PERRY COUNTY HAZARD MITIGATION PLAN

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1 | Introduction

1.1 Overview

With the 2017 Perry County Hazard Mitigation Plan set to expire in October 2022, Perry County and its constituents are aiming to adopt a new, updated hazard mitigation plan. As outlined in the Disaster Mitigation Act of 2000 (DMA2K), any local jurisdiction seeking funding from the Federal Emergency Management Agency (FEMA) must maintain an up-to-date disaster mitigation plan. This Plan meets the criteria as set forth by FEMA in the DMA2K and provides the County and its participating jurisdictions with a comprehensive guide for future mitigation efforts to combat the hazards that affect their communities.

Natural, geological, and human-caused hazards pose a variety of risks to the lives, businesses, and properties within Perry County. As such, a Core Planning Committee within Perry County has been established with the goal of developing and implementing the 2022 Perry County Hazard Mitigation Plan. Through cooperative efforts between local, county, state, and federal government agencies, this Plan is designed to minimize the adverse effects of hazardous events on the lives and properties of residents of Perry County.

This 2022 Perry County Hazard Mitigation Plan is a multi-jurisdictional plan which considers the impacts of hazards on incorporated areas (villages) and unincorporated areas (townships). Perry County's incorporated and unincorporated areas are listed below in **Tables 1.1 and 1.2**. These jurisdictions are also displayed in **Figure 1.3** on the following page. The Plan is designed for a five-year implementation period and describes the methods and procedures utilized in its development, provides the results of community involvement activities such as survey collection, identifies the mitigation activities determined to the be most important to the County, and establishes a timeline for the implementation of the actions.

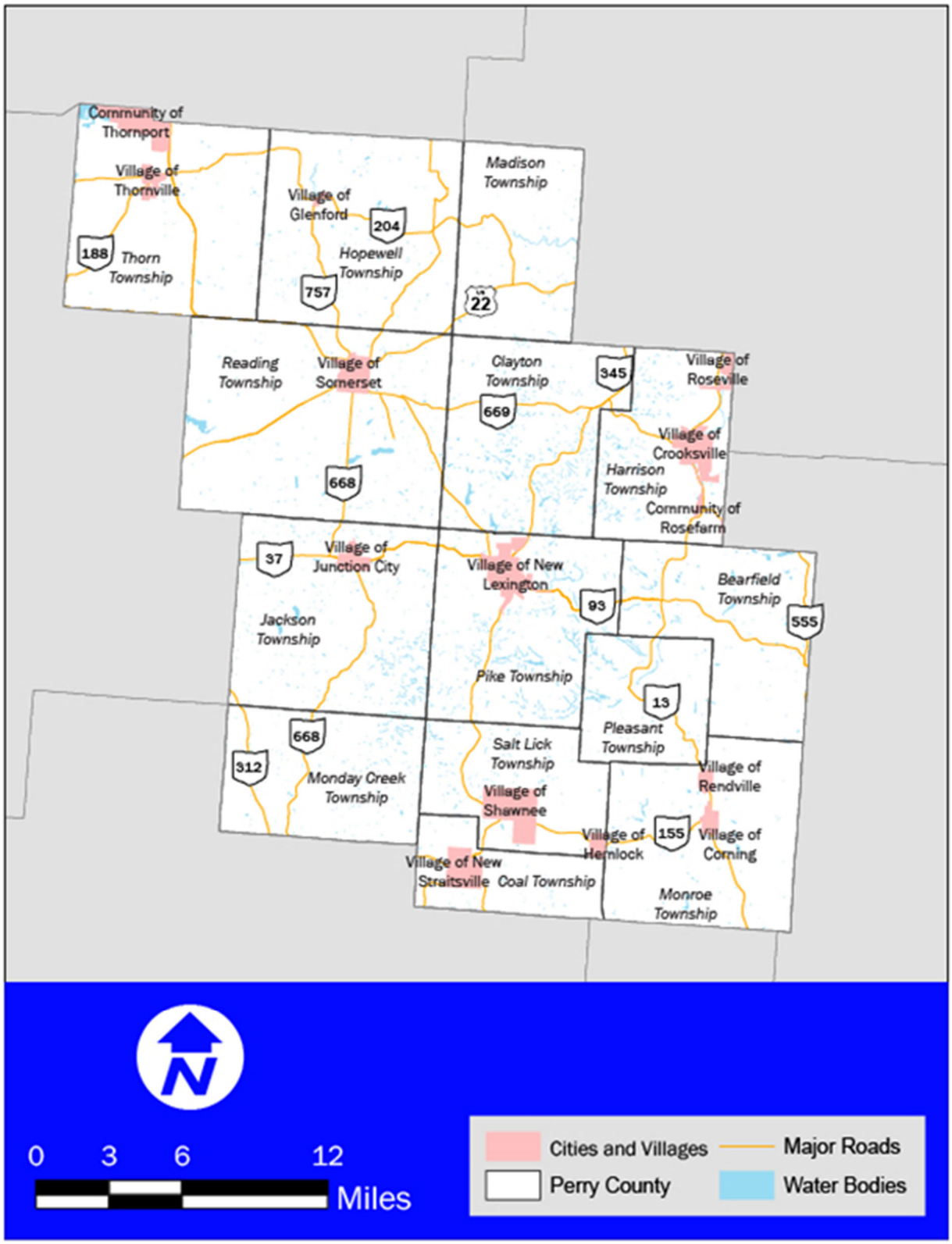
Table 1.1: Perry County Jurisdictions

Jurisdictions
Village of Corning
Village of Crooksville
Village of Glenford
Village of Hemlock
Village of Junction City
Village of New Lexington
Village of New Straitsville
Village of Rendville
Village of Roseville
Village of Shawnee
Village of Somerset
Village of Thornville

Table 1.2: Perry County Townships

Townships	
Bearfield Township	Monday Creek Township
Clayton Township	Monroe Township
Coal Township	Pike Township
Harrison Township	Pleasant Township
Hopewell Township	Reading Township
Jackson Township	Salt Lick Township
Madison Township	Thorn Township

Figure 1.3: Perry County Jurisdictions Map



This Plan is comprised of six chapters, which detail the methods, analysis, and discussion surrounding the various hazards that threaten Perry County and its jurisdictions. These chapters are as follows:

- This **Introduction** (Chapter 1) provides a discussion about the general purpose and goals that Perry County wishes to achieve throughout the development and implementation of this Plan. This section also includes a summary of the Plan's contents.
- Chapter 2, **History and Demographics**, includes a description of Perry County and each participating jurisdiction, including their history, population, and other general information.
- Chapter 3, **Planning Process**, details the process for the development of this Plan. This section includes details about the process used to develop this Plan, including a description of who participated, how the community was involved, which hazards were included in the Plan and why, as well as how the Plan was developed through public meetings, reviews, and evaluations. This section also details the review and incorporation of existing plans, studies, reports, and technical information.
- Chapter 4 contains the **Hazard Identification and Risk Assessment (HIRA)**. This section provides detailed descriptions and a corresponding analysis for each hazard that could potentially affect Perry County. The nature, location, extent, historical impact, vulnerability, and likelihood of occurrence for each hazard are provided for each hazard. These analyses include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; an estimate of the potential dollar losses to vulnerable structures; and a general description of land uses and development trends within the community.
- Chapter 5, **Hazard Mitigation**, outlines the goals, strategies, and actions for the County. The proposed actions are presented in tables, categorized by the associated hazard and community, and then ranked from highest to lowest priority based on feedback received from County officials and participating jurisdictions and stakeholders. Excluded hazards are also documented in this section, along with the rationale for exclusion from the Plan.
- The final chapter (Chapter 6) of this Plan, **Schedule and Maintenance**, provides a summary of the proposed Plan adoption, integration, and maintenance schedule. This section describes how the County will review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five years to continue to be eligible for mitigation project grant funding.

The resulting Perry County Hazard Mitigation Plan will be submitted to the Ohio Emergency Management Agency (Ohio EMA) and subsequently FEMA for their review. Following the agency review, the jurisdictions will then review the Plan for adoption. This hazard mitigation plan serves as a helpful tool for citizens, policymakers, local businesses, and other local stakeholders who all share a public interest in keeping Perry County as safe and resilient as possible. As such, this Plan aims to:

- Minimize property damage, economic loss, injury, and loss of human life – to achieve the Plan's main goal of reducing the impact of natural and manmade hazards on the County's economy and the well-being of its citizens.
- Enhance public awareness and education – to widen the public's understanding of natural and manmade hazards and how they might affect public health and safety, the environment, the local economy, and basic day-to-day operations.
- Coordinate inter-jurisdictional preparedness measures – to encourage and ensure multi-jurisdictional cooperation in County-wide mitigation actions and programs so that they may be implemented efficiently and effectively.

- Provide decision-making tools for interested stakeholders – to formulate a comprehensive, updated analysis of Perry County's vulnerability to hazards so that decision-makers can better prepare for natural and manmade disasters.
- Achieve regulatory compliance – to ensure that the County and its political subdivisions meet state and federal mitigation planning requirements so that they may be eligible to participate in and receive funding from grant programs, policies, and regulations.

1.2 Setting

Perry County is in the southeast region of Ohio and has a total area of approximately 408 square miles. The County contains 12 villages, one census designated place, and 14 townships (**Table 1.2**). The Village of New Lexington serves as the County seat. Perry County is bounded by six counties: Licking County to the north, Morgan County to the southeast, Fairfield County to the west, Hocking County to the southwest, Muskingum County to the northeast, and Athens County to the south.

As shown in **Figure 1.6**, there are various types of land uses that exist in Perry County, including agriculture, commercial, institutional/government, industrial, mining, public utility, and residential. Agriculture is the predominant land use. Land cover in Perry County is shown in **Figure 1.7**. Land cover types include barren land, cultivated crops, forested, developed, wetlands, hay and pasture, herbaceous, open water, and shrub and scrub.

1.3 Region Features

Transportation

Perry County contains several major roadways, including several State Routes (SR) and one U.S. Highway (US). Major roadways in Perry County include SR-188, SR-204, SR-669, SR-668, SR-757, SR-345, SR-13, SR-37, SR-93, SR-132, SR-155, SR-555, and US-22.

One Genesee & Wyoming Railroad intersects in New Lexington and the Ohio Southern Railroad has two lines in Perry County, connecting the Village of Glenford and the Village of New Lexington to the City of Zanesville. There are two airports in Perry County: Perry County Airport is a public use airport located near the Village of New Lexington; and Clum Airport is a private airport near the Village of Thornville. There are no navigable waterways within Perry County.

Natural Features

Table 1.4, below, principal streams and water bodies in the County. (Source: ODNR)

Table 1.4: Perry County Streams and Water Bodies

Water Body	
Buckeye Fork	Turkey Run
Honey Creek	Black Fork
Jonathan Creek	Bennett Run
McLuney Creek	Salem Run
Monday Creek	Painter Creek
Moxahala Creek	Valley Run
Middle Fork Snow Fork	Indian Run
Somerset Creek	Muddy Run
Sunday Creek	Dry Run
Rush Creek Lake	Buckeye Lake
Crooksville Reservoir	Clouse Lake

Perry County also has several parks and nature areas which are listed in **Table 1.5** below.

Table 1.5: Parks & Nature Areas in Perry County, Ohio

Name	
Perry State Forest	Perry County
Wayne National Forest	Glenford Fort Preserve
Henderson Park	Lion's Club Park
Shelly Park	Junction City Park
Sunday Creek State Wildlife Area	Thornville Community Park
Thornville Park	Clouse Lake Wilderness Area
Hanby Wildlife Area	Avondale Wildlife Area
Arethusa Springs Park	Ball's Court
Monument Square Park	Fink's Nature Preserve

Figure 1.6: Perry County Land Use Map

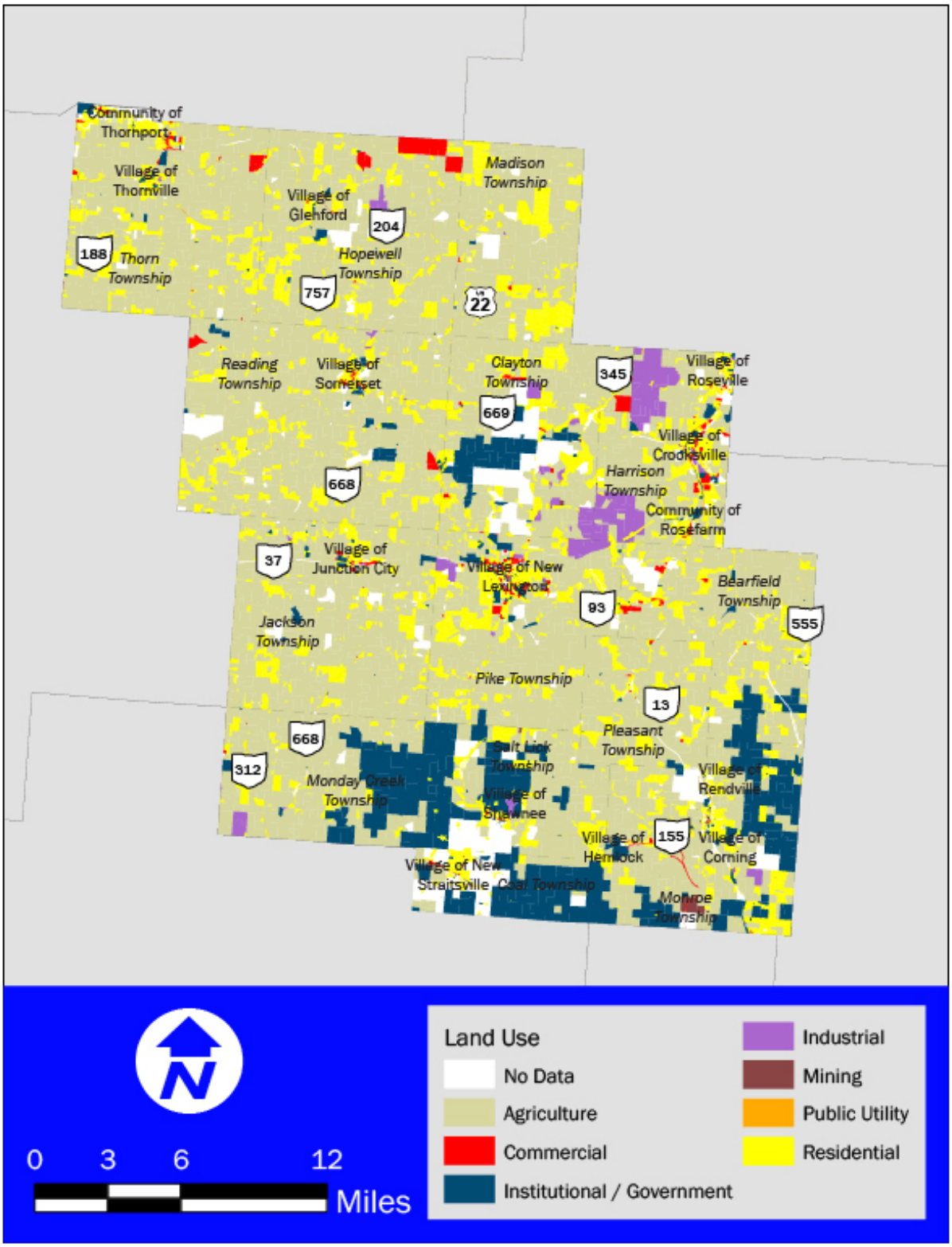
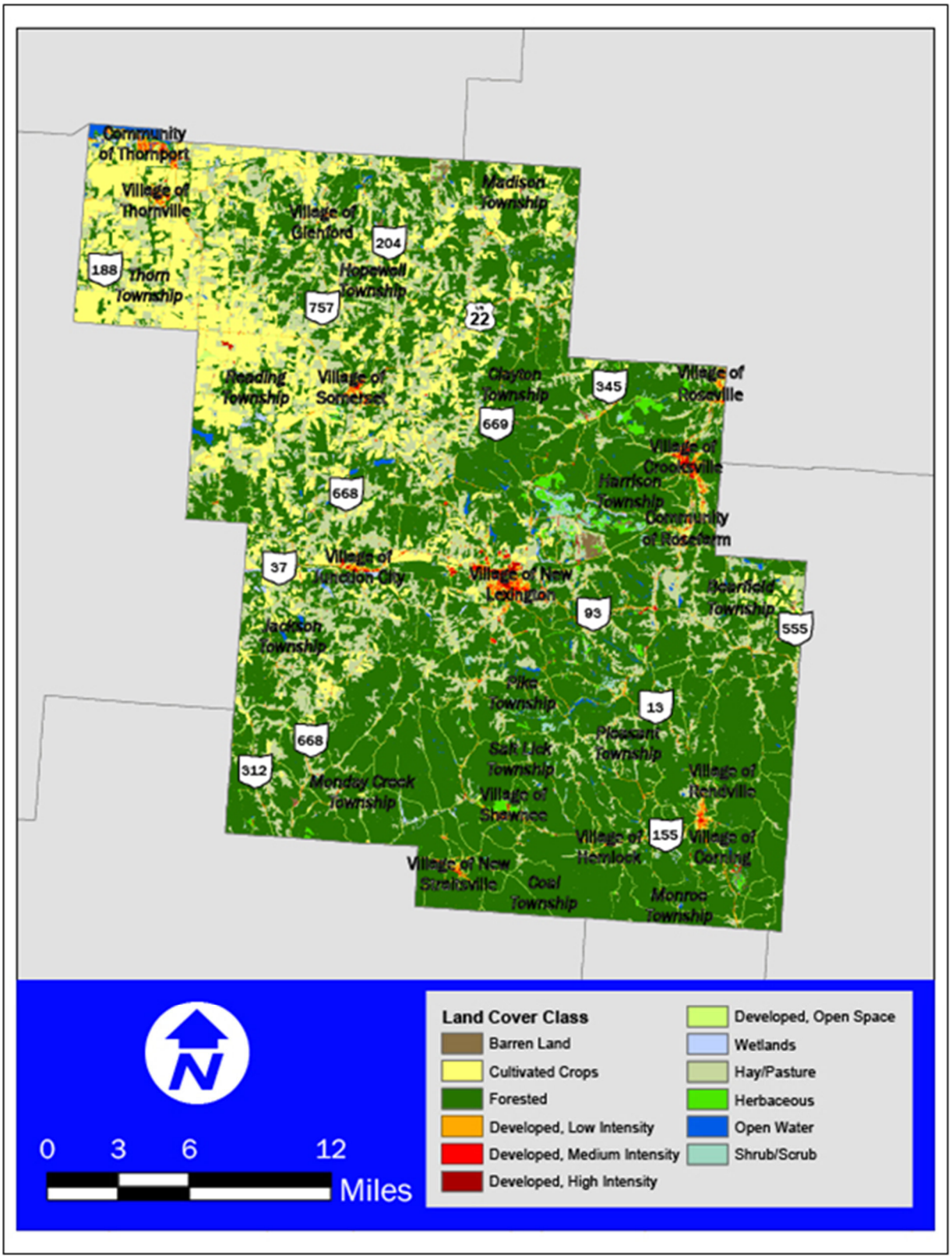


Figure 1.7: Perry County Land Cover Map



2 | History & Demographics

2.1 History

Perry County is in the southeastern part of Ohio, roughly 55 miles southeast of Columbus, the state capital. The county has a total area of 412 square miles, of which 408 square miles is land and 4.5 square miles (1.1 percent) is water. Approximately 264,062 acres (8 percent) of the county is part of the Wayne National Forest. Somerset was the county seat of Perry County until 1859 when it was moved to New Lexington.

The county encompass territory where the prehistoric indigenous Hopewell culture emerged during the Middle Woodland period (around 1 AD). From around 1650 to 1833, the area was occupied by the Shawnee nation and Delaware tribes. Perry County was founded on December 26, 1817 from parts of Fairfield, Washington, and Muskingum counties. It was the 55th county to be formed in Ohio. Perry County was named for Commodore Oliver Hazard Perry, who participated in the War of 1812 that resulted in the removal of the area indigenous habitants to reservations in Kansas and Oklahoma.

The Perry County Courthouse **(see Figure 2.1)** and County Jail **(see Figure 2.2)** in New Lexington are listed in the National Register of Historic Places. The construction of the courthouse and jail buildings started in 1886 and were completed in 1887 and continue to be in service to this day. Both buildings were designed by Columbus architect Joseph Warren Yost. His work included residences, public and institutional buildings, commercial structures, and eight other Ohio courthouses.

Figure 2.1 Historic Perry County Courthouse

Figure 2.2 Historic Perry County Jail

2.2 Communication Outlets

Perry County's primary communication outlets including websites, television, and social media are listed in **Table 2.3** below:

Table 2.3: Communication Outlets and Social Media

Communication Type	Source
Website	Perry County: www.perrycountyohio.net Perry County EMA: www.perrycountyohio.net/agencies-and-offices/perry-county-emergency-management Perry County Health Department: perrycountyhealth.info/ Perry County Waste Reduction and Recycling: www.perryrecycling.com East Central Ohio Chapter of the American Red Cross: www.redcross.org/local/ohio/central-and-southern-ohio/about-us/locations/east-central-ohio.html
Social Media	Perry County EMA: www.facebook.com/profile.php?id=100066359030218 Perry County Health Department: www.facebook.com/Perry-County-Health-Department-139224129481428/ Perry County Waste and Recycling: www.facebook.com/wastelessrecycleright www.instagram.com/perrycountywastereduction/ Village of New Lexington: www.facebook.com/NewLexington/
News/Newspaper	Perry County Tribune: www.perrytribune.com/ NPR Stations: WOUB 91.3 FM / WOUZ 90.1 FM Local Radio Station: WWJM 94.5 FM & 105.9 FM (wwjm.com)

2.3 Demographics Overview

This section provides select demographic information to help identify strategies to better serve the county residents during emergency hazard events. The information can be used to understand potential vulnerabilities in subgroups of the population. For example, knowing the number of senior citizens that live alone and that may require additional assistance during an emergency can help assistance organizations anticipate where additional services may be needed.

Table 2.4 provides a summary of the total population changes that have occurred in Perry County between the 2010 and 2021. According to the U.S. Census, Perry County's population decreased by 619 people (-1.7 percent) between 2010 and 2021. For comparison, the U.S. population grew 7.2 percent and Ohio's population grew 2.2 percent during that period. Four townships – Hopewell, Madison, Pleasant, and Thorn townships – experienced population growth. Of the townships experiencing population decline, Monroe Township experienced the greatest population decline with a decrease of 391 people (-26.0 percent).

A more detailed description of population, housing, and income demographics for Perry County and each village jurisdiction is discussed on the following pages.

Table 2.4: County and Township Population Growth Estimates Between 2010 and 2021

County/Township	Total Population 2010 Census	Total Population 2021 Census	2010-2021	
			Population Change	Percent Change
Perry County	36,058	35,439	-619	-1.7%
Bearfield Township	1,677	2,270	593	35.4%
Clayton Township	1,570	1,604	34	2.2%
Coal Township	1,044	888	-156	-14.9%
Harrison Township	5,245	5,143	-102	-1.9%
Hopewell Township	2,403	2,576	173	7.2%
Jackson Township	2,855	2,789	-66	-2.3%
Madison Township	1,377	1,013	-364	-26.4%
Monday Creek Township	727	871	144	19.8%
Monroe Township	1,501	1,110	-391	-26.1%
Pike Township	6,924	6,663	-261	-3.8%
Pleasant Township	847	636	-211	-24.9%
Reading Township	4,356	4,342	-14	-0.3%
Salt Lick Township	1,260	1,023	-237	-18.8%
Thorn Township	4,250	4,511	261	6.1%

Social Vulnerability Score

The Social Vulnerability score is a component of the Federal Emergency Management Agency (FEMA)'s National Risk Index that measures the susceptibility (risk) of social groups to the adverse impacts of natural hazards that may result in disproportionate deaths, injury, loss, or disruption of livelihood. As FEMA explains, the "Social Vulnerability score considers the social, economic, demographic, and

housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards. The score and rating represent the relative level of a community's social vulnerability compared to all other communities at the same level (e.g., county level). A community's Social Vulnerability score is proportional to a community's risk. A higher Social Vulnerability score results in a higher Risk Index score."

Perry County has a calculated Social Vulnerability score of 33.15 (on scale of 0 to 100), which is considered a relatively low susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S. For comparison, Ohio's average score is 34.28 and the national average is 38.35. In addition, 35.2 percent of Ohio Counties have a lower Social Vulnerability score.

The score is calculated using U.S. Census data for 29 socioeconomic variables, which research literature suggests contributes to the reduction in a community's ability to prepare for, respond to, and recover from hazards. Thus, making the community more vulnerable. Each of the 29 variables have a positive or negative impact in reducing vulnerability. The 29 variables are organized into eight groups. Each group has a calculated sub-score that are added to obtain the total social vulnerability score for the county. For easier understanding and interpretation, each group is assigned a positive or negative cardinality. According to this, a positive cardinality increases the vulnerability, and a negative cardinality decreases it. The eight groups and how they impact the score are described below:

- **Wealth**: this variable examines wealth, such as households with income over $200,000, and high median house values and rent. Higher wealth has a negative cardinality and decrease the total vulnerability score.
- **Race (Black) and social status**: this variable examines the percentage of the black population with lower social status indicators such as percentage in poverty, female heads of households, and automobile ownership, among others. A higher percentage of Black residents with lower social status has a positive cardinality and increases the total score.
- **Age (elderly):** this variable focuses on the elderly population and their living conditions but also looks at children under five years of age. A higher number of elderly people and higher number of children under five years of age will have a positive cardinality and increase the total score.
- **Ethnicity (Hispanic) and lack of health insurance variables:** this variable examines the percentage of the Hispanic population with limited English proficiency, and without health insurance. A higher percentage of this population has a positive cardinality and increases the total score.
- **Special needs populations**: this variable examines the percentage of the population with special needs and available access to nursing homes and hospitals. A higher percentage of special needs population with low access to nursing homes and hospital has a positive cardinality and increases the total score.
- **Service sector employment**: this variable examines the percentage of the population working in the service and extractive industries, and the percentage of females participating in the labor force. indicating a higher number of people employed by the service sector has a positive cardinality increases the total score.
- **Race (Native American):** this variable accounts for the percentage of the population that is Native American, as historically this population lives in comparably more vulnerable conditions. A higher percentage of Native American population has a positive cardinality and increase the total score.
- **Gender (female):** this variable accounts for the percentage of the population that is female, as historically females live in comparably more vulnerable conditions. A higher percentage of females in population has a positive cardinality and increase the total score.

Community Profiles

Perry County

Perry County is included in the Columbus Metropolitan Statistical Area. As of the 2021 census, the county population was 35,439, which was a 1.7 percent decrease in population since 2010. There are 13,071 households, of which 32.8 percent have at least one member under 18 years of age, and 30.9 percent have members 65 years and over. The share of the population that is 65 and older was the fastest growing group and increased from 13 percent in 2010 to 30.9 percent in 2021 (20 percent increase). The share of the population under 19 years of age decreased by at least 6 percent during the same period.

In 2021, the largest racial or ethnic group in Perry County was the white (non-Hispanic) group, which had a population of 34,037. Between 2010 and 2021, the Hispanic/Latino population had the most growth with an increase of 126 people from 2010 (195 people) to 2021 (321 people). Approximately 675 (2.0 percent) of the county's population 5 years and over speak Spanish at home. In addition, 124 (0.32 percent) of people 5 years and over speak Indo-European language and 48 (0.14 percent) speak an Asian or Pacific Islander language. Data from the American Community Survey Estimates for 2021 was primarily used in this chapter.

Table 2.5: Perry County Population by Age Statistics 2021 ACS 1-Year Supplemental Estimates

Age	Number	Percentage
Total Population	35,439	-
Under 18 Years	8,306	23.4%
18 to 24 Years	2,680	7.6%
25 to 34 Years	4,197	11.8%
35 to 44 Years	4,306	12.1%
45 to 54 Years	4,845	13.6%
55 to 64 Years	5,188	14.6%
65 Years and More	5,917	16.7%

Table 2.6: Perry County Population by Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	35,439	-
White	34,037	96.0%
Black or African American	167	0.5%
American Indian or Alaska Native	116	0.3%
Asian	14	0.0%
Native Hawaiian or Pacific Islander	28	0.1%
Other (one race)	3	0.0%
Two or More Races	753	2.1%
Hispanic or Latino (of any race)	321	0.9%

Table 2.7: Perry County Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	15,009	-
Occupied Housing Units	13,071	87.1%
Occupied Housing Units - Mobile Homes	2,507	19.2%
Vacant Housing Units	1,938	12.9%

Table 2.8: Perry County Household Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Households	13,071	-
Average Household Size	2.69	-
Households with People Under 18 Years	4,287	32.8%
Households with People 65+ Years	4,039	30.9%
Householder Living Alone 65+ Years	1,059	8.1%
No Vehicle Available	508	3.5%

Table 2.9: Perry County Household Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Number of Households
Less than $10,000	6.7%
$10,000 to $14,999	5.7%
$15,000 to $24,999	10.2%
$25,000 to $34,999	7.5%
$35,000 to $49,999	13.4%
$50,000 to $74,999	19.1%
$75,000 to $99,999	16.4%
$100,000 to $149,999	14.9%
$150,000 to $199,999	3.2%
$200,000 or more	2.9%
Median Household Income	$56,816
Mean Household Income	$69,155

Village of Corning

Tables 2.10 to 2.14 summarize the Village of Corning's population, housing statistics, and income statistics. The tables show that the Village's population decreased by 165 people (-28.3 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 13.5 percent. There are 153 households with an average size of 2.7 people and 49.0 percent have at least one member under 18 years of age. The largest percentage of households (19.0 percent) had an income between $35,000 and $49,999; approximately 20.3 percent of households had an annual income of less than $15,000. People that identify as two or more races are the second largest ethnicity and/or race (1.2 percent).

Table 2.10: Village of Corning Population 2021 by Age ACS 5-Year Estimates

Age	Number	Percentage
Total Population	418	-
Under 18 Years	145	34.7%
18 to 24 Years	9	2.2%
25 to 34 Years	68	16.3%
35 to 44 Years	41	9.8%
45 to 54 Years	44	10.5%
55 to 64 Years	68	16.3%
65 Years and More	43	10.3%

Table 2.11: Village of Corning Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	229	-
Occupied Housing Units	153	66.8%
Occupied Housing Units - Mobile Homes	18	11.8%
Vacant Housing Units	76	33.2%

Table 2.12: Village of Corning Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	153	-
Average Household Size	2.73	-
Households with People Under 18 Years	75	49.0%
Households with People 65+ Years	1	22.9%
Householder Living Alone 65+ Years	10	13.7%
No Vehicle Available	0	0.0%

Table 2.13: Village of Corning Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	418	-
White	413	98.8%
Black or African American	0	0.0%
American Indian or Alaska Native	0	0.0%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	0	0.0%
Two or More Races	5	1.2%
Hispanic or Latino (of any race)	0	0.0%

Table 2.14: Village of Corning Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	9.8%
$10,000 to $14,999	10.5%
$15,000 to $24,999	15.0%
$25,000 to $34,999	17.6%
$35,000 to $49,999	19.0%
$50,000 to $74,999	5.9%
$75,000 to $99,999	4.6%
$100,000 to $149,999	15.0%
$150,000 to $199,999	0.7%
$200,000 or more	2.0%
Median Household Income	30,625
Mean Household Income	50,218

Village of Crooksville

Tables 2.15 to 2.19 summarize the Village of Crooksville's population, housing statistics, and income statistics. The tables show that the Village's population decreased by 68 people (-2.7 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 18.4 percent. There are 923 households with an average size of 2.67 people and 34.8 percent have at least one member under 18 years of age. The largest percentage of households (19.3 percent) had an income between $50,000 and $74,999; approximately 18.7 percent of households had an annual income of less than $15,000. People that identify as two or more races are the second largest ethnicity and/or race (2.6 percent).

Table 2.15: Village of Crooksville Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	2,466	-
Under 18 Years	666	27.0%
18 to 24 Years	255	10.3%
25 to 34 Years	215	8.7%
35 to 44 Years	394	16.0%
45 to 54 Years	273	11.1%
55 to 64 Years	355	14.4%
65 Years and More	308	12.5%

Table 2.16: Village of Crooksville Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	1,131	-
Occupied Housing Units	923	81.6%
Occupied Housing Units - Mobile Homes	102	11.1%
Vacant Housing Units	208	18.4%

Table 2.17: Village of Crooksville Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	923	-
Average Household Size	2.67	-
Households with People Under 18 Years	321	34.8%
Households with People 65+ Years	1,057	25.5%
Householder Living Alone 65+ Years	32	10.0%
No Vehicle Available	12	1.0%

Table 2.18: Village of Crooksville Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	2,466	-
White	2,387	96.8%
Black or African American	0	0.0%
American Indian or Alaska Native	15	0.6%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	0	0.0%
Two or More Races	64	2.6%
Hispanic or Latino (of any race)	0	0.0%

Table 2.19: Village of Crooksville Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	7.3%
$10,000 to $14,999	11.4%
$15,000 to $24,999	10.0%
$25,000 to $34,999	14.3%
$35,000 to $49,999	16.6%
$50,000 to $74,999	19.3%
$75,000 to $99,999	18.5%
$100,000 to $149,999	2.7%
$150,000 to $199,999	0.0%
$200,000 or more	0.0%
Median Household Income	39,679
Mean Household Income	45,472

Village of Glenford

Tables 2.20 to 2.24 summarize the Village of Glenford's population, housing statistics, and income statistics. The tables show that the Village's population increased by 85 people (49.0 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 5.1 percent. There are 75 households with an average size of 3.44 people and 45.3 percent have at least one member under 18 years of age. The largest percentage of households (24.0 percent) had an income between $100,000 and $149,999; no households had an annual income of less than $15,000. People that identify as Hispanic or Latino are the second largest ethnicity and/or race (1.4 percent).

Table 2.20: Village of Glenford Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	258	-
Under 18 Years	74	28.7%
18 to 24 Years	14	5.4%
25 to 34 Years	30	11.6%
35 to 44 Years	34	13.2%
45 to 54 Years	26	10.1%
55 to 64 Years	30	11.6%
65 Years and More	50	19.4%

Table 2.21: Village of Glenford Housing 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	79	-
Occupied Housing Units	75	94.9%
Occupied Housing Units - Mobile Homes	0	0.0%
Vacant Housing Units	4	5.1%

Table 2.22: Village of Glenford Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	75	-
Average Household Size	3.44	-
Households with People Under 18 Years	34	45.3%
Households with People 65+ Years	1	29.3%
Householder Living Alone 65+ Years	1	4.0%
No Vehicle Available	0	0.0%

Table 2.23: Village of Glenford Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	258	-
White	258	100.0%
Black or African American	0	0.0%
American Indian or Alaska Native	0	0.0%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	0	0.0%
Two or More Races	0	0.0%
Hispanic or Latino (of any race)	4	1.6%

Table 2.24: Village of Glenford Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	0.0%
$10,000 to $14,999	0.0%
$15,000 to $24,999	0.0%
$25,000 to $34,999	5.3%
$35,000 to $49,999	18.7%
$50,000 to $74,999	13.3%
$75,000 to $99,999	30.7%
$100,000 to $149,999	24.0%
$150,000 to $199,999	2.7%
$200,000 or more	5.3%
Median Household Income	90,417
Mean Household Income	90,177

Village of Hemlock

Tables 2.25 to 2.29 summarize the Village of Hemlock's population, housing statistics, and income statistics. The tables show that the Village's population increased by 94 people (60.7 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 11.9 percent. There are 78 households with an average size of 3.5 people and 38.5 percent have at least one member under 18 years of age. The largest percentage of households (36.5 percent) had an income between $50,000 and $74,999; approximately 4.1 percent of households had an annual income of less than $15,000. People that identify as Hispanic or Latino are the second largest ethnicity and/or race (20.0 percent).

Table 2.25: Village of Hemlock Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	249	-
Under 18 Years	87	34.9%
18 to 24 Years	19	7.6%
25 to 34 Years	11	4.4%
35 to 44 Years	76	30.5%
45 to 54 Years	19	7.6%
55 to 64 Years	20	8.0%
65 Years and More	17	6.8%

Table 2.26: Village of Hemlock Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	84	-
Occupied Housing Units	74	88.1%
Occupied Housing Units - Mobile Homes	11	14.9%
Vacant Housing Units	10	11.9%

Table 2.27: Village of Hemlock Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	78	-
Average Household Size	3.53	-
Households with People Under 18 Years	30	38.5%
Households with People 65+ Years	12	15.4%
Householder Living Alone 65+ Years	2	2.6%
No Vehicle Available	4	5.1%

Table 2.28: Village of Hemlock Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	249	-
White	246	98.8%
Black or African American	0	0.0%
American Indian or Alaska Native	0	0.0%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	0	0.0%
Two or More Races	3	1.2%
Hispanic or Latino (of any race)	5	2.0%

Table 2.29: Village of Hemlock Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	0.0%
$10,000 to $14,999	4.1%
$15,000 to $24,999	1.4%
$25,000 to $34,999	29.7%
$35,000 to $49,999	12.2%
$50,000 to $74,999	36.5%
$75,000 to $99,999	4.1%
$100,000 to $149,999	9.5%
$150,000 to $199,999	0.0%
$200,000 or more	2.7%
Median Household Income	56,250
Mean Household Income	73,877

Village of Junction City

Tables 2.30 to 2.34 summarize the Village of Junction City's population, housing statistics, and income statistics. The tables show that the Village's population increased by 177 people (21.6 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 14.5 percent. There are 74 households with an average size of 3.36 people and 40.5 percent have at least one member under 18 years of age. The largest percentage of households (25.1 percent) had an income between $50,000 and $74,999; approximately 13.2 percent of households had an annual income of less than $15,000. People that identify as two or more races are the second largest ethnicity and/or race (4.6 percent).

Table 2.30: Village of Junction City Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	996	-
Under 18 Years	304	30.5%
18 to 24 Years	76	7.6%
25 to 34 Years	153	15.4%
35 to 44 Years	101	10.1%
45 to 54 Years	125	12.6%
55 to 64 Years	102	10.2%
65 Years and More	135	13.6%

Table 2.31: Village of Junction City Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	433	-
Occupied Housing Units	370	85.5%
Occupied Housing Units - Mobile Homes	85	23.0%
Vacant Housing Units	63	14.5%

Table 2.32: Village of Junction City Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	74	-
Average Household Size	3.36	-
Households with People Under 18 Years	30	40.5%
Households with People 65+ Years	1	16.2%
Householder Living Alone 65+ Years	1	4.1%
No Vehicle Available	0	0.0%

Table 2.33: Village of Junction City Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	996	-
White	903	90.7%
Black or African American	0	0.0%
American Indian or Alaska Native	37	3.7%
Asian	7	0.7%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	3	0.3%
Two or More Races	46	4.6%
Hispanic or Latino (of any race)	0	0.0%

Table 2.34: Village of Junction City Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	4.6%
$10,000 to $14,999	8.6%
$15,000 to $24,999	18.9%
$25,000 to $34,999	11.1%
$35,000 to $49,999	11.1%
$50,000 to $74,999	25.1%
$75,000 to $99,999	7.6%
$100,000 to $149,999	12.2%
$150,000 to $199,999	0.8%
$200,000 or more	0.0%
Median Household Income	40,000
Mean Household Income	49,554

Village of New Lexington

Tables 2.35 to 2.39 summarize the Village of New Lexington's population, housing statistics, and income statistics. The tables show that the Village's population decreased by 396 people (-8.4 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 6.4 percent. There are 1,707 households with an average size of 2.49 people and 31.5 percent have at least one member under 18 years of age. The largest percentage of households (24.0 percent) had an income between $35,000 and $49,999; approximately 20.7 percent of households had an annual income of less than $15,000. People that identify as two or more races is the second largest ethnicity and/or race (2.1 percent).

Table 2.35: Village of New Lexington Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	4,335	-
Under 18 Years	1,050	24.2%
18 to 24 Years	436	10.1%
25 to 34 Years	632	14.6%
35 to 44 Years	586	13.5%
45 to 54 Years	666	15.4%
55 to 64 Years	289	6.7%
65 Years and More	676	15.6%

Table 2.36: Village of New Lexington Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	1,824	-
Occupied Housing Units	1,707	93.6%
Occupied Housing Units - Mobile Homes	162	9.5%
Vacant Housing Units	117	6.4%

Table 2.37: Village of New Lexington Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	1,707	-
Average Household Size	2.49	-
Households with People Under 18 Years	538	31.5%
Households with People 65+ Years	1	23.8%
Householder Living Alone 65+ Years	0	5.7%
No Vehicle Available	280	16.0%

Table 2.38: Village of New Lexington Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	4,435	-
White	4,218	97.3%
Black or African American	0	0.0%
American Indian or Alaska Native	0	0.0%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	26	0.6%
Other (one race)	0	0.0%
Two or More Races	91	2.1%
Hispanic or Latino (of any race)	9	0.2%

Table 2.39: Village of New Lexington Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	10.8%
$10,000 to $14,999	9.9%
$15,000 to $24,999	13.4%
$25,000 to $34,999	7.5%
$35,000 to $49,999	24.0%
$50,000 to $74,999	12.9%
$75,000 to $99,999	9.3%
$100,000 to $149,999	9.1%
$150,000 to $199,999	0.0%
$200,000 or more	3.2%
Median Household Income	39,010
Mean Household Income	52,511

Village of New Straitsville

Tables 2.40 to 2.44 summarize the Village of New Straitsville Village's population, housing statistics, and income statistics. The tables show that the Village's population decreased by 87 people (-12.1 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 17.6 percent. There are 262 households with an average size of 2.59 people and 29.0 percent have at least one member under 18 years of age. The largest percentage of households (20.2 percent) had an income between $35,000 and $49,999; approximately 31.0 percent of households had an annual income of less than $15,000. People that identify as two or more races or Asian are the second largest ethnicity and/or race (7.0 percent each).

Table 2.40: Village of New Straitsville Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	679	-
Under 18 Years	158	23.3%
18 to 24 Years	67	9.9%
25 to 34 Years	68	10.0%
35 to 44 Years	123	18.1%
45 to 54 Years	91	13.4%
55 to 64 Years	100	14.7%
65 Years and More	72	10.6%

Table 2.41: Village of New Straitsville Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	318	-
Occupied Housing Units	262	82.4%
Occupied Housing Units - Mobile Homes	58	22.1%
Vacant Housing Units	56	17.6%

Table 2.42: Village of New Straitsville Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	262	-
Average Household Size	2.59	-
Households with People Under 18 Years	76	29.0%
Households with People 65+ Years	1	21.8%
Householder Living Alone 65+ Years	7	9.2%
No Vehicle Available	9	3.0%

Table 2.43: Village of New Straitsville Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	679	-
White	665	97.9%
Black or African American	0	0.0%
American Indian or Alaska Native	0	0.0%
Asian	7	1.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	0	0.0%
Two or More Races	7	1.0%
Hispanic or Latino (of any race)	0	0.0%

Table 2.44: Village of New Straitsville Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	17.6%
$10,000 to $14,999	13.4%
$15,000 to $24,999	6.9%
$25,000 to $34,999	1.5%
$35,000 to $49,999	20.2%
$50,000 to $74,999	19.1%
$75,000 to $99,999	14.1%
$100,000 to $149,999	4.6%
$150,000 to $199,999	1.9%
$200,000 or more	0.8%
Median Household Income	41,912
Mean Household Income	47,770

Village of Rendville

Tables 2.45 to 2.49 summarize the Village of Rendville's population, housing statistics, and income statistics. The tables show that the Village's population increased by 25 people (69.4 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 43.8 percent. There are 34 households with an average size of 2.9 people and 33.3 percent have at least one member under 18 years of age. The largest percentage of households (61.9 percent) had an income between $10,000 and $14,999; approximately 61.9 percent of households had an annual income of less than $15,000. People that identify as two or more races are the second largest ethnicity and/or race (23.0 percent).

Table 2.45: Village of Rendville Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	61	-
Under 18 Years	29	47.5%
18 to 24 Years	0	0.0%
25 to 34 Years	6	9.8%
35 to 44 Years	0	0.0%
45 to 54 Years	16	26.2%
55 to 64 Years	7	11.5%
65 Years and More	3	4.9%

Table 2.46: Village of Rendville Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	34	-
Occupied Housing Units	21	61.8%
Occupied Housing Units - Mobile Homes	5	23.8%
Vacant Housing Units	13	38.2%

Table 2.47: Village of Rendville Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	21	-
Average Household Size	2.9	-
Households with People Under 18 Years	7	33.3%
Households with People 65+ Years	0	14.3%
Householder Living Alone 65+ Years	1	14.3%
No Vehicle Available	0	0.0%

Table 2.48: Village of Rendville Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	61	-
White	38	62.3%
Black or African American	9	14.8%
American Indian or Alaska Native	0	0.0%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	0	0.0%
Two or More Races	14	23.0%
Hispanic or Latino (of any race)	0	0.0%

Table 2.49: Village of Rendville Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	0.0%
$10,000 to $14,999	61.9%
$15,000 to $24,999	23.8%
$25,000 to $34,999	14.3%
$35,000 to $49,999	0.0%
$50,000 to $74,999	0.0%
$75,000 to $99,999	0.0%
$100,000 to $149,999	0.0%
$150,000 to $199,999	0.0%
$200,000 or more	0.0%
Median Household Income	12,386
Mean Household Income	15,895

Village of Shawnee

Tables 2.50 to 2.54 summarize the Village of Shawnee's population, housing statistics, and income statistics. The tables show that the Village's population decreased by 217 people (-33.1 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 41.2 percent. There are 141 households with an average size of 2.77 people and 36.3 percent have at least one member under 18 years of age. The largest percentage of households (21.7 percent) had an income between $50,000 and $74,999; approximately 19.1 percent of households had an annual income of less than $15,000.

Table 2.50: Village of Shawnee Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	438	-
Under 18 Years	140	32.0%
18 to 24 Years	10	2.3%
25 to 34 Years	24	5.5%
35 to 44 Years	58	13.2%
45 to 54 Years	65	14.8%
55 to 64 Years	73	16.7%
65 Years and More	68	15.5%

Table 2.51: Village of Shawnee Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	267	-
Occupied Housing Units	157	58.8%
Occupied Housing Units - Mobile Homes	11	7.0%
Vacant Housing Units	110	41.2%

Table 2.52: Village of Shawnee Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	157	-
Average Household Size	2.79	-
Households with People Under 18 Years	57	36.3%
Households with People 65+ Years	1	29.3%
Householder Living Alone 65+ Years	2	3.2%
No Vehicle Available	0	0.0%

Table 2.53: Village of Shawnee Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	438	-
White	438	100.0%
Black or African American	0	0.0%
American Indian or Alaska Native	0	0.0%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	0	0.0%
Two or More Races	0	0.0%
Hispanic or Latino (of any race)	0	0.0%

Table 2.54: Village of Shawnee Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	12.7%
$10,000 to $14,999	6.4%
$15,000 to $24,999	17.2%
$25,000 to $34,999	8.3%
$35,000 to $49,999	12.7%
$50,000 to $74,999	21.7%
$75,000 to $99,999	14.0%
$100,000 to $149,999	4.5%
$150,000 to $199,999	2.5%
$200,000 or more	0.0%
Median Household Income	43,750
Mean Household Income	47,361

Village of Somerset

Tables 2.55 to 2.59 summarize the Village of Somerset's population, housing statistics, and income statistics. The tables show that the Village's population increased by 262 people (+17.7 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 5.0 percent. There are 619 households with an average size of 2.66 people and 34.7 percent have at least one member under 18 years of age. The largest percentage of households (20.5 percent) had an income between $100,000 and $149,999; approximately 16.9 percent of households had an annual income of less than $15,000. People that identify as two or more races are the second largest ethnicity and/or race (6.3 percent).

Table 2.55: Village of Somerset Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	1743	100.0%
Under 18 Years	535	30.7%
18 to 24 Years	166	9.5%
25 to 34 Years	183	10.5%
35 to 44 Years	208	11.9%
45 to 54 Years	172	9.9%
55 to 64 Years	209	12.0%
65 Years and More	270	15.5%

Table 2.56: Village of Somerset Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	661	-
Occupied Housing Units	605	92.0%
Occupied Housing Units - Mobile Homes	38	6.3%
Vacant Housing Units	56	5.0%

Table 2.57: Village of Somerset Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	619	-
Average Household Size	2.71	-
Households with People Under 18 Years	215	34.7%
Households with People 65+ Years	1	29.9%
Householder Living Alone 65+ Years	40	18.7%
No Vehicle Available	0	0.0%

Table 2.58: Village of Somerset Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	1,743	-
White	1,602	91.9%
Black or African American	24	1.4%
American Indian or Alaska Native	0	0.0%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	7	0.4%
Two or More Races	110	6.3%
Hispanic or Latino (of any race)	45	2.6%

Table 2.59: Village of Somerset Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	7.4%
$10,000 to $14,999	9.5%
$15,000 to $24,999	10.8%
$25,000 to $34,999	7.9%
$35,000 to $49,999	12.9%
$50,000 to $74,999	18.4%
$75,000 to $99,999	10.5%
$100,000 to $149,999	20.5%
$150,000 to $199,999	1.1%
$200,000 or more	0.8%
Median Household Income	51,012
Mean Household Income	59,915

Village of Thornville

Tables 2.60 to 2.64 summarize the Village of Thornville's population, housing statistics, and income statistics. The tables show that the Village's population increased by 573 people (+57.8 percent) from 2010 to 2021. For housing units, the Village had a vacancy rate of 9.7 percent. There are 589 households with an average size of 2.66 people and 41.3 percent have at least one member under 18 years of age. The largest percentage of households (26.5 percent) had an income between $100,000 and $149,999; approximately 7.1 percent of households had an annual income of less than $15,000. People that identify as Hispanic or Latino are the second largest ethnicity and/or race (3.6 percent).

Table 2.60: Village of Thornville Population by Age 2021 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	1,564	-
Under 18 Years	410	26.2%
18 to 24 Years	76	4.9%
25 to 34 Years	203	13.0%
35 to 44 Years	145	9.3%
45 to 54 Years	276	17.6%
55 to 64 Years	248	15.9%
65 Years and More	206	13.2%

Table 2.61: Village of Thornville Housing Statistics 2021 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	652	-
Occupied Housing Units	589	90.3%
Occupied Housing Units - Mobile Homes	0	0.0%
Vacant Housing Units	63	9.7%

Table 2.62: Village of Thornville Household Statistics 2021 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	589	-
Average Household Size	2.66	-
Households with People Under 18 Years	243	41.3%
Households with People 65+ Years	1	28.7%
Householder Living Alone 65+ Years	12	4.9%
No Vehicle Available	0	0.0%

Table 2.63: Village of Thornville Race and Ethnicity Statistics 2021 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	1,564	-
White	1,484	94.9%
Black or African American	0	0.0%
American Indian or Alaska Native	13	0.8%
Asian	0	0.0%
Native Hawaiian or Pacific Islander	0	0.0%
Other (one race)	55	3.5%
Two or More Races	13	0.8%
Hispanic or Latino (of any race)	56	3.6%

Table 2.64: Village of Thornville Income Statistics 2021 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	1.5%
$10,000 to $14,999	5.6%
$15,000 to $24,999	5.1%
$25,000 to $34,999	6.5%
$35,000 to $49,999	4.4%
$50,000 to $74,999	16.8%
$75,000 to $99,999	22.1%
$100,000 to $149,999	26.5%
$150,000 to $199,999	2.2%
$200,000 or more	9.3%
Median Household Income	89,732
Mean Household Income	96,008

3 | Planning Process

3.1 Methodology

The Planning Process chapter describes the steps involved in the development of the Perry County Hazard Mitigation Plan, including details about who participated, how community involvement was organized and promoted throughout the community, what hazards were included in the Plan and why, as well as how stakeholder involvement played a critical role in the planning process. This chapter also explains how the Core Planning Committee was formed and how member feedback contributed to the updating of the County's Hazard Mitigation Plan.

3.2 Existing Plans & Regulations

Perry County and the State of Ohio maintain several plans and tools that were pertinent to reference in the development of the Hazard Mitigation Plan, including:

- 2017 Perry County Hazard Mitigation Plan
- 2019 State of Ohio Hazard Mitigation Plan (SOHMP)
- Perry County Subdivision Regulations
- Zoning Regulations for all Townships

3.3 Perry County Authority to Adopt Plan

The Perry County Commissioners are elected at-large for four-year terms. The board members are the budgeting, appropriating, taxing, and purchasing authority. The Perry County Planning Commission was established by the Perry County Board of Commissioners in conformance with Section 713.21 of the Ohio Revised Code. The authority to adopt plans comes from statutory law and from Chapter 307 of the Ohio Revised Code. **Table 3.1** lists the existing authorities and regulations in place in Perry County and its municipalities.

Table 3.1: Existing Authorities and Regulations in Perry County's Municipalities

Community	Planning Commission	Comprehensive Plan	Floodplain Regulations	Building Codes*	Zoning Codes	Capital Budget	Public Works Budget
Perry County	Yes	No	Yes	Yes	Yes	(none)	Limited in-kind wages only
Village of Corning	No	No	No	Yes	No	(none)	Limited in-kind wages only
Village of Crooksville	Yes	No	Yes	Yes	Yes	(none)	Limited in-kind wages only
Village of Glenford	No	No	Yes	Yes	No	(none)	Limited in-kind wages only
Village of Hemlock	No	No	Yes	Yes	No	(none)	Limited in-kind wages only
Village of Junction City	No	No	Yes	Yes	No	(none)	Limited in-kind wages only
Village of New Lexington	Yes	Yes	Yes	Yes	Yes	(none)	Limited in-kind wages only
Village of New Straitsville	No	No	Yes	Yes	No	(none)	Limited in-kind wages only

Community	Planning Commission	Comprehensive Plan	Floodplain Regulations	Building Codes*	Zoning Codes	Capital Budget	Public Works Budget
Village of Rendville	No	No	No	Yes	No	(none)	Limited in-kind wages only
Village of Roseville (Partial)	No	No	No	Yes	No	(none)	Limited in-kind wages only
Village of Shawnee	No	No	Yes	Yes	Yes	(none)	Limited in-kind wages only
Village of Somerset	Yes	No	No	Yes	Yes	(none)	Limited in-kind wages only
Village of Thornville	Yes	No	No	Yes	Yes	(none)	Limited in-kind wages only

** All jurisdictions in Ohio now follow the State Building Code (Ohio Administrative Code 4101:1).*

3.4 Notification Process

Core Planning Committee members were invited to participate at the beginning of the planning process through a Kickoff Meeting announcement. Prior to each additional meeting, members of the Core Planning Committee were invited to participate via an email notification. Representatives from the following entities were invited to participate in the planning process. Additionally, **Table 3.2** lists the participating jurisdictions and representatives and how they participated. The Village of Rendville will be un-incorporated and will be under Monroe Township. The Village of Roseville is partially in Muskingum County and will be participate in their Hazard Mitigation Plan.

Perry County

- Perry County Commissioners
- Perry County EMA
- Perry Soil and Water Conservation District
- Perry County Health Department
- Northern Perry County Water
- Perry County Sheriff's Office
- Perry County Fire EMS
- Old Straitsville Water

City and Village Members

- Village of Corning
- Village of Crooksville
- Village of Glenford
- Village of Hemlock
- Village of Junction City
- Village of New Lexington
- Village of New Straitsville
- Village of Rendville
- Village of Roseville
- Village of Shawnee
- Village of Somerset
- Village of Thornville

Township Members

- Bearfield Township
- Clayton Township
- Coal Township
- Harrison Township
- Hopewell Township
- Jackson Township
- Madison Township
- Monday Creek Township
- Monroe Township
- Pike Township
- Pleasant Township
- Reading Township
- Salt Lick Township
- Thorn Township

Local Schools and Universities

- Crooksville Schools
- Hocking College Perry Campus
- Holy Trinity
- Junction City Schools
- New Lexington Elementary School
- New Lexington Middle School
- New Lexington High School
- Northern Local-Sheridan Schools
- Southern Local-Miller School

Other Organizations

- Corning Fire/EMS
- Crooksville Fire/EMS
- Hopewell Twp Fire/EMS
- Junction City Fire/EMS
- Monday Creek Fire
- New Lexington Fire/EMS
- New Straitsville Fire/EMS
- Roseville Fire
- Shawnee Fire
- Somerset Reading Twp Fire
- Somerset Reading Twp EMS
- Thornville-Thorn Twp Fire/EMS
- Burr Oak Regional Water District
- Genesis HealthCare
- Rush Creek Conservancy
- Corning Police Department
- Crooksville Police Department
- Junction City Police Department
- New Lexington Police Department
- New Straitsville Police Department
- Perry County Sheriff's Office
- Roseville Police Department
- Shawnee Police Department
- Somerset Police Department
- Thornville Police Department

Table 3.2: Participating Jurisdictions

Community/Organization	Representative(s)	Meetings Attended		
		1	2	Other
County				
Perry County EMA	Rita Spicer, Director	✓	✓	
Perry County Commissioners	Derek Householder	✓		
Perry County Health Department and Perry Fire EMS	Jim Mickey, Emergency Preparedness Coordinator and President	✓		
Jurisdictions				
Village of Corning	Scott Moore, Mayor			✓
Village of Crooksville	Fred Redfern, Village Council	✓	✓	
Village of Glenford	Leonard Sheppard, Mayor		✓	
Village of Hemlock	James Knippa, Mayor		✓	
Village of Junction City	Jeff Wilson, Firefighter/Medic	✓		
Village of New Lexington	Chad Gibbs, SRO	✓	✓	
Village of New Straitsville	Susan Miller, Fiscal Officer John Roberts, Mayor Tim Warren, NSVFD Chief Matthew Carney, NSVFD Asst. Chief	✓	✓	
Village of Shawnee	John Arkley, Fire Chief	✓	✓	
Village of Somerset	Robert Schons, PD Chief	✓		
Village of Thornville	Traci Sturgill, Administrator		✓	
Other				
Old Straitsville Water	Patrick Cavender, Operator	✓		
Northern Perry County Water	Kelly Green, Supervisor		✓	
Perry Soil and Water Conservation	David Snider, Administrator	✓		
Perry County Sheriff	Jeff Wilson, Lead Dispatch	✓		
Burr Oak Water District	Jay Ferguson, Board President	✓	✓	
Genesis Healthcare	Jason Adams, RN Manager		✓	
Rush Creek Conservancy District	David Snider, Administrator	✓		
Northern Local Schools	Clint Rhodes, NLS Curriculum Director		✓	

* **If representatives were unable to attend the virtual Core Planning Committee meetings, they participated via "Other" formats, including online surveys, as documented in **Appendix G**.*

3.5 Meetings

The following section details the meetings that took place during the planning process. Documentation of each meeting, including newspaper postings, email announcements and attachments, meeting materials, and completed surveys, can be found in **Appendix G**.

Core Planning Committee Kick-off

A Kickoff Announcement was emailed to stakeholders on September 6, 2022, inviting them to participate in the Perry County Hazard Mitigation Plan update process as part of the Core Planning Committee. All kickoff materials were made available on the project's website (burtonplanning.com/perry-hmp).

The Announcement outlined the following details regarding the planning process:

- Goals of the Hazard Mitigation Plan.
- A summary of who is involved in the planning process.
- Federal requirements of the hazard mitigation planning process.
- An overview of the hazard mitigation planning process.
- The proposed schedule for the Perry County Plan update.
- The role of the Core Planning Committee in the update process.
- Contact information for both Perry County EMA and Burton Planning Services.
- Dates, times, and GoToMeeting links of upcoming Core Planning and Public Meetings.

Core Planning Meeting 1

The first core planning meeting was held both virtually and in-person on Thursday, September 15, 2022 at 2:00 PM. The meeting began with a brief introduction a Burton Planning Services (BPS) representative. This introduction included a description of the in-person and virtual engagement process, including multiple options for participants to sign into the meeting. Participants that attended virtually were reminded multiple times throughout the course of the meeting to sign in using the online survey, via the chat function, or by sending an email to the County EMA or BPS. Participants that attended in-person used the sign-in sheets for attendance. The introduction also informed attendees that they could ask questions using the chat feature, or by unmuting themselves and asking their questions at any time throughout the meeting.

A BPS representative then guided the attendees through a presentation which detailed the hazard mitigation planning process, including requirements of the planning process, potential hazards that could be addressed, benefits of hazard mitigation planning, and potential types of projects that could be federally funded because of the hazard mitigation plan. BPS also described the role that the Core Planning Committee would serve in the development of the Perry County Hazard Mitigation Plan.

Following the completion of the presentation, a BPS representative guided the attendees through three surveys, detailed below. Each participant was provided multiple methods of completing the survey, including a physical hard copy of the survey, a fillable PDF that could be completed on their computer, or an online version. Links to survey locations were provided throughout the meeting.

Goals Survey

The purpose of this survey was to reflect on the goals included in the 2017 Natural Hazards Mitigation Plan to determine if they were still relevant to the 2022 Plan. Each attendee reviewed the previous goals and determined if they were still applicable, provided comments or edits to the goals that needed changed, and generated new goals to potentially be included in the Plan.

Discussion on the Goals Survey centered around the relevance of the goals. Attendees indicated a preference for adding a goal related to water treatment and water delivery systems. Other attendees mentioned the relevance of invasive species to the Plan.

Hazard Priority Survey

The purpose of this survey was to review all hazards that could be included in the Hazard Mitigation Plan and prioritize them. As such, attendees were asked to rate each hazard on a scale of zero to five, with five meaning the hazard poses the greatest possible threat to the County or their community and zero meaning the hazard should not be included in the Plan. Attendees rated hazards that were included in the 2017 Natural Hazards Mitigation Plan, as well as all potential hazards that could be included in this Plan.

Following the completion of this survey, BPS guided a discussion on which hazards were deemed to be most important and which hazards attendees did not think needed to be included. As mentioned above, attendees emphasized invasive species during this part of the meeting.

Previous Mitigation Actions Status Survey

The purpose of the Previous Mitigation Actions Status Survey was to have attendees review the mitigation actions that were included in the 2017 Natural Hazards Mitigation Plan, reflect on the status of each action, and determine if that action should be included in this Plan.

Public Meeting 1

The first public meeting took place on Thursday, September 15, 2022, at 6:00 PM. This meeting was held both virtually using Microsoft Teams and in-person at Perry County's Emergency Management Agency. Members of the public were invited to either attend in-person or using the Microsoft Teams app on their phone or desktop or call into the meeting using a phone number. No members of the public attended. A total of three people were present on the call, including two representatives from BPS and the Director of the Perry County Emergency Management Agency.

Trustees from both Monroe Township and Salt Lick Township attended the first public meeting. The lead dispatch of the Perry County Sheriff's department was in attendance as well. Two BPS representatives and the Director of the Perry County EMA remained on the meeting link for the duration of the one-hour meeting in order to ensure anyone who joined would have the opportunity to participate.

Following the meeting, additional public input was requested using social media.

Core Planning Committee Meeting 2

The second planning meeting was held in-person and virtually on Tuesday, October 25, 2022 at 2:00 PM. The meeting began with a brief introduction from a BPS representative. This introduction included a description of the virtual engagement process, including multiple options for participants to sign into the meeting virtually. Participants were reminded multiple times throughout the course of the meeting to sign in using the online survey, via the chat function, or by sending an email to the County EMA or BPS to document their participation. Participants that attended in-person used the sign-in sheets for attendance.

A BPS representative then guided the attendees through a brief presentation which detailed the progress of the hazard mitigation planning process. Following the completion of the presentation, a BPS representative guided the attendees through the hazard mitigation action scoring matrix, detailed below. Each participant was provided multiple methods of completing the survey, a fillable PDF that could be completed on their computer, an online version, or hard copy. Links to survey locations were provided throughout the meeting. Hard copies would be provided upon request.

Hazard Mitigation Action Scoring Matrix

The purpose of this survey was to reflect on the hazard mitigation actions included in the 2017 Natural Hazards Mitigation Plan to determine if they were still relevant to this Plan. New mitigation actions were developed for the Plan, and these actions were presented to the Core Planning Committee. Participants were asked to score the actions based on their priority for their jurisdiction. Participants were also told that the wording for the mitigation actions may be altered to better align with the needs of their communities. The remainder of the meeting functioned as a working session, where participants were able to ask questions as they completed their surveys. Once complete, participants were allowed to leave the meeting.

Public Meeting 2

The second public meeting took place on Tuesday, October 25, 2022, at 6:00 PM. This meeting was held both in-person and virtually using Microsoft Teams. Members of the public were invited to attend in-person at Perry County's Emergency Management Agency or using the Microsoft Teams app on their phone or desktop or call into the meeting using a phone number.

Stakeholders from the Village of Hemlock, Village of New Straitsville, Coal Township, and Monroe Township attend the second public meeting. However, no members of the public attended the meeting. Two representatives from BPS and the Director of the Perry County EMA remained on the meeting for the duration of the one-hour meeting in order to ensure anyone who joined would have the opportunity to participate.

Following the meeting, additional public input was requested using social media.

4 | Hazard Risk Assessments

4.1 Dam/Levee Failure

Description

FEMA defines a dam as "any artificial barrier of at least a minimum size, including appurtenant works, that impounds or diverts water or liquid-borne solids on a temporary or long-term basis." Dam failure occurs when that impounded water is suddenly released in an uncontrollable manner. A dam/levee failure can result in the uncontrolled release of floodwaters downstream of a facility, resulting in a flood wave that can cause significant damage to buildings and infrastructure downstream. The unexpected nature of dam collapse also increases the likelihood of loss of life in the impacted area due to reduced warning times.

Dam infrastructure can be affected by natural hazards, such as floods; man-made threats, such as sabotage; and an imbalance between a dams age and amount of resources invested towards dam maintenance, such as dam settlement and cracking, or movement of the dam's foundation. Dam failures can be caused by seepage, structural failure, or water overtopping the reservoir. A majority of dams in the U.S. are privately owned but regulated by the State or Federal government.

Common dam-related terms include:

- **Spillway**: A structure that is part of a dam or found beside a dam which allows the controlled release of water from a reservoir.
- **Outlet works:** Used to regulate or release water flow from a dam. An outlet works is a device which consists of one or more pipes or tunnels which move water through the dam.
- **Auxiliary spillway**: Also known as an emergency spillway, the auxiliary spillway is a secondary spillway only designed to operate during periods of increased water inflow or high reservoir levels.
- **Structural failure**: Caused by foundation defects such as settlement and slope instability or earthquakes.
- **Mechanical failure**: Dam failure due to malfunctioning gates, conduits, or valves.
- **Hydraulic failure**: Occurs when water overtops the dam, usually causes by inadequate spillway design, blockages in spillways, or dam crest settlement.

Normally, water passes through a dam via the main spillway or outlet works. During periods of increased water inflow or high reservoir levels, water should pass through an auxiliary spillway. Dam failure or partial failures are typically caused by structural, mechanical, or hydraulic failures, rather than during extreme storm events.

According to the U.S. Army Corps of Engineers (USACE), dams can be classified by their hazard potential. The three hazard potential classes are:

- **High Hazard Potential**: During the event of a dam failure loss of life is probable, which is the primary attribute for assigning this designation to a dam. Economic losses, environmental damages, and lifeline impacts are also likely, but are not required for this designation.
- **Significant Hazard Potential**: No loss of life is expected during a dam failure, but economic losses, environmental damages, and lifeline impacts are likely.
- **Low Hazard Potential**: No loss of life is expected during a dam failure and no lifeline impacts are expected. Environmental damages and economic losses are expected to be limited to the dam owner's property.

Location

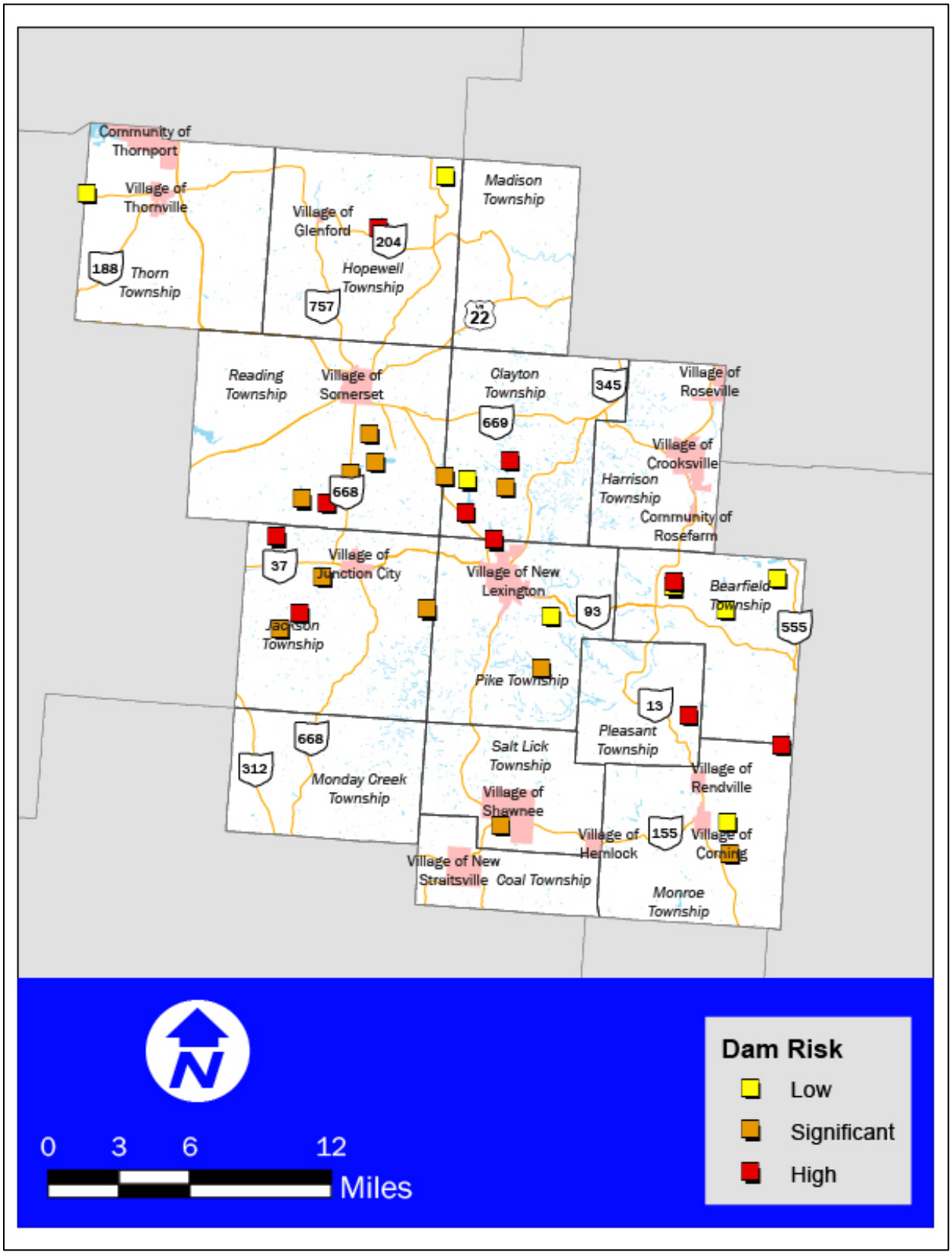
Dam properties of High to Low hazard potential are listed in **Table 4.1.1.** The status of each dam's Emergency Action Plan as of October 13, 2022 is indicated in the table (Source: USACE). Dam locations can be seen in **Figure 4.1.2**.

Table 4.1.1: Dam Properties in Perry County, Ohio

Hazard Potential	Dam Name	Owner Type	City	Height (ft)	Dam Length (ft)	Max Storage (acre-ft)	Max Discharge (ft^3/sec)	Condition	EAP Prepared
High	Perry Reclamation Dam No. 3	State	Redfield	47.5	850	249.6	1,754	Poor	Yes
High	New Lexington Reservoir Dam	Local Government	New Lexington	45	325	707	5,187	Fair	No
High	Rushcreek Structure No. IV-C	Local Government	Bremen	29	565	1687	7,789	Fair	Yes
High	Rushcreek Structure No. III-C	Local Government	Bremen	36	600	744	16,397	Satisfactory	Yes
High	Rushcreek Structure No. III-A	Local Government	Carthon	33.5	700	415	4,490	Fair	Yes
High	Altiers Lake Dam	Private	Rendville	19.2	285	70	962	Poor	No
High	San Toy Dam	Private	Glouster	25.9	325	70	433	Poor	Yes
High	Glass Rock Lake Dam	Private	East Fultonham	54	970	825	4,448	Fair	Yes
High	Rush Creek Structure No. 1-B	Local Government	New Lexington	44.5	460	1144	6,650	Satisfactory	Yes
High	Allen No. 1 Dam	Private	Milligan	58.8	600	53.8	214	Fair	No
Significant	Perry County Recreation Assoc. Lake Dam	Local Govern-ment	New Lexington	18.8	510	40	109	Poor	No
Significant	Tecumseh Lake Dam	Local Govern-ment	Shawnee	25.1	455	44.8	526	Poor	No
Significant	Somerset Reservoir Dam	Local Govern-ment	Carthon	35.1	375	130.4	2,738	Poor	Yes
Significant	Clouse Lake Dam	State	Carthon	28.5	800	948.1	10,827.6	Fair	Yes

Hazard Potential	Dam Name	Owner Type	City	Height (ft)	Dam Length (ft)	Max Storage (acre-ft)	Max Discharge (ft^3/sec)	Condition	EAP Prepared
Significant	Essington Lake Dam	State	Rehoboth	19.9	625	239.9	3,487	Fair	Yes
Significant	New York Central Reservoir Dam	Private	Glouster	11.8	310	111	1,784	Poor	No
Significant	Rushcreek Structure No. IV-A	Local Government	Bremen	26	590	1664.5	7,517	Satisfactory	Yes
Significant	Rushcreek Structure No. II	Local Government	Junction City	31.1	640	575	6,982	Fair	Yes
Significant	Rushcreek Structure No. IV-E	Local Government	Bremen	29	680	1035	5,209	Satisfactory	Yes
Significant	Rushcreek Structure No. III-E	Local Government	Carthon	42.4	1120	2667	14,701	Satisfactory	Yes
Significant	Sunnyhill Freshwater Reservoir Dam	Private	Moxahala	44.6	670	827.5	11,409	Poor	No
Significant	Rushcreek Structure No. III-B	Local Government	Carthon	38	750	871	4,243	Satisfactory	Yes
Low	Perry Reclamation Dam No. 2	State	New Lexington	26.5	315	68.5	163	Fair	Yes
Low	Crooksville Reservoir No. 3 Dam	Local Government	Crooksville	36	450	266	3,160	Fair	No
Low	South Sedimentation Basin Dam	Private	Mt. Perry	21.5	450	63.8	2,887	Fair	Yes
Low	Deerfoot Lake Dam	Private	New Lexington	28.2	205	32.4	2	Poor	No
Low	Allen No. 2 Dam (Racetrack Dam)	Private	Milligan	35.2	735	75	68	Fair	No
Low	Siemer Pond Dam	Private	Hatfield	29	200	32.1	266	Fair	No
Low	Shelton Lake Dam	Private	Firemans Park	26.2	240	45	84	Poor	Yes
Low	Thomas Lake Dam	Private	Tropic	26.7	437	66	134	Poor	Yes

Figure 4.1.2: Dam Locations in Perry County, Ohio



Extent

The Hazard Priority dam classification system considers the effects of dam failure or mismanagement during both normal and flood flow conditions, as well as worst-case-scenario situations. Dam classification may decrease with physical modifications to the dam or by eliminating downstream infrastructure. The classifications are justifiable, reasonable, and consistent with the federal guidelines for dam safety. The hazard potential classification may change depending on anticipated consequences of a dam failure, such as new development below a dam or within the dam breach floodplain. Hazard potential classification may decrease with physical modifications to the dam or by eliminating downstream infrastructure.

Sudden failure of High Hazard dams could result in one of the following outcomes, depending on environmental conditions.

- Loss of human life.
- All items listed below for failure of Significant Hazard potential dams.

Sudden failures of Significant Hazard dams could result in at least one of the following conditions:

- Disruption of a public water supply or wastewater treatment facility, release of health hazardous industrial or commercial waste, or other health hazards.
- Flooding of residential, commercial, industrial, or publicly owned structures.
- Flooding of high-value property.
- Damage or disruption to major roads including, but not limited to, interstate and state highways and the only access to residential or other critical areas such as hospitals, nursing homes, or correction facilities as determined by the chief.
- Damage or disruption to railroads or public utilities.
- Damage to downstream dams or levees. Damage to dams or levees can include, but is not limited to, overtopping of the structure. At the request of the dam owner, the chief may exempt dams from the criterion of this paragraph if the dam owner owns the potential affected property.
- Damage or disruption to local roads including, but not limited to, roads not otherwise listed as major roads.
- Damage to agricultural crops and livestock.

Sudden failures of Low Hazard dams could result in property losses restricted mainly to the dam and rural lands, and the loss of human life is not probable.

History

There have been no reported dam failures in Perry County. However, dam failures are not new to the State of Ohio, and the potential for a disaster grows as dams age.

Probability

Dam failures are unlikely but not impossible. All dams, especially High and Significant hazard potential dams, should have an Emergency Action Plan (EAP) in place. In addition, aging dam infrastructure coupled with climate change could result in more frequent dam failures. The Climate Change section in Future Trends discusses climate change further.

Vulnerability Assessment

Infrastructure Impact

Failures of High or Significant hazard potential dams could flood roadways, including major routes and local roads. Utility infrastructure (wastewater, drinking water, and commercial and industrial waste lines) may be disrupted or destroyed.

Population Impact

The local population could be impacted by loss of utilities, including the local water supply. Health hazards may also be released into the flood waters during a dam failure which may cause indirect harm to the local population. The local population could be impacted economically as well.

For social vulnerability, dam failure is not in the National Risk Index as it is not a natural disaster. However, natural disasters like flooding can occur due to or as a result of dam failure. The risk index for flooding in Perry County is 8.5 ("relatively low"), as such the risk for dam failure would also be relatively low. People that are most vulnerable to dam failure are those who live within the dam inundation areas. The index indicates an expected annual loss of $583,405 due to flood events with 1.7 events occurring per year.

Property Damage

At least one residential or commercial property is likely to face structural collapse during a High or Significant hazard potential dam failure. Dam failure has the potential to damage high value properties. Residential, commercial, industrial, and/or high value properties may be damaged by a High or Significant hazard potential dam failure, as well as publicly owned properties. Properties that are owned by the dam owner may be exempt from the property damage calculation.

Loss of Life

Loss of life is probable during a High Hazard potential dam failure. Loss of life during a Significant or Low hazard potential dam failure is not expected.

Economic Losses

Economic losses can include damages from flooding crops, flooding livestock, damaged goods, and the flooding of vital roadways.

Emergency Action Plans (EAPs) have been completed for some of the dams in the County (**Table 4.1.1**); however, the data is subjected to agreements where it cannot be published publicly. The Ohio Department of Natural Resources (ODNR) holds record of these EAPs.

Future Trends

Land Use and Development Trends

Development that has occurred in areas that will flood after a dam failure should be prepared for rapid flooding. Land use plans can limit development in these areas to prevent the increase of a dam hazard potential. To better understand where development should be limited, dam failure inundation maps should be completed for as many dams as possible.

Climate Change

Climate change may increase the frequency and/or the severity of the impacts from a dam failure event. Climate change is having an uneven effect on precipitation (rain and snow) in the U.S. – some areas are experiencing increased precipitation and flooding, while others suffer from drought. If Perry County experiences effects of climate change related to heavy rainfall, more frequent and severe flooding could occur, which could lead to or be caused by dam failure. Aging dam infrastructure coupled with climate change could result in more frequent dam failures. According to the 2018

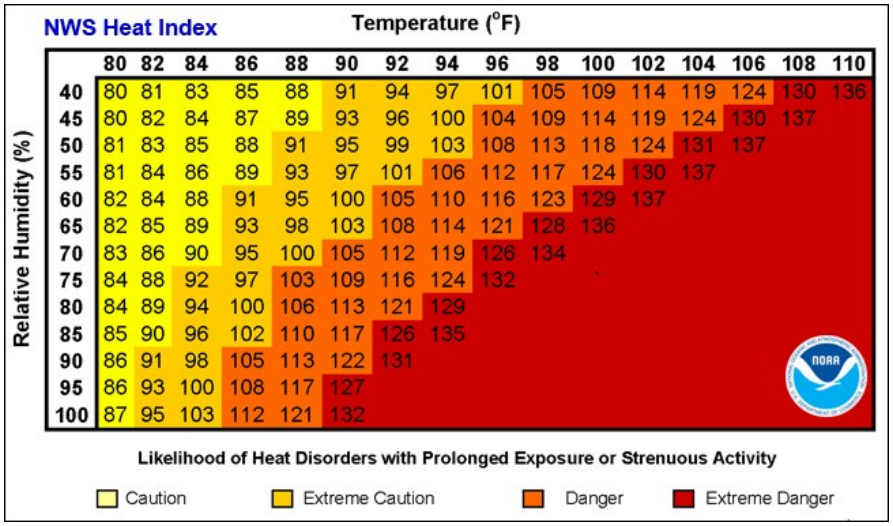
National Climate Assessment, dams and levees can fail after moderate or extreme rainfall. As precipitation frequency and intensity increase with climate change, the probability and severity of dam failure may increase as well, especially if this infrastructure is not maintained, upgraded, or, if necessary, redesigned.

4.2 Drought & Extreme Heat

Description

According to the Federal Emergency Management Agency (FEMA), extreme heat is a period of high heat and humidity with temperatures above 90 degrees for at least two to three days. In extreme heat the human body works extra hard to maintain a normal temperature, which can lead to death. Extreme heat is responsible for the highest number of annual deaths among all weather-related hazards. Humid conditions, which add to the discomfort of high temperatures, occur when a high-pressure weather system traps hazy, moist air near the ground. Extreme heat may also contribute to the formation of a drought if moisture and precipitation are lacking. The National Weather Service's Heat Index Chart is provided in **Figure 4.2.1**.

Figure 4.2.1: Heat Index Chart (Source: National Weather Service)



Extreme heat events are often accompanied by drought conditions when the events are prolonged. A drought is a shortage in precipitation over an extended period of time. Droughts are common throughout all climatic zones and can range in length from a couple weeks to multiple years or decades in some areas. In 1999, Perry County experienced its longest drought, which lasted four months.

According to the National Oceanic and Atmospheric Administration (NOAA), there are three common types of droughts: Meteorological, Agricultural, and Hydrological. Meteorological drought severity is calculated by the amount of the rainfall deficit (compared to annual averages) and the length of the dry period. Agricultural drought is based on the effects to agriculture by factors such as rainfall and soil water deficits or diminished groundwater/reservoir levels needed for irrigation. Hydrological drought is based on the effects of rainfall shortages on the water supply, such as stream flow, reservoir and lake levels, and groundwater table decline.

Location

Drought and extreme heat are countywide hazards that can affect all locations and jurisdictions in Perry County. More specifically, these hazards typically occur at a regional scale. Droughts most commonly occur in Ohio from spring through autumn; however, they may occur at any time throughout the year.

Extent

Due to the regional nature of droughts and extreme heat events, effects may be noticed throughout the County in both the urbanized and rural areas. All jurisdictions within the County may be affected in

a single drought event. In Perry County, droughts are often linked to prolonged periods of above average temperatures and little to no precipitation.

Initial effects of drought can be noticed within a short period, as soil may dry out and plants may wither and die. When drought conditions persist over several weeks, months, or years, effects may be more pronounced with reductions in water levels of wells, lakes, reservoirs, streams, and rivers. Water supply issues for agriculture, commercial/industrial activities, and private consumption may arise if drought conditions persist over a long term.

The extent of the drought is determined by the Palmer Drought Severity Index (PDSI), shown below in **Table 4.2.2**. In this way, the Index can be utilized as a tool to help define disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential for forest fires. The Palmer Drought Severity Index depicts prolonged (in months or years) abnormal dryness or wetness and is slow to respond, changing little from week to week. It also reflects long-term moisture runoff, recharge, and deep percolation, as well as evapotranspiration.

Table 4.2.2: Palmer Drought Severity Index Classifications and Federal Drought Categories

Palmer Drought Severity Index	Category	Description
-1.0 to -1.9	D0	Abnormally Dry
-2.0 to -2.9	D1	Moderate Drought
-3.0 to -3.9	D2	Severe Drought
-4.0 to -4.9	D3	Extreme Drought
-5.0 or less	D4	Exceptional Drought

The Palmer Drought Severity Index is a standardized index with values typically falling between -4.0 and +4.0, although extreme conditions can be greater in value (includes federal drought categories). Negative values indicate drought conditions while positive values represent wet conditions. Values around zero represent near normal conditions.

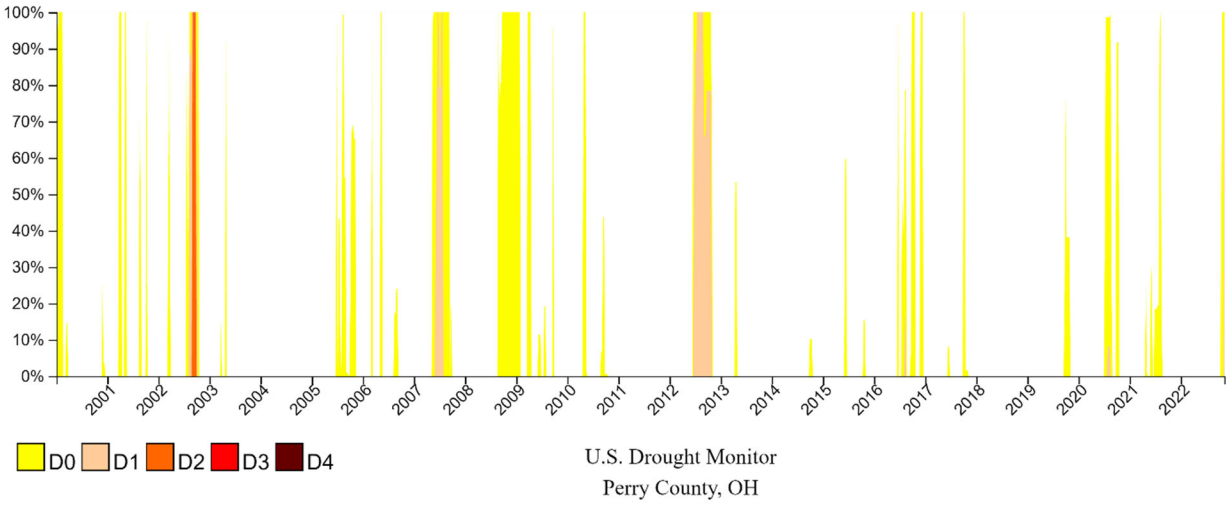
Abnormally dry (D0) and moderate drought (D1) conditions occur frequently and typically do not adversely affect agricultural activities unless conditions are sustained in nature. Severe and extreme drought (D2 & D3, respectively) conditions begin to impact agricultural crops, leading to potential economic losses. These more severe events also may impact drinking water resources, especially if the source is a lake or reservoir. Sustained severe droughts may alter the ability of the soil to absorb water, leading to potential flash flooding when rainfall resumes.

History

Drought

U.S. Drought Monitor (USDM) describes severe drought as a time when crops suffer, the numbers of wildfires are high and the soil is dry, cracked and pulling away from foundations. In an extreme drought, yields are minimal, livestock are stressed, and lawns go dormant. Data shows that Perry County has experienced severe drought once since 2000; beginning September 3, 2002 and ending September 30, 2002, Perry County experienced a severe drought. Data shows that Perry County has experienced several moderate droughts since 2000. **Figure 4.2.3** depicts the drought monitor history for Perry County from 2000 through 2021. The most extensive periods of moderate drought specific to Perry County are provided in **Table 4.2.4** (Source: U.S. Drought Monitor).

Figure 4.2.3: Drought in Perry County from 2000 to 2021



D0 = Abnormally Dry, D1 = Moderate Drought, D2 = Severe Drought, D3 = Extreme Drought, D4= Exceptional Drought

Table 4.2.4: Periods of Moderate Drought in Perry County, Ohio, 2000-2021

Start Date	End Date	# of Consecutive Weeks
6/19/2007	7/30/2007	4
7/3/2012	9/3/2012	9

- **Severe Drought (D2), September 2002:** Dry conditions began in August and peaked in September 2002. Combined with extreme heat, substantial crop loss was experienced throughout the County. Rainfall and cooler temperatures damped the drought by the end of the month.

Extreme Heat

There have been 17 heat or excessive heat events in Perry County since January 1, 1995. These events were not responsible for any deaths or injuries. Described below are the three most recent events. All events are listed individually in **Appendix A**.

- **Heat Event, July 28 through July 29, 2011:** A surge of heat and humidity affected Perry County on July 28 and July 29, 2011. Temperatures peaked from the lower to mid-90s while the heat index reached between 100- and 105-degrees Fahrenheit.
- **Heat Event, July 20 through July 22, 2011:** High heat and humidity affected Perry County from Wednesday, July 20 through Friday, July 22, 2011. Daily temperatures in the 90s and nightly temperatures between 70- and 75-degrees Fahrenheit were observed. The heat index reached around 105 degrees Fahrenheit. Scattered thunderstorms alleviated the heat on July 22, but humidity remained high.
- **Excessive Heat Event, April 16, 2002:** Unseasonably warm temperatures affected Perry County on April 16, 2022. Afternoon temperatures reached in the mid-80s to around 90-degrees Fahrenheit.

Probability

Perry County has experienced droughts in the past, and the potential exists for the County to experience droughts in the future. Seasons of drought and extreme heat have the potential to occur during any particular year when necessary conditions are met, and according to the Midwest Chapter of the Fourth National Climate Assessment, the frequency of major heat waves in the Midwest has increased over the last six decades. In addition, it is predicted that as the climate gets warmer, there will be an associated increase in the number and severity of summer droughts and extreme heat events. The Climate Change section in Future Trends discusses climate change further.

Vulnerability Assessment

Drought projections suggest that some regions of the U.S. will become drier and that most will have more extreme variations in precipitation. Even if current drought patterns remained unchanged, warmer temperatures will amplify drought effects. Drought and warmer temperatures may increase risks of large-scale insect outbreaks and wildfires, in addition to accelerating tree and shrub death, changing habitats and ecosystems in favor of drought-tolerant species. Forest and rangeland managers can mitigate some of these impacts and build resiliency in forests through appropriate management actions. Perry County is home to the largest national forest in Ohio, Wayne National Forest.

Infrastructure Impact

Drought does not have a significant impact on infrastructure or structures. The greatest impacts of drought are on agricultural interests, as crops may fail, and livestock may not have sufficient water resources.

Population Impact

Although there is no history of population impact, extreme heat can have an impact on the population of the entire county. Groups who live in areas with minimal tree cover or urban areas may experience higher temperatures relative to outlying areas due to the urban heat island affects. Groups that particularly vulnerable to extreme heat, such as older adults and people with chronic health conditions may experience illness or injury, such as heat cramps, heat exhaustion, and heat stroke.

For social vulnerability, the National Risk Index does not have a rating for drought, but it does have a rating for "Heat Wave" for a score of 5.13 ("relatively low"), due to the history of minimal population impacts in the County. The index indicates an expected annual loss of $24,605 due to heat wave events with 0.3 events occurring per year.

Property Damage

During extreme heat events, utility failure may occur due to overuse of electricity for cooling. Property damage is a possibility due to extreme heat. Vehicles are at risk of breaking down from excessive heat, as heat can reduce battery life and reduce the efficiency of the cooling system resulting in overheated engines. Extreme heat can also cause a home to dry out and prematurely age. Excessive heat in combination with lack of rainfall (drought) can cause soil to shrink and crack, which puts stress on a home's foundation that can be costly to fix. Drought and warmer temperatures may increase risks of large-scale insect outbreaks and wildfires. Drought and warmer temperatures may also accelerate tree and shrub death, changing habitats and ecosystems in favor of drought-tolerant species.

Loss of Life

Loss of life is possible during extreme heat events, especially for young children, the elderly, and individuals with respiratory conditions.

Economic Losses

Economic losses are a threat from extreme heat and droughts to Perry County. Crops and livestock may be compromised during prolonged extreme heat events. Human productivity can also be affected when working conditions become too hot. According to the 2021 Census of Agriculture developed by the U.S. Department of Agriculture (USDA), top crop items based on acreage for Perry County include soybeans for beans, forage-land used for all hay and haylage, and corn for grain. Based on data from the U.S. Department of Agriculture, Perry County's crop yields may have been impacted from previous drought events. Soybean crop yields have increased between the 2012 and 2017 Census of Agriculture, even though the amount of land used for agriculture has declined. Acreage for hay increased, yet crop yield declined, and both corn yields and acreage declined between the 2017 Census of Agriculture (**Figure 4.2.5**).

Table 4.2.5: Perry County Crop Yields 2012 - 2017

Commodity	2012		2017	
	Acres	Crop Yield	Acres	Crop Yield
Soybeans	20,940	841,376 bushels	17,752	887,094 bushels
Hay	15,286	31,682 tons	15,731	28,772 tons
Corn	23,048	2,564,315 bushels	17,325	1,725,142 bushels

Future Trends

Land Use and Development Trends

Drought and extreme heat are most likely to impact agriculture land uses and land uses that house or serve vulnerable populations, such as schools, daycares, hospitals, and nursing homes.

Climate Change

Climate change may increase the frequency and/or the severity of the impacts from drought and extreme heat events. As the climate gets warmer, there will be an associated increase in the number and severity of droughts and extreme heat events. Warmer global temperatures may be associated with a prolonged growing season, but this trend may also increase the risk of crop stress due to excessive heat and crop damage due to increased pests and disease. The longer growing season may help some crops, but crops like corn and soybean will be negatively affected by the severe heat in the summer, which will decrease these crops' yields. Additionally, in recent Ohio history, there has not been a recorded instance of excessive heat for more than two days, but climate change is expected to increase the occurrence and duration of heat waves in the coming decades.

4.3 Earthquake

Description

Earthquakes are sudden and rapid movements caused by the abrupt shifting of Earth's tectonic plates deep beneath the surface. These movements vary in length and may last from a few seconds to several minutes. In areas where tectonic plates collide often, earthquakes can be more common. Earthquakes occur along faults, which are zones of weakness in the upper crust where two blocks of rock can collide or slide against each other. Frictional resistance builds between the two blocks of crust on either side of the fault line before the blocks slip suddenly, releasing energy in the forms of seismic waves and heat. These waves are felt on the surface as earthquakes.

The seismicity, or seismic activity, of an area refers to the frequency, type, and size of earthquakes experienced over a period of time. Earthquakes are measured using observations from seismometers, which can transform ground motion (seismic waves) into computable data or into visual data, most commonly known as squiggly up-and-down lines on a paper, or seismogram. The Moment Magnitude Scale (MMS), which was developed in the 1970s, is the most common scale on which earthquakes larger than approximately 5.0 in magnitude are reported for the entire world. Earthquakes smaller than magnitude 5.0, which are more numerous, are reported by national seismological observatories and measured most commonly on the local magnitude scale – also referred to as the Richter Scale. These two scales are numerically similar over their range of validity. Earthquakes of magnitude 3.0 or lower are often almost imperceptible or weak, while earthquakes of magnitude 7.0 or greater can potentially cause serious damage over larger areas.

Damage from an earthquake also depends on the earthquake's depth in the Earth's crust. The shallower an earthquake's epicenter, the more damage to structures it will cause. Alternatively, an earthquake can also be measured by its intensity. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. The Modified Mercalli Intensity Scale (MMI) ranges in value from I to XII, in roman numerals (**Table 4.3.1**).

Earthquakes can happen anywhere without warning; they are low-probability, high-consequence events. Most major earthquakes in the U.S. have occurred along tectonic plate boundaries, which can be found in California, Alaska, Hawaii, Oregon, Washington, and Puerto Rico. In 1811, a major earthquake occurred in the Mississippi River Valley, which later revealed a large fault line in the Midwest U.S., called the New Madrid Seismic Zone. There have been recorded earthquakes throughout the U.S., and the Ohio River Valley has experienced several earthquakes exceeding the 3.0 magnitude within the last 25 years. Ohio and Perry County have numerous faults that may cause earthquakes (**Figure 4.3.2**).

Location

Earthquakes are countywide hazards and can affect all areas and jurisdictions within Perry County. According to the Ohio Department of Natural Resources (ODNR), Ohio is located on the periphery of the New Madrid Seismic Zone.

Extent

Earthquakes pose a risk to life and property depending on the severity. To monitor earthquakes, the State of Ohio and ODNR Division of Geological Survey coordinate a 20-station network (**Figure 4.3.3**) of seismograph stations throughout the state in order to continuously record earthquake activity. The Ohio Seismic Network (OhioSeis) stations are distributed across the state but are concentrated in the most seismically active areas or in areas that provide optimal conditions for detecting earthquakes. While the seismic network cannot predict earthquakes or provide an alert prior to an event, it can provide insight into earthquake risks in the state so that informed decisions about building and facility

design and construction, insurance coverage, and other planning decisions can be made by individuals, business and industry, and governmental agencies.

In the event of an earthquake, three seismometers are used to triangulate the location of the earthquake's epicenter. The WODO seismometer situated in northern Athens County, the FOXO in southern Athens County, and the Williamsport Station (P51A) seismometer situated in northern Ross County are the three OhioSeis Stations located in closest proximity to Perry County.

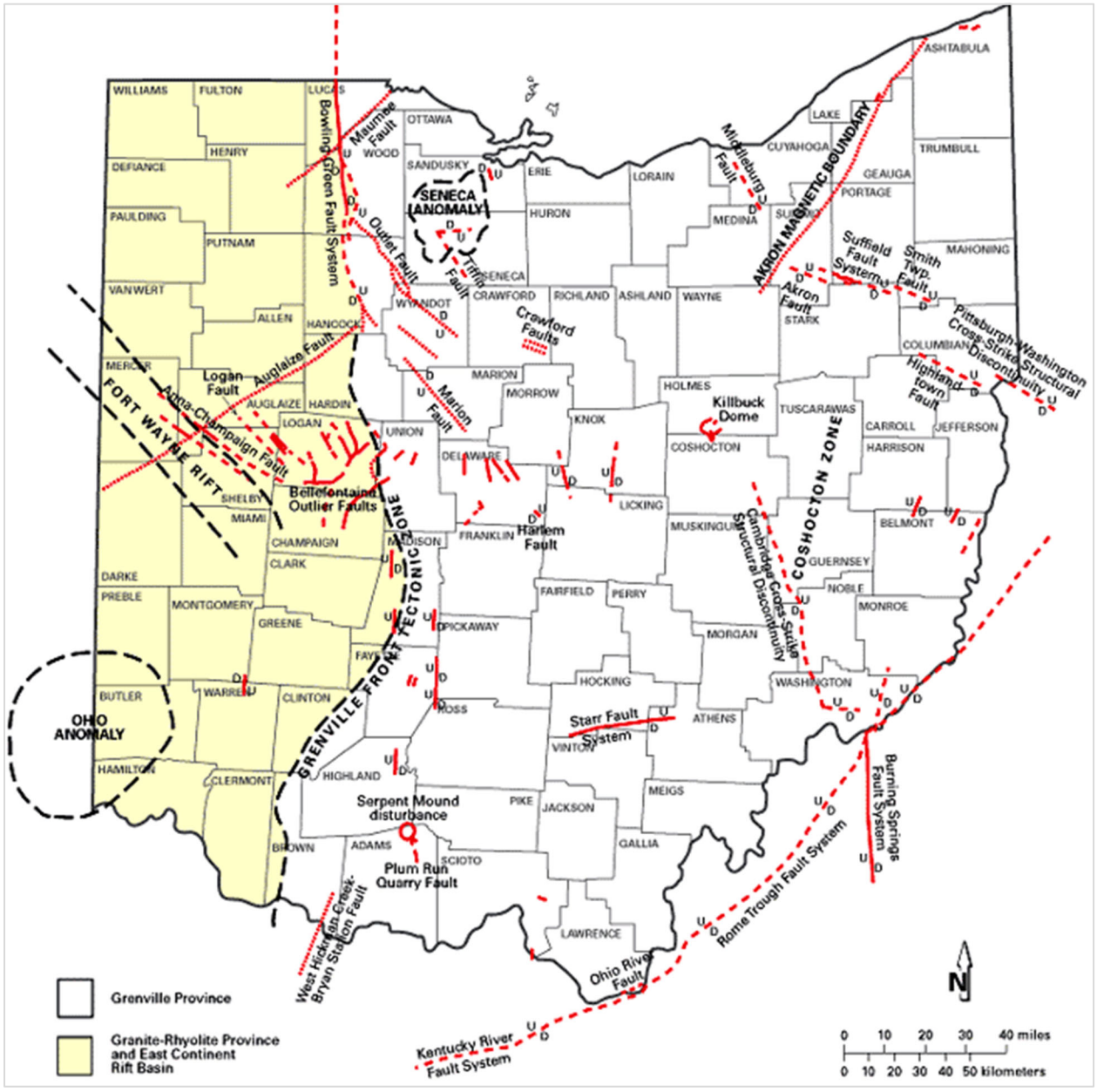
Earthquakes can yield a variety of different outcomes. With the ground shaking associated with earthquake events, buildings have a high potential to be impacted. If soil liquefaction, or the mixing of sand and soil with groundwater occurs, buildings can sink into the ground. Earthquakes also have the potential to rupture dams or levees along a river, resulting in flooding and even tsunamis (see Dam Failure section). Earthquakes can cause landslides or avalanches in high-risk areas and can cause mines to subside. Furthermore, earthquakes that break gas and power lines can result in fires.

Table 4.3.1: Modified Mercalli Intensity Scale

Modified Mercalli Intensity Scale		Magnitude (Richter Scale)
I	Detected only by sensitive instruments.	1.5
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing.	2
III	Felt noticeably indoors, but not always recognized as earthquake; standing autos rock slightly, vibrations like passing truck.	2.5
IV	Felt indoors by many, outdoors by few, at night some awaken; dishes, windows, doors disturbed; standing autos rock noticeably.	3
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects.	3.5
VI	Felt by all, many frightened and run outdoors, falling plaster and chimneys, damage small.	4
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of autos.	4.5
VIII	Panel walls thrown out of frames; walls, monuments, chimneys fall; sand and mud ejected; drivers of autos disturbed.	5
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken.	5.5
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides.	6
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent.	6.5
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up into air.	7 7.5 8

Source: ODNR

Figure 4.3.2 Map of Deep Structures in Ohio



Source: ODNR

Figure 4.3.3: Earthquake Seismometers in Ohio

Source: ODNR

History

The State of Ohio has experienced more than 300 earthquakes of 2.0 magnitude or greater since 1776, of which 15 earthquakes have caused minor-to-moderate damage. The largest historic earthquake in western Ohio was centered in Shelby County in 1937. This event was estimated to have had a magnitude of 5.4 on the Richter scale.

ODNR and the USGS maintain a record of earthquake events. Only one earthquake has been thought to originate in Perry County in the last ten years. Below are the most significant earthquake events that were within or have affected Perry County.

June 2, 2017: The most recent earthquake recorded in Perry County occurred in Harrison Township with a magnitude of 1.7.

March 8, 1937: An earthquake measuring 5.4 in magnitude was recorded in the town of Anna in Shelby County. In Anna, where most of the damage occurred, 69 chimneys toppled, foundations and plaster cracked, water wells were disturbed, and cemetery monuments were rotated. The earthquake caused building damage as far away as Fort Wayne, Indiana, and was reportedly felt in Indiana, Illinois, Kentucky, Michigan, Missouri, West Virginia, Pennsylvania, and Southern Canada.

***1811-1812*;** There were a series of earthquakes in New Madrid, Missouri which were the largest earthquakes in historic times in the continental United States. Half the town of New Madrid was destroyed. The Mississippi River changed its course, creating numerous geographic exclaves, including Kentucky Bend. Some sections of the Mississippi River appeared to run backward for a short time. Church bells were reported to ring as far as Boston and sidewalks were reported cracked and broken in Washington, D.C.

Probability

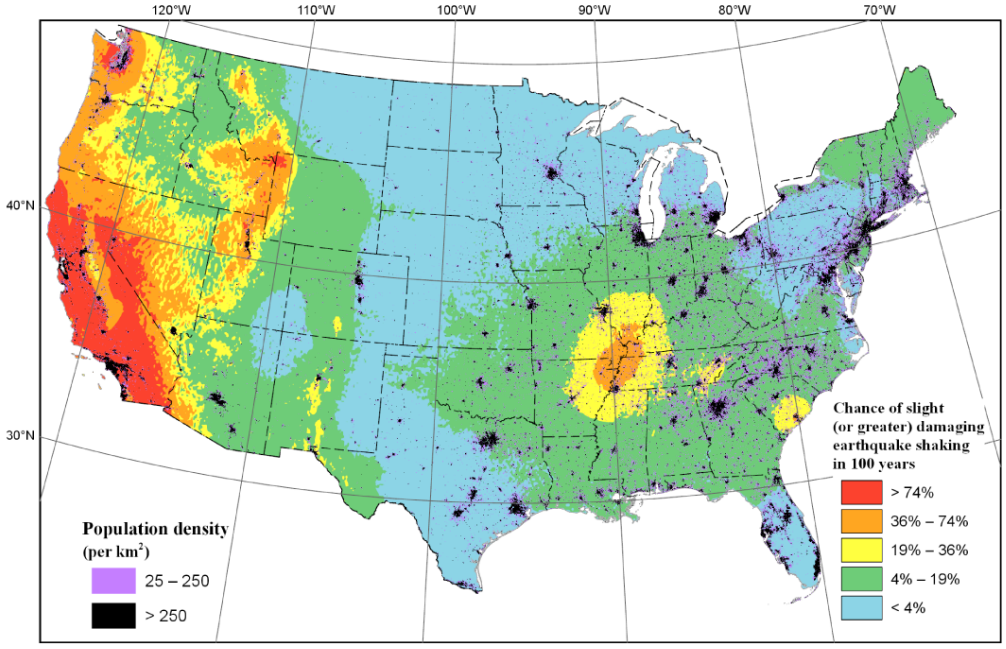
The USGS uses fault location and earthquake frequency to create both long-term and short-term probabilistic seismic hazard forecasts. The 2023 USGS National Seismic Hazard Model by the United States Geological Survey estimates that there is a less than four to nineteen percent chance of slight or greater-damage ground shaking for Perry County in the next 100 years (**Figure 4.3.4**).

The USGS also determined the long-term hazard of earthquakes for the U.S. (**Figure 4.3.5**). The measurement used in this estimation is based on the chance of ground shaking – peak ground acceleration – as a percentage of the natural force of gravity over time. This map identifies that most of Perry County has the probability of experiencing an earthquake between two and four times in 10,000 years.

The USGS also prepared national seismic hazard maps (NSHMP) for the U.S. These time-independent maps are shown for 2.0-percent and 10.0-percent probability of earthquake ground-shaking exceedance levels at specified probabilities over a 50-year time period at several hundred thousand sites across the U.S. The map (**Figure 4.3.6)** shows the 2.0-percent probability of ground acceleration (PGA) occurring in 50 years in Ohio, and Perry County is located within the 4.0- to 8.0-percent range, which is the lowest range in Ohio.

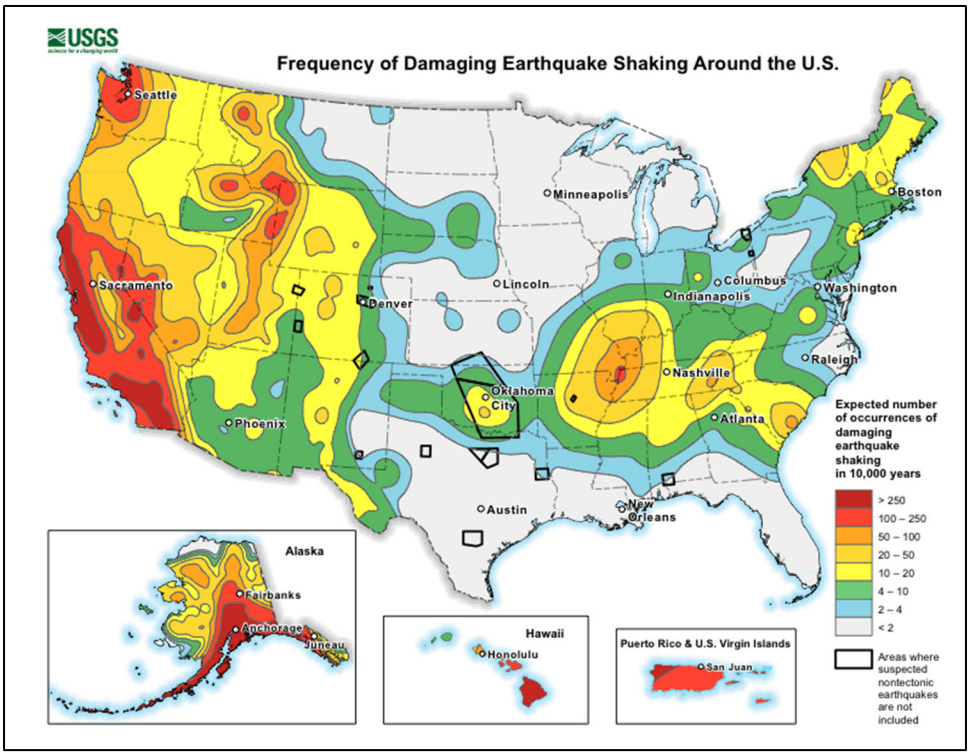
Furthermore, the ODNR indicates that the brief historic record of Ohio earthquakes suggests a risk of moderately damaging earthquakes in the western, northeastern, and southeastern parts of Ohio.

Figure 4.3.4: Chance of Slight or Greater Damaging Earthquake Shaking in 100 years



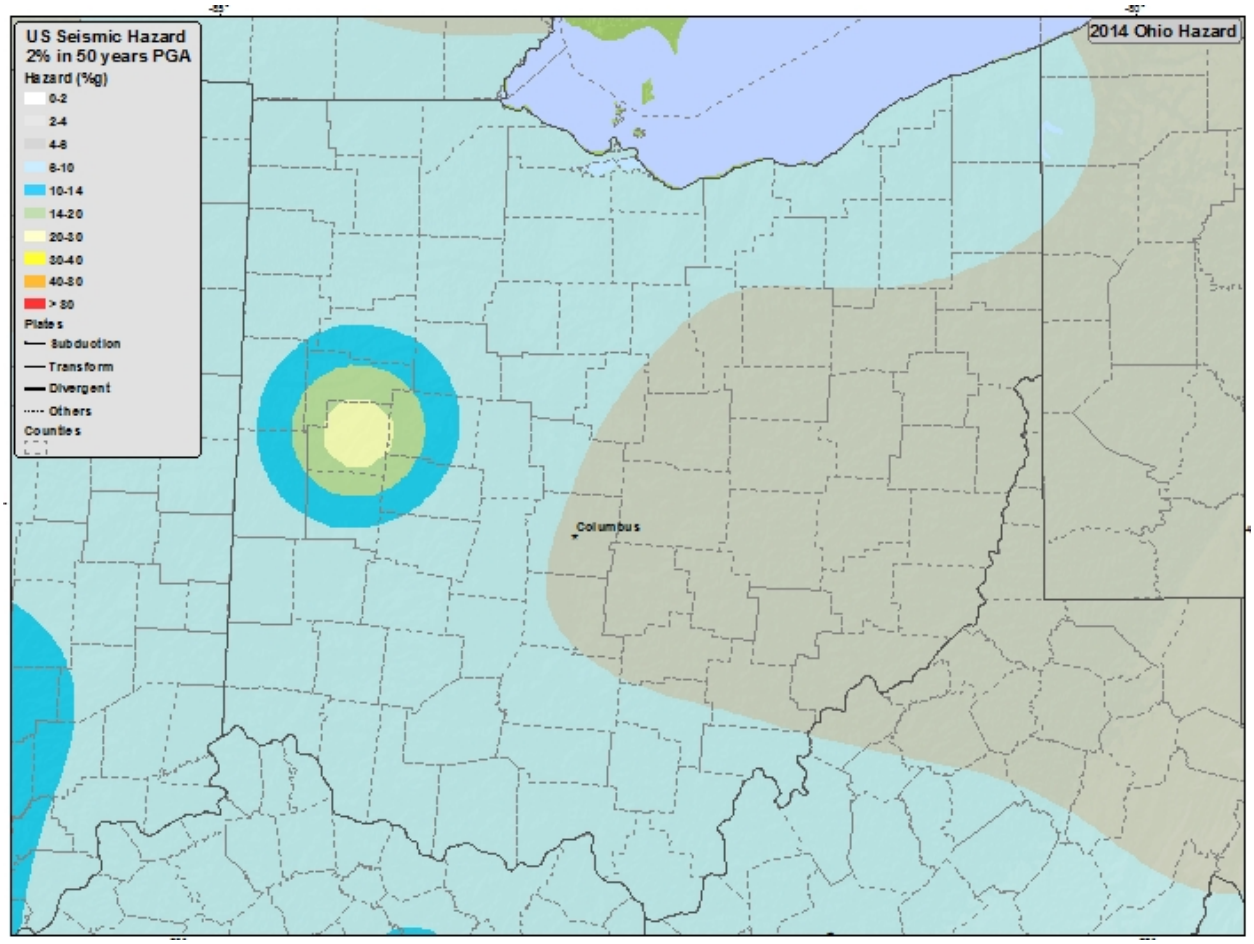
Source: USGS

Figure 4.3.5: Probability of Earthquakes in the U.S.



Source: USGS

Figure 4.3.6: 2014 Seismic Hazard Map of Ohio



Source: USGS

Vulnerability Assessment

Infrastructure Impact

Since there are no recent earthquake events with recorded damages, exact damages to infrastructure are unknown. Buildings, roadways, and utilities, such as gas and power lines have the potential to be affected. Since the probability of an earthquake occurring in Perry County is less than one percent, there is a low risk of impact to infrastructure as a result. However, FEMA's Hazus Earthquake model estimated the potential impacts that could occur in Perry County if a 5-magnitude earthquake occurred. Tables 4.3.7 to 4.3.10 include the estimated impact quantities.

Population Impact

There is a low risk of earthquakes occurring in Perry County. Accordingly, there is low risk of impact to the population. If an earthquake would occur within the County, the population could be impacted by loss of homes, loss of utilities, as well as potential reduction of air quality from dust. Minor earthquakes could briefly interrupt daily activities but would otherwise have minimal impact. However, FEMA's Hazus Earthquake model estimated the potential impacts that could occur in Perry County if a 5-magnitude earthquake occurred. Tables 4.3.7 to 4.3.10 include the estimated impact quantities.

For social vulnerability, the National Risk Index indicates that the population in Perry County has a score of 1.53 ("very low"). Earthquakes are unlikely to occur in Perry County; therefore, the population

is unlikely to be affected by earthquakes. Socially vulnerable populations may be more affected by earthquakes if they live in older housing units or apartment complexes that do not have adequate earthquake-resilient infrastructure. The index indicates an expected annual loss of $20,294 due to earthquakes with a less than 0.016 percent chance of an event occurring per year.

Property Damage

With any earthquake event, there is potential for property damage to occur, as ground shaking can lead to damaged buildings. Due to the non-site-specific nature of this hazard, all structures within Perry County have potential impacts from earthquakes. FEMA's Hazus Earthquake model estimated the potential impacts that could occur in Perry County if a 5-magnitude earthquake occurred. **Tables 4.3.7 to 4.3.10** include the estimated impact quantities.

Loss of Life

Perry County has no recorded earthquake events that have resulted in loss of life; however, in the event that an earthquake occurs, there is potential for loss of life. If there are more people and structures in an earthquake-prone location, there is likely to be more of an impact. Loss of life can be mitigated by educating the public on proper protection in the event of an earthquake. For example, the USGS has resources on preparing for an earthquake hazard (USGS Resources for Earthquake Preparedness), as well as the Ready Campaign (Ready.gov) which is a national public service campaign designed to educate and empower the American people to prepare for, respond to, and mitigate disasters. These resources provide materials for how to educate the public on earthquake preparedness.

Economic Losses

Earthquakes have the potential to damage buildings and infrastructure, resulting in economic burden of clean up and repairs. Compared with other hazards, earthquakes are relatively unlikely to occur in Perry County, meaning there is low risk of economic loss as a result of an earthquake.

However, according to FEMA's Hazus Earthquake model (**see Appendix E**), if a 5-magnitude earthquake were to occur in Perry County, the total economic losses are estimated at $838.54 million, including building and lifeline-related losses. The total building-related losses were $628.31 million, and 18 percent of the estimated losses were related to the business interruption of the region. The largest loss was sustained by residences, which made up over 38 percent of the total loss. Hazus estimates that about 3,591 buildings will be at least moderately damaged, which is over 21 percent of existing buildings in the region, and there will be an estimated 232 buildings that will be damaged beyond repair. **Table 4.3.7** shows the potential building-related economic impacts.

Table 4.3.7: Structure Vulnerability from Earthquakes

Occupancy	$ Million	Percentage
Single Family	$186.33	30%
Other Residential	$49.73	8%
Commercial	$178.11	28%
Industrial	$62.42	10%
Others	$151.71	24%
Total	**$628.31**	**100%**

Additionally, Hazus estimated the potential damage to essential critical facilities, transportation lifelines, and utility lifelines, as shown in **Tables 4.3.8, 4.3.9, and 4.3.10**, respectively.

Table 4.3.8: Potential Damage to Essential Critical Facilities from Earthquakes

Classification	Total Facilities	Number Damaged	Percent Damaged
Hospitals	0	0	0%
Schools	18	7	39%
EOCs	1	0	0%
Police Stations	9	7	78%
Fire Stations	11	9	82%
Totals	**39**	**23**	**59%**

Table 4.3.9: Potential Damage to Transportation Lifelines from Earthquakes

System	Inventory Value ($ Million)	Economic Loss ($ Million)	Loss Percentage
Highways & Bridges	$526.34	$0.67	0.13%
Railways & Bridges	$218.69	$0.87	0.40%
Bus	$0.00	$0.00	0.00%
Ferries & Ports	$0.00	$0.00	0.00%
Airports	$8.58	$2.30	26.81%
Totals	**$753.61**	**$3.84**	**0.51%**

Table 4.3.10: Potential Damage to Utility Lifelines from Earthquakes

System	Inventory Value ($ Million)	Economic Loss ($ Million)	Loss Percentage
Potable Water Lines	$32.38	$0.74	2.30%
Wastewater Facilities	$1,254.22	$182.77	14.57%
Natural Gas Pipelines	$729.41	$20.02	2.74%
Crude & Refine Oil	$0.00	$0.00	0.00%
Electric Power Facilities	$17.06	$2.71	15.90%
Communications Facilities	$0.42	$0.15	34.67%
Totals	**$2,033.49**	**$206.38**	**10.15%**

Future Trends

Land Use and Development Trends

Because incidence and likelihood of earthquakes is low in Perry County, all communities are at low risk. By planning for and managing land use to accomplish social, ecological, and economic sustainability, communities can reduce the negative impacts caused by earthquakes. This can be

accomplished through comprehensive land use plans and supportive federal and state policies. As such, enforcement of stricter building codes that ensure that all new developments are built to code can reduce risk. Infrastructure (constructed facilities and lifelines) should be designed and constructed to resist earthquake shaking following current state-of-the-art engineering and technology practices.

Climate Change

Climate change has no known effect on the probability or severity of earthquakes.

4.4 Flood

Description

FEMA describes a flood as "a general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland or tidal waters [and] the unusual and rapid accumulation or runoff of surface waters from any source." Floods are typically riverine, coastal, or shallow. Flash floods are floods that occur quickly, even occurring without visible signs of precipitation.

Urban flooding is a type of flood that can occur in areas of development that have a high level of impervious surfaces such as concrete. The level of development and the level of stormwater management practices impact the severity of urban flooding.

Common flood-related terms include:

- **100-Year Flood:** A flood that has a one percent chance to occur each year. The 100-year floodplain can be seen in **Figure 4.4.1: Flood Hazard Map**. The elevation of the water from the 100-year flood is called the Base Flood. Mitigation strategies should be based on the base flood elevation.
- **Floodplain:** An area that has the potential to flood from any source.
- **Floodway:** Sometimes referred to as a regulatory floodway. FEMA defines a floodway as "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the Base Flood without cumulatively increasing the water surface elevation more than a designated height."
- **Flash flood:** Flash floods are typically caused by heavy rainfall over a short period of time. These floods are particularly dangerous because they can occur in minutes and can sometimes occur even without rainfall such as when an ice jam breaks or dissolves. Areas impacted by wildfires are particularly susceptible to flash floods. Flash floods can occur just about anywhere with enough rainfall and are not restricted to the 100-year floodplain. Development/restriction to drainage or increased impervious surfaces can contribute to flash flood frequency.

Location

Flooding can occur throughout Perry County. Flash flooding is more likely to occur in developed areas or along lakes and rivers. **Figure 4.4.1** shows the location of the 100-year floodplain. Floods can and do occur outside the FEMA-defined 100-year flood zone. Sometimes very small watersheds are not included in the FEMA analyses, but floods can occur in these smaller watersheds, as well.

Extent

Perry County currently has 53 flood insurance maps (see **Appendix F**). The most recent update is from August 2017.

Perry County and nine communities within the County participate in the NFIP. These communities include the villages of Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, New Straitsville, Rendville, and Shawnee. The remaining jurisdictions fall outside of the FEMA- defined 100-year floodplain.

Figure 4.4.1: 100-Year Flood Zone in Perry County, Ohio

There are eight repetitive loss properties and one severe repetitive loss property in or near Perry County, Ohio, detailed in **Table 4.4.2**. FEMA defines a repetitive loss property as an insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period since 1978. FEMA defines a severe repetitive loss property as a single family property that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property. The County has had severe repetitive loss properties in the Village of Corning.

Table 4.4.2: Repetitive Loss Properties in Perry County, Ohio

Community Name	Occupancy	Total Losses	Total Paid	Average Paid per Loss	Severe Repetitive Loss
Village of Corning	Residential	5	$113,788	$22,758	Yes
Village of Corning	Residential	2	$15,922	$7,961	No
Village of Corning	Residential	2	$144,374	$72,187	No
Village of Corning	Residential	2	$16,975	$8,488	No
Village of Glenford	Residential	2	$24,984	$12,492	No
Morgan County	Residential	2	$4,966	$2,483	No
Morgan County	Residential	2	$8,813	$4,406	No
Village of New Lexington	Residential	2	$44,436	$22,218	No
Perry County	Residential	2	$14,899	$7,450	No

History

There have been 50 floods or flash floods in Perry County between January 1996 and March 2022. These events have caused $6,367,000 in property damages. Described below are the three most damaging events by property damage over the past two decades.

Countywide Flooding on June 28, 1998:

During a 96-hour period from June 26-30, 1998, a series of storms dumped 10 inches of train or more across 23 counties in central, east central, and southeastern Ohio. The hardest hit streams include Sunday Creek and its tributaries in southeastern Perry County.

According to the U.S. Geological Survey (USGS), Little Rush Creek and Sunday Creek flooded 200 homes and businesses in the villages of New Lexington and Corning. Flash flooding peaked on June 28. Approximately two deaths were reported from the incident. This event caused $2,000,000 in property damage.

Countywide flooding on September 8, 2004:

Over the course of 30 hours, remnants of Hurricane Frances combined with a stationary frontal boundary resulted in 4 to 7 inches of rain across Perry and Morgan counties. Within Perry County, New Lexington received 7.5 inches of rain. Previously dry conditions resulted flooding in streets and low-lying areas. Countywide, 50 homes had major damage and 3 homes were destroyed. There were no deaths or injuries. This event caused $2,000,000 in property damage.

Flooding in Southern Perry County on May 18, 2004:

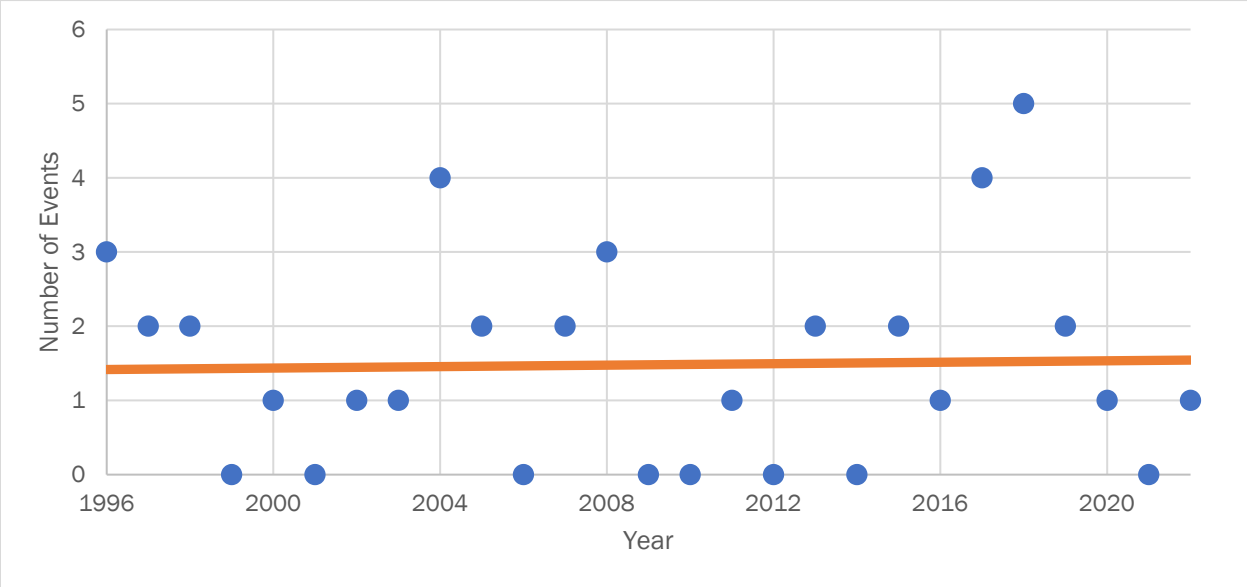
Repetitive showers and thunderstorms produced heavy rain and flooding in Perry and Morgan counties during the late hours of Tuesday, May 18, 2004 after developing along a frontal boundary. In 5 hours, 3 to 4 inches of rain fell near the Village of Shawnee and the Village of Corning.

Flooding occurred along Monday and Sunday Creeks. Homes and business in the Village of Corning were flooding, displacing 70 residents. In total, 3 homes were destroyed, 20 homes had major damage, 35 homes had minor damage, and 3 businesses had minor damage. There were no deaths or injuries. This event caused $800,000 in property damage.

Probability

Figure 4.4.3 shows the trend of flood events over time since January 1998, as this is the earliest year with complete data from the NCEI. Between 1996 and 2022, Perry County experienced 50 flooding events, including both floods and flash floods, which equals approximately two floods or flash floods per year. The trend of flood occurrences per year has not increased significantly over time, which may suggest that Perry County can expect a similar frequency of flood events each year. In addition, according to the State of Ohio Hazard Mitigation Plan (SOHMP), increased precipitation and variability by climate change will also increase the likelihood and intensity of flood events. The Climate Change section in Future Trends discusses climate change further.

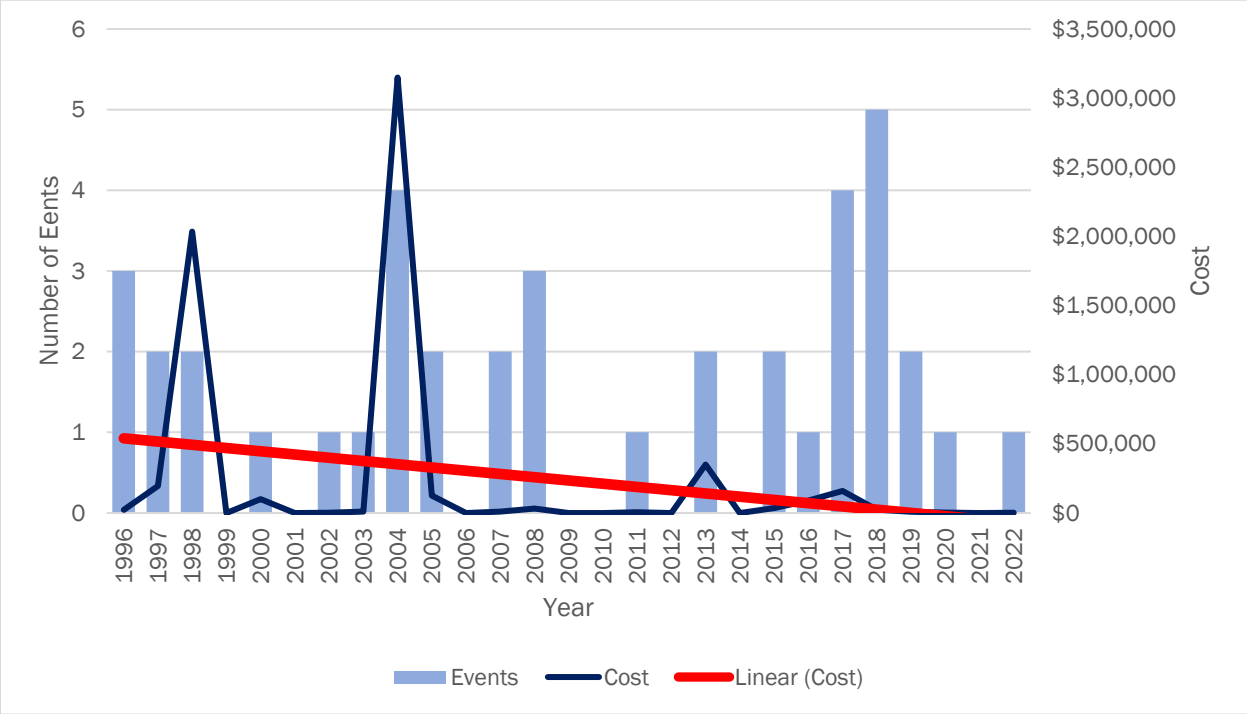
Figure 4.4.3 Probability of Flooding



Data Source: NOAA

Figure 4.4.4 shows both the trend of flood events and affiliated cost over time since January 1998. Between 1996 and 2021, floods or flash flood evens have resulted in $6,367,000 in property damage (Source: NCEI). Annually, this amounts to approximately $254,680 in property damages. The trendline (show in red) indicates a gradual decline in property damage costs; however, the trendline may be skewed due to the two significant 2004 floods.

Figure 4.4.4 Probability and Cost of Flooding



Data Source: NOAA

Vulnerability Assessment

Infrastructure Impact

Floods can impact roadways, including interstates and state routes, by blocking them due to high water, filling them with debris or washing away the road altogether.

Population Impact

Floods and flash floods have caused damages to occupied homes and businesses in the past. During flood events, shelter and temporary housing may need to be provided to those impacted by flooding.

For social vulnerability, in the National Risk Index, "riverine flooding" had a score of 8.50 ("relatively low"). People that are most vulnerable to flooding are those who live within the 100-year floodplain in structures that are not elevated about the base flood elevation. The index indicates an expected annual loss of $583,405 due to flood events with 1.7 events occurring per year.

Property Damage

Property damage is likely during floods to both residential and non-residential properties. According to FEMA's Hazus Flood model (**see Appendix E**), the value of all properties exposed to 100-year floods is $1.8 million, or 32.1 percent of all properties in the County, as detailed in **Table 4.4.5**.

Table 4.4.5 Structure Vulnerability from Flooding

Occupancy	County Exposure ($1000)	100-Year Floodplain Exposure ($1000)	Percentage Exposure in 100-Year Floodplain
Residential	$3,553,329	$1,028,904	29.0%
Commercial	$835,627	$295,152	35.3%
Industrial	$323,227	$206,979	64.0%
Agricultural	$272,065	$49,485	18.2%
Religion	$178,529	$93,239	52.2%
Government	$91,489	$16,922	18.5%
Education	$352,062	$111,504	31.7%
Total	**$5,606,328**	**$1,802,185**	**32.1%**

Additionally, Hazus estimated the potential damage to essential critical facilities. No impacts were estimated to occur, as shown in **Table 4.4.6**.

Table 4.4.6: Potential Damage to Essential Critical Facilities from Flooding

Classification	Total Facilities	Number Damaged	Percent Damaged
Hospitals	0	0	0%
Schools	18	0	0%
EOCs	1	0	0%
Police Stations	9	0	0%
Fire Stations	11	0	0%
Totals	**39**	**0**	**0%**

Loss of Life

There are no reported deaths from flood events in Perry County. However, loss of life has occurred in other counties during the same flood events. Loss of life is possible in future floods or flash floods.

Economic Losses

Floods can halt economic activity, block roadways, and destroy agricultural crops. Businesses may need to shut down their operations due to flood water damage or road closures. Crop losses are also possible during floods or flashfloods.

Future Trends

Land Use and Development Trends

Any development that occurs in flood zones will be at risk. Development in these areas should be limited. Flash flooding is more likely to occur in areas with a high percentage of impervious surfaces. Future land use practices should limit the percentage of impervious surfaces. **Chapter 5** contains mitigation actions that address these issues.

Climate Change

According to the International Panel on Climate Change, climate change has impacted human and natural systems. For example, infrastructure and stormwater systems in the Midwest are threatened by increased precipitation frequency and intensity induced by climate change (NCA 2018). According to the SOHMP, increased precipitation and variability by climate change will also increase the likelihood and intensity of flood events, which will mostly occur during the summer and fall months. The OEMA predicts a ten to 40 percent increase in stream flows after 2040. These events will mainly occur late summer to early winter, increasing the likelihood of cool season flood events in the late autumn and early winter. Additionally, heavy precipitation events and precipitation are projected to increase during winter and spring, causing flooding, sewer overflow, inundated roadways, and infrastructure damage. Emergency action plans, green infrastructure, and anticipating extreme events are important steps to prepare for climate change.

4.5 Invasive Species

Description

Harmful species are species that have potential negative impacts on the environment and economy of Perry County. Harmful species can be native or invasive. The National Oceanic and Atmospheric Administration (NOAA) defines an invasive species as "an organism that causes ecological or economic harm in a new environment and is not native." Harmful species are species that are native to a region, but that also cause significant ecological, public health, or economic harm. Their growth is often encouraged through human activity.

Invasive species can be terrestrial (land dwelling) or aquatic (water dwelling). Terrestrial species include plants, trees, shrubs, animals, birds, and insects, as well as fungi, bacteria, molds, and viruses. Aquatic species include aquatic plants and algae, fish, mollusks, amphibians, and insects, as well as fungi, bacteria, molds, and viruses.

Location

Invasive species have the potential to impact any location within the County. The most invasive of terrestrial species degrade woodlands, wetlands, and prairies. Aquatic invasive species use rivers to spread. Ohio has over 66,000 miles of streams, 312 miles of Great Lakes shoreline, nearly 2,000 inland lakes and reservoirs, and shares major watersheds with other states and Canada. Perry County lies in the Mississippi River basin, which is an ecologically diverse river system and is susceptible to invasions through the Ohio River and its tributaries.

Extent

Once invasive species become widely established, controlling their spread is both technically difficult and expensive, making eradication nearly impossible. Invasive species can usually overtake native species and alter the natural wildlife habitat.

The most common invasive species in Perry County is the **Emerald Ash Borer (EAB) (Figure 4.6.1)**. It is an exotic beetle that feeds on ash trees inhibiting its ability to transport water and nutrients. This insect was first found in Ohio in 2002 and has since been found in every county in the State. The EAB was first discovered in Perry County in 2010. Since the EAB has been found in every county, there are no quarantines in effect with Ohio's borders. Ohio is still listed in the Federal quarantine boundary.

Figure 4.6.1 Emerald Ash Borer and infested Ash Tree host.

Source: USDA

Another common invasive species in Perry County is the **Spongy Moth (formerly Gypsy Moth) (Figure 4.6.2).** It is a non-native species that moved into Ohio from Michigan and Pennsylvania in 1971, feeding on over 300 different tree and shrub species, though they prefer oak trees. They are considered the most destructive insects in Ohio. Each egg mass can contain up to 1,000 eggs, and each larval can consume up to one square foot of foliage in a 24-hour period. New Lexington, Ohio is being treated with SPLAT, which is a pheromone treatment that is sprayed by low-flying planes and disrupts Spongy Moth mating. Of the 88 counties, 51 counties have established populations. Perry County has been under active federal quarantine since prior to 2006.

Figure 4.6.2 Spongy Moth (formally Gypsy Moth)

Source: Ohio Department of Agriculture

Approximately 2,300 plant species occur in the wild in Ohio. Of these, about 78 percent are native, that is, they were found in the region before the times of European settlement. Of the remaining 22 percent, fewer than 100 have been identified to be problems in natural areas. According to the Ohio Invasive Plants Council, there are 38 invasive plant species in Ohio that have been banned and more under consideration (**Table 4.6.3**). These plants cannot be sold, distributed, or imported.

Studies conducted by the Ohio Department of Natural Resources (ODNR), Ohio Sea Grant, and the Ohio State University have identified over 70 invasive aquatic species in Ohio (**Table 4.6.4**). With the exception of White Perch, it is unlawful to possess, import, or sell these species live.

Table 4.6.3: Plant Invasive Species in Ohio as of January 7, 2018

Scientific Name	Common Name
Ailanthus altissima	Tree-of-heaven
Alliaria petiolate	Garlic mustard
Berberis vulgaris	Common barberry
Butomus umbellatus	Flowering rush
Celastrus orbiculatus	Oriental bittersweet
Centaurea stoebe ssp. Micranthos	Spotted knapweed
Dipsacus fullonum	Common teasel
Dipsacus laciniatus	Cutleaf teasel
Egeria densa	Brazilian elodea
Elaegnus angustifolia	Russian olive

Scientific Name	Common Name
Elaegnus umbellate	Autumn olive
Epilobium hirsutum	Hairy willow herb
Frangula alnus	Glossy buckthorn
Heracleum mantegazzianum	Giant hogweed
Hesperis matronlis	Dame's rocket
Hydrilla verticillata	Hydrilla
Hydrocharis morsus-ranae	European frog-bit
Lonicera japonica	Japanese honeysuckle
Lonicera maackii	Amur honeysuckle
Lonicera morrowii	Morrow's honeysuckle
Lonicera tatarica	Tatarian honeysuckle
*Lythrum salicaria**	Purple loosestrife
Lythrum virgatum (effective January 7, 2019)	European wand loosestrife
Microstegium vimineum	Japanese stiltgrass
Myriophyllum aquaticum	Parrotfeather
*Myriophyllum spicatum**	Eurasian water-milfoil
Nymphoides peltata	Yellow floating heart
Phragmites australis	Common reed
Potamogeton crispus	Curley-leaved pondweed
Pueraria montana var. lobate	Kudzu
Pyrus calleryana (effective January 7, 2023)	Callery pear
Ranunculus ficaria	Fig buttercup, lesser celandine
Rhamnus cathartica	Common Buckthorn
Rosa multiflora	Multiflora rose
Trapa natans	Water chestnut
Typha angustifolia	Narrow-leaved cattail
Typha x glauca	Hybrid cattail
Vincetoxicum nigrum	Black Swallow-Wort

* *Species most likely found in Perry County*

Table 4.6.4: Aquatic Invasive Species in Ohio

Type	Scientific Name	Common Name
Fish	*Alosa pseudoharengus*	Alewife
Fish	*Carassius auratus**	Goldfish
Fish	*Carassius carassius*	Crucian Carp
Fish	*Carassius gibelio*	Prussian Carp
Fish	*Channa app. and Parachanna app.*	Snakeheads
Fish	*Claris batrachus*	Walking Catfish
Fish	*Ctenopharyngodon idella*	Diploid Grass Carp - White Amur
Fish	*Ctenopharyngodon Idella**	Grass Carp
Fish	*Cyprinus carpio**	Common Carp
Fish	*Fundulus catenatus*	Northern Studfish
Fish	*Fundulus diaphanus*	Eastern Banded Killifish
Fish	*Gambusia holbrooki and Gambusia affinis**	Eastern & Western Mosquitofish
Fish	*Gasterosteus aculeatus*	Three Spine Stickleback
Fish	*Gymnocephalus cernuus*	Ruffe
Fish	*Hypophthalmichthys harmandi*	Large-scale Silver Carp
Fish	*Hypophthalmichthys molitrix**	Silver Carp
Fish	*Hypophthalmichthys nobilis**	Bighead Carp
Fish	*Lates niloticus*	Nile Perch
Fish	*Leuciscus idus*	Ide
Fish	*Morone americana*	White Perch
Fish	*Mylopharyngodon piceus*	Black Carp
Fish	*Neogobius melanostomus*	Round Goby
Fish	*Osmerus mordax*	Rainbow Smelt
Fish	*Perca fluviatilis*	European Perch
Fish	*Perccottus glenii*	Amur Sleeper
Fish	*Petromyzon marinus*	Sea Lamprey
Fish	*Phoxinus phoxims*	Eurasian Minnow
Fish	*Proterorhinus marmoratus*	Tubenose Goby
Fish	*Pseudorasbora parva*	Stone Moroko
Fish	*Rhodeus sericeus*	Bitterling
Fish	*Rutilus sericeous*	Roach

Type	Scientific Name	Common Name
Fish	*Sander lucioperca*	Zander
Fish	*Scardinius erythrophthalmus*	European Rudd
Fish	*Scardinius erythrophthalmus*	Rudd
Fish	*Silurus glanis*	Wels Catfish
Fish	*Tinca tinea*	Tench
Mollusks	*Bellamya (Cipangopaludina)*	Mystery Snails
Mollusks	*Bithynia tentaculata*	Faucet Snail
Mollusks	*Corbicula fluminea**	Asian Clam
Mollusks	*Dreissena bugensis*	Quagga Mussel
Mollusks	*Dreissena polymorpha**	Zebra Mussel
Mollusks	*Limnoperna fortune*	Golden Mussel
Mollusks	*Potamopyrgus antipodarum*	New Zealand Mudsnail
Crustaceans	*Bythotrephes longimanus*	Spiny Waterflea
Crustaceans	*Cercopagis pengoi*	Fishhook Waterflea
Crustaceans	*Cherax destructor*	Yabby
Crustaceans	*Cherax tenuimanus*	Marron
Crustaceans	*Dikerogammarus villosus*	Killer Shrimp
Crustaceans	*Eriocheir sinensis*	Chinese Mitten Crab
Crustaceans	*Eriocheir sinensis*	Chinese Mitten Crab
Crustaceans	*Faxonius virilis*	Virile Crayfish
Crustaceans	*Hemimysis anomala*	Bloody-red Shrimp
Crustaceans	*Procambarus clarki*	Red Swamp Crayfish
Plant	*Butomus umbellatus*	Flowering-rush
Plant	*Egeria densa*	Brazilian Waterweed
Plant	*Hydrilla verticillata*	Hydrilla
Plant	*Hydrocharis morsus-ranae*	European Frog-bit
Plant	*Iris pseudacorus*	Yellow Iris
Plant	*Ludwigia peploides**	Creeping Water-primrose
Plant	*Lysimachia nummularia*	Moneywort
Plant	*Lythrum salicaria*	Purple Loosestrife
Plant	*Marsilea quadrifolia*	European Water Clover
Plant	*Myriophyllum aquaticum*	Parrotfeather
Plant	*Myriophyllum spicatum*	Eurasian Watermilfoil

Type	Scientific Name	Common Name
Plant	*Najas minor**	Brittle Naiad
Plant	*Nelumbo nucifera*	Pink Lotus
Plant	*Nitellopsis obtusa*	Starry Stonewort
Plant	*Nymphoides peltata*	Yellow Floating Heart
Plant	*Phalaris arundinacea**	Reed Canary Grass
Plant	*Phragmites australis*	Common Reed (Phragmites)
Plant	*Pistia stratiotes*	Water Lettuce
Plant	*Potamogeton crispus**	Curly-Leaf Pondweed
Plant	*Trapa natans*	Water Chestnut
Plant	*Typha angustifolia, Typha x glauc**	Narrowleaf and Hybrid Cattails

** Species most likely found in Perry County*

Other invasive species that have the potential to impact to Perry County and the surrounding counties in Ohio include:

- **Asian Long-Horned Beetles** are wood-boring beetles native to Asia that were unintentionally introduced to North America, likely in wood packing material. Near-by Clermont County experienced an infestation in 2011. They pose a significant threat to forested land. There are no known Asian Long-Horned Beetle infestations in Perry County.
- **Feral Swine** are a combination of Eurasian wild boar and escaped or un-kept domestic swine. Common names for this species include feral hog, swine, or pig and Eurasian boar, Russian wild boar, or razorback. Feral swine cause significant damage each year to agricultural crops and property, as well as natural resources. Currently, known breeding populations of feral swine have been confirmed in Adams, Athens, Champaign, Gallia, Hocking, Jackson, Lawrence, Scioto, and Vinton counties. There are no known feral swine in Perry County.
- **Hemlock Wooly Adelgid (HWA)** are small invasive pests that can be found on the underside of hemlock needles. They feed on the sap causing the tree to dry up and die. They are common in northeast Ohio and have been seen in southern Ohio counties. Though there are no known Hemlock Wooly Adelgid infestations in Perry County. However, HWA has been found in both Hocking and Athens Counties just south of Perry County. Ohio has quarantine regulations restricting hemlock movement from a quarantined county to a non-infested county.
- **Mute Swans** are non-native invasive species found on public lakes across Ohio, originally known as winter visitors with the first published record in the United States in 1936 and Ohio in 1987. During the breeding season, March through May, adult mute swans become highly territorial and will fight to push native birds out of their nesting area. Mute Swans have attacked humans and pets during this time as well. Mute Swans can consume submerged aquatic vegetation and usually uproot the whole plant leaving nothing behind. This behavior takes away natural habitat from fish and leaves little food source for native waterfowl. The removal of aquatic vegetation can also cause water quality issues and erosion problems. There are no known sightings of Mute Swans in Perry County.

History

Perry County has been impacted by the Emerald Ash Borer, with infestations observed in Wayne National Forest staring in 2010. The extent of this damage is unknown. The Spongy Moth infestation in Perry County is being treated with SPLAT. The first sighting of the Spongy Moth in Ohio was in 1978 and Perry County's federal quarantine started prior to 2006. Additionally, it is possible that any of the other species listed above have at one point affected the County and its residents.

Probability

Since there are many invasive species throughout Ohio, it is probable that Perry County will experience some of the invasive species listed above, especially those noted as most likely to be found in the County (**Tables 4.6.3 and 4.6.4**). In addition, climate change can favor non-native invasive species over native ones due to the tolerance of invasive species to warmer climates versus native species, thus increasing the probability of potentially destructive invasive species occurring in the County. The Climate Change section in Future Trends discusses climate change further.

Vulnerability Assessment

Infrastructure Impact

There are no likely impacts to public roadways or utilities. Public trees may be destroyed or impacted by various invasive species. Aquatic invasive species could destroy water quality, make poor habitat for fish, and clog water intake pipes. Some species also increase fire potential and can be problematic to levees, dams, and irrigation systems.

Population Impact

There are no likely impacts on the local population. Recreational activities such as boating and fishing may experience minor impacts.

For social vulnerability, although this hazard was not included in the National Risk Index, invasive species could be widespread throughout the County and have some effects on the socially-vulnerable populations who are involved in agriculture.

Property Damage

Property damage, in the form of reduced values from impacts on landscaping, is likely.

Loss of Life

Loss of life because of invasive species is very unlikely. Some of these species consumed as food could lead to diseases and other health impact in humans.

Economic Losses

Economic impacts can vary greatly depending on the target and the invasive species and their impacts on those targets. Agricultural revenue losses may be experienced if crops are affected by an invasive species. Also, there may be indirect economic losses with degradation of forested lands and tree canopies. Examples include reduction in viable lumber for construction, increased heating and cooling costs, and reduced property value.

Future Trends

Land Use and Development Trends

There could be minor impacts on development and land use due to invasive species. Some invasive species can be particularly damaging to crops, agricultural land, and wetlands. Future development may involve site investigation to identify any potential invasive species on the property.

Climate Change

According to the Fourth National Climate Assessment, warming temperature caused by climate change is aiding in the spread of invasive species. Climate change can favor non-native invasive species over native ones due to the tolerance of invasive species to warmer climate zones and native species' decreased resistance to the new extreme weather in their environment. Species and ecosystems are typically most at risk when temperature increases occur with land use changes, habitat loss, environmental pollution, and the presence of non-native species. These changes can make ecosystems more favorable to invasive species.

4.6 Landslide & Land Subsidence

Description

The Ohio Department of Natural Resources (ODNR) defines a landslide as "a variety of downslope movements of earth materials. Some slides are rapid, occurring in seconds, whereas others may take hours, weeks, or even longer to develop." Landslides are commonly triggered by human-induced vibrations, over-steepened slopes, increased weight on a slope, and removal of vegetation on areas with landslide-prone slopes. Landslides can also be caused by heavy precipitation.

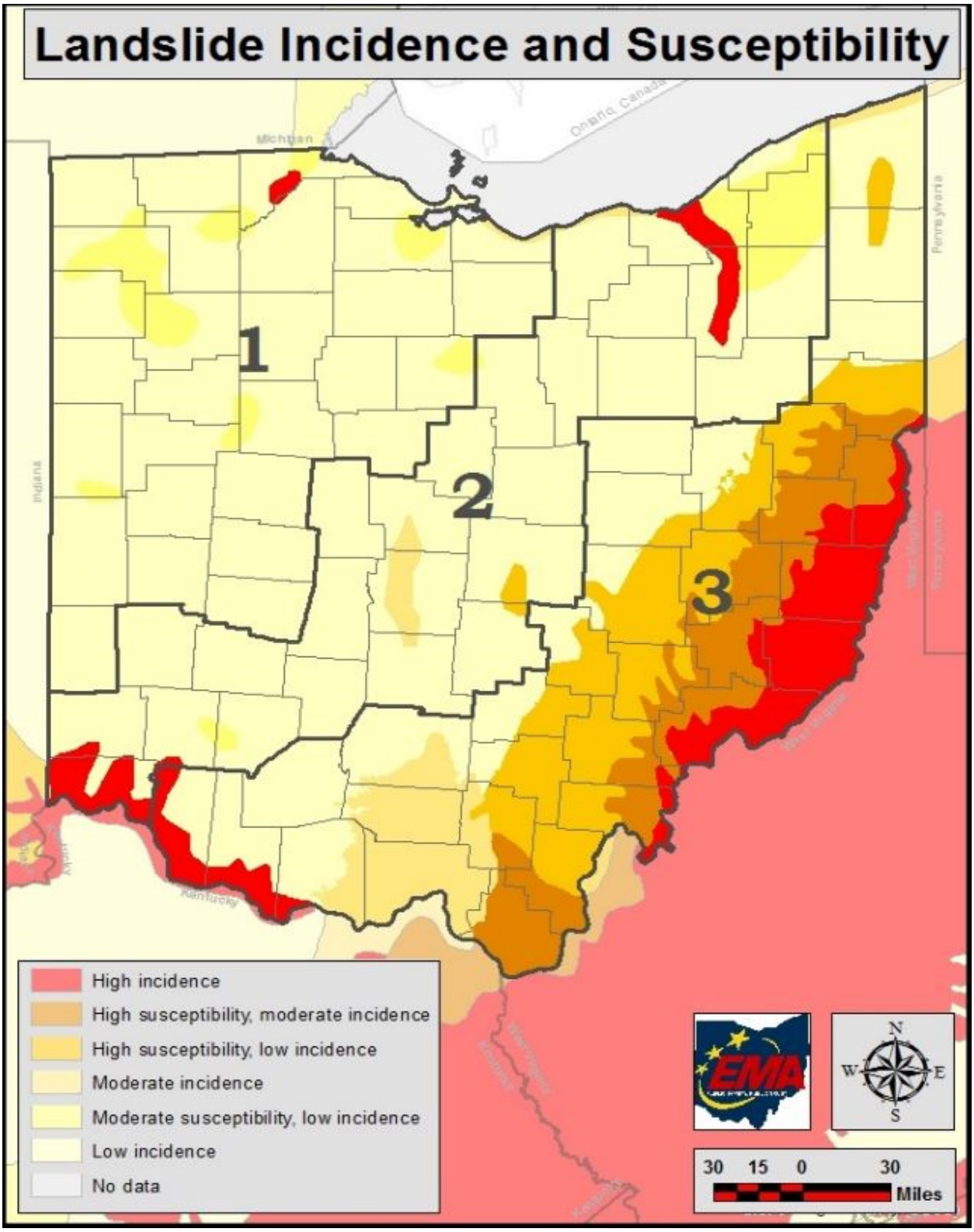
Subsidence is the motion of the earth's surface as it shifts downward relative to a benchmark (often sea level) of the surrounding terrain. In Ohio, the two primary causes are abandoned underground mines (AUMs) and karst. Karst is a topographic feature formed when carbonate rock, such as limestone, dolomite, and gypsum, is eroded by water draining or moving from these areas. Karsts are commonly represented as caves. For the purposes of this Plan, there are no known karsts in Perry County, so karst subsidence will not be assessed further.

According to the Ohio Administrative Code 3901-1-48, mine subsidence is loss caused by the collapse or lateral or vertical movement of structures resulting from the caving in of underground mines including coal mines, clay mines, limestone mines, and salt mines. Mine subsidence does not include loss caused by earthquakes, landslides, volcanic eruptions, or collapse of strip mines, storm and sewer drains, or rapid transit tunnels. Several factors determine the potential for mines to collapse including depth, mining technique used, types of rock and/or soils, and the development on the ground surface. Additionally, abandoned underground coal mines in Ohio have the potential to discharge acidic water which, if discharged into creeks or streams, can alter the chemical composition of the water habitat and cause considerable harm to sensitive aquatic life.

Location

Figure 4.7.1 shows the location of areas at risk for landslides. Half of Perry County is in Region 2 and has some moderate incidence for landslides, and the remaining half of Perry County is in Region 3 and has high susceptibility for landslides but low incidence.

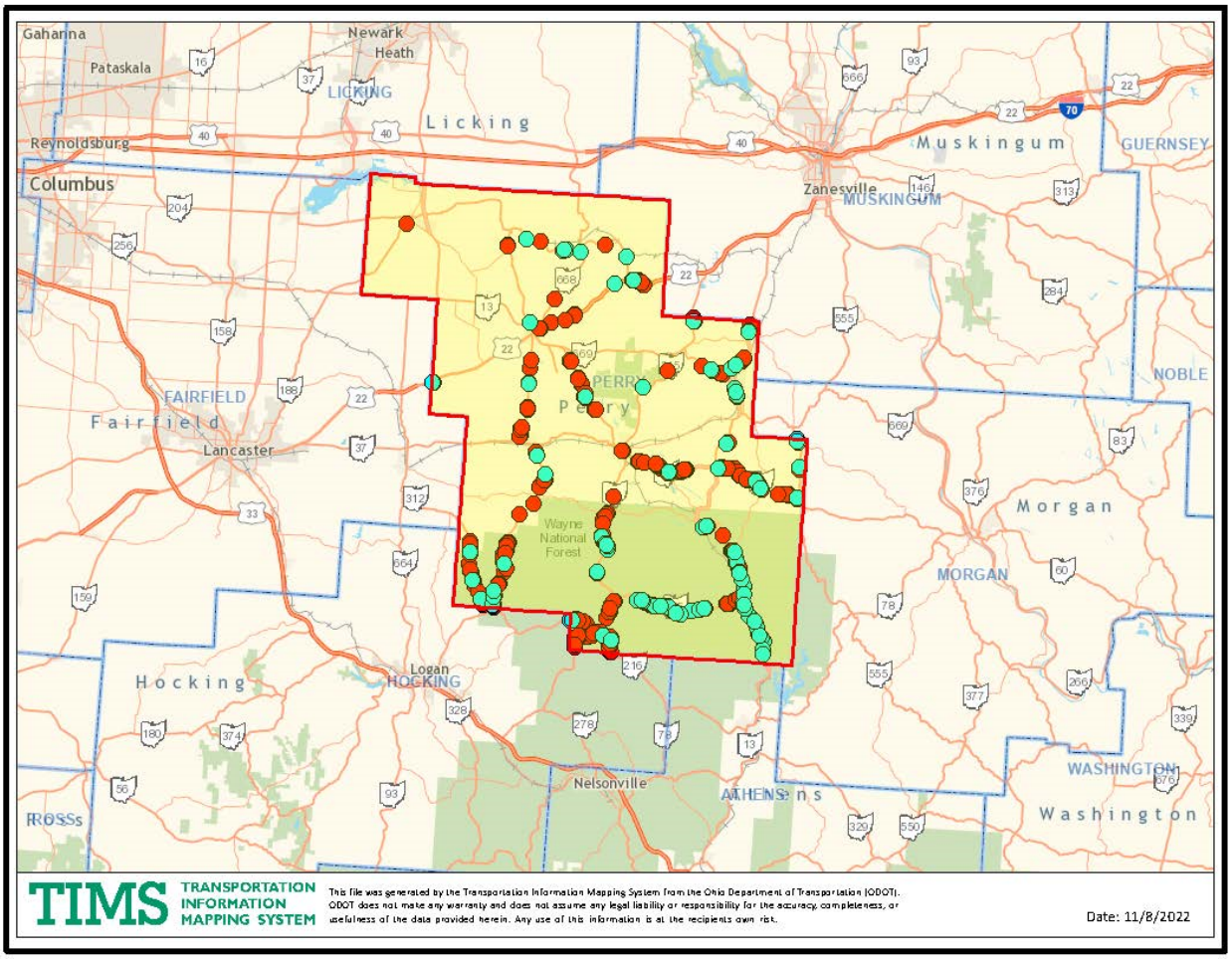
Figure 4.7.1: Landslide Incidence and Susceptibility Map



Source: Ohio EMA

Figure 4.7.2 shows the geohazard locations of all recorded landslide (red) or rock slope (blue) locations in Perry County. Rockfalls and rock slopes are grouped together. These incidences primarily occur along roadways. According to the Ohio Department of Transportation Geohazard Dashboard, Perry County has 355 active landslide sites and 101 active rock slope sites.

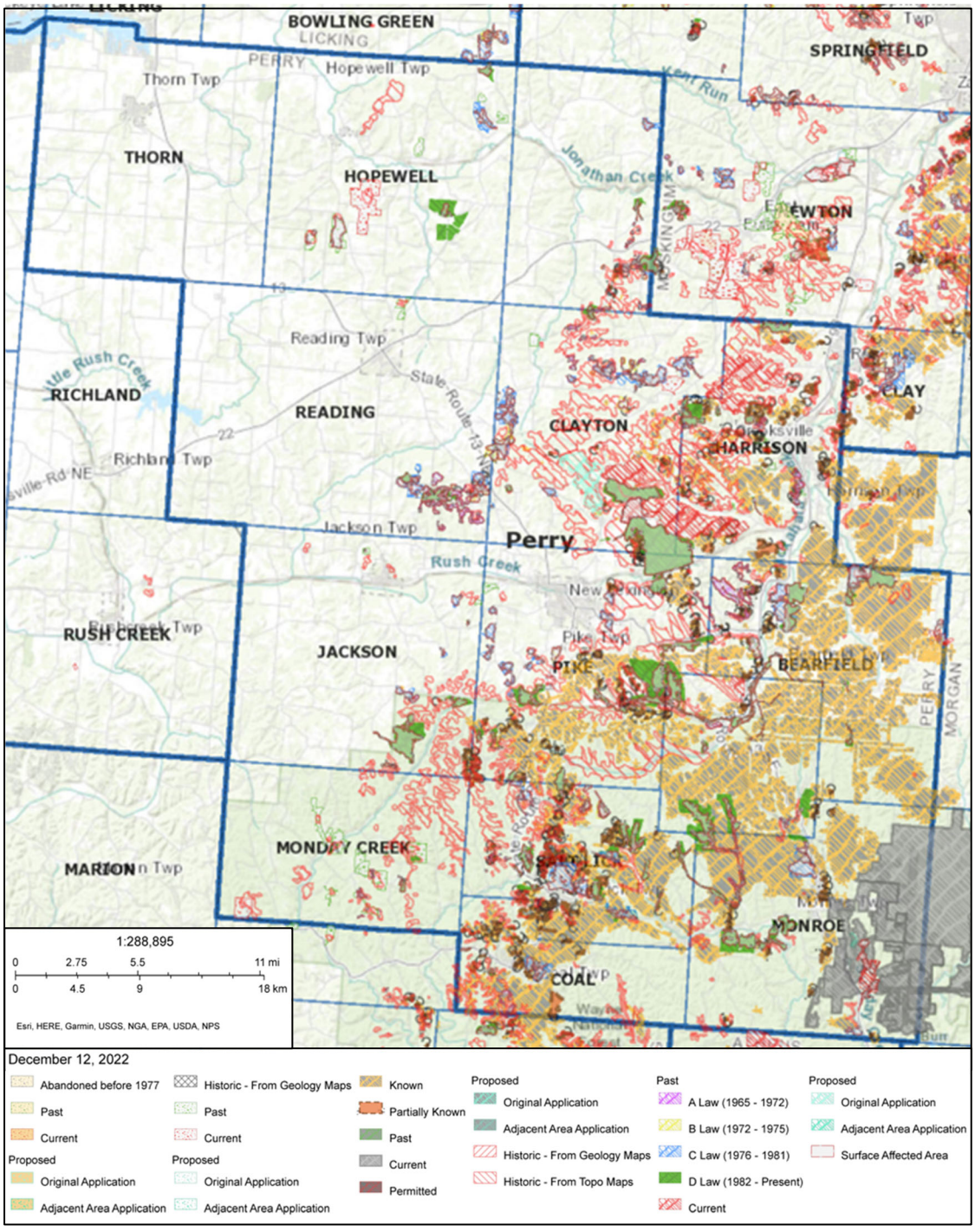
Figure 4.7.2: Perry County Landslide and Rock Slope Geohazard Inventory



Source: Ohio Department of Transportation

Figure 4.7.3 shows past and current mines in Perry County and surrounding areas. According to ODNR, Perry County falls within Ohio's coal region, and contains both surface mines and abandoned underground mines.

Figure 4.7.3: Mines in Perry County



Source: ODNR

Extent

According to ODNR Division of Geologic Survey, Perry County is home to three bedrock formations: the Allegheny and Pottsville Groups undifferentiated, Conemaugh Group, and Logan and Cuyahoga Formations undivided. These formations include a mix of shale, sandstone, siltstone, conglomerate, limestone, clay, flint, and coal. Most mines in Perry County occur in the Allegheny and Pottsville Groups and Logan and Cuyahoga Formations, where coal can be found.

There are three major types of landslides:

1. **Rotational slump**, or a mass of weak rock or sediment moving as a block unit along a slope. These are the largest types of landslides found in Ohio.
2. **Earthflow**, or a mass of rock or sediment flowing downslope. These are the most common landslides in Ohio.
3. **Rock fall**, or a rapid downslope movement of large blocks of bedrock. Most rockfalls in Ohio involve sandstone or limestone that has been weakened by surface water.

There are two major types of mine subsidence:

1. **Pit**, also known as a sinkhole or pothole, is an abrupt sinking of the ground surface that causes a circular crater with steep sides. Pit subsidence is associated with total roof collapse of a mine that is less than 90 feet below ground.
2. **Sag or trough**, or a gentle, gradual settling of the ground associated with the roof or pillar collapse of a deeper mine.

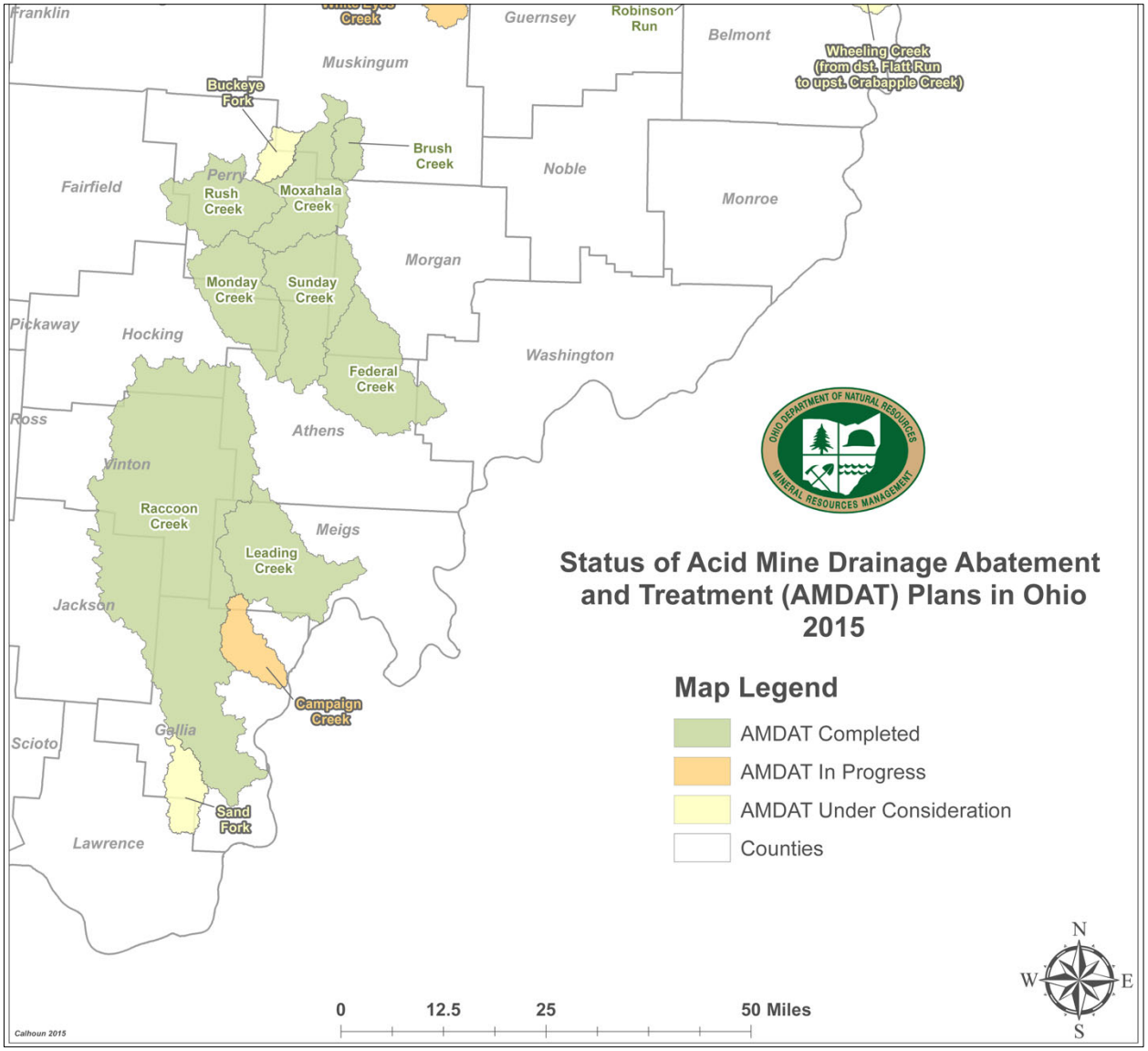
According to the 2021 Annual Ohio Mine Subsidence Insurance report, Perry County has 485 abandoned mines and 2 active mines. Both abandoned and active mines have a potential for acid mine drainage.

Acid mine drainage (AMD) occurs when acidic water flows outward from a mining site into surface or ground water sources. The water usually contains a low (acidic) pH value and high concentrations of sulfate, iron, aluminum, and other toxic metals that leach from the mine. AMD is easily identifiable due to its characteristic rust coloring, or through degradation of water quality, injury to aquatic life, and corroded materials. According to ODNR, acid mine drainage can be found in the Sunday Creek, Monday Creek, Moxahala Creek, and Rush Creek watersheds. **Figure 4.7.3** shows the status of acid mine drainage abatement and treatment (AMDAT) in Ohio as of 2015.

- **Sunday Creek Watershed AMDAT:** The Sunday Creek Watershed covers 139 square miles, including parts of Wayne National Forest. Approximately 2,401 acres of surface drainage entered deep mines within Perry County, Athens County, and Morgan County. Six stream captures were closed and completed from 2004 to 2011, diverting 884,012,000 gallons per year of surface drainage from entering the deep mines, preventing the generation of acid mine drainage.
- **Monday Creek Watershed AMDAT:** The Monday Creek Watershed covers 116 square miles, including parts of Wayne National Forest. Seven stream captures were closed and completed from 2001 to 2016, diverting 363,425,000 gallons per year of surface drainage from the deep mines.
- **Moxahala Creek Watershed AMDAT:** The Moxahala Creek Watershed covers 302 square miles, beginning near the Village of New Lexington and ending in the Muskingum River and eventually the Ohio River. Approximately 13 square miles of surface mining and 13.25 square miles of deep mining have resulted in acid mine drainage pollution in the watershed. Reclamation for two mining refuse piles took place from 2004 to 2005 and a wetland reclamation project began in in 1994.

- **Rush Creek Watershed AMDAT:** The Rush Creek Watershed covers 234.5 square miles and intersects the villages of Junction City, New Lexington, and Somerset. Acid mine drainage from 3,899 acres of surface mines and 1,965 acres of underground mines pollutes the watershed. ODNR implemented a three-phase site reclamation plan from 1997 to 2022.

Figure 4.7.3 Status of AMDAT Plans in Ohio



Source: ODNR

History

Below are the three most recent landslide and land subsidence events in Perry County.

June 2018: Perry County officials were notified of a sinkhole in Bearfield Township, near Township Road 426, according to the Zanesville Times Recorder. The sinkhole was reportedly 50 feet wide and 40 feet deep and is situated above an abandoned rail line. The sinkhole damaged a water line. Total repairs cost more than $400,000 and involved two phases.

May 2019: A large sinkhole shut down SR-155 west of Corning, near Miller High School, according to the Zanesville Times Recorder. The sinkhole impacted school transportation due to its proximity to the Southern Local Schools bus barn.

May 2021: A 20-foot-wide sinkhole appeared on private property on Marietta Road, according to the Zanesville Times Recorder. No utilities were affected by the sinkhole's appearance.

Figure 4.7.4 shows the number of claims reported by the Ohio Mine Subsidence Insurance Underwriting Association (OMSIUA) since the 2016 Perry County HMP.

Figure 4.7.4 OMSIUA Claims

Event Year	Closed Insurance Claims	Insured Damage
2016	2	$2,047
2017	1	$13,954
2018	0	$0
2019	1	$648
2020	0	$0
2021	1	$1,633

Probability

Landslides are rare in much of Ohio due to a lack of steep slopes and bedrock geology prone to failure, but there are a few areas where landslides could occur. Predicting landslides is site-specific, and data indicates that Perry County has a moderate-to-high risk of landslide but low probability of incidence. In addition, extreme precipitation caused by climate change could increase the likelihood of landslides in areas with steep slopes. The Climate Change section in Future Trends discusses climate change further.

According to the Ohio Revised Code section 3929.56, property and homeowner's insurance agencies that provide coverage to Perry County must also include mine subsidence coverage provided by the Ohio Mine Subsidence Insurance Underwriting Association (OMSIUA). The Mine Subsidence Insurance Governing Board (MSIGB) determines which counties are covered by mine subsidence insurance, administers the Mine Subsidence Insurance Fund, and governs the OMSIUA. The MSIGB consists of the Director of ODNR or designee, the Ohio Treasurer or designee, and a representative from the insurance industry.

Vulnerability Risk Assessment

Infrastructure Impact

Landslides can block or damage roadways, and damage existing utility infrastructure. Mine subsidence can occur under existing roadways or utility infrastructure causing anything from minor damage to complete destruction.

Population Impact

Landslides can cause injury or death if a person is struck by or trapped under falling earthen material. Mine subsidence can cause sinkholes under occupied structures which could lead to injuries.

For social vulnerability, land subsidence is not listed in the National Risk Index, but landslide is listed with a score of 12.52 ("relatively low"). This is the highest score for the County for any of the hazards listed. In general, the Perry County population is more exposed to these hazards because they live in hilly areas that are more susceptible to landslides and there are a number of underground mines. The

index indicates an expected annual loss of $66,889 due to landslides with zero events occurring per year.

Property Damage

Properties caught in the path of a landslide can be completely destroyed or severely damaged. Properties, including their structures, can be completely destroyed by mine subsidence.

Loss of Life

Loss of life is possible during sudden mine subsidence or landslides. However, there are no known fatalities in Perry County due to mine subsidence or landslides.

Economic Losses

Landslides and mine subsidence can block or destroy sections of roadways vital to shipping. Stores, storage facilities, and other structures that are important to economic activity can also be severely damaged or destroyed. It can also be quite expensive to repair sinkholes when they occur.

Future Trends

Land Use and Development Trends

Uses that serve vulnerable populations, such as schools and hospitals, should not be placed in areas that are in high-risk zones for landslides. Development should be limited to areas with minimal slope to reduce potential losses during landslides. Development should also consider low-impact techniques to reduce the likelihood of runoff from precipitation and therefore reduce the risk of landslides.

Climate Change

According to the Midwest National Climate Assessment, the likelihood of precipitation has increased nine percent, and the amount of rain falling during heavy precipitation events has increased by 30 percent on average between 1901 to 1960. Extreme precipitation could increase the likelihood of landslides in areas with steep slopes. Flooding caused by heavy precipitation could also increase the rate of runoff for acid mine drainage and erosion along rivers and streams.

4.7 Severe Summer Storms

Description

Severe summer weather events may include severe thunderstorms and thunderstorm winds, hail, and lightning. High winds, tornadoes, and flooding may also be related to severe summer storms, and due to the potential threat of these events, they are each discussed in separate risk assessments. While tropical storms and hurricanes are also forms of severe summer storms, Perry County does not have any record of such events affecting the County; therefore, the County has not deemed tropical storms and hurricanes to be a threat, so these specific types of weather will not be addressed further.

According to the U.S. National Weather Service (NWS), a severe thunderstorm is a thunderstorm that produces a tornado, has winds of at least 58 MPH, and/or hail at least one inch in diameter. A Severe Thunderstorm Watch is issued by the NWS if conditions are favorable for the development of severe thunderstorms. A watch is usually in place for four to eight hours, during which time people should be prepared to move to a safe place if threatening weather approaches.

A Severe Thunderstorm Warning is issued if either the WSR-88D radar indicates a severe thunderstorm or if a spotter reports a storm producing hail or winds meeting the criteria outlined in the description above. The WSR-88D radar is an advanced Weather Surveillance Doppler Radar utilized by the NWS to generate a radar image. The NWS recommends that people in the affected area seek safe shelter immediately, as severe thunderstorms have the potential to produce tornadoes with little-to-no advance warning. Lightning frequency is not a criterion for issuing a severe thunderstorm warning. The warnings are usually issued for one hour and can be issued without a Severe Thunderstorm Watch already in effect. The National Weather Service Forecast Office in Wilmington, Ohio is responsible for issuing Severe Thunderstorm Watches and Warnings for Perry County.

Lightning is caused by a rapid discharge of electrical energy that has built up in the atmosphere between clouds, the air, or the ground. Lightning strikes can be either direct or indirect. A direct strike is when lightning strikes a building or a specific zone, which can result in fusion points melting holes of varying sizes at the point of impact of materials with high resistivity. An indirect lightning strike is when lightning causes power surges that disrupt electrical equipment.

Severe summer storms can also create strong winds – often called “straight-line” winds – to differentiate thunderstorm winds from tornadic winds. These winds, which have the potential to cause damage, are caused by an outflow generated by a thunderstorm downdraft.

Hail is a type of frozen precipitation that occurs when thunderstorm updrafts carry raindrops upward into extremely cold atmospheric zones where they freeze before falling to the ground. According to the NWS, the resulting hailstones can fall at speeds greater than 100 MPH and range in size from smaller than a half inch (the size of a pea) to 4.5 inches (the size of a softball).

The NWS can issue various types of wind advisories and warnings. A **wind advisory** is issued when sustained winds of 31 to 39 MPH are reached for an hour or more and/or if there are wind gusts of 46 to 57 MPH for any duration. A **High Wind Watch** indicates that sustained, strong winds are possible and outdoor items should be secured. People should modify plans so they are not caught outside. Additionally, a **High Wind Warning** indicates that sustained, strong winds (40 MPH or greater) with even stronger gusts (greater than 58 MPH) are happening. People should seek shelter, and those driving should keep both hands on the wheel and slow down. An **extreme wind warning** is issued for surface winds of 115 MPH or greater associated with non-convective, downslope, derecho (not associated with a tornado), or sustained hurricane winds that are expected to occur within one hour.

Location

Severe summer storms are a countywide hazard, and all of Perry County is susceptible to severe summer weather.

Extent

Severe summer storm events have the potential to create large-scale damage in Perry County. According to NOAA, lightning is responsible for approximately 20 deaths annually across the U.S., as well as hundreds of injuries. Winds associated with severe summer storms have the potential to cause damage by bringing down tree limbs and generating widespread power outages. Additionally, hail can result in property damage. Severe summer storms can lead to flooding, downed trees and power lines, and other dangerous conditions.

History

According to the National Centers for Environmental Information (NCEI), there have been 169 high-, strong-, or thunderstorm wind events; seven heavy rain events; and 58 hail events recorded in Perry County from January 1996 to August 2022. These events resulted in $2.65 million in property damage. There were no deaths or injuries reported. Events from 1995 to 2022 are summarized in **Table 4.8.1**, below:

Table 4.8.1: Thunderstorm-Related Events in Perry County since 1996

Severe Summer Storm Event Type	Number of Events	Injuries	Deaths	Property Damage	Crop Damages
Strong Wind	169	0	0	$2,609,250	$0
Heavy Rain	7	0	0	$0	$0
Hail	56	0	0	$40,000	$0
Total	**234**	**0**	**0**	**$2,649,250**	**$0**

Perry County has been subject to one thunderstorm-related disaster declaration since the previous hazard mitigation plan. The Presidential declaration of a major disaster is described below. An event that caused $1 million in property damages is also described in more detail below.

Severe Summer Storms & Straight-Line Winds in Perry County, May 27-29, 2019 (FEMA-4447-DR)

A warm front and potent upper-level wave moved through Ohio at the same time, affecting several counties (Auglaize, Columbiana, Darke, Greene, Hocking, Mahoning, Mercer, Miami, Montgomery, Muskingum, **Perry**, Pickaway). The warm front and upper-level wave led to severe thunderstorm development, multiple tornadoes, and wind damage. There were 1,779 residences impacted by the storm, with 154 homes destroyed, 788 homes with major damage, 429 homes with minor damage, and 408 homes affected otherwise. Residents of Perry County affected by the severe summer storms were granted individual assistance by FEMA. The total individual assistance cost estimate was $9,443,353 for the 12 counties in Ohio according to FEMA.

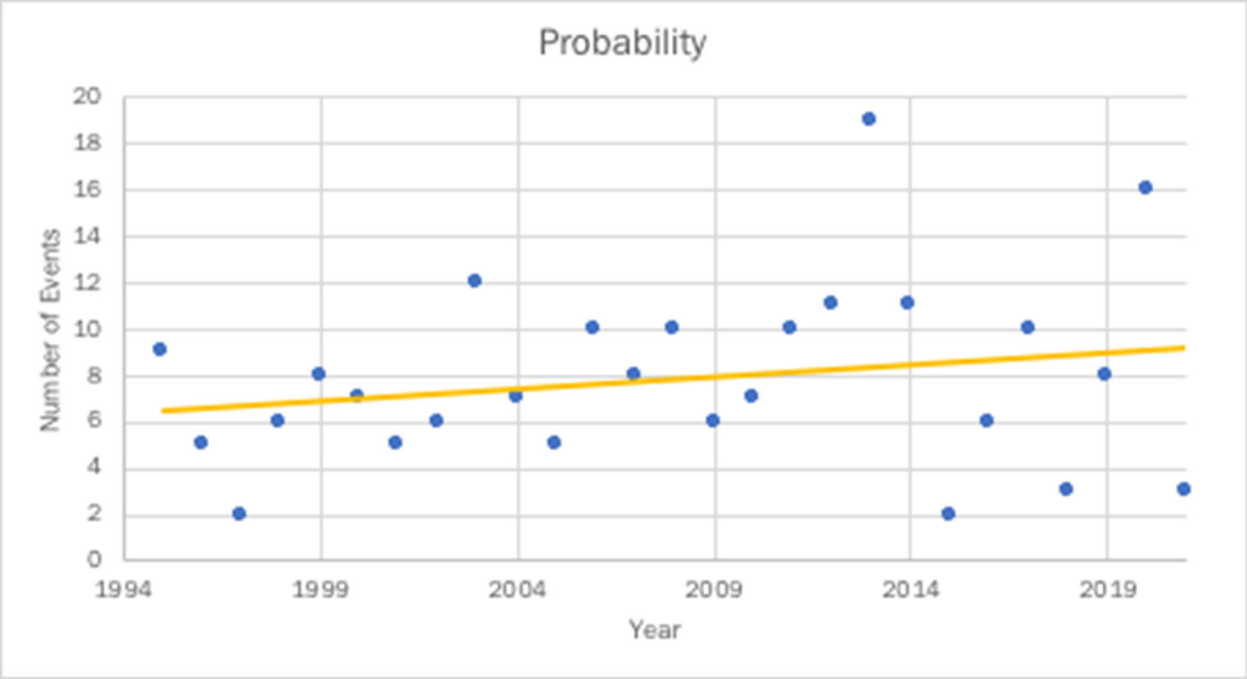
Thunderstorm Winds in Perry County, June 29, 2012 (FEMA-4077-DR/FEMA-3346-EM)

A derecho, widespread and long-lived windstorm, moved across northern Indiana into western Ohio with a large convective available potential energy (CAPE) of 4,000 to 5,000 joule/kilogram. The derecho traveled at 65 MPH, reaching southeast Ohio at the hottest time of the day. Strong gusts lasted up to ten minutes and were recorded at 60 to 85 MPH. The wind caused some structural damage, metal and siding ripped off some buildings, trees fell onto houses and cars, and several power lines fell onto roads blocking traffic. Some families were without power for four to seven days. During this event, southwest Ohio was in a heat wave as well, with temperatures rising to over 100 degrees in several counties. A major disaster declaration was declared on August 20, 2012 with a total public assistance cost estimate of $22,125,266 for the 37 counties affected.

Probability

According to the NCEI, there have been 234 severe summer storm events reported in Perry County from January 1995 to August 2022 with total losses reaching at least $2.95 million in property damage. This amounts to around eight severe summer storm events annually with average annual damages of $94,616. Furthermore, **Figure 4.8.2** below shows the trend in number of thunderstorm events per year since 1995. The trend line has a positive slope, which indicates that the number of severe summer storms has increased over the last 28 years. Years prior to 1995 are excluded from the probability calculation due to missing and/or unreliable data reporting. In addition, preliminary research suggests that the frequency and intensity of severe thunderstorms could increase as the climate changes, according to the National Climate Assessment. The Climate Change section in Future Trends discusses climate change further.

Figure 4.8.2: Severe Summer Storm Probability



Vulnerability Assessment

Infrastructure Impact

Above-ground infrastructure is at risk for storm damage by wind and falling debris. For infrastructure, high winds and hail are the most damaging part of a severe summer storm. Thunderstorm winds can strip bark from trees and detach limbs. If large branches fall, they can damage buildings and supporting above-ground infrastructure. In the most severe summer storms with high winds, large trees can be uprooted and have the potential to fall on buildings, including houses, which can cause harm or death.

Utilities are at risk for damage by severe summer storms as well. Electrical lines are spread throughout the County, connecting homes, businesses, and other facilities. Severe summer storms are likely to down tree limbs and generate other debris that can affect above-ground electrical lines causing power outages. Downed power lines that are still live are extremely hazardous and can cause death by electrocution.

Population Impact

Summer storms are random in nature and affect the entire area of the County. Everyone within the County should be prepared during a storm event. Populations residing in mobile home parks are particularly vulnerable and should seek out shelters.

For social vulnerability, according to the National Risk Index, hail and lightning had scores of 3.96 ("very low") and 9.94 ("relatively low") for Perry County, yet lightning had the second highest score of all of the hazards in the County. This information indicates that severe summer storms are exposing the population of Perry County to some risk from storm events. The index indicates an expected annual loss of $10,220 due to hail events and $64,484 due to lightning events, with three and 68 events occurring per year, respectively.

Property Damage

As described above, these events have caused an average of $94,646 in property damages annually. Due to the non-site-specific nature of this hazard, **Table 4.8.3** lists all structures within Perry County as having potential impacts from severe summer storms.

Loss of Life

Although no loss of life was reported due to the 234 severe summer storm events on record with the NCEI, there is always potential for injuries and fatalities during severe summer weather.

Economic Losses

Severe summer storms usually cause minor damage to structures, such as blowing shingles off roofs, and breaking windows and damaging above-ground infrastructure with falling branches. More severe damage may also result. The costliest storm for property damages in the County's history was the high wind event on June 19, 2012 which caused upwards of $1 million in property damage. **Table 4.8.3** shows the potential economic impacts if all structures within Perry County were damaged.

Table 4.8.3: Structure Vulnerability from Severe Summer Storms

Structure Type	Number	Property Value	Building Value	Total Value
Residential	20,763	$107,112,690	$383,799,790	$490,912,480
Non-Residential	9,361	$114,282,350	$258,736,580	$373,018,930
Community Lifelines	47	$1,082,910	$22,242,760	$23,325,670
Totals	**30,124**	**$221,395,040**	**$642,536,370**	**$863,931,410**

Note: Community lifelines (critical facilities) are non-residential structures, so their value is also incorporated into the non-residential totals. Calculated totals are determined by summing the residential and non-residential values. The types located in the County are listed in ***Appendix C.***

Future Trends

Land Use and Development Trends

Severe summer storms can occur anywhere. Any development that has occurred since the previous plan, and any future development, has the potential to be impacted by severe summer storms.

Climate Change

Preliminary research suggests that the frequency and intensity of severe thunderstorms could increase as the climate changes, according to the National Climate Assessment. Future modeling techniques could reveal additional information about the correlation between atmospheric changes and severe thunderstorm formation and intensity.

4.8 Tornado

Description

FEMA defines a tornado as "a violently rotating column of air extending from a thunderstorm to the ground." Tornadoes can generate wind speeds greater than 250 MPH. Tornado paths can be as large as one mile wide and 50 miles long. Nationally, there is an average of 800 tornadoes reported annually across all 50 states.

In general, the midsection of the U.S. experiences a higher rate of tornadoes than other parts of the country because of the recurrent collision of moist, warm air moving north from the Gulf of Mexico with colder fronts moving east from the Rocky Mountains. Supercells, which form from rotating thunderstorms, are the most destructive variety of tornado.

Tornado Warnings are issued by the NWS Forecast Office in Charleston, West Virginia when a tornado is indicated by the WSR-88D radar or sighted in person by spotters. The WSR-88D radar is an advanced Weather Surveillance Doppler Radar utilized by the NWS to generate a radar image. Once a warning has been issued, people in the warning area should seek shelter immediately. Warnings will include the location of the tornado, as well as what communities will be in its path. A tornado warning can be issued without a tornado watch, and they are typically issued for 30 minutes at a time. If the thunderstorm responsible for the formation of the tornado is also producing large volumes of rain, the tornado warning may be combined with a Flash Flood Warning. The NWS will follow up any Tornado Warnings with Severe Weather Statements to provide up-to-date information on the tornado and inform the public when the warning is no longer in effect (Source: NWS).

Location

Tornadoes can occur anywhere in Perry County. All areas and jurisdictions should be considered at risk for a tornado.

Extent

Tornadoes are measured by damage scale for their winds with greater damage equating greater wind speed. The original Fujita Tornado Damage Scale (F-scale) was developed in 1971 without much consideration to a structure's integrity or condition as it relates to the wind speed required to damage it. The Enhanced Fujita-scale (EF-Scale) took effect on February 1, 2007. This scale starts with the original F-scale's F0 through F5 ratings and classifies tornado damage across 28 different types of damage indicators. These indicators mostly involve building/structure type and are assessed at eight damage levels from 1 through 8. Therefore, construction types and their relative strengths and weaknesses are incorporated into the EF classification given to a particular tornado. The most intense damage within the tornado path will generally determine the EF scale given the tornado. Table 4.9.1 lists the classifications under the F- and EF-scale. It should be noted that the wind speeds listed in this table are estimates based on damage rather than measurements.

There are no plans by NOAA or the NWS to re-evaluate the historical tornado data using the enhanced scale. Therefore, this Plan and subsequent plans will reference both scales until a complete switchover is deemed necessary.

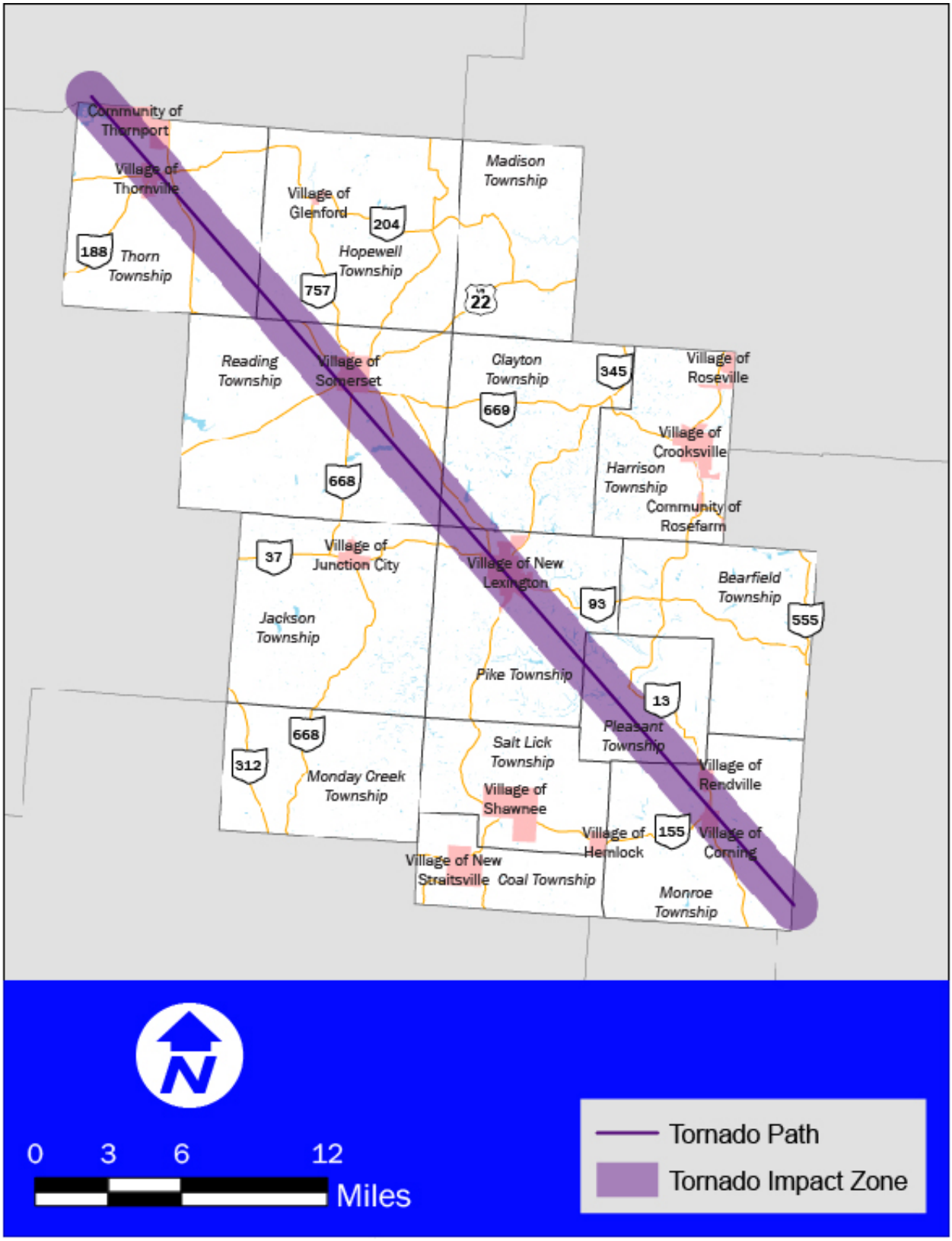
Figure 4.9.2 simulates an extremely destructive, worst-case scenario EF5 tornado and its impacts on County assets and infrastructure. The worst-case scenario is simulated by running the EF5 tornado on a straight path through the most populated areas of the County. This theoretical scenario is performed to determine maximum potential damage within the County. The damages associated with this theoretical scenario are used to identify the County's potential vulnerability to tornadoes (Table 4.9.3).

Table 4.9.1 Fujita and Enhanced Fujita Scale Classifications

Fujita Scale 3-Second Wind Gust (MPH)		Damage Levels	Enhanced Fujita Scale 3-Second Wind Gust (MPH)	
F0	45-78	Light Damage: Tree branches down.	EF-0	65-85
F1	79-117	Moderate damage: Roof damage.	EF-1	86-110
F2	118-161	Considerable damage: Houses damaged.	EF-2	111-135
F3	162-209	Severe damage: Buildings damaged.	EF-3	136-165
F4	210-261	Devastating damage: Structures leveled.	EF-4	166-200
F5	262-317	Incredible damage: Whole towns destroyed.	EF-5	Over 200

Source: SOHMP

Figure 4.9.2: Worst-Case Tornado Scenario



History

There have been four tornado events in Perry County between January 1995 and August 2022, resulting in a total of $1,105,000 in property damage. Average annual property damages from 1995 to 2022 are approximately $40,925. Most tornado events resulted only in property damage, but one of the tornado events, on September 16, 2020, resulted in one injury in Perry County and one death and ten injuries on the West Virginia side of the Ohio River. The tornado events in Perry County from 1995 to 2022 that caused the most damage and/or resulted in an injury and/or death are listed below.

EF2 Tornado & EF1 Tornado in Perry County, September 16, 2010

A cold front mixed with a strong mid- and upper-level forcing, produced five tornadoes, four in Ohio and one in West Virginia. One tornado formed in Fairfield County and traveled into western Perry County with winds up to 120 MPH. Eights homes were destroyed, and several homes were heavily damaged. One person was injured during this tornado when a door struck them. The second tornado touched down in Perry County and traveled into Morgan County. The third and fourth tornadoes were not in Perry County. Property damage was $500,000 for Perry County. No deaths were reported in Ohio from the tornado outbreak; however, there was one reported injury in Perry County and one fatality and ten injuries in West Virginia.

F1 Tornado in the Village of Junction City, May 23, 2000

The tornado touched down in Jackson Township near Township Road 371 and moved east for two miles along Pen Road. The tornado was 150 feet wide and damaged multiple roofs, destroyed a barn, and moved a modular home several inches off its foundation. The tornado resulted in $185,000 in property damages. No injuries or deaths were reported.

EF0 Tornado in Thorn Township, April 3, 2018

A tornado touched down in Thorn Township near Ridenour Road and skipped 1.25 miles east towards Bruno Road. In its path it tossed some pull-along campers and shifted a modular home several feet off its foundation. The tornado resulted in $100,000 in property damage. No deaths or injuries were reported.

EF1 Tornado in Village of Roseville, May 28, 2019

A tornado traveled west through the Village of Roseville for 0.31 mile with winds peaking at 109 MPH. There was extensive tree damage – roots of over 70 hardwood trees and 20 softwood trees were uplifted. Ten homes saw less than 20 percent of their shingles lost, and a shed was destroyed. The tornado resulted in $70,000 in damage. No deaths or injuries were reported.

Probability

There have been four tornado events in Perry County between January 1995 and August 2022, resulting in a total of $1,105,000 in property damage, which averages to $40,925 a year in property damage.

The annual rate for tornadoes and severe wind events in Perry County is less than 0.18 tornadoes a year since 1995. However, when conditions are right, there may be multiple tornadoes in one year or in one storm event. For instance, on January 16, 2010 a cold front moved over warmer air resulting in the production of five tornadoes in Perry County. On the same day there were severe storms throughout Ohio, resulting in 13 tornado events with a total of $38,754,000 in property damage and $4,000 in crop damage.

Although it is difficult to predict future tornado activity, a research study saw an eastward shift in tornado frequency (“Spatial trends in United States tornado frequency,” Gensini & Brooks 2018). Two other research studies showed an increase in tornado frequency in the eastern U.S. and a decrease

in tornado activity in the central part of the U.S. ("Changes in the seasonality of tornado and favorable genesis conditions in the central United States," Lu, Tippett & Lall 2015 and "Spatial Redistribution of U.S. Tornado Activity between 1954 and 2013," Agee, Larson, Childs & Marmo 2016). The 2016 study stated that there is a documented increase in hazardous conductive weather (HCW) in the lower Ohio valley regions. Also, the studies note that the number of tornadoes produced from a single storm are increasing. For instance, in 2020 there were 20 documented tornadoes in Ohio, seven from one storm and five from another. In addition, although tornadoes are exhibiting changes that may be related to climate change, scientists cannot yet fully predict the direction and magnitude of changes to tornadoes from climate change. The Climate Change section in Future Trends discusses climate change further.

Vulnerability Assessment

Infrastructure Impact

Above-ground infrastructure can be damaged by tornadoes. Debris caught in tornadoes as well as fallen trees can cause damage to buildings and infrastructure, which can lead to closures. Also, above ground utility infrastructure can be damaged or destroyed, which can cause service outages.

Population Impact

Tornadoes are random in nature and have the potential to occur anywhere in the County. Everyone within the County should be prepared for a tornado. Residents in mobile home parks are particularly vulnerable and should have a plan in place.

For social vulnerability, according to the National Risk Index, tornadoes have a score of 9.39 ("relatively low") in Perry County. Tornadoes that have occurred in Perry County are typically weaker tornadoes, rated EF-2 or lower. The index indicates an expected annual loss of $224,309 due to tornadoes with 0.1 events occurring per year.

Property Damage

Tornadoes can cause significant damage to buildings and properties. There have been four tornadoes in Perry County which have caused more than $1.1 million in property damages. Annually, this amounts to $40,925 in damages. As demonstrated in **Figure 4.9.2, Table 4.9.3** details the structural vulnerability from the worst-case scenario tornado for Perry County.

Loss of Life

There was one reported death in West Virginia caused by a tornado event on September 16, 2020 that produced five tornadoes, two of which occurred in Perry County. There has been one reported injury caused by the same tornado event in Perry County. There is potential for loss of life during any tornado event.

Economic Losses

Tornadoes can cause major damage to structures and roads. Higher severity tornadoes have the potential to destroy structures. Debris also has the potential to cause damage to structures by breaking windows, damaging walls, or falling directly onto buildings and above-ground infrastructure.

Damage to utilities and roadways may also cause economic damage due to business closures, destruction of goods that require electricity, and the halt of economic activity. The following table projects the vulnerability to structures in Perry County based on the worst-case scenario tornado depicted in **Figure 4.9.2**. This modeling is completed only to demonstrate potential damage associated with an EF-5 tornado that tracks through the most populated areas of the County.

Table 4.9.3: Structure Vulnerability from Tornadoes

Structure Type	Number	Property Value	Building Value	Total Value
Residential	6,961	$40,491,610	$137,412,850	$177,904,460
Non-Residential	2,559	$26,683,280	$96,707,110	$123,390,390
Community Lifelines	16	$718,200	$12,913,340	$13,631,540
Totals	**9,520**	**$67,174,890**	**$234,119,960**	**$301,294,850**

Note: Community lifelines (critical facilities) are non-residential structures, so their value is also incorporated into the non-residential totals. Calculated totals are determined by summing the residential and non-residential values. The types located in the County are listed in ***Appendix C.***

Future Trends

Land Use and Development Trends

Tornadoes can occur anywhere. Any development that has occurred since that previous plan and any future development has the potential to be impacted by tornadoes.

Climate Change

According to the Fourth National Climate Assessment, certain hazards such as rainfall and heat can be directly linked to a warmer world, but the link between climate change and tornadoes is not yet fully understood. Tornado records in the U.S. are often only available starting during the 1950s. This limited data set makes it difficult to compare trends over long periods of time. Additionally, tornado reporting was not fully standardized until 2007, when the Enhanced Fujita Scale was released. As a result, although tornadoes are exhibiting changes that may be related to climate change, scientists cannot yet fully predict the direction and magnitude of changes to tornadoes from climate change.

However, the Center for Climate and Energy Solutions has identified some short-term trends, although they are not yet linked directly to climate change. The number of days with tornadoes in the U.S. has fallen, but tornado outbreaks, or the number of tornadoes in one day, have increased. The density and strength of tornadoes has also increased. Finally, tornado distribution has shifted eastwards, which includes a move towards Ohio.

4.9 Wildfire

Description

A wildfire is an uncontrolled fire that burns in a natural area of combustible vegetation such as a forest, grassland, or prairie, and typically occurs in rural areas. Non-wilderness fires are uncontrolled burning in residential or commercial development that are out of the scope of this plan, however, it is important to note that non-wilderness fires often accidentally cause wildfires. They can happen at any time or anywhere and more than half of the wildfires recorded have been started due to human activity. While wildfires can be caused by human activity or a natural phenomenon such as lighting, it is often the weather conditions that determine how much a wildfire grows.

Location

According to the State of Ohio Hazard Mitigation Plan (SOHMP), Perry County is within the ODNR Division of Forestry's Expanded Forest Fire Protection Area and is bordered on all sides by counties within this protection area: Fairfield, Licking, Muskingum, Morgan, Hocking, and Athens. Counties within this region tend to have abundant forested lands and grasslands and, as such, represent the area of highest wildfire risk and hazard in Ohio. The Ohio Wildfire Hazard Assessment is included in **Figure 4.10.1**. This assessment identifies wildfire risk level by township and classifies all townships in Perry County as low risk for wildfires.

Extent

Several factors can contribute to the escalation of risk of wildfires, including the prevalence of forests and agricultural lands and their close proximity to homes, residences, and structures, as well as the distance between fire and emergency management services. In these cases, presence of fire near structures causes fire departments to shift focus away from fire suppression and towards structure protection.

According to the SOHMP, 99.9 percent of wildfires in Ohio are caused by human action or accident. As such, many wildfires in Ohio burn in proximity to homes and structures. From 1997 to 2007, the main causes of wildfires in Ohio included debris burning, incendiary (arson), equipment, smoking, campfires, children (playing with matches), lightning, and railroad.

History

The SOHMP identifies 113 total fire events from January 1, 2007 to December 31, 2017, which averaged to 10 events annually. These events burned a total of 710 acres averaging 6.28 acres per event.

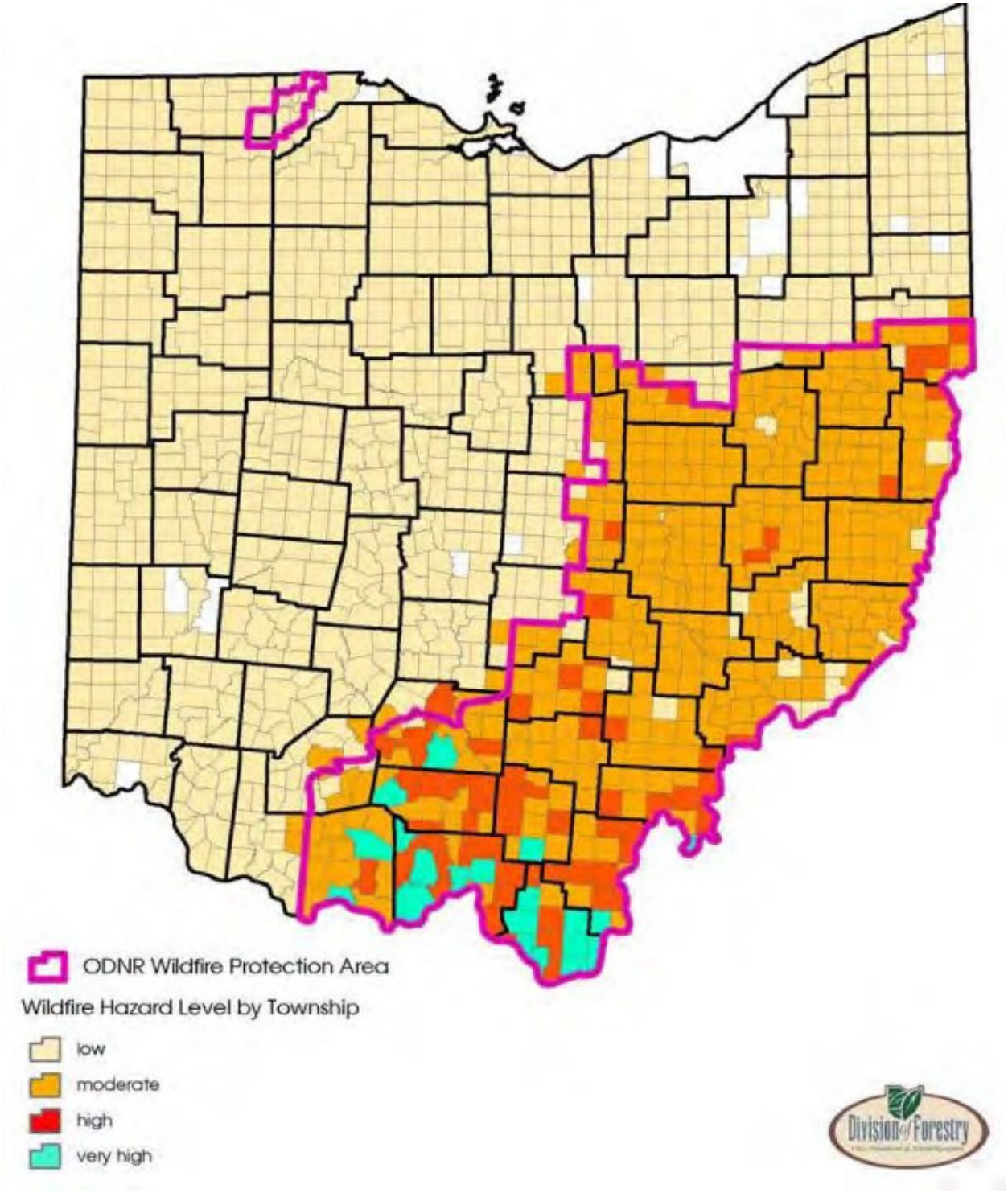
Estimating the monetary losses associated with wildfires is difficult due to the fact that most of these events occur in open land or fields with monetary losses often not being recorded. This lack of data may result in inconsistencies if an analysis was done based on reported monetary loss. As such, acres burned per fire event is a more consistent method of analysis for this hazard.

Of the 113 events, 103 fires (91 percent) burned less than ten acres; nine events (eight percent) burned between ten and 100 acres; and one event (one percent) burned more than 100 acres.

Probability

According to the *State of Ohio Hazard Mitigation Plan*, there is a 100 percent probability that a wildfire will occur within any county in any given year. Since 113 total fire events occurred in Perry County between January 1, 2007 to December 31, 2017, an average of ten fire events are estimated to occur annually in the County. In addition, according to the U.S. EPA, the average total area burned by wildfires has increased since the 1980s, and the record-breaking fires tend to occur during record-breaking warm years. The Climate Change section in Future Trends discusses climate change further.

Figure 4.10.1: Ohio Wildfire Hazard Level



Source: ODNR Ohio Division of Forestry

Vulnerability Assessment

Infrastructure Impact

There is low risk that wildfires in Perry County will impact infrastructure. Wildfires will most likely impact the County through property and crop damage.

Population Impact

Figure 4.10.1 shows the Ohio Wildfire Hazard Assessment, which indicates wildfire hazard level by township. On average, there is a moderate risk of wildfires occurring in Perry County. Reading Township is noted to have a high risk of wildfires. Accordingly, there is a moderate risk of impact to the population. If a wildfire would occur within the County, the population could be impacted by loss of homes and crops.

For social vulnerability, according to the National Risk Index, wildfires have a score of 0.47 ("very low") in Perry County, which is the lowest non-zero score of all of the hazards. The wildfires that have occurred in Perry County have only had some impacts to properties and crops. The index indicates an expected annual loss of $32 due to wildfires with a less than 0.001 percent change of a wildfire event occurring per year.

Property Damage

As there were 113 recorded wildfire events in Perry County's history, it is currently estimated that the County has experienced some property and crop damage as a result of wildfires. Occasionally, in the event of a wildfire, fire engines belonging to local fire departments are damaged while suppressing wildfires. Wildfire suppression has resulted in a great amount of personal property being saved by fire departments.

Due to the non-site-specific nature of this hazard, Table 4.10.2 lists all structures within the County as having potential impacts from wildfires.

Additionally, there are currently 50 state-owned and state-leased critical facilities located within Perry County, as determined by ODNR. All 50 of these facilities are located within a low wildfire risk area and have a value of approximately $4,930,612.

Loss of Life

Perry County has no recorded wildfire events resulting in loss of life, so it is unlikely that loss of life will result from wildfires. However, with any wildfire event, there is potential for loss of life. Advanced evacuation warnings can reduce the likelihood of death as a result of wildfires.

Economic Losses

Wildfires have the potential to damage agricultural crops and tree plantations, which can result in economic losses. According to the SOHMP, there are 20 state-owned or state-leased community lifelines (critical facilities) within regions of moderate wildfire hazard exposure and no community lifelines are within regions of high wildfire exposure. These structures are valued at $4,019,441. Table 4.10.2 shows the potential economic impacts if all structures within Perry County were damaged.

Table 4.10.2: Structure Vulnerability from Wildfires

Structure Type	Number	Property Value	Building Value	Total Value
Residential	20,763	$107,112,690	$383,799,790	$490,912,480
Non-Residential	9,361	$114,282,350	$258,736,580	$373,018,930
Community Lifelines	47	$1,082,910	$22,242,760	$23,325,670

Totals	**30,124**	**$221,395,040**	**$642,536,370**	**$863,931,410**

Note: Community lifelines (critical facilities) are non-residential structures, so their value is also incorporated into the non-residential totals. Calculated totals are determined by summing the residential and non-residential values. The types located in the County are listed in ***Appendix C.***

Climate Change

According to the U.S. EPA, the average total area burned by wildfires has increased since the 1980s, and the record-breaking fires tend to occur during record-breaking warm years. Combustion from wildfires also releases carbon dioxide into the atmosphere, contributing to climate change.

Future Trends

Land Use and Development Trends

Communities should monitor areas that are especially susceptible to wildfires and avoid development in such areas. New developments in these areas should implement fire protective measures.

Climate Change

According to the U.S. EPA, the average total area burned by wildfires has increased since the 1980s, and the record-breaking fires tend to occur during record-breaking warm years. Combustion from wildfires also releases carbon dioxide into the atmosphere, contributing to climate change.

4.10 Winter Storm

Description

Severe winter weather includes winter storms, heavy snow, and extreme cold. Winter storms including blizzards are events that have heavy snow, sleet, ice, freezing rain, or high winds as their primary type of precipitation. While the precipitation itself is typically not dangerous, frozen roads and exposure to cold can cause death and injury.

A winter storm forms under the correct combination of three causes:

1. Below freezing temperatures in the clouds and near the ground, which are necessary to make snow and ice.
2. Lift, which raises the moist air from the clouds and causes precipitation. Warm air colliding with cold air and being forced to rise over the cold is an example of lift.
3. Moisture is needed to form clouds and precipitation. Air blowing across a body of water is a common source of moisture.

Winter storms are categorized by their type: blizzards, ice storms, lake effect storms, and snow squalls.

- **Blizzards** are winter storms that are a combination of blowing snow and wind which lead to very low visibility. Heavy snowfalls and severe cold often accompany blizzards, but this is not required. Ground blizzards occur when strong winds pick up snow that has already fallen.
- **Ice Storms** occur when at least a quarter inch of ice accumulates on exposed surfaces. Roads and sidewalks can become dangerously slick, and trees and powerlines can easily break under the weight of accumulated ice.
- **Lake Effect Storms** are cold, dry air masses that move over the Great Lakes regions and drop the moisture as snow in the northeastern portion of Ohio near the Great Lakes area.
- **Snow Squalls** are brief, intense snow showers accompanied by strong winds. Impacts may be significant.

Location

Winter storms are typically large events that impact large areas at once. Winter storms will impact the entire County and have the potential to impact multiple counties.

Extent

The State of Ohio Hazard Mitigation Plan 2019 lists winter storms as one of the three highest threat hazards in Ohio. The average annual snowfall in Perry County is 10-20 inches, significantly lower than the state average of about 27 inches. However, during the winter of 2020-2021, Perry County had above normal snowfall with an average of 34.6 inches according to the New Lexington 2 NW, Ohio station. Snowfall typically occurs between November and April with January being the coldest month on average.

History

There have been at least 15 winter storm events, and another 79 winter weather events including heavy snow, extreme cold, wind chill, ice storm, and frost, in Perry County since January 1996. These events caused $157,000 in property damage and did not have any direct or indirect deaths according to The National Centers for Environmental Information (NCEI).

There have been two emergency declarations and one major disaster declaration related to severe winter weather covering Perry County reported by several federal sources as described below:

Major Disaster Declaration, February 15, 2005 (DR-1580-OH): Severe winter storms and ice impacted 59 counties including Perry County on February 15, 2005. This event was combined with flooding and mudslides. $7,534,746 in Hazard Mitigation Grants and $123,935,836 in public assistance were distributed throughout all impacted counties.

Emergency Declaration, January 26, 1978 (EM-3055-OH):

An extremely severe blizzard impacted all counties including Perry County on January 26, 1978. $3,546,669 in public assistance were distributed throughout all impacted counties (**Figure 4.11.1**).

Emergency Declaration, February 2, 1977 (EM-3029-OH):

A severe snowstorm impacted 47 counties including Perry County on February 2, 1977.

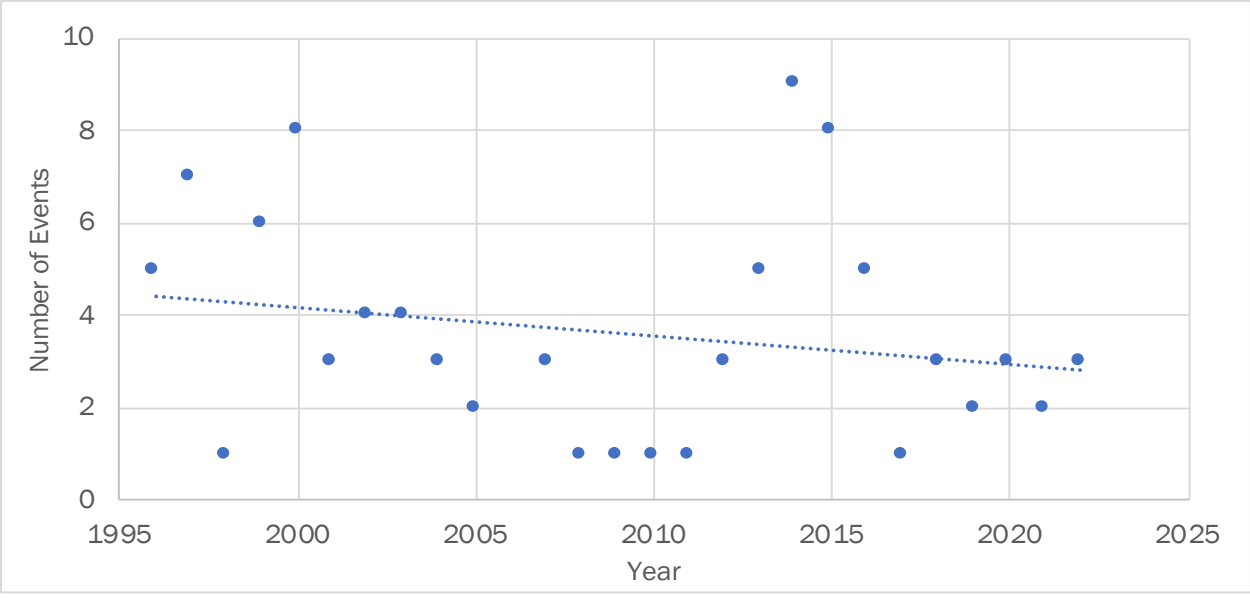
Figure 4.11.1: Blizzard of 1978

Source: NOAA

Probability

According to the NCEI, there have been a total of 94 winter storm and winter weather events reported in Perry County from January of 1996 to March 2022, with total losses amounting to $157,000 in property. This amounts to approximately three winter storm events annually with average annual damages of $6,038. **Figure 4.11.2** shows the trend of severe winter weather events over time between January 1996 and April 2022. The trend line slightly decreases over the 26 years. 2014 recorded nine events, the highest in the last 26 years followed by eight events recorded in 2000 and 2015. At least one event has been reported each year in the last 26 years. In addition, according to the Fourth National Climate Assessment, due to the warming climate, extreme winter weather will be less severe and less frequent in Ohio, and heavy snowfall will manifest as heavy rainfall in future years. The Climate Change section in Future Trends discusses climate change further.

Figure 4.11.2: Winter Storm Probability



Vulnerability Assessment

Infrastructure Impact

Winter storms can cause damage to overhead utilities. Wires can collapse under the weight of accumulated snow and ice leading to disruption in communication and power supply for days. Debris can block roadways or damage property as tree limbs can also collapse under the weight of accumulated snow and ice. Water pipes can be frozen under extreme low temperatures that may accompany severe winter storms. Roads and sidewalks can be blocked by the accumulation of snow, as well as being iced over. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

Population Impact

All residents of Perry County are expected to be impacted by severe winter storms. Infants, older adults, sick people, and pets are more vulnerable to injuries and health conditions related to exposure to heavy snow and ice. It is advisable to equip vulnerable populations with indoor easy-to-read thermometers and heating devices in locations where they are highly visible.

For social vulnerability, according to the National Risk Index, winter weather has a score of 9.63 ("relatively low") in Perry County, which is the third highest score of all of the hazards. There have been numerous winter weather events in Perry County, although typically they did not result in an emergency declaration. The index indicates an expected annual loss of $21,041 due to winter weather with 2.6 winter weather events occurring per year.

Property Damage

Property can be damaged by accumulated snow and ice, debris, and falling trees and utility poles. Extreme low temperatures can also freeze the water in pipes which could cause them to explode. All buildings in the County are exposed and vulnerable to winter storms. The State of Ohio Hazard Mitigation Plan 2019 estimates annual potential losses due to damage caused by winter storms in Perry County to be $32,990.42. Because severe winter weather can impact all parts of the County, **Table 4.11.3** lists all structures within the County as having potential impacts from severe winter weather.

Property owners should weatherproof their homes and buildings and conduct regular inspections to eliminate impacts from extreme weather conditions. FEMA suggests that individuals with damaged property should contact their insurance company and take photos of any damage. If individuals are uninsured or underinsured, they should seek assistance by visiting www.DisasterAssistance.gov.

Loss of Life

There are no reported direct or indirect deaths from any severe weather event in Perry County. However, the events that have impacted Perry County have caused deaths in other parts of Ohio and its neighboring states Kentucky and West Virginia. An extreme windchill event in January 2014 had an indirect death in Athens County, Ohio. Likely causes of death are from iced-over and dangerous roads which lead to vehicular accidents, frostbite or hypothermia from prolonged exposure to cold, heart attacks from heavy snow shoveling, and carbon monoxide poisoning due to toxic fumes from heating sources.

A few ways to prepare and protect from extreme winter weather conditions include, but are not limited to, staying indoors and dressing warmly, staying off roads, avoid driving if already in a vehicle, equipping vehicles with an emergency supply kit, preparing for power outages and using heating devices intended for indoor use only, staying updated about emergency information and alerts, seeking medical assistance on signs of hypothermia or frostbite, and checking on neighbors.

Economic Losses

Economic losses can occur from businesses shutting down for potentially long periods of time. Economic activity can be completely halted during winter storms including transportation of goods and people. Electricity outages may lead to spoiled goods. Since winter storms occur during the winter season, damages to crops are unlikely but possible. Damaged buildings and pipes, fallen trees and power lines, and costs to repair damages and remove snow further impact the economy of cities and towns. Table 4.11.3 shows the potential economic impacts if all structures within Perry County were damaged.

Table 4.11.3: Structure Vulnerability from Winter Storms

Structure Type	Number	Property Value	Building Value	Total Value
Residential	20,763	$107,112,690	$383,799,790	$490,912,480
Non-Residential	9,361	$114,282,350	$258,736,580	$373,018,930
Community Lifelines	47	$1,082,910	$22,242,760	$23,325,670
Totals	**30,124**	**$221,395,040**	**$642,536,370**	**$863,931,410**

Note: Community lifelines (critical facilities) are non-residential structures, so their value is also incorporated into the non-residential totals. Calculated totals are determined by summing the residential and non-residential values. The types located in the County are listed in ***Appendix C.***

Future Trends

Land Use and Development Trends

Winter storms can occur anywhere bringing an entire community or region to a standstill, including commuter and emergency transportation and medical services. Any development that has occurred since the adoption of the previous plan, and any future development, has the potential to be impacted by winter storms. All land uses are equally impacted by severe winter weather.

Building design and construction is also impacted by the amount of snowfall. Areas that receive high snowfall should have buildings designed to withstand the weight of the snow in order to avoid sagging, cracking and collapsing roofs. On the other hand, snow is a natural insulator, and snow accumulated on rooftops helps hold heat in buildings and, consequently, reduces heating costs.

It is important to maintain consistency between emergency planning, financial plans and budgets, and development planning. Zoning codes should ensure that there is adequate greenspace in existing and new developments to foster drainage and offers space to pile cleared snow. Locating emergency facilities, and partnering with emergency organizations during the planning process, will help develop improved contingency responses in cases where emergency transportation and services are cut off during an extreme weather event.

Climate Change

According to the Midwest chapter of the Fourth National Climate Assessment, the average Midwest air temperature increased by more than 1.5 degrees Fahrenheit between 1900 and 2010. In recent years, however, warming has increased three times as quickly between 1980 and 2010. By the end of 2030, Ohio's climate may trend towards the climate of Southern Illinois. By 2100, Ohio might feel like Arkansas or Texas. As a result, the warming climate suggests that extreme winter weather will be less severe and less frequent in Ohio, and heavy snowfall will manifest as heavy rainfall in future years.

5 | Hazard Mitigation Strategy

5.1 Hazard Mitigation Strategy

Hazard Priorities

Potential hazards, including natural, geological, and human-caused hazards, were rated by members of the Core Planning Committee, which included representatives from each jurisdiction in Perry County. Each potential hazard was rated on a scale of zero to five, with zero indicating the hazard should not be studied and five indicating the most significant threat to the representative's jurisdiction. A priority score was developed for each hazard by averaging the representatives' ratings. The hazards were then ranked by their priority score, where the highest priority score was given a hazard rank of one. The resulting hazard rank and associated priority score for each hazard are shown in **Table 5.1**.

Table 5.1: Hazard Priorities

Hazard	Priority Score	Hazard Rank
Tornado	4.27	1
Flood	4.14	2
Winter Storm	4.14	3
Severe Summer Storms (Lightning)	2.91	4
Landslide & Land Subsidence	2.86	5
Wildfire	2.36	8
Dam/Levee Failure	2.27	9
Drought & Extreme Heat	1.59	10
Earthquake	1.00	11
Invasive Species	1.00	12

Hazards Not Assessed

Below is a discussion covering hazards that were not included in this Plan update, as compared to the hazards included in the SOHMP and in Perry's County's previous 2017 HMP.

Coastal Erosion

Coastal erosion is hazard that is not applicable to Perry County due to the County's inland location, so it was not assessed.

Hazardous Materials Incident

Hazardous Materials Incident was included in the 2017 Plan, and it was considered for this Plan update. However, the Perry County EMA determined that it was not a priority for this Plan update.

Hurricanes/Tropical Storms

Hurricanes/tropical storms are hazards that are not directly applicable to Perry County due to the County's inland location, so they were not assessed; however, if remnants of hurricanes or tropical storms were experienced as thunderstorms, thunderstorm winds, or high/severe winds, those events were included in the severe summer storms and/or tornado assessments.

Lightning

Although lightning was not assessed as a separate hazard in this Plan update, it was included and assessed in Severe Summer Storms.

Seiche/Coastal Flooding

Seiche/coastal flooding is hazard that is not applicable to Perry County due to the County's inland location, so it was not assessed.

Terrorism

Terrorism was included in the 2017 Plan, and it was considered for this Plan update. However, the Perry County EMA determined that it was not a priority for this Plan update.

5.2 Hazard Mitigation Goals

Developing achievable goals forms the foundation for all mitigation actions and activities that will aid Perry County in attaining the overall mission of the Core Planning Committee. As such, the Core Planning Committee and participating jurisdictions assessed the goals of the 2017 Hazard Mitigation Plan and updated them for this Plan update. Goals were established and reviewed based upon their relationship to the hazard priorities and potential adverse impact of those hazards upon the community. The goals, as well as the hazards assessed for this Plan, informed the development of actions that the County and participating jurisdictions can take to mitigate the impacts of the hazards. The goals of the Perry County Hazard Mitigation Plan are as follows:

- Goal 1: Increase public information and awareness about hazards that affect Perry County.
- Goal 2: Expand awareness about tornadoes.
- Goal 3: Expand awareness and minimize the effects from flooding.
- Goal 4: Expand awareness about the effects from winter storms.
- Goal 5: Expand awareness about severe summer storms and lightning events.
- Goal 6: Expand awareness about landslides and land subsidence.
- Goal 7: Decrease wildfire hazard levels.
- Goal 8: Decrease dam/levee hazard levels.
- Goal 9: Expand awareness and minimize the effects from drought and extreme heat.
- Goal 10: Expand awareness about earthquakes.
- Goal 11: Minimize the effects from invasive species.

5.3 Hazard Mitigation Actions & Priorities

Members of the Core Planning Committee completed a Previous Mitigation Action Status survey, which indicated the status of mitigation actions included in the 2017 Hazard Mitigation Plan. This survey asked representatives to indicate whether the mitigation actions from the previous plan were completed, deleted, deferred, unchanged, or ongoing. It also asked the representative if the mitigation action should be included in this Plan update. The final results are included in **Appendix B**. In addition, new mitigation actions were developed and considered for inclusion in this Plan update that address gaps in the previous plan or new issues that have arisen since the 2017 Plan.

All new and old mitigation actions were reviewed and rated by members of the Core Planning Committee and local jurisdictions based on five criteria: cost-effectiveness, technical feasibility, environmentally soundness, immediate need, and total risk reduction. For each action, each of the five criteria were rated on a scale of one to five (low to high). All the surveys were collected and the

individual criteria for each mitigation action were averaged and then added together to develop a single raw score for each individual mitigation action. The raw score for each action was used in combination with the rankings of the associated hazard, as determined by the Hazard Priority Survey (**Table 5.1**), to develop a score for each mitigation action. The action scores were then ranked to indicate the priority of each specific action. The action with the highest action score was given an action priority of one, indicating that action was the highest priority. Hazard Mitigation Action priorities are organized by hazard in **Table 5.2**. The information used to develop the priorities from the jurisdictions surveys and comments can be found in **Appendix G**, along with all completed surveys that were used to prioritize the hazards and develop the goals.

Mitigation projects will only be implemented if the benefits outweigh the associated cost of the proposed project. The Core Planning Committee, in coordination with the Perry County EMA, performed a general assessment of each action that would require FEMA funding as part of the planning process. A detailed cost-benefit analysis of each mitigation action will be required during the project planning phase in order to determine the economic feasibility of each action. Projects will also be evaluated for social and environmental impact-related feasibility, as well as technical feasibility and any other criteria that evaluate project effectiveness. This evaluation of each project will be performed during the pre-application phase of a grant request. Project implementation will be subject to the availability of FEMA grants and other funding sources, as well as local resources.

Projects that are determined to be infeasible during this review process will be re-evaluated by members of the Core Planning Committee for re-scheduling or deletion.

Table 5.2: Mitigation Actions Priority Table by Hazard

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
Dam/Levee Failure								
1	Obtain inundation for high and significant hazard potential dams.	Perry County, Corning, Somerset, Monroe Twp, Pike Twp	10	96	County Commissioners, County EMA, ODNR	Existing Budget	12/2021 - 12/2027	New
2	Rehabilitate any high or significant hazard potential dams, as needed.	Perry County, Corning, Somerset, Monroe Twp, Pike Twp	10	98	County Commissioners, County EMA, ODNR	Existing Budget	12/2021 - 12/2027	New
3	Identify and record any high hazard potential dams in the County in need of rehabilitation.	Perry County, Crooksville, New Lexington, Monroe Twp, Pike Twp	10	100	County Commissioners, County EMA, ODNR	Existing Budget	12/2021 - 12/2027	New
4	Coordinate with ODNR Division of Water, in accordance with ORC Section 1512.062, to periodically reclassify any dam within Perry County as a result of a change in circumstances to ensure adequate safety according to the potential for downstream damage.	Perry County, Crooksville, Monroe Twp, Pike Twp	10	99	County Commissioners, County EMA, ODNR	Existing Budget	12/2005 - 12/2016	Previous

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
5	Complete special needs assessment of the county. Coordinate with officials in Athens and Morgan Counties to provide notification and warning of a failure of the Burr Oak Reservoir Dam, which would greatly affect Perry County, especially the Village of Corning.	Perry County, Corning, Junction City, New Lexington, Monroe Twp	10	102	County Commissioners, County EMA, ODNR	Existing Budget	12/2016 - 12/2021	Previous
6	Coordinate with the US Army Corps of Engineers to update outdated flood studies encompassing areas affected by the failure or topping of the Class 1 dams within and near Perry County, including, for example, the Tecumseh Lake Dam, Buckeye Lake Dam, and Burr Oak Reservoir Dam.	Perry County, Junction City, New Lexington, Shawnee, Monroe Twp	10	101	County Commissioners, County EMA, OEMA, ODNR, USACE	FMA	12/2005 - 12/2021	Previous
7	Coordinate with the ODNR, Dam Safety Engineering Program to conduct periodic safety inspections of existing dams in Perry County, and garner community support for the removal or repair of dams in disrepair.	Perry County, Crooksville, New Lexington, Shawnee, Monroe Twp, Pike Twp	10	97	County Commissioners, County EMA, OEMA, ODNR, USACE	Existing Budget	12/2016 - 12/2021	Previous
Drought & Extreme Heat								
8	Identify local drought indicators, such as precipitation, temperature, surface water levels, soil moisture, etc.	Perry County, Crooksville, Junction City, New Lexington, Somerset, Pike Twp	11	92	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New
9	Establish a regular schedule to monitor and report conditions on at least a monthly basis.	Crooksville, Junction City, Somerset, Pike Twp	11	94	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New
10	Install low-flow water fixtures in public buildings, such as shelters, schools, and government offices.	Junction City, Somerset, Pike Twp	11	88	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
11	Monitor local drought indicators in Perry County.	Perry County, Crooksville, Junction City, New Lexington, Straitsville, Pike Twp	11	95	County Commissioners, County EMA, OEMA, ODNR, USACE	PDM, FMA, Existing Budget	12/2016 - 12/2021	Previous
12	Develop and implement a plan to process donations, acquire feeds and provide potable water supplies for livestock.	Perry County, New Lexington, Thornville, Pike Twp	11	90	OEMA, County Commissioners	Existing Budget	12/2005 - 12/2021	Previous
13	Provide alternate potable water source in the event that existing water supplies are disrupted, or wells run dry.	Perry County, Corning, Crooksville, Junction City, New Lexington, Straitsville, Somerset, Thornville, Coal Twp, Monroe Twp, Pike Twp	11	87	County Commissioners, Northern Perry County Water District, Southern Perry County Water District, Crooksville Mayor	OEPA Grant	12/2005 - 12/2021	Previous
14	Establish an enforceable open burning ban to be implemented during droughts	Crooksville, Hemlock, Junction City, Straitsville, Coal Twp, Monroe Twp, Pike Twp	11	86	ODNR, County Commissioners	Existing Budget	12/2005 - 12/2021	Previous
15	Construct additional water storage facility for emergency crop management and fire suppression.	Perry County, Crooksville, Junction City, Straitsville, Coal Twp, Monroe Twp, Pike Twp	11	89	OEMA, County Commissioners	Existing Budget	12/2005 - 12/2021	Previous
16	Develop a public education program concerning the hazards associated with droughts and water restrictions during drought conditions.	Perry County, Crooksville, Junction City, New Lexington, Coal Twp, Monroe Twp, Pike Twp	11	91	OEMA, County EMA	Existing Budget	12/2005 - 12/2021	Previous
17	Educate the public about the symptoms associated with dehydration and hypothermia or other illnesses that can result from extreme temperatures.	Perry County, Crooksville, Junction City, New Lexington, Somerset, Pike Twp	11	93	County Commissioners, County EMA, OEMA	Existing Budget	12/2005 - 12/2021	Previous
Earthquake – included under "Multiple Hazards"								

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
			Flood					
18	Develop a floodplain management plan and update it regularly.	Perry County, Crooksville, Hemlock, Junction City, New Lexington, Straitsville, Thornville, Pike Twp	3	52	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
19	Establish a "green infrastructure" program to link, manage, and expand existing parks, preserves, greenways, etc.	Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Shawnee, Monroe Twp, Pike Twp	3	69	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
20	Develop a stormwater committee that meets regularly to discuss issues and recommend projects.	Corning, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Somerset, Pike Twp	3	63	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
21	Form a regional watershed council to help bring together resources for comprehensive analysis, planning, decision-making, and cooperation.	Crooksville, Glenford, Hemlock, Junction City, Straitsville, Shawnee, Somerset, Thornville, Monroe Twp, Pike Twp	3	49	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
22	Require that floodplains be kept as open space.	Glenford, Junction City, Straitsville, Somerset, Thornville, Monroe Twp	3	67	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
23	Limit the percentage of allowable impervious surface within developed parcels.	Corning, Glenford, Junction City, Straitsville, Monroe Twp	3	58	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
24	Adopt ASCE 24-05 Flood Resistant Design and Construction. ASCE 24 is a referenced standard in the IBC that specifies minimum requirements and expected performance for the design and construction of buildings and structures in the flood hazard areas to make them more resistant to flood loads and flood damage.	Corning, Crooksville, Glenford, Junction City, Somerset	3	55	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
25	Identify and map areas with stormwater management issues.	Corning, Crooksville, Glenford, Junction City, New Lexington, Monroe Twp, Pike Twp	3	47	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
26	Complete a stormwater drainage study for known problem areas.	Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Shawnee, Somerset, Thornville, Monroe Twp, Pike Twp	3	61	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
27	Encourage the participation in the NFIP for all eligible jurisdictions.	Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Shawnee, Somerset, Thornville, Monroe Twp, Pike Twp	3	67	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
28	Identify and map streams that require regular debris clearing.	Corning, Glenford, Hemlock, Junction City, Straitsville, Pike Twp	3	59	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
29	Routinely clear identified streams to limit the impacts of flooding.	Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Shawnee, Coal Twp, Monroe Twp, Pike Twp	3	56	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
30	Ensure that all utilities and other mechanical devices are placed above expected flood levels.	Perry County, Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Coal Twp, Monroe Twp, Pike Twp	3	60	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
31	Require that all critical facilities including emergency operations centers (EOC), police stations, and fire department facilities be located outside of flood-prone areas.	Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Thornville, Pike Twp	3	48	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
32	Acquire and demolish, relocate, or retrofit repetitive loss and severe repetitive loss properties.	Corning, Crooksville, Junction City, New Lexington, Straitsville, Somerset, Monroe Twp, Pike Twp	3	51	County Commissioners, County EMA, Mayors	Existing Budget	12/2021 - 12/2027	New
33	Clean/drag creeks and streams, clearing log jams, trees and shrubs, and sediments bars.	Perry County, Corning, Junction City, Monroe Twp	3	57	County Commissioners, County Engineers Office, ODNR	Existing Budget	12/2005 - 12/2021	Previous
34	Facilitate the formation of flood task forces throughout the county to address flooding problems on a regular basis, which could include the Floodplain Coordinator, and Township Trustees.	Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Coal Twp, Monroe Twp, Pike Twp	3	49	County Commissioners, County EMA, Mayors	Existing Budget	12/2005 - 12/2021	Previous

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
35	Establish an interagency network to monitor activities, such as floodplain development, throughout the county.	Corning, Glenford, Junction City, Monroe Twp, Pike Twp	3	64	County Commissioners, County EMA, Mayors	Existing Budget	12/2005 - 12/2021	Previous
36	Review and update floodplain maps on a regular basis.	Corning, Glenford, Hemlock, Junction City, Monroe Twp, Pike Twp	3	65	County Engineers Office	FMA	12/2005 - 12/2016	Previous
37	Develop specific flood mitigation plan(s) to accompany this mitigation plan for flood-prone areas.	Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Monroe Twp, Pike Twp	3	62	County Engineers Office, County EMA	Existing Budget	12/2005 - 12/2021	Previous
38	Participate in the Community Rating System (CRS) and join the National Flood Insurance Program (NFIP) where applicable to reduce flood insurance rates.	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Monroe Twp, Pike Twp	3	66	County Commissioners, County EMA	NFIP	12/2005 - 12/2021	Previous
39	Conduct acquisition and relocation projects in flood-prone portions of the county.	Perry County, Corning, Crooksville, Glenford, Hemlock, Junction City, Straitsville, Monroe Twp, Pike Twp	3	53	County Commissioners, OEMA	State or Federal Funds	12/2005 - 12/2021	Previous
40	Consider elevating low bridge decks or removing bridge piers to allow water to flow freely, especially at times of elevated water levels.	Perry County, Glenford, Junction City, Monroe Twp	3	53	County Commissioners, County Engineers Office	PDM Grant	12/2005 - 12/2021	Previous
41	Undertake diking projects to channel water away from populated areas, being careful not to adversely affect properties downstream.	Perry County, Corning, Crooksville, Glenford, Junction City, Pike Twp	3	45	County Commissioners, County Engineers Office	PDM Grant	12/2005 - 12/2021	Previous

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
42	Install dry dams upstream from areas frequently impacted by flood events.	Perry County, Glenford, Junction City, Monroe Twp	3	46	County Commissioners, County Engineers Office	PDM Grant	12/2005 - 12/2021	Previous
43	Install weather stations throughout county, public buildings, and private dwellings.	Perry County	3	44	County Commissioners, County Engineers Office	State or Federal Funds	12/2021 - 12/2028	New
Invasive Species								
44	Identify and map all known invasive species in the County.	Glenford, New Lexington	12	103	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New
45	Create a database for known invasive species incidents and their impacts.	Glenford, New Lexington	12	103	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New
46	Hold an annual meeting with ODNR to discuss potential invasive species issues.	Glenford, New Lexington, Coal Twp, Monroe Twp	12	105	County Commissioners, County EMA, ODNR	Existing Budget	12/2021 - 12/2027	New
Landslides and Land Subsidence								
47	Identify and map landslide hazard areas.	Perry County, Shawnee, Monroe Twp	5	107	County EMA, County Engineers Office, County SWCD	Existing Budget	12/2021 - 12/2027	New
48	Apply soil stabilization areas in landslide hazard areas on publicly owned slopes.	Shawnee, Pike Twp	5	106	County EMA, County Engineers Office, County SWCD	Existing Budget	12/2021 - 12/2027	New
Multiple Hazards								
49	Adopt the International Building Code (IBC) and International Residential Code (IRC).	Corning, Crooksville, Glenford, Junction City, Straitsville, Pike Twp	1	32	County EMA, County Engineers Office	Existing Budget	12/2021 - 12/2027	New
50	Identify and map existing emergency shelters.	Perry County, Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Somerset, Thornville, Monroe Twp	1	35	County EMA, County Engineers Office	Existing Budget	12/2021 - 12/2027	New

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
51	Distribute maps and information on existing emergency shelters.	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Thornville, Monroe Twp	1	25	County EMA	Existing Budget	12/2021 - 12/2027	New
52	Increase tree plantings around buildings and along streets to provide shade and reduce the risk of flash flooding and other hazards.	Glenford, Junction City, Somerset	1	23	County Commissioners	State or Federal Sources, Existing Budget	12/2021 - 12/2027	New
53	Encourage or mandate the installation of green roofs, which provide shade, reduce the risk of flash flooding, and remove heat from the surrounding air.	Glenford, Junction City	1	0	County Commissioners, County Engineers Office	Existing Budget	12/2021 - 12/2027	New
54	Identify vulnerable populations, such as concentrated elderly populations, racial minorities, and poverty, who may be at greater risk from natural hazards.	Perry County, Corning, Junction City, New Lexington, Straitsville, Monroe Twp, Pike Twp	1	40	County Engineers Office	Existing Budget	12/2021 - 12/2027	New
55	Organize outreach programs for identified vulnerable populations, including how to prepare for specific natural hazards and sharing the location of emergency shelters.	Perry County, Corning, Junction City, New Lexington, Straitsville, Thornville, Monroe Twp, Pike Twp	1	32	County Commissioners	State or Federal Sources, Existing Budget	12/2021 - 12/2027	New
56	Elevate and anchor mobile homes, mobile home parks, and camp grounds as appropriate to limit the impacts of flooding, flash flooding, tornadoes, etc.	Corning, Junction City, Straitsville, Somerset	1	37	County Engineers Office, County EMA	State or Federal Sources, Existing Budget	12/2021 - 12/2027	New
57	Ensure that high occupancy buildings, mobile homes, and camp grounds have emergency shelters in case of flooding, flash flooding, tornadoes, etc.	Corning, Junction City, Straitsville, Monroe Twp	1	31	County Engineers Office, County EMA	State or Federal Sources, Existing Budget	12/2021 - 12/2027	New

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
58	Encourage or organize a tree trimming program to reduce debris and utility failure during tornadoes, severe summer weather, and severe winter weather events.	Corning, Glenford, Junction City, Shawnee, Somerset, Monroe Twp, Pike Twp	1	22	County Commissioners, County Engineers Office, ODNR	State or Federal Sources, Existing Budget	12/2021 - 12/2027	New
59	Protect Power Lines and infrastructure by inspecting utility poles to ensure they meet specifications and are wind resistant, burying power lines to provide uninterrupted power after severe winds, considering both maintenance and repair issues and upgrading overhead utility lines (e.g., adjust utility pole sizes, utility pole span widths, and/or line strength).	Perry County, Corning, Glenford, Junction City, Thornville, Monroe Twp, Pike Twp	1	7	County Commissioners, County EMA	Existing Budget	12/2005 - 12/2021	Previous
60	Provide permanent shelters for residents of mobile home parks and campgrounds, where citizens may seek safety.	Perry County, Crooksville, Glenford, Junction City, Straitsville	1	17	County Commissioners, County EMA	State or Federal Sources	12/2005 - 12/2021	Previous
61	Upgrade the radio communications system throughout the County for all public safety services.	Perry County, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Somerset, Thornville, Coal Twp, Monroe Twp	1	4	County Commissioners, County EMA	Existing Budget	12/2005 - 12/2016	Previous
62	Provide back-up generators for critical facilities, including shelters, which need to maintain continuous power to protect human health and life.	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Shawnee, Somerset, Thornville, Coal Twp, Monroe Twp	1	9	County Commissioners, County EMA, School Districts	PDM Grant	12/2005 - 12/2021	Previous

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
63	Promote or Require Site and Building Design Standards to Minimize Wind Damage.	Crooksville, Glenford, Junction City, Somerset	1	43	County Commissioners, County EMA	State or Federal Sources	12/2005 - 12/2021	Previous
64	Provide/encourage NOAA weather radios for all critical facilities within the County	Perry County, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Thornville, Coal Twp, Monroe Twp, Pike Twp	1	16	County EMA	State or Federal Sources	12/2005 - 12/2021	Previous
65	Seek funding to acquire portable generators to loan out to critical facilities and shelters to loan out to critical facilities and shelters. This is noted as a high priority request by attendee(s).	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Shawnee, Somerset, Thornville, Coal Twp, Monroe Twp, Pike Twp	1	12	County Commissioners, County EMA	Existing Budget	12/2005 - 12/2021	Previous
66	Developing and maintaining a database to track community vulnerability to severe wind.	Perry County, Glenford, Junction City, Somerset, Monroe Twp, Pike Twp	1	27	County EMA, OEMA	State or Federal Sources	12/2005 - 12/2021	Previous
67	Coordinate with the National Weather Service (NWS) to warn residents of impeding severe winds and possible tornado conditions.	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Thornville, Coal Twp, Monroe Twp, Pike Twp	1	14	County EMA, OEMA, NWS	Existing Budget	12/2005 - 12/2021	Previous
68	Conduct landscape designs to control surface runoff and enhance rainwater collections.	Corning, Glenford, Junction City, Somerset, Coal Twp, Monroe Twp, Pike Twp	1	36	OEMA, County Commissioners	Existing Budget	12/2005 - 12/2021	Previous

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
69	Develop and implement a domestic water management/ conservation program.	Corning, Glenford, Junction City, Straitsville, Somerset, Thornville	1	41	OEMA, County Commissioners	Existing Budget	12/2005 - 12/2021	Previous
70	Identify the value of crops and property in Perry County.	Glenford, Junction City, New Lexington	1	42	OEMA, County Commissioners	USDA Grant, Existing Budget	12/2005 - 12/2021	Previous
71	Establish a series of dry hydrants throughout the County.	Perry County, Crooksville, Glenford, Junction City, Straitsville, Coal Twp, Monroe Twp	1	10	OEMA, County Commissioners	Existing Budget	12/2005 - 12/2021	Previous
72	Educate residents in Perry County on the benefits of conserving water at all times, not just during drought.	Perry County, Corning, Crooksville, Glenford, Junction City, Somerset, Thornville, Coal Twp	1	38	County EMA	Existing Budget	12/2005 - 12/2021	Previous
73	Identify location of vulnerable populations in Perry County. Collaborate with hospitals & retirement homes for the elderly to provide services to these vulnerable populations	Perry County, Corning, Crooksville, Glenford, Junction City, Straitsville, Thornville, Coal Twp, Monroe Twp	1	28	County Commissioners, County EMA	Existing Budget	12/2005 - 12/2021	Previous
74	Conduct pre-season public information campaigns to educate people about how to respond to emergency situations.	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Thornville, Coal Twp	1	26	County Commissioners, County EMA	Existing Budget	12/2005 - 12/2021	Previous
75	Set up a program for more regular inspections of endangered facilities during extreme temperature events.	Corning, Glenford, Junction City, Thornville	1	29	County Commissioners, Muskingum County Building & Permits Department	Existing Budget	12/2005 - 12/2021	Previous

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
76	Establish cooling centers in centralized locations to serve the largest populations.	Perry County, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset	1	20	County EMA	Existing Budget	12/2005 - 12/2021	Previous
77	Provide Electric Heaters or Oscillating Fans for the specific-at-risk population especially the elderly.	Perry County, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Thornville, Monroe Twp, Pike Twp	1	15	County EMA, Thornville Mayor	Existing Budget	12/2005 - 12/2021	Previous
78	Educate residents how to weather proof and protect their property.	Perry County, Glenford, Junction City, Pike Twp	1	8	County EMA	Existing Budget	12/2005 - 12/2021	Previous
79	Develop a brochure to distribute to local residents.	Perry County, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Coal Twp	1	34	County EMA	Existing Budget	12/2005 - 12/2021	Previous
80	Consider installing, re-routing, or increasing the capacity of existing storm drainage systems that may involve detention or retention ponds.	Corning, Glenford, Junction City, Somerset	1	39	County Commissioners, County Engineers Office, Mayors of All Participating Local Jurisdictions	Existing Budget	12/2005 - 12/2021	Previous
81	Update storm drainage systems.	Crooksville, Glenford, Junction City, New Lexington, Straitsville, Shawnee, Somerset, Thornville, Monroe Twp	1	29	County Commissioners, County Engineers Office, Rendville Mayor	PDM Grant	12/2005 - 12/2021	Previous

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
82	Strategically place or identify existing sites that could be used as emergency shelters throughout Perry County.	Perry County, Corning, Crooksville, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Shawnee, Thornville, Monroe Twp, Pike Twp	1	17	County Commissioners, County EMA	Existing Budget	12/2005 - 12/2021	Previous
83	Encourage the use of NOAA weather radios that continuously broadcast National Weather Service forecasts that provide direct warnings to the public for natural, technological, and man-made hazards.	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Thornville, Coal Twp, Monroe Twp	1	21	County Commissioners, County EMA	Existing Budget	12/2005 - 12/2021	Previous
84	Conduct a yearly drill to prepare for a disaster involving hazardous materials	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Monroe Twp	1	19	County EMA, County Commissioners, County EMS, OEMA	HMEP	12/2016 - 12/2021	Previous
85	Report what hazardous materials are being handled on-site	Perry County, Corning, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Monroe Twp	1	11	County EMA	Existing Budget	12/2016 - 12/2021	Previous
86	Report if additional hazardous materials are added or removed to the site	Perry County, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Monroe Twp	1	13	County EMA	Existing Budget	12/2016 - 12/2021	Previous
87	Install networked weather stations at courthouse, water, and sewer plants.	Somerset	1	2	County EMA, County Commissioners, County Engineers Office	Existing Budget	12/2021 - 12/2029	New

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
88	Upgrade reservoir on Big Inch to meet ODNR standards and provide early warning system.	Somerset	1	2	County EMA, County Commissioners, County Engineers Office	Existing Budget	12/2021 - 12/2030	New
89	Install and train for defibrillators in public and quasi-public buildings.	Somerset	1	5	County EMA, County Commissioners, County Engineers Office	Existing Budget	12/2021 - 12/2031	New
90	Acquire portable generators, heaters, and chillers for group deployment.	Somerset	1	5	County EMA, County Commissioners, County Engineers Office	Existing Budget	12/2021 - 12/2032	New
91	Acquire properties with long term drug abuse associations.	Somerset	1	1	County EMA, County Commissioners, County Engineers Office	Existing Budget	12/2021 - 12/2033	New
92	Augment training and manpower for youth advocacy, mental health improvements and high school diplomas.	Somerset	1	23	County EMA, County Commissioners, County Engineers Office	Existing Budget	12/2021 - 12/2034	New
93	Complete a plan with the Public Health Department to better prepare for an epidemic or pandemic.	Perry County, Glenford, Junction City, Straitsville, Thornville, Pike Twp	14	108	County Commissioners, County EMA, County Health Department	Existing Budget	12/2021 - 12/2027	New
Severe Summer Storms								
94	Developed a severe summer weather brochure for distribution by recreation equipment retailers and outfitters, as well as utility service providers.	Perry County, Glenford, Junction City, Thornville	5	80	County EMA, OEMA	Existing Budget	12/2021 - 12/2027	New
95	Post warning signs at local parks, county fairs, and other outdoor venues.	Perry County, Glenford, Junction City, Somerset	5	81	County EMA, OEMA	Existing Budget	12/2021 - 12/2027	New
96	Install and maintain surge protection on critical electronic equipment.	Perry County, Glenford, Junction City, Straitsville, Somerset	5	83	County EMA, County Engineers Office, OEMA	Existing Budget	12/2021 - 12/2027	New

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
97	Coordinate efforts with the local media to post advance warnings of hailstorms.	Perry County, Glenford, Junction City, New Lexington, Somerset	5	82	County EMA, OEMA	Existing Budget	12/2005 - 12/2021	Previous
Winter Storm								
98	Identify specific at-risk populations that may be exceptionally vulnerable to extreme cold and snow-related emergencies (such as the elderly).	Perry County, Corning, Glenford, Junction City, New Lexington, Straitsville, Monroe Twp	4	74	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New
99	Identify priority areas for snow removal services (such as critical roadways and areas with vulnerable populations).	Corning, Glenford, Hemlock, Junction City, New Lexington, Straitsville, Somerset, Coal Twp, Monroe Twp	4	73	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New
100	Create and maintain an on-call snow removal service for vulnerable populations.	Corning, Glenford, Hemlock, Junction City, New Lexington, Somerset, Coal Twp, Monroe Twp	4	71	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New
101	Educate vulnerable populations (particularly) on the dangers of snow shoveling. Elderly populations in particular are susceptible to heart attacks while shoveling snow.	Glenford, Junction City, Pike Twp	4	72	County Commissioners, County EMA	Existing Budget	12/2021 - 12/2027	New
102	Use snow fences or “living snow fences” (e.g., rows of trees or other vegetation) to limit blowing and drifting of snow over critical roadway segments.	Glenford, Junction City, Pike Twp	4	74	County Commissioners, County EMA, County Engineers Office	Existing Budget	12/2021 - 12/2027	New
103	Develop a Resource Manual Database that can be used to inventory emergency resources that can be employed to aid in emergency snow removal	Perry County, Crooksville, Glenford, Junction City, New Lexington, Somerset, Coal Twp	4	70	County EMA	Existing Budget	12/2005 - 12/2021	Previous

#	Mitigation Action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
			Tornado					
104	Require construction of safe rooms in new schools, daycares, nursing homes, and mobile home parks.	Glenford, Junction City, New Lexington, Straitsville, Somerset, Thornville, Pike Twp	2	76	County Engineers Office	State or Federal Funds	12/2021 - 12/2027	New
105	Encourage the construction and use of safe rooms in homes and shelter areas of manufactured home parks, fairgrounds, shopping malls, or other vulnerable public structures.	Perry County, Glenford, Junction City, Somerset	2	79	County EMA, County Engineers Office	State or Federal Sources	12/2021 - 12/2027	New
106	Distribute tornado shelter location information.	Perry County, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Thornville	2	77	County EMA	Existing Budget	12/2021 - 12/2027	New
107	Conduct outreach activities to increase awareness of tornado risk.	Perry County, Crooksville, Glenford, Junction City, New Lexington, Straitsville, Somerset, Pike Twp	2	78	County EMA, OEMA	Existing Budget	12/2005 - 12/2021	Previous
			Wildfire					
108	Map wildfires that occur within the County to identify potential hazard areas.	Perry County, Glenford, Junction City, New Lexington, Straitsville, Coal Twp, Monroe Twp, Pike Twp	9	84	County Engineers Office	Existing Budget	12/2021 - 12/2027	New
109	Join the "Firewise Communities/USA" program.	Glenford, Junction City, Straitsville, Somerset, Coal Twp, Monroe Twp	9	85	County Commissioners	Existing Budget	12/2021 - 12/2027	New

6 | Schedule & Maintenance

6.1 Participation Overview

The Perry County Hazard Mitigation Plan will be adopted by all jurisdictions in Perry County, including the county, all townships, and the cities and villages. After the jurisdictions have adopted the plan, their signed resolutions or ordinances will be added to the plan in **Appendix G**.

6.2 Continued Public Involvement

The public will continue to provide feedback on the Plan, as the Plan will be available through the Perry County Emergency Management Agency and Ohio Emergency Management Agency websites. Perry County will provide access to the Plan to all county, municipal, and township offices, and will make the Plan available in hardcopy and electronic format to the public as appropriate. The Perry County EMA Director will post notices of any meetings for updating and evaluating the Plan, using the usual methods for posting meeting announcements in the County to invite the public to participate. All meetings will be open to the general public. Perry County will publicly announce the mitigation action items that are slated for development in the current year, as well as any updates to the Plan as part of the annual review process.

6.3 Previous Integration Efforts

Local governments play a major role in enforcing and implementing mitigation strategies because their daily operations guide the development of the communities in Perry County. Every village in Perry County has a planning commission or a zoning board that deals with development and growth issues in their jurisdiction, referencing regulations, development plans, and mitigation strategies as they make decisions. These jurisdictions are small and have limited full-time staff, so the county as an organization provides strong leadership and oversight of economic development, community development, and land use planning. Many local officials wear numerous hats as they guide, direct, and facilitate local growth and development through regulation. Mitigation efforts are considered simultaneously with building code enforcement, zoning regulations, and land use rules at the county level. There is significant overlap between county officials when it comes to growth and development, including plan approval, issuance of permits, and occupancy approval responsibilities.

Perry County also has a Floodplain Manager who works with the Perry County Engineer to help plan, approve, modify, and regulate new facilities, subdivisions, and neighborhoods not only in the context of building codes, but also with consideration for flood risk. They also collaborate to be sure that new structures are not placed within flood risk zones without taking compensatory measures like elevation as early as the site development stage of construction. The Perry County Engineer works with the Perry County Auditor to manage the floodplain mapping and parcel identification and documentation by developing and maintaining GIS mapping. The Perry County Engineer also ensures that mitigation actions, like elevation, are properly included in the submitted building and occupancy permits during the approval process. The Perry County Engineer is also responsible for county ditch maintenance, which ties the County Engineer's office to the Soil Water Conservation District Office as well as the Farm Service Agency director as agricultural drainage concerns are shared and resolved. These officials work with the Floodplain Manager to check and evaluate the floodplain maps as introduced by FEMA to ensure accuracy through the map adoption process.

The Perry County EMA Director, Perry County Engineer, and Perry County Floodplain Manager are part of the planning committee that develops the Perry County Floodplain Management Plan. The most recent plan was approved by FEMA in 2016. The committee works continuously with floodplain regulations, NFIP participation, CRS community ratings, and other thresholds that signify smart development measures directed at creating resilient communities. This wide collaboration between jurisdictional representatives and officials helps Perry County engage in resilient development activities that intersect with the mitigation strategies.

6.4 Future Integration Efforts

Because local government plays a key role in the execution and implementation of mitigation strategies, each community will be responsible for understanding which items they are accountable for implementing. Annually, jurisdictions and responsible agencies should provide a status update for each mitigation action that is under their purview. This meeting should coincide with the budget process so that future funding sources can be determined and set aside for actions slated for that particular year. This meeting will also be available to the public. Additionally, each jurisdiction and the County will review the Hazard Mitigation Plan during other planning processes, such as development of comprehensive plans or capital improvement plans and incorporate appropriate goals and mitigation actions into such documents.

Additionally, the County and its participating jurisdictions will make a concerted effort to integrate the Hazard Mitigation Plan and its mitigation actions into existing plans and regulations, such as comprehensive plans, capital improvement plans, zoning codes and subdivision regulations, parks and open space plans, active shooter plans, and emergency operations plans.

Specifically for the Perry County Emergency Operations Plan, the EOP should facilitate integration of mitigation into response and recovery activities where appropriate, so key staff responsible for administering and updating the EOP should coordinate with the Core Planning Committee to identify integration areas and perform them. For the jurisdictions with floodplain regulations (County, Crooksville, Glenford, Hemlock, Junction City, New Lexington, New Straitsville, and Shawnee), this Plan includes an action to "review and update floodplain maps on a regular basis," so as floodplain regulations are reviewed and updated, the local floodplain coordinator(s) should continue to participate in the NFIP and should keep their maps updated. The Core Planning Committee should also engage the local floodplain coordinators and include them in their annual meetings for coordination, support, and to ensure this action is being met. For the zoning and land use regulations, this plan can be integrated in several ways. When zoning and/or land use regulations are reviewed and updated, related to flooding and dam failure, potential impact areas should be designated for limited to no development; and for landslides and land subsidence, land bordering waterways should either be left free of development or be reinforced to resist erosion. The Core Planning Committee should also engage the staff involved in administering and updating zoning codes and land use regulations and include them in their annual meetings for coordination, support, and assistance in integrating these recommendations from the plan.

6.5 Updating the Plan

The Hazard Mitigation Plan must be updated within five years and re-adopted by the County and all participating jurisdictions to maintain compliance with federal regulations and ensure eligibility for certain federal mitigation grant funds. Perry County will identify any necessary modifications to the Plan, including changes in mitigation goals and actions that should be incorporated into the next update. The Perry County EMA Director and the County Commissioners will initiate the process of updating the plan in accordance with federal guidelines in sufficient time to meet state and federal deadlines.