Upper Scioto Watershed) Open House	6/8/2022
Marion County (Upper Scioto Watershed) Open House	6/8/2022
Delaware County (Upper Scioto Watershed) Open House	6/14/2022
Licking County (Upper Scioto Watershed) CCO and Open House	6/28/2022
Ross County (Chillicothe Levee PMR) CCO	7/22/2022
Morrow County (Upper Scioto Watershed) CCO and Open House	7/25/2022
Ross County (Chillicothe Levee PMR) Open House	7/26/2022
Williams County Discovery Meeting	8/9/2022
Henry County- Discovery Meeting	8/9/2022
Wyandot County- Discovery Meeting	8/10/2022
Fayette County Discovery Meeting	8/11/2022
Vinton County Discovery meeting	8/11/2022
Hardin County (Upper Scioto Watershed) CCO	11/9/2022
Hardin County (Upper Scioto Watershed) Open House	12/5/2022
Fairfield County (Upper Scioto Watershed) CCO and Open House	12/19/2022
Hamilton County (Lower Great Miami Watershed) CCO and Open House	5/23/2023
Warren County (Lower Great Miami Watershed) CCO and Open House	5/24/2023
Wyandot County- Discovery Workshop	8/11/2023
Henry County- Discovery Workshop	8/12/2023
Vinton County Discovery workshop	8/13/2023
Fayette County Discovery workshop	8/13/2023
Auglaize County CCO and Open House	9/20/2023

USACE-OEMA HAZUS-MH LEVEL 2 FLOOD ANALYSIS

From November 2022 to December 2023, Ohio EMA coordinated with the US Army Corps of Engineers (USACE) to undertake a HAZUS analysis project under the USACE's Silver Jackets program. In this project, the USACE completed Level 2 flood analysis for 25 counties: Ashland, Ashtabula, Butler, Cuyahoga, Delaware, Fairfield, Franklin, Geauga, Greene, Hamilton, Knox, Lake, Licking, Lorain, Mahoning, Medina, Montgomery, Pickaway, Portage, Richland, Stark, Summit, Trumbull, Warren, and Wayne. This analysis assessed 25 and 100-year Flood Event Scenarios and utilized refined property inventory and values from the National Structure Inventory (NSI) developed by the US Army Corp of Engineers. For Ashtabula, Lake, Cuyahoga, and Lorain Counties, coastal flooding was also assessed and are included in the loss estimates. While it is a considerable enhancement from HAZUS-MH Level 1 Assessments, it is important to remember all the information reported via the state's HAZUS-MH analyses is an estimate and cannot be interpreted as precise losses.

RESULTS

Table 2.2.e

USACE-OEMA HAZUS-MH Level 2 Scenario Analysis, 100-Year Flood Event											
			Percent Damage						Estimated Building Interuption		
County	2020 Population	Building Exposure Value ($1,000)	1-10% Damage Count	11-20% Damage Count	21-30% Damage Count	31-40% Damage Count	41-50% Damage Count	>50% Damage Count	Building Loss	Content Loss	Inventory Loss
Ashland	52,447	$ 1,786,016	31	68	57	33	29	74	$ 27,462,740	$ 50,388,642	$ 17,852,898
Ashtabula	97,574	$ 3,643,344	31	110	53	37	21	38	$ 19,939,706	$ 34,675,439	$ 7,873,924
Butler	390,357	$ 8,676,740	256	701	763	429	235	270	$ 236,333,798	$ 484,932,872	$ 52,986,063
Cuyahoga	1,264,817	$ 16,268,693	97	296	184	102	74	81	$ 110,148,410	$ 222,970,401	$ 50,484,705
Delaware	214,124	$ 4,605,739	31	63	55	50	96	200	$ 59,947,876	$ 71,221,313	$ 14,222,396
Fairfield	158,921	$ 4,876,227	104	244	241	185	125	180	$ 83,947,013	$ 140,004,516	$ 26,315,536
Franklin	1,323,807	$ 22,711,477	391	1245	849	424	202	140	$ 205,452,090	$ 360,984,631	$ 52,799,748
Geauga	95,397	$ 2,394,681	23	26	15	7	1	3	$ 3,779,520	$ 2,387,798	$ 387,155
Greene	167,966	$ 3,847,505	45	89	69	51	29	23	$ 25,902,724	$ 54,337,409	$ 11,646,306
Hamilton	830,639	$ 14,035,544	229	446	534	471	346	393	$ 260,672,817	$ 522,711,416	$ 125,950,224
Knox	62,721	$ 3,035,442	111	178	153	52	27	28	$ 24,522,874	$ 41,375,025	$ 8,131,340
Lake	232,603	$ 5,311,483	257	184	130	75	35	24	$ 44,122,438	$ 79,301,434	$ 17,613,802
Licking	178,519	$ 7,430,274	160	600	513	268	148	152	$ 139,207,415	$ 203,643,604	$ 77,905,295
Lorain	312,964	$ 9,936,457	78	523	177	66	65	37	$ 69,008,624	$ 82,233,163	$ 11,753,947
Mahoning	228,614	$ 3,234,470	24	27	22	9	10	6	$ 27,791,110	$ 59,808,946	$ 12,493,156
Medina	182,470	$ 3,587,560	33	43	37	12	8	18	$ 9,751,739	$ 12,456,129	$ 4,203,784
Montgomery	537,309	$ 9,433,776	369	847	970	382	190	140	$ 185,681,990	$ 313,380,060	$ 43,916,675
Pickaway	58,539	$ 2,231,664	9	17	12	7	6	15	$ 8,207,035	$ 18,729,370	$ 5,579,817
Portage	161,791	$ 3,436,926	14	39	37	26	23	19	$ 12,034,305	$ 13,531,471	$ 1,517,746
Richland	124,936	$ 2,447,972	54	114	107	70	28	20	$ 48,955,311	$ 122,777,488	$ 24,396,653
Stark	374,853	$ 6,972,526	147	284	255	150	77	77	$ 87,069,885	$ 166,595,976	$ 29,080,510
Summit	540,428	$ 8,604,422	124	243	188	121	82	49	$ 92,633,342	$ 213,287,593	$ 37,610,013
Trumbull	201,977	$ 5,686,303	103	218	213	96	55	47	$ 57,033,857	$ 103,635,138	$ 29,768,583
Warren	242,337	$ 7,232,933	164	313	365	259	192	388	$ 169,573,015	$ 209,941,822	$ 39,354,218
Wayne	116,894	$ 2,506,200	40	39	55	17	19	65	$ 15,989,241	$ 28,071,829	$ 5,359,223

Table 2.2.f

USACE-OEMA HAZUS-MH Level 2 Scenario Analysis, 25-Year Flood Event											
			Percent Damage						Estimated Building Interuption		
County	2020 Population	Building Exposure Value ($1,000)	1-10% Damage Count	11-20% Damage Count	21-30% Damage Count	31-40% Damage Count	41-50% Damage Count	>50% Damage Count	Building Loss	Content Loss	Inventory Loss
Ashland	52,447	$ 1,695,478	32	57	39	33	27	59	$ 23,288,697	$ 44,058,069	$ 15,181,274
Ashtabula	97,574	$ 3,418,081	35	77	41	32	17	27	$ 15,402,842	$ 27,391,231	$ 6,041,745
Butler	390,357	$ 8,363,347	305	692	676	322	185	174	$ 190,817,572	$ 399,163,626	$ 40,899,521
Cuyahoga	1,264,817	$ 14,419,866	79	200	128	69	54	54	$ 72,911,583	$ 148,085,340	$ 26,833,852
Delaware	214,124	$ 4,316,934	33	45	49	51	125	149	$ 47,326,486	$ 57,079,850	$ 12,380,390
Fairfield	158,921	$ 4,757,527	96	237	226	160	77	147	$ 66,022,137	$ 101,170,214	$ 21,417,755
Franklin	1,323,807	$ 21,918,863	338	1086	679	297	144	82	$ 158,994,206	$ 271,413,567	$ 42,865,767
Geauga	95,397	$ 2,328,381	20	23	15	4	0	2	$ 2,886,568	$ 1,782,382	$ 170,157
Greene	167,966	$ 3,566,605	43	78	67	34	22	16	$ 19,947,065	$ 42,247,485	$ 8,719,237
Hamilton	830,639	$ 12,249,209	221	378	449	339	216	232	$ 168,632,561	$ 321,475,400	$ 65,978,019
Knox	62,721	$ 2,852,888	84	115	67	31	14	21	$ 14,537,298	$ 27,164,521	$ 5,279,994
Lake	232,603	$ 5,237,565	215	140	84	44	21	15	$ 27,387,287	$ 49,823,911	$ 11,973,759
Licking	178,519	$ 7,012,362	139	509	343	202	95	86	$ 99,801,480	$ 154,369,200	$ 69,384,279
Lorain	312,964	$ 9,433,866	77	454	144	57	46	24	$ 54,451,730	$ 62,459,316	$ 9,560,832
Mahoning	228,614	$ 3,098,374	22	25	9	8	6	4	$ 18,736,709	$ 37,648,703	$ 8,311,469
Medina	182,470	$ 3,244,067	19	33	21	8	5	16	$ 6,730,158	$ 9,101,297	$ 3,570,124
Montgomery	537,309	$ 8,857,241	370	799	809	292	111	119	$ 150,860,931	$ 244,693,166	$ 33,740,875
Pickaway	58,539	$ 1,868,437	13	13	9	6	6	11	$ 6,908,945	$ 16,095,996	$ 4,330,285
Portage	161,791	$ 3,390,137	9	36	37	26	19	9	$ 10,169,772	$ 11,340,557	$ 1,255,748
Richland	124,936	$ 2,309,819	60	98	89	37	18	13	$ 37,693,936	$ 91,195,046	$ 18,025,391
Stark	374,853	$ 6,494,442	147	266	229	101	61	63	$ 69,154,224	$ 136,862,487	$ 23,281,666
Summit	540,428	$ 7,640,781	97	166	166	101	44	34	$ 75,047,116	$ 179,628,379	$ 32,798,450
Trumbull	201,977	$ 5,481,407	97	202	166	73	36	32	$ 43,751,882	$ 79,223,992	$ 22,842,122
Warren	242,337	$ 7,044,205	200	311	361	211	152	316	$ 143,920,200	$ 177,865,171	$ 32,813,459
Wayne	116,894	$ 2,115,292	35	37	41	20	10	61	$ 12,266,426	$ 19,848,576	$ 3,464,242

FEMA NATIONAL RISK INDEX: RIVERINE FLOODING

The FEMA National Risk Index (NRI) is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards. For Riverine Flooding, the Expected Annual Loss was determined by multiplying the frequency, exposure, and the historical loss ratio. This equation was calculated to determine population, agriculture, and building losses. For more information on current methods and data, refer to section 17 of the National Risk Index Technical Manual.

RESULTS

In Region 1, Lucas, Hancock, Erie, and Mercer counties are estimated to experience the most damages from flooding.

- Lucas County, which has a small coastline to Lake Erie and has the largest population in the region, is estimated to experience $4 million in expected annual loss. This is mainly from building damage and population equivalence at $2 million each.
- Hancock County, which has less than a fifth of the population of Lucas County but historically have flooding issues, is also estimated to experience $4 million in expected annual loss. The vast majority of this estimate comes from building damages at $3.7 million.

In Region 2, Franklin County is estimated to experience the most damages from flooding, followed by Summit and Cuyahoga Counties.

- Franklin County, located in central Ohio and have the most people per county in the state, is estimated to experience over $8.5 million in expected annual loss. The vast majority of this estimate comes from population equivalence at $8.2 million.
- Summit and Cuyahoga Counties are neighboring counties and both located in northeastern Ohio. Summit County, with less than half the number of people as Cuyahoga County, is estimated to experience slightly more damage at roughly $7 million in expected annual loss with a majority of that coming from building damages. Cuyahoga County, which borders Lake Erie, has an expected annual loss of $6.5 million.

In Region 3, Trumbull County is estimated to experience the most damages from flooding, followed by Scioto and Washington Counties.

- Trumbull County, located in the northeast border of the state, does not border Lake Erie but is one of the larger counties in the region, is estimated to experience over $6.9 million in expected annual loss. The vast majority of this estimate comes from population equivalence at $6.5 million.
- Scioto and Washington Counties are both in southern Ohio along the Ohio River. Both counties are estimated to experience over $3.4 million in expected annual loss. For Scioto County, this estimate heavily comes from population equivalence, while for Washington County's estimate heavily comes from building damage.

Table 2.2.g

FEMA National Risk Index Riverine Flood Analysis, October 2023, OEMA Region 1								
County	2020 Population	Exposure (Population)	Exposure (Agriculture)	Exposure (Buildings)	Expected Annual Loss (Pop. Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Buildings)	Expected Annual Loss (Total)
Allen	102,206	2,045	$ 8,949,368	$ 353,580,418	$ 90,337	$ 37,465	$ 27,434	$ 155,236
Auglaize	46,422	751	$ 7,892,493	$ 236,066,119	$ 169,121	$ 43,063	$ 57,703	$ 269,887
Champaign	38,714	883	$ 11,106,109	$ 191,822,919	$ 324,570	$ 162,729	$ 13,764	$ 501,063
Clark	136,001	3,016	$ 11,655,277	$ 804,382,892	$ 361,248	$ 52	$ 45,534	$ 406,834
Crawford	42,025	584	$ 11,098,057	$ 109,868,056	$ 72,257	$ 188,779	$ 277,064	$ 538,100
Darke	51,881	1,064	$ 43,955,080	$ 268,799,155	$ 258,503	$ 1,012,064	$ 32,007	$ 1,302,574
Defiance	38,286	828	$ 4,617,930	$ 166,876,981	$ 51,199	$ 297	$ 18,244	$ 69,740
Erie	75,622	3,943	$ 3,395,931	$ 1,682,841,074	$ 818,688	$ 88,791	$ 2,154,421	$ 3,061,900
Fulton	42,713	927	$ 15,412,986	$ 139,260,735	$ 40,963	$ 77,370	$ 7,120	$ 125,454
Hancock	74,920	4,718	$ 7,779,824	$ 1,046,790,703	$ 138,868	$ 158,350	$ 3,673,247	$ 3,970,465
Hardin	30,696	480	$ 3,282,819	$ 75,749,809	$ 74,284	$ 48,101	$ 5,555	$ 127,939
Henry	27,662	469	$ 2,743,891	$ 98,625,522	$ 24,881	$ 5,276	$ 13,148	$ 43,305
Huron	58,565	679	$ 5,718,715	$ 143,118,027	$ 156,815	$ 94,534	$ 499,996	$ 751,345
Logan	46,150	1,648	$ 7,074,663	$ 504,035,938	$ 385,892	$ 156,970	$ 224,567	$ 767,429
Lucas	431,279	11,530	$ 8,150,558	$ 2,433,226,443	$ 2,037,496	$ 899	$ 2,011,568	$ 4,049,964
Marion	65,359	1,762	$ 24,311,710	$ 356,362,227	$ 396,913	$ 7,550	$ 206,572	$ 611,034
Mercer	42,528	998	$ 66,407,200	$ 587,556,670	$ 251,250	$ 1,584,624	$ 1,104,933	$ 2,940,807
Miami	108,774	2,316	$ 8,231,977	$ 526,798,417	$ 450,120	$ 151,633	$ 72,286	$ 674,039
Ottawa	40,364	5,943	$ 13,883,405	$ 2,894,513,142	$ 472,560	$ 105,202	$ 528,775	$ 1,106,537
Paulding [1]	18,806	0	$ 490	$ -	$ -	$ 1	$ -	$ 1
Preble	40,999	1,293	$ 6,977,453	$ 274,554,341	$ 62,731	$ 113,919	$ 43,513	$ 220,164
Putnam	34,451	1,793	$ 34,390,907	$ 329,943,915	$ 183,744	$ 9,327	$ 30,099	$ 223,170
Sandusky	58,896	1,557	$ 10,762,551	$ 411,174,665	$ 220,070	$ 184,562	$ 485,525	$ 890,157
Seneca	55,069	1,348	$ 6,071,147	$ 254,877,154	$ 186,622	$ 61,368	$ 174,741	$ 422,731
Shelby	48,230	1,425	$ 14,428,880	$ 346,097,712	$ 295,882	$ 283,901	$ 40,870	$ 620,652
Van Wert [1]	28,931	66	$ 9,419	$ 12,297,010	$ 4,112	$ 55	$ 8,613	$ 12,780
Williams	37,102	722	$ 5,972,113	$ 226,302,228	$ 19,143	$ 9,824	$ 216,039	$ 245,006
Wood	132,248	2,209	$ 6,362,731	$ 545,810,789	$ 302,494	$ 7,689	$ 191,949	$ 502,131
Wyandot	21,900	747	$ 4,775,853	$ 202,339,733	$ 106,392	$ 60,986	$ 37,643	$ 205,021

1 – Paulding and Van Wert Counties were missing effective flood mapping data during the development of the National Risk Index (March 2023 Version) which resulted in significantly lower results. Due to this, the NRI Expected Annual Loss estimates for Paulding and Van Wert Counties are not indicative of their actual risk.

Table 2.2.h

FEMA National Risk Index Riverine Flood Analysis, October 2023, OEMA Region 2								
County	2020 Population	Exposure (Population)	Exposure (Agriculture)	Exposure (Buildings)	Expected Annual Loss (Pop. Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Buildings)	Expected Annual Loss (Total)
Ashland	52,447	862	$ 5,272,502	$ 293,982,482	$ 156,137	$ 113,381	$ 762,855	$ 1,032,373
Butler	390,357	5,808	$ 4,660,867	$ 1,374,603,007	$ 302,149	$ 124,877	$ 244,716	$ 671,742
Clinton	42,018	1,047	$ 5,729,071	$ 208,945,715	$ 279,700	$ 58	$ 6,702	$ 286,460
Cuyahoga	1,264,817	5,037	$ 341,905	$ 1,768,484,362	$ 1,535,292	$ 9,876	$ 4,965,690	$ 6,510,858
Delaware	214,124	1,213	$ 2,774,950	$ 398,390,058	$ 224,977	$ 48,791	$ 26,752	$ 300,520
Fairfield	158,921	5,383	$ 6,886,956	$ 1,249,739,367	$ 686,968	$ 182	$ 97,373	$ 784,523
Fayette	28,951	651	$ 6,889,589	$ 192,473,922	$ 83,425	$ 83,643	$ 9,056	$ 176,123
Franklin	1,323,807	22,464	$ 6,414,104	$ 3,802,772,707	$ 8,236,779	$ 222,869	$ 108,078	$ 8,567,725
Geauga	95,397	346	$ 226,994	$ 67,473,007	$ 39,749	$ 992	$ 214,308	$ 255,049
Greene	167,966	2,118	$ 7,201,811	$ 724,560,733	$ 467,728	$ 150,747	$ 10,316	$ 628,791
Hamilton	830,639	10,262	$ 10,390,421	$ 4,714,157,320	$ 1,143,254	$ 569,824	$ 1,522,550	$ 3,235,627
Knox	62,721	2,500	$ 5,468,371	$ 589,675,526	$ 265,101	$ 60,115	$ 895,678	$ 1,220,894
Lake	232,603	2,495	$ 781,206	$ 623,630,441	$ 192,400	$ 18,134	$ 1,870,706	$ 2,081,240
Licking	178,519	6,069	$ 12,574,534	$ 1,446,106,673	$ 1,501,346	$ 294,792	$ 206,105	$ 2,002,244
Lorain	312,964	4,662	$ 5,066,614	$ 959,971,572	$ 678,419	$ 150,651	$ 1,535,824	$ 2,364,894
Madison	43,824	495	$ 6,753,783	$ 79,808,918	$ 52,445	$ 67,857	$ 16,019	$ 136,322
Medina	182,470	1,091	$ 3,371,400	$ 286,759,660	$ 183,095	$ 66,753	$ 1,390,922	$ 1,640,771
Montgomery	537,309	8,613	$ 4,031,073	$ 1,899,861,648	$ 2,206,871	$ 97,878	$ 40,499	$ 2,345,248
Morrow	34,950	369	$ 1,962,038	$ 135,501,534	$ 32,632	$ 21,186	$ 302,026	$ 355,844
Pickaway	58,539	1,401	$ 16,406,753	$ 376,664,009	$ 309,545	$ 343,423	$ 126,758	$ 779,725
Portage	161,791	1,671	$ 598,277	$ 335,647,365	$ 184,571	$ 882	$ 826,732	$ 1,012,184
Richland	124,936	1,442	$ 7,354,428	$ 596,214,363	$ 250,071	$ 165,585	$ 2,271,450	$ 2,687,107
Stark	374,853	3,799	$ 3,065,599	$ 1,178,621,629	$ 922,954	$ 19,207	$ 4,492,105	$ 5,434,266
Summit	540,428	4,411	$ 478,157	$ 1,251,315,064	$ 880,340	$ 3,933	$ 6,082,620	$ 6,966,893
Union	62,784	685	$ 13,622,477	$ 193,256,009	$ 108,936	$ 205,303	$ 245,531	$ 559,769
Warren	242,337	5,172	$ 4,068,433	$ 1,142,560,905	$ 652,262	$ 129,442	$ 265,430	$ 1,047,134
Wayne	116,894	1,659	$ 20,692,437	$ 586,704,766	$ 175,877	$ 2,092	$ 743,260	$ 921,229

Table 2.2.i

National Risk Index Riverine Flood Analysis, October 2023, OEMA Region 3								
County	2020 Population	Exposure (Population)	Exposure (Agriculture)	Exposure (Buildings)	Expected Annual Loss (Pop. Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Buildings)	Expected Annual Loss (Total)
Adams	27,477	988	$ 1,246,457	$ 275,112,308	$ 646,458	$ 37,049	$ 2,137,052	$ 2,820,558
Ashtabula	97,574	753	$ 817,071	$ 156,847,041	$ 129,758	$ 15,916	$ 724,260	$ 869,934
Athens	62,431	12,739	$ 4,178,187	$ 3,880,321,617	$ 255,295	$ 122,440	$ 1,689,880	$ 2,067,615
Belmont	66,497	2,947	$ 673,615	$ 1,069,990,936	$ 740,680	$ 33,735	$ 3,375,181	$ 4,149,595
Brown	43,676	1,170	$ 1,542,643	$ 357,156,104	$ 1,001,963	$ 39,394	$ 1,010,155	$ 2,051,512
Carroll	26,721	977	$ 2,427,809	$ 271,676,540	$ 211,584	$ 49,802	$ 160,530	$ 421,917
Clermont	208,601	3,038	$ 658,824	$ 1,118,439,889	$ 839,703	$ 24,547	$ 743,541	$ 1,607,790
Columbiana	101,877	1,737	$ 3,040,980	$ 464,769,728	$ 406,638	$ 52	$ 566,643	$ 973,333
Coshocton	36,612	760	$ 15,417,214	$ 375,009,313	$ 265,255	$ 639,574	$ 784,910	$ 1,689,739
Gallia	29,220	2,418	$ 6,685,198	$ 848,632,705	$ 215,527	$ 198,705	$ 468,765	$ 882,997
Guernsey	38,438	1,634	$ 6,176,522	$ 620,903,789	$ 389,838	$ 200,700	$ 546,428	$ 1,136,965
Harrison	14,483	457	$ 1,619,683	$ 96,839,498	$ 70,719	$ 34,457	$ 77,905	$ 183,081
Highland	43,317	160	$ 2,982,231	$ 65,087,562	$ 32,501	$ 57,430	$ 56,292	$ 146,223
Hocking	28,050	2,438	$ 2,109,424	$ 806,616,606	$ 635,381	$ 52,102	$ 450,406	$ 1,137,889
Holmes	44,223	969	$ 11,688,377	$ 362,192,466	$ 145,514	$ 74,495	$ 1,542,011	$ 1,762,021
Jackson	32,653	868	$ 1,028,893	$ 340,527,211	$ 160,965	$ 18,091	$ 1,054,775	$ 1,233,831
Jefferson	65,249	2,493	$ 450,261	$ 972,299,958	$ 407,437	$ 6,974	$ 1,856,738	$ 2,271,149
Lawrence	58,240	5,274	$ 2,729,127	$ 945,547,113	$ 482,385	$ 31,348	$ 1,382,238	$ 1,895,971
Mahoning	228,614	450	$ 967,428	$ 402,595,945	$ 55,704	$ 11,340	$ 1,488,066	$ 1,555,110
Meigs	22,210	3,096	$ 3,876,003	$ 757,188,786	$ 644,789	$ 111,962	$ 813,010	$ 1,569,760
Monroe	13,385	459	$ 4,057,955	$ 132,439,713	$ 249,659	$ 122,890	$ 961,457	$ 1,334,006
Morgan	13,802	785	$ 1,920,176	$ 216,333,314	$ 421,295	$ 24,116	$ 313,636	$ 759,046
Muskingum	86,410	1,226	$ 10,271,570	$ 329,205,630	$ 270,896	$ 317,917	$ 947,625	$ 1,536,438
Noble	14,115	296	$ 1,506,697	$ 133,893,195	$ 262,351	$ 49,786	$ 877,889	$ 1,190,027
Perry	35,408	1,496	$ 2,265,859	$ 341,428,715	$ 264,435	$ 37,943	$ 471,726	$ 774,104
Pike	27,088	1,430	$ 15,194,603	$ 538,030,206	$ 599,102	$ 324,411	$ 357,297	$ 1,280,809
Ross	77,093	1,572	$ 15,053,796	$ 547,986,729	$ 499,955	$ 365,519	$ 293,714	$ 1,159,188
Scioto	74,008	3,976	$ 9,810,586	$ 685,522,763	$ 2,144,233	$ 369,635	$ 964,075	$ 3,477,943
Trumbull	201,977	3,296	$ 1,560,720	$ 1,096,784,245	$ 299,479	$ 35,936	$ 6,591,168	$ 6,926,583
Tuscarawas	93,263	3,159	$ 15,726,979	$ 970,055,225	$ 227,185	$ 32	$ 1,666,799	$ 1,894,017
Vinton	12,800	354	$ 1,602,354	$ 47,999,129	$ 90,791	$ 38,907	$ 199,604	$ 329,301
Washington	59,771	6,028	$ 7,277,149	$ 2,342,726,275	$ 275,909	$ 258,950	$ 2,897,121	$ 3,431,980

STATE-OWNED AND STATE-LEASED CRITICAL FACILITIES VULNERABILITY ANALYSIS & LOSS ESTIMATION

Utilizing the dataset of critical facilities in Appendix C, state-owned and state-leased critical facilities were assessed based on their coordinates to determine if they were in a flood zone. Those in flood zones AE and AH were further assessed to determine their first-floor elevations (FFE) and base flood elevations (BFE). These FFEs and BFEs, along with each structures' square footage and replacement values were plugged into FEMA's BCA Tool and DFA depth-damage curves to estimate building and content damages for each structure. The data for each state agency, by county, is summarized in table 2.2.j below. Structures that returned zero building damages and contents indicate that while they are in a flood zone, their first-floor elevations were above the base flood elevation.

Table 2.2.j

State-owned and State-leased Critical Facilities in Flood Zones AE and AH				
County Department	OEMA Region	# of Critical Facilities	Building Damages	Content Damages
OTTAWA	**1**	**36**	**$ 16,981,249**	**$ 9,882,530**
ADJUTANT GENERAL		36	$ 16,981,249	$ 9,882,530
CLARK	**1**	**9**	**$ 175,992**	**$ 98,654**
DEPARTMENT OF TRANSPORTATION		9	$ 175,992	$ 98,654
PICKAWAY	**2**	**20**	**$ 5,695,920**	**$ 3,332,675**
DEPARTMENT OF YOUTH SERVICES		20	$ 5,695,920	$ 3,332,675
CUYAHOGA	**2**	**8**	**$ 448,325**	**$ 263,238**
DEPARTMENT OF PUBLIC SAFETY		1	$ -	$ -
DEPARTMENT OF TRANSPORTATION		7	$ 448,325	$ 263,238
KNOX	**2**	**1**	**$ 133,884**	**$ 78,777**
DEPARTMENT OF ADMINISTRATIVE SERVICES		1	$ 133,884	$ 78,777
WARREN	**2**	**7**	**$ 40,681**	**$ 23,555**
DEPARTMENT OF REHABILITATION AND CORRECTION		7	$ 40,681	$ 23,555
ATHENS	**3**	**20**	**$ 1,769,127**	**$ 1,031,265**
DEPARTMENT OF MENTAL HEALTH AND ADDICTION SERVICES		10	$ 4,471	$ 2,635
DEPARTMENT OF TRANSPORTATION		10	$ 1,764,656	$ 1,028,630
SCIOTO	**3**	**9**	**$ 331,462**	**$ 192,000**
DEPARTMENT OF TRANSPORTATION		9	$ 331,462	$ 192,000
MONROE	**3**	**3**	**$ 257,159**	**$ 151,460**
DEPARTMENT OF TRANSPORTATION		3	$ 257,159	$ 151,460
JEFFERSON	**3**	**5**	**$ 67,830**	**$ 34,138**
DEPARTMENT OF TRANSPORTATION		5	$ 67,830	$ 34,138
BELMONT	**3**	**8**	**$ -**	**$ -**
DEPARTMENT OF PUBLIC SAFETY		1	$ -	$ -
DEPARTMENT OF TRANSPORTATION		7	$ -	$ -
TUSCARAWAS	**3**	**4**	**$ -**	**$ -**
DEPARTMENT OF TRANSPORTATION		4	$ -	$ -
TOTAL		130	$ 25,901,629	$ 15,088,292