Elk County 2023 Hazard Mitigation Plan

Prepared for:

Elk County Planning Department

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Prepared by:

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Certification of Annual Review Meetings

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED? *	SIGNATURE
2023			
2024			
2025			
2026			
2027			

**Confirm yes here annually and describe on record of change page.*

Record of Changes

DATE	DESCRIPTION OF CHANGE MADE, MITIGATION ACTION COMPLETED, OR PUBLIC OUTREACH PERFORMED	CHANGE MADE BY (PRINT NAME)	CHANGE MADE BY (SIGNATURE)

Table of Contents

Figures

Tables

Acronyms

AACT:	American Academy of Clinical Toxicology
ACHA:	American College Health Association
ACMT:	American College of Medical Toxicology
AHJ:	Authority Having Jurisdiction
AMD:	Acid Mine Drainage
ANSI:	American National Standards Institute
ASAM:	American Society of Addiction Medicine
ASHRAE:	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASIRT:	Association for Safe International Road Travel
BFE:	Base Flood Elevation
CBRNE:	Chemical, Biological, Radiological, Nuclear, or Explosive
CDC:	Centers for Disease Control and Prevention
CERT:	Community Emergency Response Team
CFR:	Code of Federal Regulations
CFS:	Commodity Flow Study
CHSN:	College Health Surveillance Network
CCIDRAP:	Center for Infectious Disease Research and Policy
CRS:	Community Rating System
DCNR:	Department of Conservation and Natural Resources
DDAP:	Department of Drug and Alcohol Programs
DEA:	Drug Enforcement Administration
DFIRM:	Digital Flood Insurance Rate Map
DMA:	Disaster Mitigation Act
DPS:	Department of Public Safety
EF:	Enhanced Fujita
EIA:	Energy Information Administration
EMA:	Emergency Management Agency
EMPG:	Emergency Management Performance Grant

EMS:	Emergency Medical Services
EOP:	Emergency Operations Plan
EPA:	Environmental Protection Agency
EPCRA:	Emergency Planning and Community Right-To-Know Act
EPZ:	Emergency Planning Zone
FBI:	Federal Bureau of Investigations
FEMA:	Federal Emergency Management Agency
FMA:	Flood Mitigation Assistance Grant Program
FRA:	Federal Railroad Association
GIS:	Geographic Information Systems/Sciences
HAZUS:	Hazards U.S. Software
HMA:	Hazard Mitigation Assistance
HMEP:	Hazardous Material Emergency Planning Grant
HMGP:	Hazard Mitigation Grant Planning
HMP:	Hazard Mitigation Plan
HMRF:	Hazardous Material Response Fund
HSCA:	Hazardous Sites Cleanup Act
HSGP:	Homeland Security Grant Program
HVE:	Homegrown Violent Extremist
ICC:	International Code Council
IES:	Illuminating Engineering Society
LEPC:	Local Emergency Planning Committee
LGTBQ:	Lesbian, Gay, Bisexual, Trans & Queer
LPT:	Local Planning Team
MAT:	Medication-Assisted Treatment
MPC:	Municipalities Planning Code
NARM:	Notification and Resource Manual
NAS:	Neonatal Abstinence Syndrome
NCDC:	National Climatic Data Center
NCEI:	National Centers for Environmental Information

NFIP:	National Flood Insurance Program
NFPA:	National Fire Protection Association
NIH:	National Institute of Health
NLD:	National Levee Database
NOAA:	National Oceanic and Atmospheric Administration
NTP:	Narcotic Treatment Program
NWS:	National Weather Service
OIH:	Opioid-Induced Hyperalgesia
OUD:	Opioid Use Disorder
PA DCED:	Pennsylvania Department of Community and Economic Development
PA DEP:	Pennsylvania Department of Environmental Protection
PA DOA:	Pennsylvania Department of Agriculture
PA GWIS:	Pennsylvania Groundwater Information System
PA HART:	Pennsylvania Helicopter Aquatic Rescue Team
PAWNVCP:	Pennsylvania West Nile Virus Control Program
PDMP:	Prescription Drug Monitoring Program
PDSI:	Palmer Drought Severity Index
PEMA:	Pennsylvania Emergency Management Agency
PennDOT:	Pennsylvania Department of Transportation
PHMSA:	Pipeline and Hazardous Materials Safety Administration
PISC:	Pennsylvania Invasive Species Council
POD:	Points of Dispensing
PWSA:	Public Water Service Area
RF:	Risk Factor
SARA:	Superfund Amendments and Reauthorization Act
SC:	Steering Committee
SFHA:	Special Flood Hazard Area
TRI:	Toxic Release Inventory
UCC:	Uniform Construction Code

US HHS:	United States Department of Health and Human Services
USACE:	Untied States Army Corp of Engineers
USDA:	United States Department of Agriculture
USDA FS:	United States Department of Agriculture Forest Service
USGS:	United States Geological Survey
WL:	Working Level
WMD:	Weapon of Mass Destruction
WUI:	Wildland Urban Interface

Executive Summary

Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. Hazard mitigation focuses attention and resources on county and municipal policies and actions that will produce successive benefits over time. State and local governments engage in hazard mitigation planning to identify risks and vulnerabilities associated with natural as well as human-caused hazards and develop long-term strategies for protecting people and property from future hazard events. Mitigation plans are key to breaking the cycle of disaster damage, reconstruction, and repeated damage. This plan represents the work of citizens, elected and appointed government officials, business leaders, and volunteer and nonprofit groups to protect community assets, preserve the economic viability of the community, and save lives.

In 2022, the Elk County Planning Department contracted the services of a consulting agency to revise and update the Elk County Hazard Mitigation Plan. The plan was successfully updated in accordance with the requirements set forth by PEMA and FEMA. The updated Elk County Hazard Mitigation Plan was adopted by the Elk County Commissioners in 2023. All twelve municipalities adopted the 2018 Elk County Hazard Mitigation Plan as the municipal hazard mitigation plan, and it is anticipated that all participating municipalities will adopt the 2023 Elk County Hazard Mitigation Plan Update.

The Elk County Commissioners secured a grant to complete the 2023 update to the Elk County Hazard Mitigation Plan. MCM Consulting Group, Inc. was hired to assist the county with the update of the plan. The local planning kick-off meeting was conducted on December 19, 2022.

The planning process for the 2023 Elk County Hazard Mitigation Plan Update consisted of the following:

- Identification and prioritization of the hazards that may affect the county and its municipalities.
- Assessment of the county's and municipalities' vulnerability to these hazards.
- Identification of the mitigation actions and projects that can reduce that vulnerability.
- Development of a strategy for implementing the actions and projects, including identifying the agency(ies) responsible for that implementation.

Throughout the planning process, the general public was given the opportunity to comment on the existing HMP and provide suggestions for the updated version. Due to COVID-19, public meetings were offered via an online platform to provide residents an opportunity to provide input on the HMP. Several meetings were held in person with a virtual option, and participants were invited to submit surveys and other documents via an online survey.

The following hazards were identified by the local planning team as presenting the highest risk to the county and its municipalities:

Natural hazards:

- Drought
- Earthquake
- Flooding, Flash Flooding, Ice Jam Flooding
- Invasive Species
- Landslide
- Pandemic and Infectious Disease
- Radon Exposure
- Subsidence/Sinkhole
- Tornado/Windstorm
- Wildfire
- Winter Storm

Human-caused hazards:

- Civil Disturbance
- Dam Failure
- Emergency Services
- Environmental Hazards / Hazardous Materials
- Levee Failure
- Opioid Epidemic
- Terrorism/Cyberterrorism Incidents
- Transportation Accidents
- Urban Fire / Explosion
- Utility Interruption

A total of twenty-one hazards have been identified in the 2023 Elk County Hazard Mitigation Plan. A total of fourteen identified hazards were listed in the previous 2018 plan update. The new hazards include earthquake, invasive species, pandemic, epidemic, and infectious disease, radon exposure, subsidence and sinkhole, civil disturbance, emergency services, levee failure, and opioid epidemic.

To mitigate against the effects of these hazards, the local planning team identified the following goals for hazard mitigation over the next five years:

- Reduce potential injury/death and damage to existing community assets due to floods, flash floods, and ice jams.
- Reduce potential injury/death and damage to community assets due to all hazards.
- Promote disaster-resistant future development.
- Promote hazard mitigation as a public value in recognition of its importance to the health, safety, and welfare of the population.
- Improve response and recovery capabilities.
- Protect critical infrastructure.

Mitigation actions are specific projects and activities that help achieve goals. A total of sixty-six actions were developed for this plan update as they pertain to hazards identified by the local planning team. The 2018 Elk County Hazard Mitigation Plan consisted of twenty-one total actions. The individual objectives and actions that will be implemented are shown in Section 6.4. Each municipality was provided the opportunity to submit new project opportunity forms for this update. No new project opportunity forms were submitted during the 2018 HMP update. A total of thirteen project opportunities were submitted for this plan update.

The 2023 Elk County Hazard Mitigation Plan is the cornerstone to reducing Elk County's vulnerability to disasters. It is the commitment to reducing risks from hazards and serves as a guide for decision makers as they commit resources to reducing the effects of hazards. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage.

The 2023 Elk County Hazard Mitigation Plan is a living document that reflects ongoing hazard mitigation activities and requires monitoring, evaluating, and updating to ensure the mitigation actions are implemented. To facilitate the hazard mitigation planning process and adhere to regulatory requirements, the plan will be reviewed annually, and any major revisions will be incorporated into the five-year update.

1. Introduction

1.1. Background

The Elk County Board of Commissioners, in response to the Disaster Mitigation Act of 2000 (DMA 2000), organized a countywide hazard mitigation planning effort to prepare, adopt, and implement a multi-jurisdictional Hazard Mitigation Plan (HMP) for Elk County and all of its twelve municipalities. The Elk County Planning Department was charged by the County Board of Commissioners to prepare the 2023 plan. The 2018 HMP has been utilized and maintained during the five-year life cycle.

The Elk County Commissioners were successful in securing hazard mitigation grant funding to update the county hazard mitigation plan. The pre-disaster mitigation grant funding was administered by the Pennsylvania Emergency Management Agency and provided to Elk County as a sub-grantee. The Elk County Commissioners assigned the Elk County Planning Department with the primary responsibility to update the hazard mitigation plan. MCM Consulting Group, Inc. was selected to complete the update of the HMP. A local hazard mitigation planning team was developed comprised of government leaders and citizens from Elk County. This updated HMP will provide another solid foundation for the Elk County Hazard Mitigation Program.

Hazard mitigation describes sustained actions taken to prevent or minimize long-term risks to life and property from hazards and to create successive benefits over time. Pre-disaster mitigation actions are taken in advance of a hazard event and are essential to breaking the disaster cycles of damage, reconstruction, and repeated damage. With careful selection, successful mitigation actions are cost-effective means of reducing risk of loss over the long term.

Hazard mitigation planning has the potential to produce long-term and recurring benefits. A core assumption of mitigation is that current dollars invested in mitigation practices will significantly reduce the demand for future dollars by lessening the amount needed for recovery, repair, and reconstruction. These mitigation practices will also enable local residents, businesses, and industries to reestablish themselves in the wake of a disaster, getting the economy back on track sooner with less interruption.

1.2. Purpose

The purpose of this all-hazard mitigation plan (HMP) is:

- Protect life, safety, and property by reducing the potential for future damages and economic losses that result from hazards.
- Qualify for additional grant funding, in both the pre-disaster and the post-disaster environment.

- Speed recovery and redevelopment following future disaster events.
- Demonstrate a firm local commitment to hazard mitigation principles.
- Comply with both state and federal legislative requirements for local hazard mitigation plans.

1.3. Scope

This Elk County Multi-Jurisdictional Hazard Mitigation Plan serves as a framework for saving lives, protecting assets, and preserving the economic viability of the twelve municipalities in Elk County. The HMP outlines actions designed to address and reduce the impact of a full range of natural hazards facing Elk County, including drought, earthquakes, flooding, tornadoes, hurricanes/tropical storms, invasive species, and severe winter weather. Human-caused hazards such as transportation accidents, emergency services shortage, hazardous materials spills, and fires are also addressed.

A multi-jurisdictional planning approach was utilized for the Elk County HMP update, thereby eliminating the need for each municipality to develop its own approach to hazard mitigation projects, common mitigation goals and objectives, and an evaluation of a broad capabilities assessment examining policies and regulations throughout the county and its municipalities.

1.4. Authority and References

Authority for this plan originates from the following federal sources:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C., Section 322, as amended
- Code of Federal Regulations (CFR), Title 44, Parts 201 and 206
- Disaster Mitigation Act of 2000, Public Law 106-390, as amended
- National Flood Insurance Act of 1968, as amended, 42 U.S.C. 4001 et seq.

Authority for this plan originates from the following Commonwealth of Pennsylvania sources:

- Pennsylvania Emergency Management Services Code. Title 35, Pa C.S. Section 101
- Pennsylvania Municipalities Planning Code of 1968, Act 247 as reenacted and amended by Act 170 of 1988.
- Pennsylvania Stormwater Management Act of October 4, 1978. P.L. 864, No. 167

The following Federal Emergency Management Agency (FEMA) guides and reference documents were used to prepare this document:

- FEMA 386-1: Getting Started. September 2002

- FEMA 386-2: Understanding Your Risks: Identifying Hazards and Estimating Losses. August 2001
- FEMA 386-3: Developing the Mitigation Plan. April 2003
- FEMA 386-4: Bringing the Plan to Life. August 2003
- FEMA 386-5: Using Benefit-Cost Review in Mitigation Planning. May 2007
- FEMA 386-6: Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning. May 2005
- FEMA 386-7: Integrating Manmade Hazards into Mitigation Planning. September 2003
- FEMA 386-8: Multijurisdictional Mitigation Planning. August 2006
- FEMA 386-9: Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects. August 2008
- FEMA Local Multi-Hazard Mitigation Planning Guidance. July 1, 2008
- FEMA National Fire Incident Reporting System 5.0: Complete Reference Guide. January 2008
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards. January 2013
- FEMA Rehabilitation of High Hazard Potential Dams: Grant Program Guidance, June 2020

The following Pennsylvania Emergency Management Agency (PEMA) guides and reference documents were used to prepare this document:

- PEMA: Hazard Mitigation Planning Made Easy!
- PEMA Mitigation Ideas: Potential Mitigation Measures by Hazard Type: A Mitigation Planning Tool for Communities. March 6, 2009
- PEMA: All-Hazard Mitigation Planning Standard Operating Guide, 2020.

The following document produced by the National Fire Protection Association (NFPA) provided additional guidance for updating this plan:

NFPA 1600: Standard on Disaster/Emergency Management and Business Continuity Programs. 2011

2. Community Profile

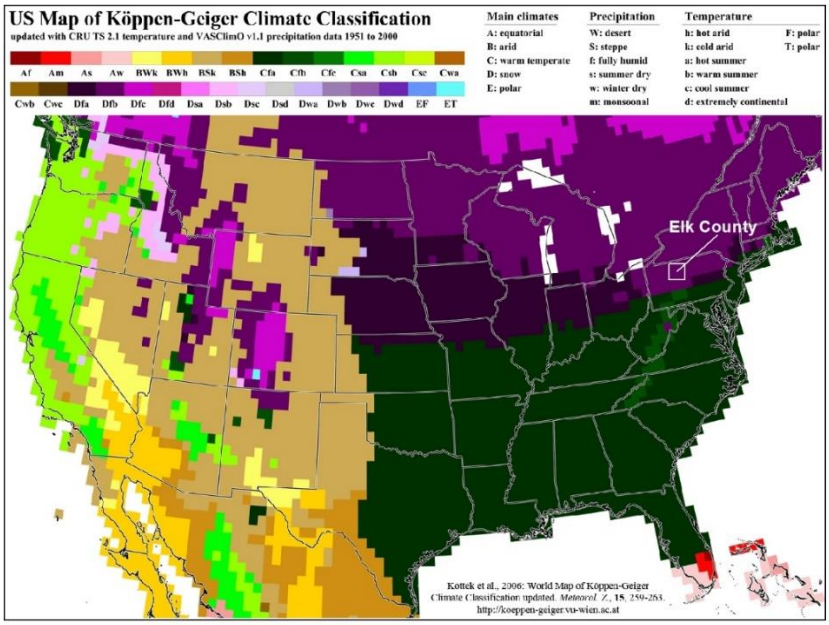
2.1. Geography and the Environment

Elk County covers approximately 832 square miles and is situated in northwest-central Pennsylvania. The county is bordered by Forest County in the west, by McKean County to the north, by Cameron County to the east, by Clearfield County to the south, by Jefferson County to the southwest, and by Warren County to the northwest, which can be seen in *Figure 3 Elk County Base Map.* Elk County lies within the Appalachian Plateaus physiographic province. The county is the 59th ranked county in terms of population within the Commonwealth of Pennsylvania. There is a total of 827 square miles of land and 4.9 square miles of water.

Elk County presents a wide range of topographic features. The surface ranges from almost level on plateaus and in valleys, to rolling and hilly in other areas. Elevations in the county range from a high of 2,376 feet near the middle of Jones Township in the northeast of the county to a low of 883.36 feet approximately 800 feet west of the intersection of Dents Run and Hicks Run in the southeast corner of the county.

The Köppen-Geiger Climate Areas map classifies Elk County, and the rest of Pennsylvania, as Humid Continental, which can be seen in *Figure 1 – Köppen-Geiger Climate Map*. While the counties of Pennsylvania share many weather similarities, there are also a few unique characteristics to the area.

Figure 1 - Koppen-Geiger Map



According to current data, the climate in Elk County is temperate, being characterized by moderately hot summers and moderately severe winters. In winter, the average temperature is 26.46˚F and the average daily minimum temperature is 22.39˚F. In summer, the average temperature is 66.78˚F and the average daily maximum temperature is 84.66˚F. The average amount of snowfall each winter is 12.56 inches.

River and stream valleys and low, rolling hills dominate the landscape of Elk County. The Clarion River is the primary water feature in Elk County and is formed at Johnsonburg Borough from the east and west branches. The Clarion River flows past Ridgway Borough and out of Elk County into Clarion County. Its major tributaries include but are not limited to East Branch Clarion River, West Branch Clarion River, Johnson Run, Powers Run, Riley Run, Little Mill Creek, Mason Creek, and Elk Creek. Many smaller tributaries exist from the Clarion River.

Elk County is comprised of four large watersheds and nine small watersheds as shown in *Figure 4 Elk County Watersheds* and *Table 1 – Watersheds in Elk County*:

Table 1 - Watersheds in Elk County

Watersheds in Elk County	
Watershed Name	**Size**
Clarion Watershed	Large
Middle Allegheny-Redbank Watershed	Large
Sinnemahoning Water Shed	Large
Upper West Branch Susquehanna Watershed	Large
Bogus Run Watershed	Small
Chaffee Run Watershed	Small
Coon Run Watershed	Small
Crane Run Watershed	Small
East Branch Tionesta Creek Watershed	Small
Iron Run Watershed	Small
Martin Run Watershed	Small
South Branch Tionesta Creek Watershed	Small
Wolf Run Watershed	Small

2.2. Community Facts

Elk County was created in 1843, on April 18th and was made from portions of Jefferson, Clearfield, and McKean Counties. Elk County is named for the indigenous elk population that is unique to the region, specifically the eastern elk. The county seat is Ridgway, Pennsylvania and the largest municipality by population is the city of St. Marys.

The following cities, boroughs and townships are located in Elk County:

- Cities: St. Marys
- Boroughs: Johnsonburg and Ridgway
- Townships: Benezette, Fox, Highland, Horton, Jay, Jones, Millstone, Ridgway, and Spring Creek

There is one museum in Elk County, and that museum is the Elk County Historical Society's Robinson Museum. Based on information from the Elk County Historical Society, the Robinson Museum "houses thousands of artifacts from Victorian clothing to an expensive archive of photographs and documents spanning the county's nearly two-hundred-year history." The Robinson Museum also includes cemetery records, census records, obituaries, newspaper records, county and township histories, school yearbooks, and town directories. The museum also has a small bookstore offering writing on local interest stories. The Robinson Museum is located in Ridgway at the following address: 109 Center Street, Ridgway, Pennsylvania 15853.

The National Park Service's (NPS) National Register of Historic Places lists six in Elk County that are National Historic places. These buildings can be found in *Table 2 – Elk County National Historic Places*, including the year that the building was added to the list and the municipality where it is located.

Table 2 - Elk County National Historic Places

Elk County National Historic Places		
Building/Location Name	**Date Added to NRHP**	**Municipality**
Bonifels	12/14/1978	Ridgway Township
Decker's Chapel	11/12/1998	City of St. Marys
John R. Weidenboerner House	07/24/1992	City of St. Marys
O.B. Grant House	04/05/2004	Ridgway Township
Ridgway Armory	12/22/1989	Ridgway Borough
Swedish Lutheran Parsonage	02/24/2005	Johnsonburg Borough
Source: NPS NRHP, 2023		

Within Elk County, there is also one cultural district that is listed on the National Register of Historic Places. This cultural district is the Johnsonburg Commercial Historic District that is located in Johnsonburg Borough. The district includes approximately thirty-two structures and are of mostly a brick construction. This district was added to the National Register of Historic Places in 1999. The largest building in this district is the Anderson Brick Block. All of Elk

County's National Historic Places and Cultural Districts can be found in *Figure 5 – Elk County Cultural and Historic Locations*.

2.3. Population and Demographics

The total population for Elk County is 30,990 based on the 2020 United States Decennial Census. The total change in population for Elk County from 2010 to 2020 was a decrease of 956 and a percent change of -3%. The most populous municipality is the city of St. Marys. The municipalities in the county that had the largest percentage of decrease from 2010 to 2020 were Highland Township (-18.1%), Spring Creek Township (-14%), and Horton Township (-5.9%). The municipalities that had the highest percentage increase for the period from 2010 to 2020 were Millstone Township (15.9%) and Benezette Township (4.4%). *Table 3 – Population Change in Elk County* illustrates the trends and data from the United States Census Bureau. These figures are based off data from the 2020 United States Decennial Census. *Figure 6 – Elk County Population Density* illustrates the average population density values per census track in the various municipalities of Elk County.

Table 3 - Population Change in Elk County

Population Change in Elk County from 2010-2020			
Municipality	**2010 Census**	**2020 Census**	**Percent of Change 2010-2020**
Benezette Township	207	216	4.4%
Fox Township	3,630	3,576	-1.5%
Highland Township	492	403	-18.1%
Horton Township	1,452	1,366	-5.9%
Jay Township	2,072	1,963	-5.3%
Johnsonburg Borough	2,483	2,404	-3.2%
Jones Township	1,624	1,573	-3.1%
Millstone Township	82	95	15.9%
Ridgway Borough	4,078	4,039	-1.0%
Ridgway Township	2,523	2,416	-4.2%
Spring Creek Township	233	201	-14.0%
St. Marys, City of	13,070	12,738	-3.0%
TOTAL	**31,946**	**30,990**	**-3.0%**
Source: United States Census Bureau 2023, 2010 and 2020 Census Data			

There are approximately 16,836 housing units in Elk County, Pennsylvania. Of these housing units, there are an estimated 13,499 households within the county, with an average size of 2.27 persons. Married couples make up a plurality of households in the county (47.1%), with an

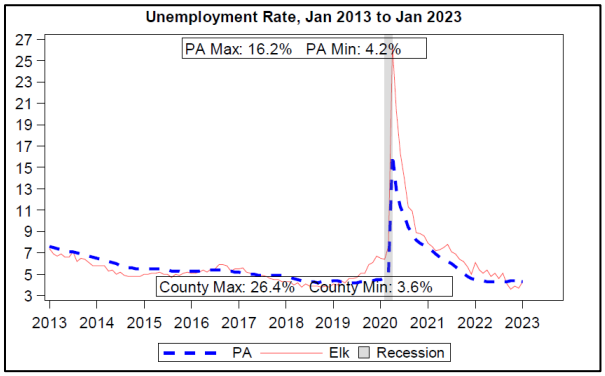
average household size of 2.27 persons. The estimated owner-occupied housing rate of Elk County is 79.9%. The median value of the owner-occupied housing units in Elk County from 2016 to 2021 is $106,900.00. The median monthly owner's costs for a structure with a mortgage was $1,056.00 and the median monthly owner's costs for a structure without a mortgage was $433.00. The median gross rent for rental properties in Elk County was $657.00 for the same date range.

Based on the American Community Survey results for 2021, the most recent year available, the racial composition of the county is 96.7% White, 0.7% Black or African American, 0.9% Hispanic or Latino, 0.1% American Indian and Alaska Native, 0.4% Asian, <0.1% native Hawaiian and other Pacific Islander, and 2.1% two or more races. The median age of Elk County is 48.1 years of age, which is higher than the median age of Pennsylvania at 40.9 and the national median of 38.1 years of age. The percentage of Elk County under the age of 5 years old is 2.5%, between the ages of 18 and 64 years old is 87.2%, and aged 65 years old and older is 10.3%.

The median household income for households in Elk County is $57,551.00 and the poverty rate of Elk County is 9.3% of the total population. The poverty rate for the Commonwealth of Pennsylvania as a whole is 12.1%. There are approximately 2,287 veterans in Elk County. The median veteran income in Elk County as of 2020 was $34,952.00, with 4.5% of Elk County veterans living below the poverty level. The veteran unemployment rate in the county was approximately 6.6%.

The Covid-19 Pandemic created an increase in unemployment and interruptions in employment throughout the United States, to include Pennsylvania and Elk County. According to Pennsylvania Department of Labor and Industry data, there was a large spike in unemployment both across the Commonwealth and Elk County. At the height of the Covid-19 Pandemic in the spring of 2020, the unemployment rate for Elk County hit 26.4% of the working population of the county. That is higher than the peak unemployment percentage for Pennsylvania, which peaked at 16.2% of the working population of the entire state. *Figure 2 – Unemployment Rate Jan. 2013 to Jan. 2023* illustrates the trend and large spike in unemployment. The unemployment rate for Elk County in January of 2023 was 4.3%, which roughly accounted for 600 working age adults (ages 16 to 65). The total estimated workforce for Elk County was 14,200 working age adults (ages 16 to 65) in January of 2023.

Figure 2 - Unemployment Rate Jan. 2013 to Jan. 2023



Elk County's leading industries are healthcare, manufacturing, and retail trade. The primary employment providers within Elk County are displayed below in *Table 4 – Elk County Top Employers.* Domtar Paper Company, LLC., SGL Carbon, LLC., Keystone Powdered Metal Company, Metal Powder Products, LLC., Amphenol Thermometrics, Inc., Eastern Sintered Alloys, Inc. and Morris Compressors, Inc. are all employers who are involved in manufacturing or industrial production.

Table 4 - Elk County Top Employers

Elk County Top Employers (Excluding State Employers)	
Ranking	**Company**
1	Elk Regional Health Center, Inc.
2	Domtar Paper Company, LLC.
3	Wal-Mart Associates, Inc.
4	SGL Carbon, LLC.
5	Keystone Powdered Metal Company
6	Saint Marys Area School District
7	Metal Powder Products, Inc.
8	Amphenol Thermometrics, Inc.
9	Eastern Sintered Alloys, Inc.
10	Morris Compressors, Inc.
Source: Pennsylvania Department of Labor & Industry, 2023	

The top employers' data was obtained through the Pennsylvania Department of Labor and Industry, Center for Workforce Information and Analysis. This data only provided a list of employers, their ranking, and North American Industry Classification System (NAICS) descriptions. *Table 5 – Quarterly Census of Employment and Wages, 2021 Annual Averages in*

Elk County only calls out how many locations per NAICS description and total number of employees.

Table 5 - Quarterly Census of Employment and Wages, 2021 Annual Averages in Elk County

Quarterly Census of Employment and Wages, 2021 Annual Averages in Elk County					
NAICS	**Description**	**Number of Locations**	**Number of Employees**	**Employment Percentage**	**Average Wages**
11	Agriculture, Forestry, Fishing, and Hunting	28	56	.4	$35,441.00
21	Mining, Quarrying, and Oil & Gas	10	16	.1	$64,319.00
22	Utilities	11	-	-	-
23	Construction	82	553	4.2	$51,474.00
31-33	Manufacturing	138	5,556	41.7	$55,968.00
42	Wholesale Trade	33	269	2.0	$59,210.00
44-45	Retail Trade	109	1,327	10	$29,119.00
48-49	Transportation and Warehousing	52	522	3.9	$51,385.00
51	Information	15	101	.8	$31,222.00
52	Finance and Insurance	37	200	1.5	$63,822.00
53	Real Estate, Rental, and Leasing	16	57	.4	$51,545.00
54	Professional and Technical Services	43	281	2.1	$36,472.00
55	Management of Companies and Enterprises	8	92	.7	$88,026.00
56	Administrative and Waste Services	34	214	1.6	$33,251.00
61	Educational Services	18	-	-	-
62	Healthcare and Social Assistance	146	1,691	12.7	$43,106.00
71	Arts, Entertainment, and Recreation	10	70	.5	$20,563.00
72	Accommodation and Food Services	74	751	5.6	$13,284.00

Quarterly Census of Employment and Wages, 2021 Annual Averages in Elk County					
NAICS	**Description**	**Number of Locations**	**Number of Employees**	**Employment Percentage**	**Average Wages**
81	Other Services (Except Public Administration)	90	454	3.4	$20,955.00
92	Public Administration	24	421	3.2	$44,783.00
-	**Total, All Industries**	**978**	**12,631**	-	-
NAICS (North American Industry Classification System), PA DLI, 2023					

2.4. Land Use and Development

Elk County is composed of twelve municipalities, which include:

- 9 townships
- 2 boroughs
- 1 city

The majority of acreage in Elk County is forested, while approximately 4.3% (or 22,982) of the acreage is agriculture. The land use is broken up into different areas including commercial, industrial, and residential activities. The developed areas of the county are located near more urban areas including the City of St. Marys, Ridgway Borough, and Johnsonburg Borough. Elk County has approximately 529,280 acres of total land area, and 3,136 acres of water area, with a population density of thirty-eight people per square mile based on 2020 data estimates. Elk County is largely rural in character. Based on information included in the Elk County Comprehensive Plan, approximately 45% of the county was vacant forest land and agricultural land in 1999 (Elk County CP, 1999). Since 1999, 1,458 housing units were built in Elk County, so the amount of vacant forest or agricultural land is likely to have decreased and the amount of residential land in the county has increased in certain areas. Within the Elk County Comprehensive Plan, land use was broken down into nine categories, these include residential and urban, commercial/light industrial, public/semi-public, industrial, rural residential/forest/ agriculture, vacant/forest /agriculture, National forest, state forest, and state game lands (Elk County CP, 1999). A very small percentage of land in Elk County is designated as residential, as visualized in *Figure 7 – Elk County Land Cover*. Based on the information included in *Figure 7 – Elk County Land Cover*, the following acreage percentages can be evaluated for the county. This information is presented in *Table 6 – Elk County Land Cover by Acres*. Based on this analysis, Deciduous Forest land cover makes up over two-thirds of the land cover in Elk County.

Table 6 - Elk County Land Cover by Acres

Elk County Land Cover by Acres			
Cover Description	**Description Code**	**Acres**	**Percent of Total Land Area**
Roads	14	3,370	0.64%
Row Crops	21	5,136	0.97%
Pasture/Grass	24	29,781	5.63%
Deciduous Forest	41	358,787	67.79%
Evergreen Forest	42	74,858	14.14%
Mixed Deciduous and Evergreen	43	42,155	7.96%
Forested Wetlands	61	3,024	0.57%
Emergent Wetlands	62	801	0.15%
Residential Land; 5-30% impervious	111	2,735	0.52%
Residential Land; 31-74% impervious	112	713	0.13%
Residential Land; 74% < impervious	113	495	0.09%
Institutional/Industrial/Commercial Land; 5-30% impervious	121	696	0.13%
Institutional/Industrial/Commercial Land; 31-74% impervious	122	1085	0.20%
Institutional/Industrial/Commercial Land; 74% < impervious	123	367	0.07%

State forest, state game lands, and national forests make up a large portion of land use in Elk County, including the following areas:

- State Game Land 14
- State Game Land 25
- State Game Land 28
- State Game Land 44
- Elk State Forest
- Moshannon State Forest
- Allegheny National Forest

2.5. Data Sources

The following data sources were used during the update process. Additional data sources can be found in Appendix A of this hazard mitigation plan:

- United States Census Bureau.

- National Climatic Data Center (NCDC).
- National Oceanic and Atmospheric Administration (NOAA).
- Pennsylvania Department of Conservation and Natural Resources (PA DCNR).
- Pennsylvania Department of Environmental Protection (PA DEP).
- Pennsylvania Department of Labor and Industry (PA DLI).
- Pennsylvania Groundwater Information System (PaGWIS).
- Pennsylvania Emergency Incident Reporting System.
- Pennsylvania Emergency Management Agency (PEMA).
- Elk County Comprehensive Plan 1999 (Elk County CP 1999).

The countywide Digital Flood Insurance Rate Maps (DFIRM) were used for all flood risk analysis and estimation of loss. The Elk County DFIRMs were approved and effective in 2012. The DFIRM database provides flood frequency and elevation information used in the flood hazard risk assessment and are the regulatory tools for floodplain management. Other Elk County GIS datasets including road centerlines, structures, municipalities, and depth grids were utilized in conjunction with the DFIRM data.

In order to assess the vulnerability of different jurisdictions to the hazards, data on past occurrences of damaging weather events was compiled. A large number of natural-hazard events were gathered from the National Climatic Data Center (NCDC) database. The NCDC is a division of the United States Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Information on hazard events is compiled by the NCDC from data gathered by the National Weather Service (NWS), another division of NOAA. The data is then presented by the NCDC as tabular data that can be queried in the United States Storm Events database, which "documents the occurrences of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce" (NOAA, 2006). The classification of storm events in the database is based off of data collected from around the United States and the Commonwealth of Pennsylvania, so the data may not be filed under the correct storm category due to user input error. The reason for this data issue results from some storm events falling under multiple categories, including but not limited to winter storm, ice storm, tornado, hurricane / tropical storm, flooding, and flash flooding. Many of the events listed in the United States Storm Events database can fall under multiple of these categories. In an effort to include a comprehensive list of prior storm events for Elk County, search queries with multiple storm classifications were conducted for each hazard.

Throughout the risk and vulnerability assessment included in Section 4 of this Hazard Mitigation Plan, descriptions of limited data indicate some areas in which the county and the municipalities can improve their ability to identify vulnerable structures and improve loss estimates. As the county and municipal governments work to increase their overall technical capacity and

implement comprehensive planning goals, they will also attempt to improve the ability to identify areas of increased vulnerability.

This hazard mitigation plan evaluates the vulnerability of the county's community lifelines. For the purposes of this plan, critical infrastructure facilities and community lifeline facilities are those entities that are essential to the health, welfare, and safety of the community. This includes but is not limited to airports, county offices, EMS agencies, fire departments and stations, food banks, gas stations, grocery stores, homeless assistance facilities, hospitals, medical clinics, municipal buildings, police departments, post offices, power plants, power substations, sewage plants, toxic release inventory locations, wastewater treatments plants, and water treatment plants. The locations of these facilities were provided by the Elk County GIS Department and geocoded based on information from internet research.

Geographic Information Systems (GIS) Data

GIS data was utilized in risk assessment, estimation of loss and the development of map products for the hazard mitigation plan update. A foundation of data was available from the Elk County GIS Department. Some of the utilized data was downloaded from the Pennsylvania Spatial Data Access (PASDA). A large portion of the plan utilizes census data from the United States Census Bureau, but the 2020 census data collection and dissemination was disrupted due to the COVID-19 Pandemic in 2020 and 2021. The 2020 census was delayed, and the information received during the census was spread out due to social distancing and the limiting of census takers going door to door to gather information. A large effort was made in 2020 to increase awareness of completing the census online and the census information has been released sporadically between 2021 and 2023. Most data is available at the time of this writing.

The Elk County GIS Department provided the following layers for use in the development of hazard profiles and hazard profile mapping for the 2023 Hazard Mitigation Plan Update:

- Elk County Address Points
- Elk County Boundary
- Elk County Municipal Boundary
- Elk County Road Centerlines

The following GIS data layers were developed for use in the 2023 Hazard Mitigation Plan Update. This list is not comprehensive, but covers the major datasets:

- Elk County Abandoned Mine Areas
- Elk County Address Points in Landslide Vulnerable Areas
- Elk County Address Points in the Special Flood Hazard Area
- Elk County Adjacent Counties
- Elk County Airports
- Elk County Areas Unsuitable for Mining

- Elk County Community Lifelines
- Elk County Dam Inventory
- Elk County Electric Substations
- Elk County Electric Transmission Lines
- Elk County EMS Agencies
- Elk County Food Banks
- Elk County Ground Water Withdrawal Locations
- Elk County Large Watersheds
- Elk County National Risk Inventory – Census Tracts
- Elk County National Register of Historic Places – Buildings
- Elk County National Register of Historic Places – Cultural Districts
- Elk County Natural Gas Pipelines
- Elk County Police Departments
- Elk County Power Plants
- Elk County Public Water Supply Areas
- Elk County Rail Lines
- Elk County Small Waterbodies
- Elk County Tornado Impacted Municipalities
- Elk County Traffic Count Data
- Elk County Wildland Urban Interface
- Elk County Zip Codes with Radon Data

Figure 3 - Elk County Basemap

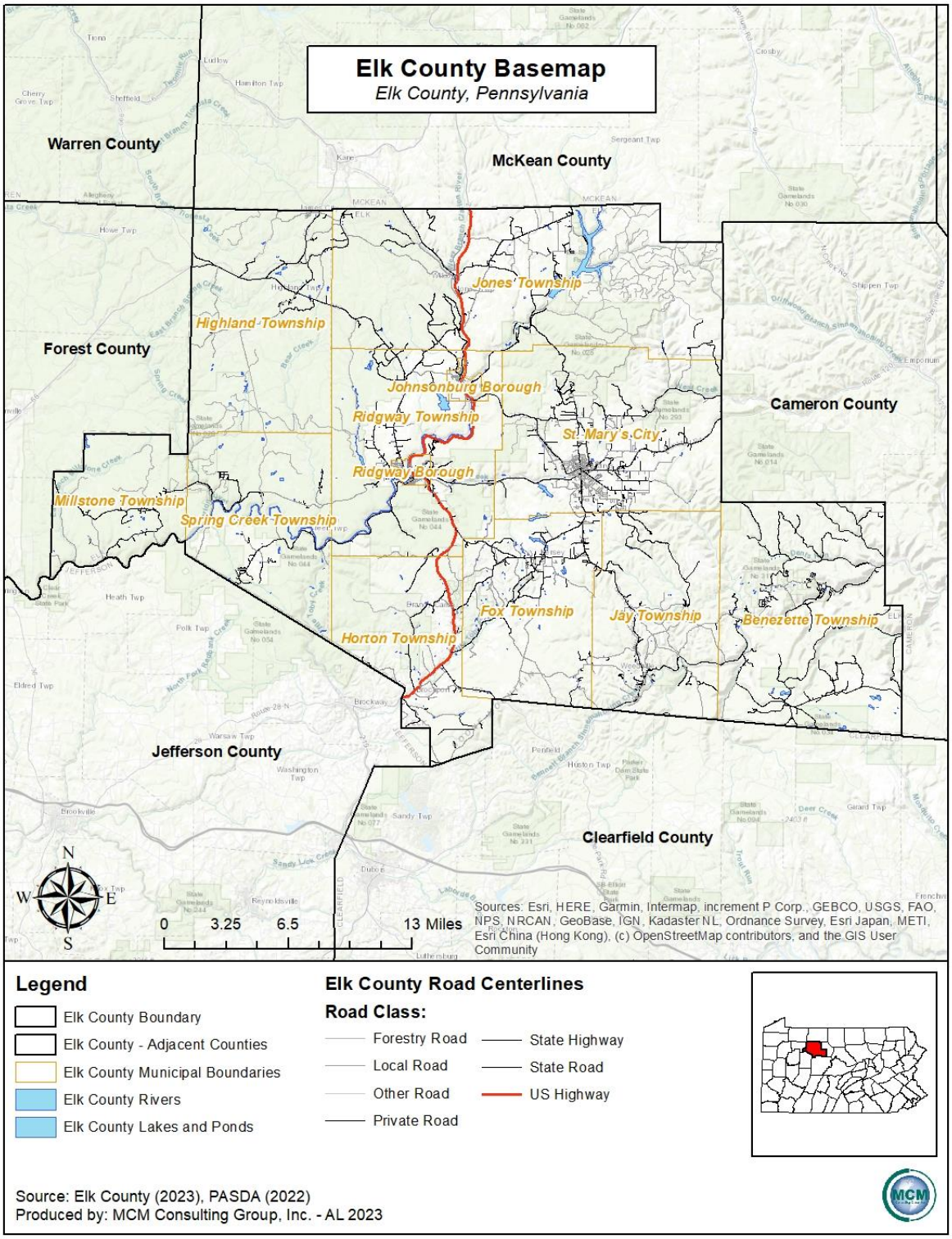


Figure 4 - Elk County Watersheds

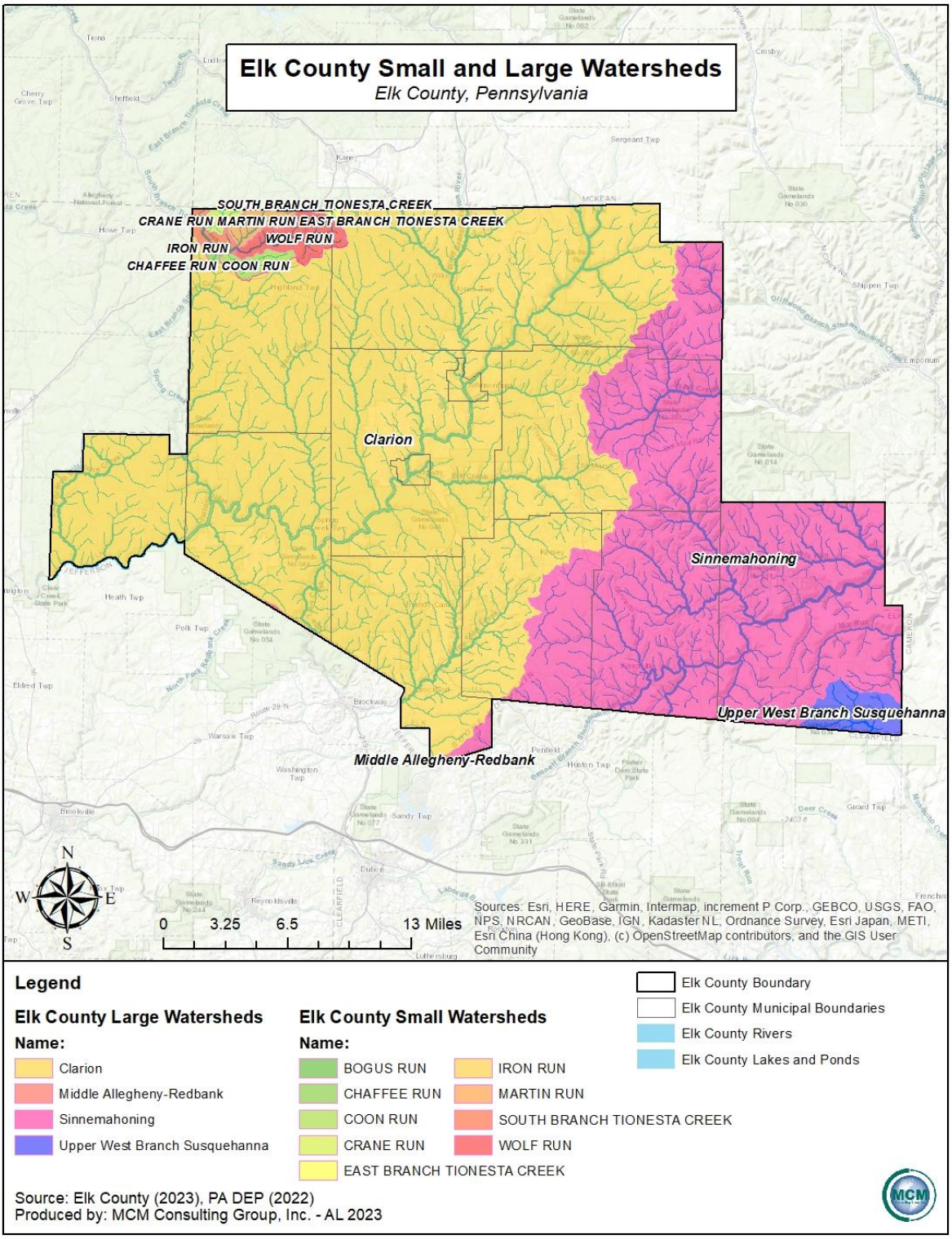


Figure 5 - Elk County Cultural and Historic Locations

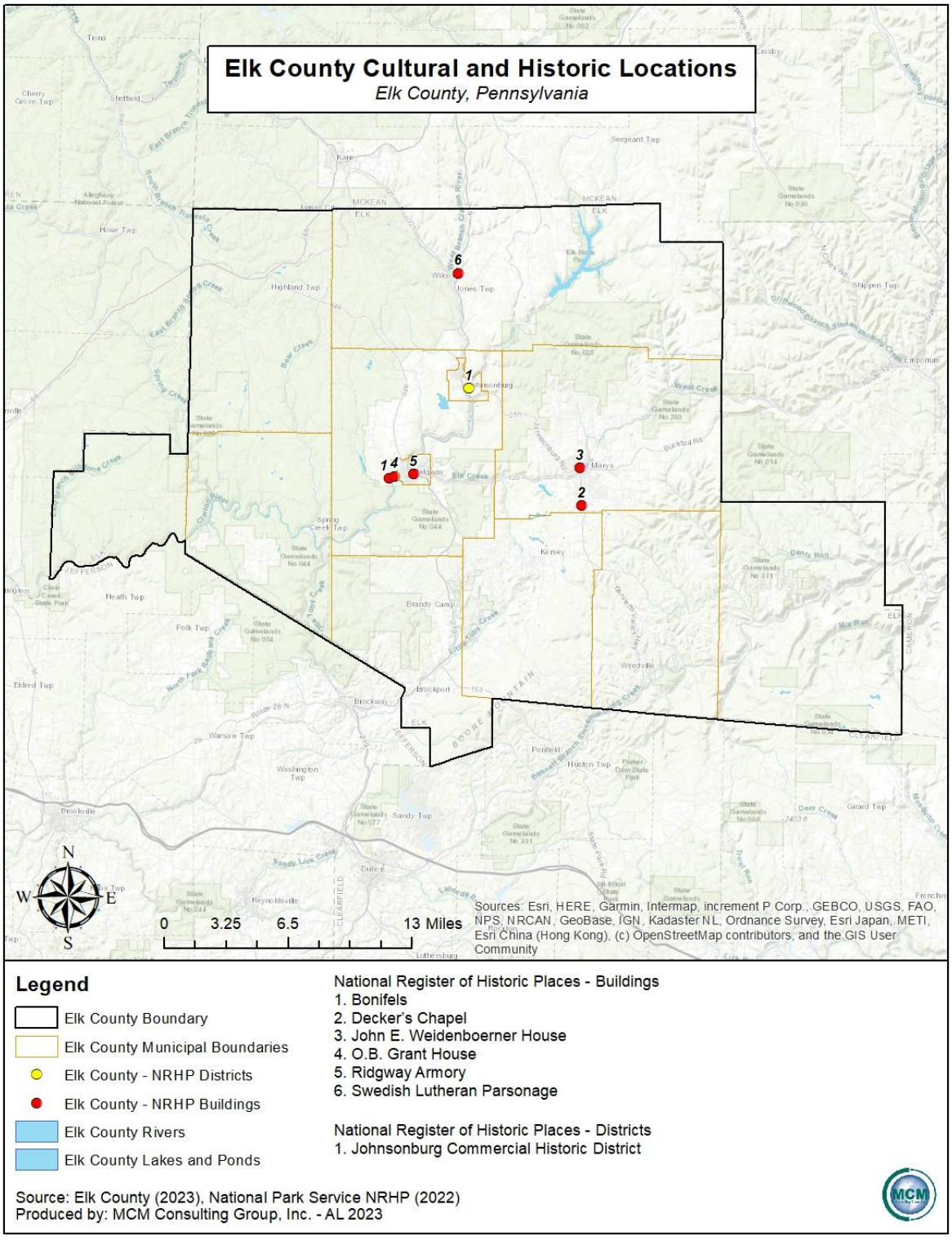


Figure 6 - Elk County Population Density

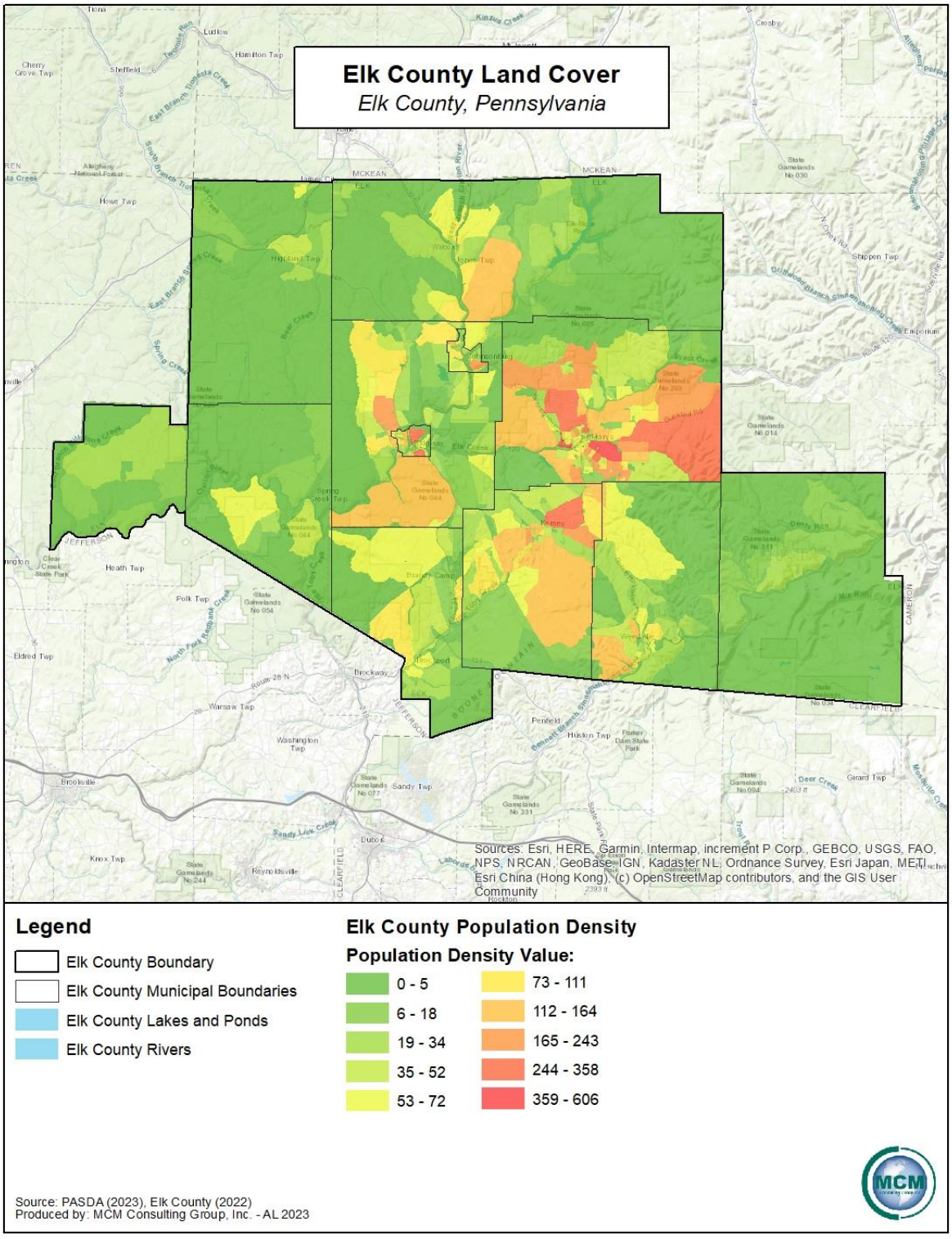
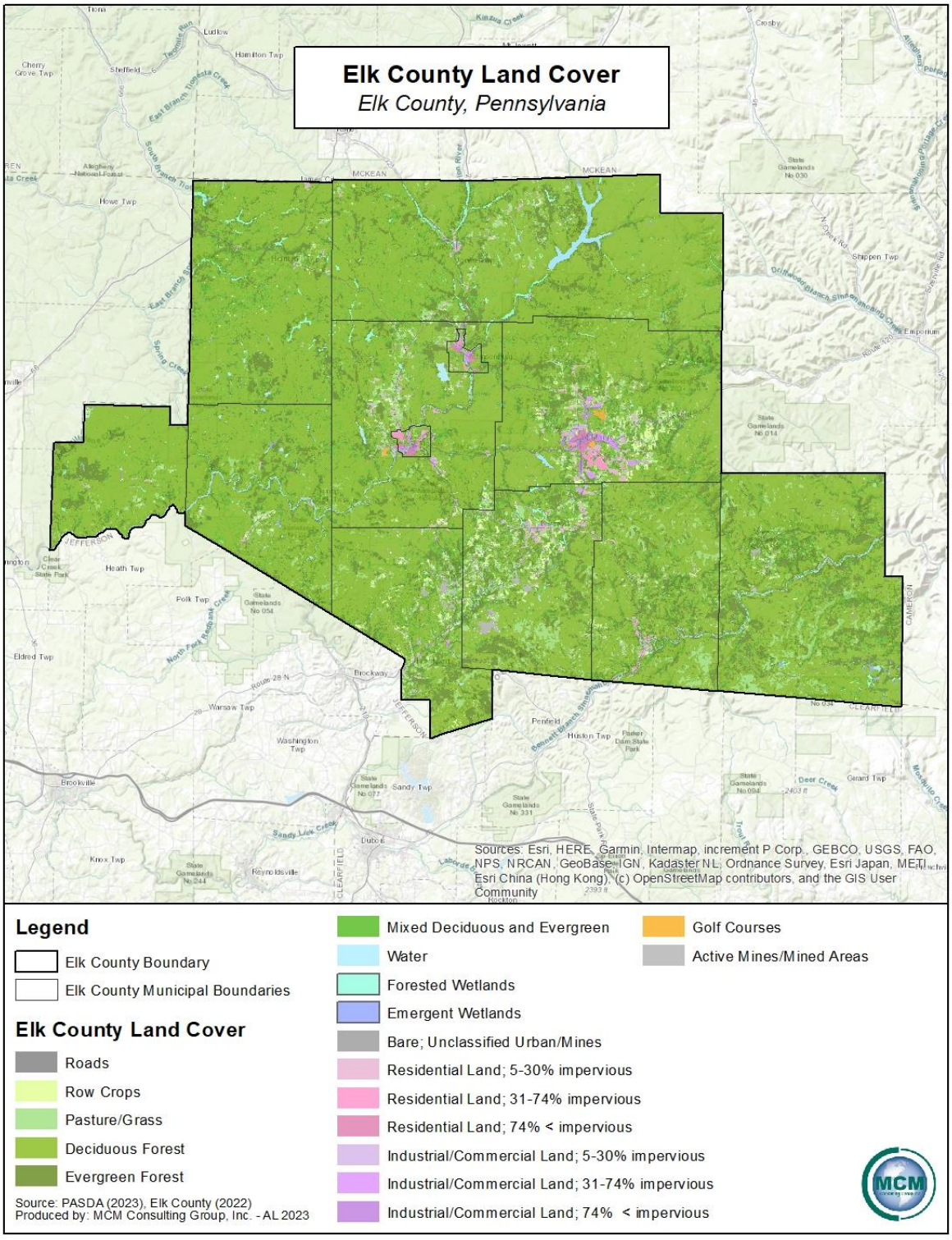


Figure 7 - Elk County Land Cover



3. Planning Process

3.1. Update Process and Participation Summary

The Elk County Hazard Mitigation Plan update began November 14, 2022. The Elk County Commissioners were able to secure a hazard mitigation grant to start the process. The Elk County Planning Department was identified as the lead agency for the Elk County Hazard Mitigation Plan update. The planning process involved a variety of key decision makers and stakeholders within Elk County. Elk County immediately determined that the utilization of a contracted consulting agency would be necessary to assist with the plan update process. MCM Consulting Group, Inc. was selected as the contracted consulting agency to complete the update of the hazard mitigation plan. The core hazard mitigation team, which was referred to as the steering committee, included officials from the Elk County Planning Department and the Elk County Office of Emergency Services and MCM Consulting Group, Inc. (MCM).

The process was developed around the requirements laid out in the Federal Emergency Management Agency (FEMA) Local Hazard Mitigation Crosswalk, referenced throughout this plan, as well as numerous other guidance documents including, but not limited to, Pennsylvania's All-Hazard Mitigation Standard Operating Guide, FEMA's State and Local Mitigation Planning How-to Guide series of documents (FEMA 386-series), and the National Fire Protection Association (NFPA) 1600 Standard on Disaster/Emergency Management and Business Continuity Programs.

MCM Consulting Group, Inc. assisted Elk County Planning Department in coordinating and leading public involvement meetings, local planning team meetings, analysis, and the writing of the updated HMP. The Elk County Local Planning Team (LPT) worked closely with MCM in the writing and review of the HMP. MCM conducted project meetings and local planning team meetings throughout the update process. Due to COVID-19, meetings were held with the option to attend virtually. Meeting agendas, meeting minutes and sign-in sheets were developed and maintained for each meeting conducted by MCM. These documents are detailed in Appendix C of this plan.

Public meetings with local elected officials were held, as well as work sessions and in-progress review meetings with the Elk County Local Planning Team and staff. At each of the public meetings, respecting the importance of local knowledge, municipal officials were strongly encouraged to submit hazard mitigation project opportunity forms, complete their respective portions of the capability's assessment and review, and eventually adopt the county hazard mitigation plan. Elk County will continue to work with all local municipalities to collect local hazard mitigation project opportunities.

The HMP planning process consisted of:

- Applying for and receiving a hazard mitigation planning grant (HMPG) to fund the planning project.
- Announcing the initiative via press releases and postings on the county website.
- Involving elected and appointed county and municipal officials in a series of meetings, training sessions, and workshops.
- Identifying capabilities and reviewed the information with the municipalities.
- Identifying hazards.
- Assessment of risk and analyzing vulnerabilities.
- Identifying mitigation strategies, goals, and objectives.
- Developing an implementation plan.
- Announcing completion via press releases and postings on the county website.
- Plan adoption at a public meeting of the Elk County Board of Commissioners.
- Plan submission to PEMA and FEMA.

The 2023 Elk County HMP was completed May15, 2023. The 2023 plan follows an outline developed by PEMA which provides a standardized format for all local HMPs in the Commonwealth of Pennsylvania. The 2023 HMP format is consistent with the PEMA recommended format. The 2023 Elk County HMP combined dam failure and East Branch dam repair profiles; removed the profiles for drowning and fuel shortage; and has added additional hazard profiles to the HMP, and these additional profiles increased the subsections in section 4.3 of the HMP.

3.2. The Planning Team

The 2023 Elk County Hazard Mitigation Plan update was led by the Elk County Steering Committee. The Elk County Steering Committee provided guidance and leadership for the overall project. The steering committee assisted MCM Consulting Group, Inc. with dissemination of information and administrative tasks. *Table 7 – Steering Committee* outlines the individuals that comprise this team.

Table 7 - Steering Committee

Elk County Hazard Mitigation Plan Update Steering Committee		
Name	**Organization**	**Position**
Tracy Gerber	Elk County Planning Department	Director
Mike McAllister	Elk County Office of Emergency Services	Director
Michael Rearick	MCM Consulting Group, Inc.	Director of Operations
Adam Leister	MCM Consulting Group, Inc.	Senior GIS Consultant

Elk County Hazard Mitigation Plan Update Steering Committee		
Name	**Organization**	**Position**
Valerie Zents	MCM Consulting Group, Inc.	Senior Consultant
Daniel Becker	MCM Consulting Group, Inc.	Consultant

In order to represent the county, the Elk County Steering Committee developed a diversified list of potential local planning team (LPT) members. Members that participated in the 2017 hazard mitigation plan were highly encouraged to join the 2023 team. The steering committee then provided invitations to the prospective members and provided a description of duties to serve on the LPT. The invitations for members of the LPT were disseminated by the Elk County Planning Department utilizing letters, email, and telephone calls. The LPT worked throughout the process to plan and hold meetings, collect information, and conduct public outreach.

The stakeholders listed in *Table 8 – Local Planning Team* served on the 2023 Elk County Hazard Mitigation Local Planning Team, actively participated in the planning process by attending meetings, completing assessments, surveys, and worksheets and/or submitting comments. All potential local planning team members were presented with a mailed letter on November 22, 2022, and only two of those individuals declined. Those invitation letters for the local planning team are included in Appendix C – Support Documentation of this hazard mitigation plan update.

Individual representing local interests in dams were presented with the opportunity to participate in the local planning team. Letters were sent to the United States Army Corp of Engineers and the Ridgway Borough Dam Planner on November 22, 2022. Increased participation for representatives for socially vulnerable and unserved populations in Elk County is a goal for the next planning period, and mitigation actions can be found in section 6.4.

Table 8 - Local Planning Team

Elk County Hazard Mitigation Plan Local Planning Team			
Name	**Organization**	**Position**	**Process of Invitation**
Joe Daghir	Elk County	Commissioner	Letter mailed on November 22, 2022, email
Tracy Gerber	Elk County Planning Department	Director	Letter mailed on November 22, 2022, email
Mike McAllister	Elk County Office of Emergency Services	Director	Letter mailed on November 22, 2022, email
Toby Herzing	DCNR Forestry	Service Forester	Letter mailed on November 22, 2022, email

Elk County Hazard Mitigation Plan Local Planning Team			
Name	**Organization**	**Position**	**Process of Invitation**
Ray Imhof	Ridgway Borough	Mayor	Letter mailed on November 22, 2022, email
Sam MacDonald	Elk County Catholic School District	President	Letter mailed on November 22, 2022, email
Rachel Kilhoffer	Chamber of Commerce/ Johnsonburg Borough	Borough Secretary	Letter mailed on November 22, 2022, email
Kate Wehler	Elk County Conservation District	District Manager	Letter mailed on November 22, 2022, email
Jim Abbey	Elk County IT/GIS Department	Director	Letter mailed on November 22, 2022, email
Heather McMahon	Ridgway Area School District	Superintendent	Letter mailed on November 22, 2022, email
Matt McCullough	FEMA	Community Planner	Letter mailed on November 22, 2022, email

3.3. Meetings and Documentation

Meetings with local elected officials and the local planning team were held as needed. At each of the meetings, municipal officials were strongly encouraged to submit hazard mitigation project opportunity forms, complete their respective portions of the capability assessment, review and eventually adopt the multi-jurisdictional HMP. *Table 9 – HMP Process Timeline* lists the meetings held during the HMP planning process, which organizations and municipalities attended and the topic that was discussed at each meeting. All meeting agendas, sign-in sheets, presentation slides, and other documentation is in Appendix C.

The draft plan was made available for public review on May 16th, 2023. The draft was advertised on Elk County's social media page and was made available digitally on the Elk County website at: https://www.co.elk.pa.us/index.php/planning-department-top-menu/item/330-elk-county-hazard-mitigation-plan-update.

The public comment period remained open until June 14th, 2023. All public comments were submitted via an online survey or in writing to Tracy Gerber the Elk County Planning Department. Public commenting was available during the public comment period via a Survey Monkey link that was advertised on the county website and social media pages.

Table 9 - HMP Process Timeline

Elk County HMP Process Timeline		
Date	**Meeting**	**Description**
11/14/2022	Steering Committee Kickoff	Kickoff meeting with steering committee.
12/19/2022	Local Planning Team Kickoff	Kickoff meeting with local planning team.
12/19/2022	Municipality Kickoff	Kickoff meeting with municipalities.
01/24/2023	Local Planning Team	Risk factor assessment. Review of 2018 goals and objectives, and mitigation actions.
02/13/2023	Local Planning Team	Mitigation strategy – 2023 goals and objectives finalized; mitigation actions developed.
02/13/2023	Municipality Meeting	Project opportunities.
02/13/2023	Public Meeting	Risk assessment session discussion.
02/28/2023	Local Planning Team	Mitigation strategies.
03/06/2023	Local Planning Team	Mitigation strategies.
03/27/2023	Local Planning Team	Finalized mitigation action plan.
05/15/2023	Public meeting	Draft plan presentation

3.4. Public and Stakeholder Participation

Elk County engaged numerous stakeholders and encouraged public participation during the HMP update process. Advertisements for public meetings were completed utilizing the local newspaper and the Elk County website. Copies of those advertisements are in Appendix C. Municipalities and other county entities were invited to participate in various meetings and encouraged to review and update various worksheets and surveys. Copies of all meeting agendas, meeting minutes and sign-in sheets are located in Appendix C. Worksheets and surveys completed by the municipalities and other stakeholders are located in appendices of this plan update as well. Municipalities were also encouraged to review hazard mitigation related items with other constituents located in the municipality like businesses, academia, private and nonprofit interests.

The tools listed below were distributed with meeting invitations, provided directly to municipalities for completion and return to the Elk County Planning Department or at meetings to solicit information, data, and comments from both local municipalities and other key stakeholders. Responses to these worksheets and surveys are available for review at the Elk County Planning Department.

1. **Risk Assessment Hazard Identification and Risk Evaluation Worksheet**: Capitalizes on local knowledge to evaluate the change in the frequency of occurrence, magnitude, or impact and/or geographic extent of existing hazards and allows communities to evaluate hazards not previously profiled using the Pennsylvania Standard List of Hazards.

2. **Capability Assessment Survey**: Collects information on local planning, regulatory, administrative, technical, fiscal, and political capabilities that can be included in the countywide mitigation strategy.
3. **Municipal Project Opportunity Forms and Mitigation Actions**: There were no project opportunity forms from the Elk County 2018 Hazard Mitigation Plan. New project opportunity forms were developed for this planning period and these opportunities are located in Appendix G. The previous mitigation actions were provided and reviewed at update meetings. New 2023 municipal project opportunity forms are included as well, located in Appendix G.

In an effort to capture public input, the Elk County LPT held in-person meetings, virtual meetings, and offered on-line surveys. Members of the public were also encouraged to contact Elk County Planning Department or MCM Consulting Group, Inc. with any comments or questions regarding this update. Any public comment that was received during public meetings or during the draft review of the plan were documented and included in the plan. Copies of newspaper public meeting notices, website posted public notices, and other correspondence are included in Appendix C of this plan.

3.5. Multi-Jurisdictional Planning

Elk County used an open, public process to prepare this HMP. Meetings and letters to municipal officials were conducted to inform and educate them about hazard mitigation planning and its local requirements. Municipal officials provided information related to existing codes and ordinances, the risk and impacts of known hazards on local infrastructure and critical facilities and recommendations for related mitigation opportunities. The pinnacle to the municipal involvement process was the adoption of the final plan. *Table 10 – Municipality Worksheets, Surveys, and Forms Participation* reflects the municipalities participation by completing worksheets, surveys, and forms.

Table 10 - Municipality Worksheets, Surveys, and Forms Participation

Elk County HMP Worksheets, Surveys, and Forms Participation				
Municipality	**Capability Assessment Survey**	**Risk Assessment Hazard Identification and Risk Evaluation Worksheet**	**NFIP**	**Hazard Mitigation Opportunity Form Review and Updates**
Benezette Township	X	X	X	X
Fox Township	X	X	X	X
Highland Township	X	X	X	X
Horton Township	X	X	X	

Elk County HMP Worksheets, Surveys, and Forms Participation				
Municipality	**Capability Assessment Survey**	**Risk Assessment Hazard Identification and Risk Evaluation Worksheet**	**NFIP**	**Hazard Mitigation Opportunity Form Review and Updates**
Jay Township	X	X	X	X
Johnsonburg Borough	X	X	X	X
Jones Township	X	X	X	X
Millstone Township	X	X	X	X
Ridgway Borough	X	X	X	X
Ridgway Township	X	X	X	X
Spring Creek Township	X	X	X	X
St. Marys City	X	X	X	

All of the municipalities within Elk County adopted the 2018 Elk County Hazard Mitigation Plan as the municipal hazard mitigation plan. The goal of the Elk County Local Planning Team is to have 100% participation by municipalities in adopting the 2023 Elk County Hazard Mitigation.

The table above was completed with the most accurate information available at the time of the writing of this Hazard Mitigation Plan Update.

4. Risk Assessment

4.1. Update Process Summary

A key component to reducing future loss is to first have a clear understanding of what the current risks are and what steps may be taken to lessen their threat. The development of the risk assessment is a critical first step in the entire mitigation process, as it is an organized and coordinated way of assessing potential hazards and risks. The risk assessment identifies the effects of both natural and human-caused hazards and describes each hazard in terms of its frequency, severity, and county impact. Numerous hazards were identified as part of the process.

A risk assessment evaluates threats associated with a specific hazard and is defined by probability and frequency of occurrence, magnitude, severity, exposure, and consequences. The Elk County risk assessment provides in-depth knowledge of the hazards and vulnerabilities that affect Elk County and its municipalities. This document uses an all-hazards approach when evaluating the hazards that affect the county and the associated risks and impacts each hazard presents.

This risk assessment provides the basic information necessary to develop effective hazard mitigation/prevention strategies. Moreover, this document provides the foundation for the Elk County Emergency Operations Plan (EOP), local EOPs and other public and private emergency management plans.

The Elk County risk assessment is not a static document, but rather, is a biennial review requiring periodic updates. Potential future hazards include changing technology, new facilities and infrastructure, dynamic development patterns and demographic and socioeconomic changes into or out of hazard areas. By contrast, old hazards, such as brownfields and landfills, may pose new threats as county conditions evolve.

Using the best information available and geographic information systems (GIS) technologies, the county can objectively analyze its hazards and vulnerabilities. Assessing past events is limited by the number of occurrences, scope and changing circumstances. For example, ever-changing development patterns in Pennsylvania have a dynamic impact on traffic patterns, population density and distribution, storm water runoff and other related factors. Therefore, limiting the risk assessment to past events is myopic and inadequate.

The Elk County Local Planning Team (LPT) reviewed and assessed the change in risk for all natural and human-caused hazards identified in the 2018 hazard mitigation plan. The mitigation planning team then identified hazards that were outlined within the Pennsylvania Hazard Mitigation Plan but not included in the 2018 Elk County Hazard Mitigation Plan that could

impact Elk County. The team utilized the hazard identification and risk evaluation worksheet that was provided by the Pennsylvania Emergency Management Agency.

The Elk County Steering Committee met with municipalities and provided guidance on how to complete the municipal hazard identification and risk evaluation worksheet. All twelve of the municipalities in Elk County returned a completed worksheet. This information was combined with the county information to develop an overall list of hazards that would need to be profiled.

Once the natural and human-caused hazards were identified and profiled, the local planning team then completed a vulnerability assessment for each hazard. An inventory of vulnerable assets was completed utilizing GIS data and local planning team knowledge. The team used the most recent Elk County assessment data to estimate loss to particular hazards. Risk factor was then assessed to each of the twenty hazards utilizing the hazard prioritization matrix. This assessment allows the county and its municipalities to focus on and prioritize local mitigation efforts on areas that are most likely to be damaged or require early response to a hazard event.

4.2. Hazard Identification

4.2.1. Presidential and Gubernatorial Disaster Declarations

Table 11 – Presidential & Gubernatorial Disaster Declarations contains a list of all Presidential and Gubernatorial disaster declarations that have affected Elk County and its municipalities from 1955 through 2022, according to the Pennsylvania Emergency Management Agency.

Table 11 - Presidential & Gubernatorial Disaster Declarations

Presidential Disaster Declarations and Gubernatorial Declarations and Proclamations		
Date	**Hazard Event**	**Action**
August 1955	Flood	Presidential
March 1956	Flood	Presidential
May 1956	Severe storms	Presidential
August 1956	Severe storms	Presidential
January 1959	Flood	Presidential
January 1966	Heavy snow	Gubernatorial
February 1972	Heavy snow	Gubernatorial
June 1972	Flood	Presidential
March 1993	Snow	Presidential
February 1974	Trucker’s strike	Gubernatorial
January 1978	Heavy snow	Gubernatorial
February 1978	Blizzard	Gubernatorial

Presidential Disaster Declarations and Gubernatorial Declarations and Proclamations		
Date	**Hazard Event**	**Action**
September 2004	Severe storms	Presidential
September 2004	Hurricane	Presidential
September 2005	Hurricane Katrina	Gubernatorial
September 2006	Tropical Depression Ernesto	Gubernatorial
February 2007	Severe winter storm	Gubernatorial
February 2007	Waive of regulations	Gubernatorial
April 2007	Severe winter storm	Gubernatorial
February 2010	Severe winter storm	Gubernatorial
January 2011	Severe winter storm	Gubernatorial
August 2011	Severe storms and flooding (Lee/Irene)	Gubernatorial
April 2012	Spring winter storms	Gubernatorial
October 2012	Hurricane Sandy	Gubernatorial
June 2013	High winds, thunderstorms, heavy rain, tornado, flooding	Gubernatorial
January 2014	Extreme weather, utility interruption	Gubernatorial
February 2014	Severe winter storm	Gubernatorial
January 2015	Severe winter storms	Gubernatorial
August 2015	Severe storms	Gubernatorial
January 2016	Severe winter storm	Gubernatorial
March 2017	Severe winter storm	Gubernatorial
January 2018	Opioid crisis	Gubernatorial
June 2018	Severe weather	Gubernatorial
August 2018	Rapid, heavy rainfall resulting in flash floods	Gubernatorial
January 2019	Severe winter event	Gubernatorial
March 2020	COVID-19	Gubernatorial
December 2020	Winter weather	Gubernatorial
February 2021	Winter weather	Gubernatorial
Source: Pennsylvania Emergency Management Agency and Federal Emergency Management Agency, 2023		

4.2.2. Summary of Hazards

The Elk County LPT was provided the Pennsylvania Standard List of Hazards to be considered for evaluation in the 2023 HMP Update. Following a review of the hazards considered in the 2018 HMP and the standard list of hazards, the local planning team decided that the 2023 plan should identify, profile, and analyze twenty hazards. The list below contains the hazards that

have the potential to impact Elk County as identified through previous risk assessments, the Elk County Hazard Vulnerability Analysis and input from those who participated in the 2023 HMP update. Hazard profiles are included in Section 4.3 for each of these hazards.

Identified Natural Hazards

Drought

Drought is defined as a deficiency of precipitation experienced over an extended period of time, usually a season or more. Droughts increase the risk of other hazards, like wildfires, flash floods, and landslides or debris flows. This hazard is of particular concern in Pennsylvania due to the prevalence of farming and other water-dependent industries, water dependent recreation uses, and residents who depend on wells for drinking water.

Earthquake

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper ten to twenty miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons and disrupt the social and economic functioning of the affected area. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking which is dependent upon amplitude and duration of the earthquake.

Flooding, Flash Flooding, and Ice Jam Flooding

Flooding is the temporary condition of partial or complete inundation of normally dry land, and it is the most frequent and costly of all-natural hazards in Pennsylvania. Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often along mountain streams and in urban areas where much of the ground is covered by impervious surfaces. Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams.

Invasive Species

An invasive species is a species that is not indigenous to the ecosystem under consideration and whose introduction causes or is likely to cause economic, environmental, or human harm. These

species can be any type of organism: plant, fish, invertebrate, mammal, bird, disease, or pathogen.

Landslide

In a landslide, masses of rock, earth or debris move down a slope. Landslides can be caused by a variety of factors, including earthquakes, storms, fire, and human modification of land. Areas that are prone to landslide hazards include previous landslide areas, areas on or at the base of slopes, areas in or at the base of drainage hollows, developed hillsides with leach field septic systems, and areas recently burned by forest or brush fires.

Pandemic and Infectious Disease

A pandemic is a global outbreak of disease that occurs when a new virus emerges in the human population, spreading easily in a sustained manner, and causing serious illness. An epidemic describes a smaller scale infectious outbreak, within a region or population, that emerges at a disproportionate rate. Infectious disease outbreaks may be widely dispersed geographically, impact large numbers of the population, and could arrive in waves lasting several months at a time.

Radon Exposure

Radon is a radioactive gas produced by the breakdown of uranium in soil and rock that can lead to lung cancer in people exposed over a long period of time. Most exposure comes from breathing in radon gas that enters homes and buildings through foundation cracks and other openings. According to the DEP, approximately 40% of Pennsylvania homes have elevated radon levels.

Subsidence/Sinkhole

Land subsidence is a gradual settling or sudden sinking of the ground surface due to the movement of subsurface materials. A sinkhole is a subsidence feature resulting from the sinking of surficial material into a pre-existing subsurface void. Subsidence and sinkholes are geologic hazards that can impact roadways and buildings and disrupt utility services. Subsidence and sinkholes are most common in areas underlain by limestone and can be exacerbated by human activities such as water, natural gas, and oil extraction.

Tornadoes/Windstorm

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. About 1,250 tornadoes hit the U.S. each year, with about sixteen hitting Pennsylvania. Damaging winds exceeding 50-60 miles per hour can occur during tornadoes, severe thunderstorms, winter storms, or coastal storms. These winds can have severe

impacts on buildings, pulling off the roof covering, roof deck, or wall siding and pushing or pulling off the windows.

Wildfire

A wildfire is an unplanned fire that burnt in a natural area. Wildfires can cause injuries or death and can ruin homes in their path. Wildfires can be caused by humans or lightning, and can happen anytime, though the risk increases in period of little rain. In Pennsylvania, 98% of wildfires are caused by people.

Winter Storm

A winter storm is a storm in which the main types of precipitation are snow, sleet, or freezing rain. A winter storm can range from a moderate snowfall or ice event over a period of a few hours to blizzard conditions with wind-driven snow that lasts for several days. Most deaths from winter storms are not directly related to the storm itself, but result from traffic accidents on icy roads, medical emergencies while shoveling snow, or hypothermia from prolonged exposure to cold.

Identified Human Caused Hazards

Civil Disturbance

A civil disturbance is defined by FEMA as a civil unrest activity (such as a demonstration, riot, or strike) that disrupts a community and requires intervention to maintain public safety.

Dam Failure

Dam failure is the uncontrolled release of water (and any associated wastes) from a dam. This hazard often results from a combination of natural and human causes, and can follow other hazards such as hurricanes, earthquakes, and landslides. The consequences of dam failures can include property and environmental damage and loss of life.

Emergency Services

Emergency medical services (EMS) and fire department services play a crucial role in the emergency response system, and the functionality of these emergency services directly impacts many of the other hazard profiles in this report. Both EMS and fire services face challenges from lack of funding and lower rates of volunteerism.

Environmental Hazards/Hazardous Materials

Environmental hazards are hazards that pose threats to the natural environment, the built environment and public safety through the diffusion of harmful substances, materials, or products. Environmental hazards include the following:

- Hazardous material releases: at fixed facilities or as such materials are in transit and including toxic chemicals, infectious substances, biohazardous waste and any materials that are explosive, corrosive, flammable, or radioactive (PL 1990-165, § 207(e)).
- Air or Water Pollution; the release of harmful chemical and waste materials into water bodies or the atmosphere, for example (National Institute of Health Sciences, July 2009; Environmental Protection Agency, Natural Disaster PSAs, 2009).
- Superfund Facilities: hazards originating from abandoned hazardous waste sites listed on the National Priorities List (Environmental Protection Agency, National Priorities List, 2009).
- Manure Spills: involving the release of stored or transported agricultural waste, for example (Environmental Protection Agency, Environmental Impacts of…, 1998).
- Product Defect or Contamination; highly flammable or otherwise unsafe consumer products and dangerous foods (Consumer Product Safety Commission, 2003).

Hazardous material releases can contaminate air, water, and soils and have the potential to cause injury or death. Dispersion can take place rapidly when transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events.

Levee Failure

A levee is a human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water to provide protection from temporary flooding (FEMA, 2016). A levee failure or breach occurs when a levee fails to prevent flooding on the landside of the levee. The consequences of a sudden levee failure can be catastrophic, with the resulting flooding causing loss of life, emergency evacuations, and significant property damage.

Opioid Epidemic

An opioid epidemic is the rapid increase in the use of prescription and non-prescription opioid drugs in the United States beginning in the late 1990s and continuing throughout the first two decades of the 2000s. Opioids are a diverse class of moderately strong painkillers, including oxycodone, hydrocodone, and a very strong painkiller, fentanyl, which is synthesized to resemble other opiates such as opium-derived morphine and heroin. The potency and availability

of these substances, despite their high risk of addiction and overdose, have made them popular both as formal medical treatments and as recreational drugs. Due to their sedative effects on the part of the brain which regulates breathing, opioids in high doses present the potential for respiratory depression and may cause respiratory failure and death.

The Commonwealth of Pennsylvania, along with other states in the nation has enacted legislation to curb the prescription and distribution of these drugs to try to prevent addiction rising from abuse as a painkiller. This includes but is not limited to restrictions to prescribing to minors, quantity limits, a prescription database with entry requirements and other limits to its availability.

Terrorism/Cyberterrorism Incidents

Terrorism is use of force or violence against persons or property with the intent to intimidate or coerce. Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb scares and bombings; cyberattacks (computer-based); and the use of chemical, biological, nuclear, and radiological weapons. Cyberattacks have become an increasingly pressing concern. Cyberterrorism refers to acts of terrorism committed using computers, networks, and the internet. The most widely cited definition comes from Denning's Testimony before the Special Oversight Panel on Terrorism: "Cyberterrorism…is generally understood to mean unlawful attacks and threats of attack against computers, networks, and the information stored therein when done to intimidate or coerce a government or its people in furtherance of political or social objectives. Further, to qualify as cyberterrorism, an attack should result in violence against persons or property, or at least cause enough harm to generate fear".

Transportation Accidents

Transportation accidents are technological hazards involving the nation's system of land, sea, and air transportation infrastructure. A flaw or breakdown in any component of this system can and often does result in a major disaster involving loss of life, injuries, property and environmental damage, and economic consequences.

Urban Fire and Explosions

Urban fires and explosions include those fires and explosions that occur within urban, or developed, regions, and often pose an increased threat due to their tendency to easily spread to neighboring structures. The effects may be minor or severe and include injury, loss of life, property damage, and residential or economic disruption/displacement.

Utility Interruption

Utility interruption hazards are hazards that impair the functioning of important utilities in the energy, telecommunications and public works and information network sectors. Utility interruption hazards include the following:

- Geomagnetic Storms; including temporary disturbances of the Earth's magnetic field resulting in disruptions of communication, navigation, and satellite systems (National Research Council et al., 1986).
- Fuel or Resource Shortage; resulting from supply chain breaks or secondary to other hazard events.
- Electromagnetic Pulse; originating from an explosion or fluctuating magnetic field and causing damaging current surges in electrical and electronic systems (Institute for Telecommunications Sciences, 1996).
- Information Technology Failure; due to software bugs, viruses, or improper use (Rainer Jr., et al, 1991).
- Ancillary Support Equipment; electrical generating, transmission, system-control, and distribution-system equipment for the energy industry (Hirst & Kirby, 1996).
- Public Works Failure; damage to or failure of highways, flood control systems, deep-water ports and harbors, public buildings, bridges, dams, for example (United States Senate Committee on Environment and Public Works, 2009).
- Telecommunications System Failure; Damage to data transfer, communications, and processing equipment, for example (FEMA, 1997)
- Transmission Facility or Linear Utility Accident; liquefied natural gas leakages, explosions, facility problems, for example (United States Department of Energy, 2005).
- Major Energy, Power, Utility Failure; interruptions of generation and distribution, power outages, for example (United States Department of Energy, 2000).

4.2.3. Climate Change

Impacts of Climate Change on Identified Hazards

Humans have become the dominant species on Earth and our society and influence is globalized. Human activity such as the large-scale consumption of fossil fuels and de-forestation has caused atmospheric carbon dioxide concentrations to significantly increase and a notable diversity of species to go extinct. The result is rapid climate change unparalleled in Earth's history and an extinction event approaching the level of a mass extinction (Barnosky et al., 2011; Wake & Vredenburg, 2008). The corresponding rise of average atmospheric temperatures is intensifying many natural hazards, and further threatening biodiversity. The effects of climate change on

these hazards are expected to intensify over time as temperatures continue to rise, so it is prudent to be aware of how climate change is impacting natural hazards.

The most obvious change is in regard to extreme temperature. As average atmospheric temperatures rise, extreme high temperatures become more threatening, with record high temperatures outnumbering record low temperatures 2:1 in recent years. As climate change intensifies, it is expected that the risk of extreme heat will be amplified whereas the risk of extreme cold will be attenuated. Some studies show increased insect activities during a similar rapid warming event in Earth's history. Other studies make projections that with the warming temperatures and lower annual precipitation that are expected with climate change, there will be an expansion of the suitable climate for mosquitos, potentially increasing the risk of infectious disease.

Climate change is likely to increase the risk of droughts (Section 4.3.1). Higher average temperatures mean that more precipitation will fall as rain rather than snow, snow will melt earlier in the spring, and evaporation and transpiration will increase. Along with the prospect of decreased annual precipitation, the risk of hydrological and agricultural drought is expected to increase (Sheffield & Wood, 2008). Correspondingly this will impact wildfires. Drought is accompanied by drier soils and forests, resulting in an elongated wildfire season and more intense and long-burning wildfires (Pechony & Shindell, 2010). However, the Southwest United States is at a greater risk of this increased drought and wildfire activity than Elk County in the Eastern United States.

While it may seem counterintuitive considering the increased risk of drought, there is also an increased risk of flooding associated with climate change (Section 4.3.3). Warmer temperatures mean more precipitation will fall as rain rather than snow. Combined with the fact that warmer air holds more moisture, the result is heavier and more intense rainfall and dam and levee failures. Similarly, winter storms are expected to become more intense, if possibly less frequent. Climate change is also expected to result in more intense hurricanes and tropical storms. With the rise of atmospheric temperatures, ocean surface temperatures are rising, resulting in warmer and more moist conditions where tropical storms develop (Stott et al., 2010). A warmer ocean stores more energy and is capable of fueling stronger storms. It is projected that the Atlantic hurricane season is elongating, and there will be more category 4 and 5 hurricanes than before (Trenberth, 2010).

Climate change is contributing to the introduction of new invasive species (Section 4.3.6). As maximum and minimum seasonal temperatures change, non-native species are able to establish themselves in previously inhospitable climates where they have a competitive advantage. This

may shift the dominance of ecosystems in favor of non-native species, contributing to species loss and the risk of extinction.

This type of sudden global change is novel to humanity. Despite the myriad of well thought out research, there is still much uncertainty surrounding the future of the Earth. All signs point to the intensification of the hazards mentioned above, especially if human society and individuals do not make swift and significant changes combat species losses.

4.3. Hazard Profiles

4.3.1. Drought

4.3.1.1 Location and Extent

While Pennsylvania is generally more water-rich than many U.S. states, the commonwealth may experience drought conditions intermittently throughout the calendar year. A drought is broadly defined as a time period of prolonged dryness that contributes to the depletion of ground and surface water. Droughts are regional climatic events, so when such an event occurs in Elk County, impacts are not restricted to the county and are often more widespread. The spatial extent of the impacted area can range from localized areas in Pennsylvania to the entire Mid-Atlantic region.

There are three types of droughts:

Meteorological Drought – A deficiency of moisture in the atmosphere compared to average conditions. Meteorological drought is defined by the duration of the deficit and degree of dryness and is often associated with below average rainfall. Depending on the severity of the drought, it may or may not have a significant impact on agriculture and the water supply.

Agricultural Drought – A drought inhibiting the growth of crops, due to a moisture deficiency in the soil. Agricultural drought is linked to meteorological and hydrologic drought.

Hydrologic Drought – A prolonged period without rainfall that has an adverse effect on streams, lakes, and groundwater levels, potentially impacting agriculture.

Droughts are often the leading contributing factor to wildfires, as they leave areas with little to no moisture.

4.3.1.2 Range of Magnitude

The average annual precipitation of 4.48” (rain) occurs primarily during the spring and summer months. This value is derived from averaging ten years of mean annual precipitation data for Elk County. Rural farming areas of Elk County are most at risk when a drought occurs. A drought can create a significant financial burden for the community. Approximately 42.3% of Elk County farms are family-owned and operated. Additionally, 41% of the county farmland use is devoted to crop cultivation and 11% to livestock and poultry. Wildfires are often the most severe secondary effect associated with drought. Wildfires can devastate wooded and agricultural areas, structures near high wildfire loads, and farm production facilities, and threaten natural resources. Prolonged drought conditions can have a lasting impact on the economy and can cause major ecological changes, such as increases in scrub growth, flash flooding, and soil erosion.

Long-term water shortages during severe drought conditions can have a significant impact on agribusiness, public utilities, and other industries reliant on water for production services. Elk County also has a growing agritourism business that would be threatened by long-term drought.

Local municipalities may, with the approval of the Pennsylvania Emergency Management Council, implement local water rationing. These individual water rationing plans, authorized through provisions of 4 PA code Chapter 120, will require specific limits on individual water consumption to achieve significant reductions in use. Under mandatory water usage restrictions imposed by the commonwealth and/or local municipalities, procedures are provided for granting of variances to consider individual hardships and economic dislocations. *Table 12 – Drought Preparation Phases* shows the FEMA-defined levels of drought severity along with suggested actions, requests, and goals.

Table 12 - Drought Preparation Phases

Drought Preparation Phases				
Phase	**General Activity**	**Actions**	**Request**	**Goal**
Drought Watch	Early stages of planning and alert for drought possibility.	Increased water monitoring, awareness, and preparation for response among government agencies, public water suppliers, water users, and the public.	Voluntary water conservation.	Reduce water use by 5%.
Drought Warning	Coordinate a response to imminent drought conditions and potential water shortages.	Reduce shortages – relieve stressed sources, develop new sources if needed.	Continue voluntary water conservation, impose mandatory water use restrictions if needed.	Reduce water use by 10 – 15%.
Drought Emergency	Management of operations to regulate all available resources and respond to emergency.	Support essential and high priority water uses and avoid unnecessary uses.	Possible restrictions on all nonessential water uses.	Reduced water use by 15%.

Drought Preparation Phases				
Phase	**General Activity**	**Actions**	**Request**	**Goal**
Source: Pennsylvania Department of Environmental Protection, 2017				

The commonwealth uses five parameters to assess drought conditions:

- Stream flows (compared to benchmark records)
- Precipitation (measured as the departure from normal, thirty-year average precipitation)
- Reservoir storage levels in a variety of locations such as three New York City reservoirs in the upper Delaware River Basin
- Groundwater elevations in a number of counties (comparing to past month, past year, and historic records)
- Soil moisture via the Palmer Drought Index as seen in *Table 13 – Palmer Drought Severity Index*, which is a soil moisture algorithm calibrated for relatively homogenous regions which measures dryness based on recent precipitation and temperature.

Table 13 - Palmer Drought Severity Index

Palmer Drought Severity Index (PDSI)	
Severity Category	**PDSI Value**
Extremely Wet	4.0 or more
Very Wet	3.0 to 3.99
Moderately Wet	2.0 to 2.99
Slightly Wet	1.0 to 1.99
Incipient Dry Spell	0.5 to 0.99
Near Normal	0.49 to -0.49
Incipient Dry Spell	-0.5 to -0.99
Mild Drought	-1.0 to -1.99
Moderate Drought	-2.0 to -2.99
Severe Drought	-3.0 to -3.99
Extreme Drought	-4.0 or less

The effects of a drought can be far-reaching both economically and environmentally. Economic impacts include reduced productivity of aquatic resources, mandatory water use restrictions, well failures, cutbacks in industrial production, agricultural losses, and limited recreational opportunities. Environmental impacts of drought include the following: *Table 14 – Economic and Environmental Impacts of Drought Events* qualifies the potential economic and environmental impacts from a drought event.

Table 14 - Economic and Environmental Impacts of Drought Events

Economic and Environmental Impacts of Drought Events	
Economic	**Environmental**
- Reduced productivity of aquatic resources - Mandatory water use restrictions - Well failures - Cutbacks in industrial production - Agricultural losses - Limited recreational opportunities	- Hydrologic effects - Adverse effects on animal populations - Damage to plant communities - Increased number and severity of fires - Reduced soil quality - Air quality effects - Loss of quality in landscape

4.3.1.3 Past Occurrence

The Pennsylvania Department of Environmental Protection (PA DEP) maintains the most comprehensive data on drought occurrences across the commonwealth. Descriptions of drought status categories (i.e., watch, warning, and emergency) are included in the "Range of Magnitude" section above. The declared drought status from 1980 to 2021 is shown in *Table 15 – Past Drought Events in Elk County*.

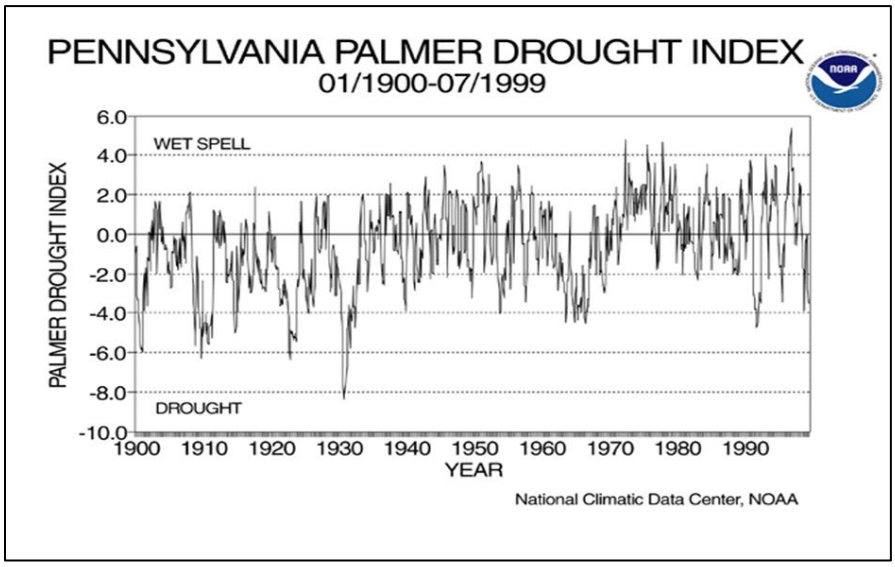
The National Oceanic and Atmospheric Administration (NOAA) has archived records showing extreme droughts for the commonwealth in 1931 and a prolonged event in the 1960s as seen in *Figure 8 – Pennsylvania Palmer Drought Index 1900 – 1999*.

Table 15 - Past Drought Events in Elk County

Past Drought Events in Elk County			
Start	**End**	**Number of Days**	**Description**
11/18/1980	4/20/1982	518	Emergency
4/26/1985	12/19/1985	237	Watch
7/7/1988	8/24/1988	48	Watch
8/24/1988	12/12/1988	110	Warning
3/3/1989	5/15/1989	73	Watch
6/28/1991	7/24/1991	26	Watch
7/24/1991	8/16/1991	23	Warning
8/16/1991	4/20/1992	248	Emergency
4/20/1992	6/23/1992	64	Warning
6/23/1992	9/11/1992	80	Watch
9/1/1995	12/18/1995	108	Watch
12/3/1998	12/8/1998	5	Watch
12/8/1998	12/16/1998	8	Warning
12/16/1998	3/15/1999	89	Emergency

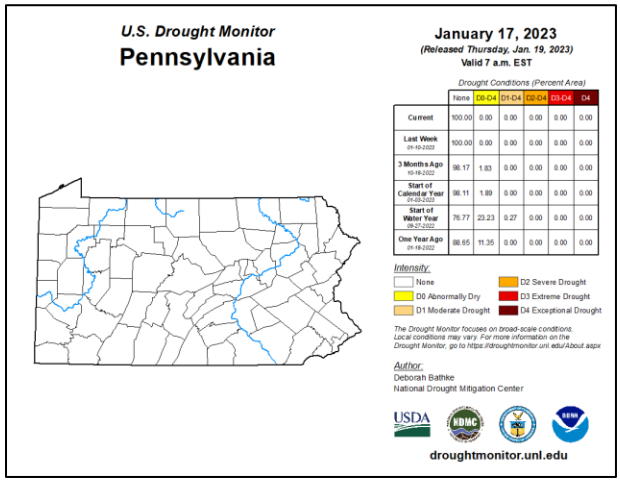
Past Drought Events in Elk County			
Start	**End**	**Number of Days**	**Description**
3/15/1999	9/30/1999	199	Watch
9/30/1999	2/25/2000	148	Warning
2/25/2000	5/5/2000	70	Watch
11/6/2001	5/13/2002	188	Watch
4/11/2006	6/30/2006	80	Watch
8/6/2007	2/15/2008	193	Watch
11/7/2008	1/26/2009	80	Watch
9/16/2010	12/17/2010	92	Watch
8/5/2011	9/2/2011	28	Warning
9/2/2011	10/13/2011	41	Watch
8/2/2016	11/3/2016	93	Watch
9/10/2020	1/7/2021	119	Watch

Figure 8 - Pennsylvania Palmer Drought Index 1900 - 1999



The warmest July on record in Pennsylvania occurred in 2020, and sixteen counties entered Drought Watch status on August 21 of that year. In June 2021, dry conditions were again affecting the commonwealth. By 2022, most of Pennsylvania was experiencing normal conditions, with intermittent drought watches. *Figure 9 – U.S. Drought Monitor, Pennsylvania* illustrates the conditions of drought in Pennsylvania at the time of the report. Currently, Pennsylvania is under normal drought conditions.

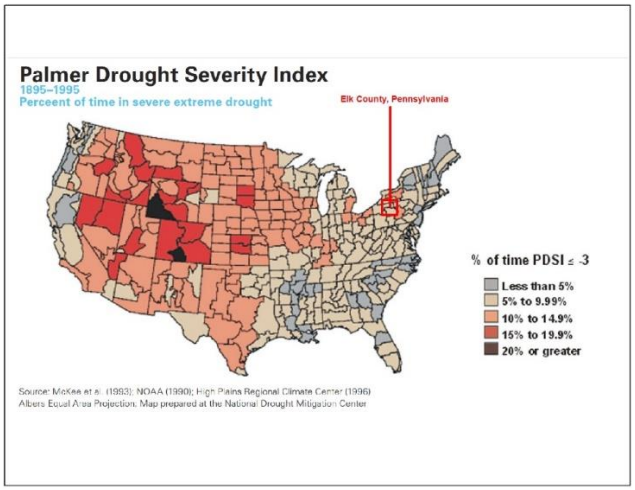
Figure 9 - U.S. Drought Monitor, Pennsylvania



4.3.1.4 Future Occurrence

It is difficult to forecast the exact severity and frequency of future drought events. Climate change will lead to increased uncertainty and extremity of climate events. Elk County has experienced severe drought between 5% to 10% of the time between 1895 and 1995 as seen in *Figure 10 – Palmer Drought Severity Index*. This report can be used to make a rough estimate of the future probability of drought in Elk County, although it does not account for changes introduced by climate change. Drought conditions are expected to become more severe with climate change, as evaporation and transpiration will increase with higher temperatures.

Figure 10 - Palmer Drought Severity Index



The potential for a drought to occur in Elk County is high. Given the frequency of drought watches issued for Elk County and its municipalities, the county can reasonably expect to be

under a drought watch at least once every two years. While some form of drought condition frequently exists in Elk County, the impact depends on the duration of the event, severity of conditions, and area affected. The map above shows that Elk County, and most of Pennsylvania, is currently (and most often) in normal (non-drought) conditions.

As stated above in Section 4.2.3, climate change will have an effect on the frequency of droughts in the future. As global temperatures rise, weather patterns will change, increasing the number of dry days an areas experiences. This could result in more drought periods for a local or regional area. Droughts could also become longer in duration, compared with pre-climate change patterns.

4.3.1.5 Vulnerability Assessment

The magnitude of drought vulnerability depends on the duration and area of impact. However, other factors contribute to the severity of a drought. Unseasonably high temperatures, prolonged winds, and low humidity can heighten the impact of a drought.

Extended periods of drought can lead to lowered stream levels, altering the delicate balance of riverine ecosystems. Certain tree species are susceptible to fungal infections during prolonged periods of soil moisture deficit. Fall droughts pose a particular threat because groundwater levels are typically at their lowest following the height of the summer growing season.

There are many hazards that can be considered cascading hazards related to drought events. Wildfire is the most severe cascading hazard effect associated with drought. Wildfires can devastate wooded and agricultural areas, threatening natural resources and farm production facilities. With drought events, water infiltration into the ground becomes more difficult. This lack of infiltration can result in flash flooding events in areas of steep slopes, canyons, and rolling hills. A loss of vegetation from a drought can also increase the occurrence of landslides in areas of steep slopes with loose packed soil profiles. A discussion on the county's vulnerability to wildfire, flash floods, and landslides can be found in Section 4.3.10.5, 4.3.3.5, and 4.3.5.5 respectively.

Droughts can have adverse effects on farms and other water-dependent industries resulting in local economic loss. Areas of extensive agriculture use are particularly vulnerable to drought; 22,982 acres of Elk County, or roughly 4.34% of the 529,280 total land acreage, make up farmland (United States Department of Agriculture [USDA], 2017 Census). The total number of farms for Elk County is 232 and the average acreage for farms in Elk County is ninety-nine acres. Elk County ranks 63rd of sixty-seven counties in the commonwealth for agricultural production, totaling over $4 million annually. Agricultural production from crops, including nursery and greenhouse crops, accounts for more than $2 million in commerce annually. Production from livestock, poultry, and their products accounts for $2 million annually. The livestock that has the greatest potential to be impacted are the broilers and other meat-type

chickens and cattle and calves. There are approximately 3,431 broilers and meat-type chickens, and 2,379 cattle and calves. Acreage for farming has decreased since the 2012 USDA Census when there was a reported total of 22,984 farming and drought vulnerable acres. Information for an updated agricultural census will be released during the next planning period.

Ek County also has 399 domestic water wells and four irrigation wells that would be adversely impacted by drought events. This impact would lead to lower water levels for at least 399 households and potentially four large farms. This well information was obtained by using the PA GEOCODE application to find well information from 01/01/2000 and 10/01/2023.

Additionally, emergency services can be adversely impacted by drought as a cascading hazard. Local fire departments often utilize ponds, creeks, and streams for water onboard fire apparatus. With low water levels in waterbodies, responders may be unable to draft enough water to efficiently respond to and extinguish a fire. Also, with an increased number of potential wildfires due to drought conditions, agencies may not have the personnel to efficiently respond to all fires in a timely manner.

A map of properties with tillable agricultural land use, forestry, and other land in the county vulnerable to drought is shown below in *Figure 11 – Drought-Vulnerable Land Use and Public Water Supply*.

All of the properties in Elk County that are part of the National Register of Historic Places have the same vulnerability to drought. No one property has a greater risk than the others, but each of the historic and cultural properties is vulnerable at some level.

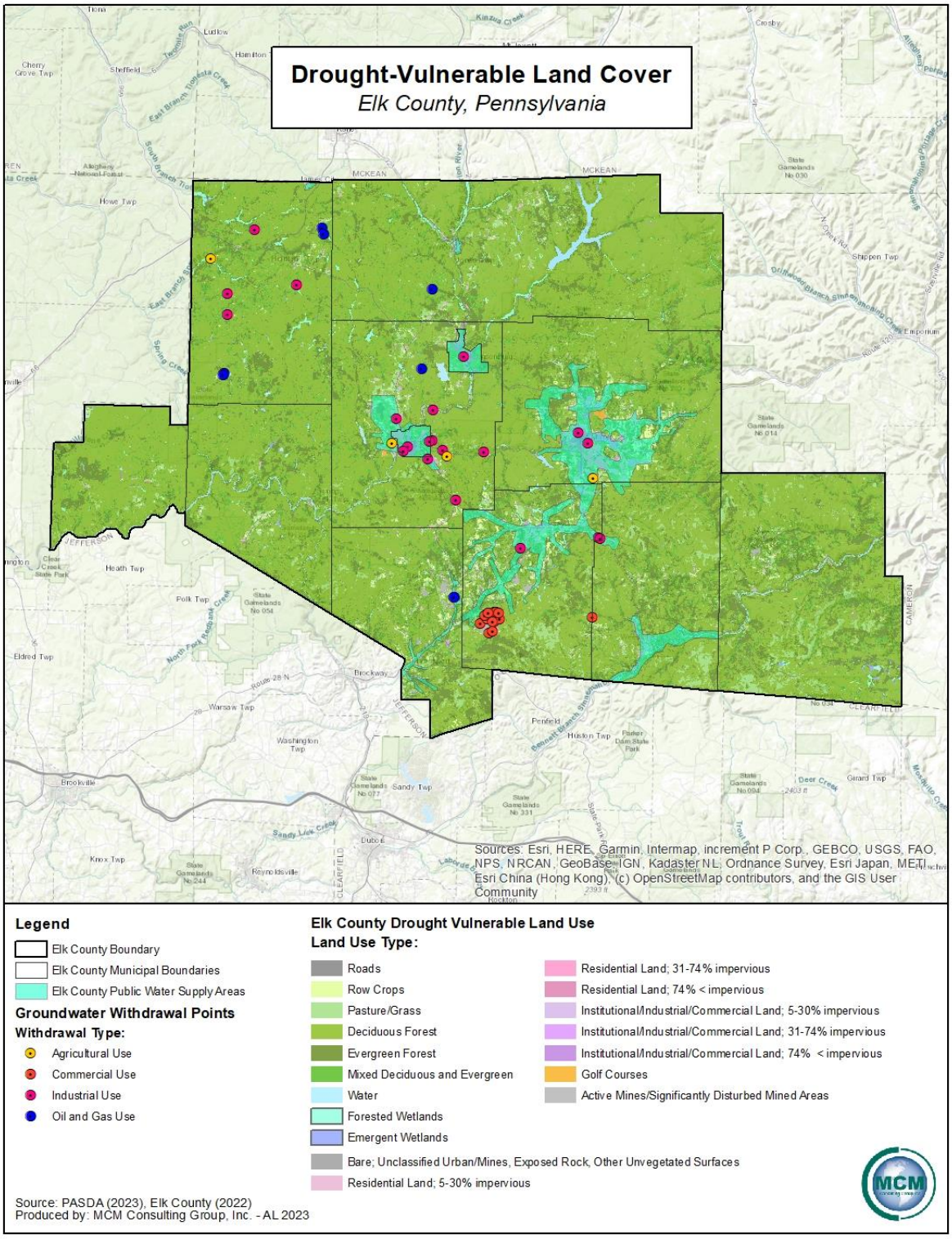
Municipalities with high risk due to drought:

- Benezette Township
- Fox Township
- Highland Township
- Horton Township
- Jay Township
- Johnsonburg Borough
- Jones Township
- Millstone Township
- Ridgway Borough
- Ridgway Township
- Spring Creek Township
- City of St Marys

Drought in Elk County can have an adverse effect on land use, especially forested areas. Approximately ninety percent of land use in Elk County is forest areas to include deciduous, evergreen, mixed deciduous and evergreen, forested wetlands, and emergent wetlands. There are four state game lands, two state forests, and one national forest that make up a large portion of the county. Long periods of drought can increase the potential for wildfires and invasive species that could damage these forested areas. Economic benefits through the provision of wood products would also be affected.

As seen in *Table 3 – Population Change in Elk County*, ten of the twelve municipalities in Elk County have experienced a population loss since the previous 2010 US Census. However, Benezette Township (4.4% or a total of nine people) and Millstone Township (15.9% or a total of thirteen people) saw minor total population growth over the same period. Based on this information, it can be speculated that these two municipalities may have an increased risk to drought conditions, since 2010, due to the increase in population.

Figure 11 - Drought-Vulnerable Land Use and Public Water Supply

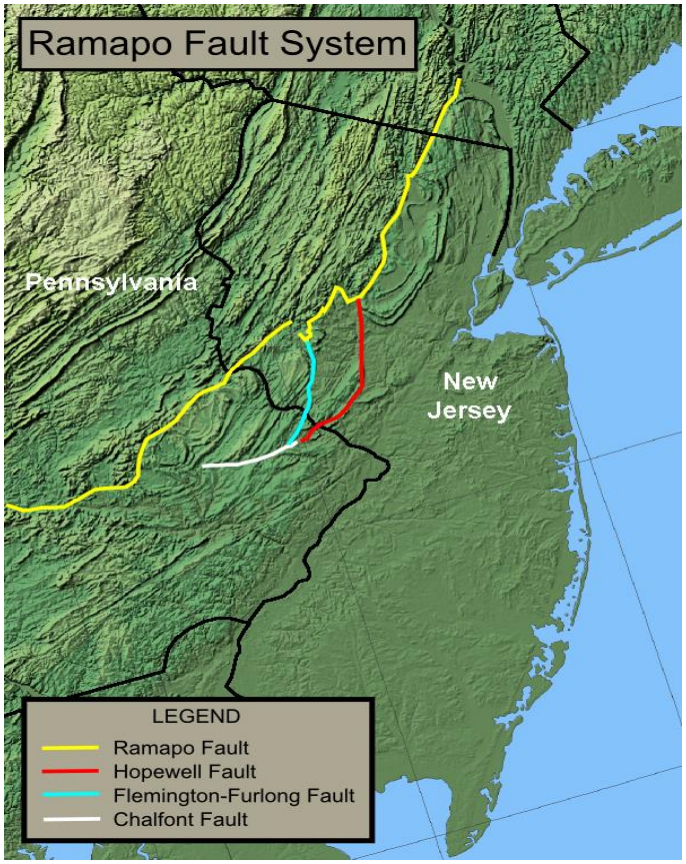


4.3.2. Earthquake

4.3.2.1 Location and Extent

An earthquake is sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge off the earth's tectonic plates, a volcanic eruption, or by a human induced explosion (DCNR, 2007). Earthquake events in Pennsylvania, including Elk County, are usually mild events, impacting areas no greater than 62 miles in diameter from the epicenter. A majority of earthquakes occur along boundaries between tectonic plates, and some earthquakes occur at faults on the interior of plates. Today, Eastern North America, including Elk County, Pennsylvania, is far from the nearest plate boundary. That plate boundary is the Mid-Atlantic Ridge and is approximately 2,000 miles to the east, under the Atlantic Ocean. The Ramapo Fault System runs through New York, New Jersey, and eastern Pennsylvania (See *Figure 12 - Ramapo Fault System.* This fault system is associated with some small earthquakes, and it is thought unlikely to produce significant disruption.

Figure 12 - Ramapo Fault System



When the supercontinent of Pangaea broke apart about 200 million years ago, the Atlantic Ocean began to form. Since then, many faults have developed. Locating all of the faults would be an ideal approach to identifying the region's earthquake hazard; however, many of the fault lines in this region have no seismicity associated with them. The best way to determine earthquake history for Elk County is to conduct a probabilistic earthquake-hazard analysis with the earthquakes that have already happened in and around the county. (See *Figure 13 – Pennsylvania Earthquake Hazard Zones*). Nevertheless, the United States Geological Survey (USGS) indicates that Elk County has a low earthquake risk, and zero historical earthquake events have occurred.

Natural gas extraction of the Marcellus/Utica Shale formation (see *Figure 14 - Pennsylvania Oil and Gas Geology*) has occurred in many regions of the commonwealth, but eastern and southeastern Pennsylvania are not among them. Hydraulic fracturing, or fracking, is used to extract the gas, and the process is thought to lead to an increase in seismic activity (Meyer, 2016).

However, fracking does not appear to be linked to the increased rate of magnitude three and larger earthquakes (USGS 2014). In recent years, permits for extraction of the natural gas and oil in the commonwealth have been issued by the Pennsylvania Department of Environmental Protection, but no records of requested permits for gas extraction or injection wells were found for Elk County at the writing of this plan.

4.3.2.2 Range of Magnitude

Earthquakes result in the propagation of seismic waves, which are detected using seismographs. These seismograph results are measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake. *Table 16 – Richter Scale* summarizes Richter Scale magnitudes as they relate to the spatial extent of impacted areas. The Modified Mercalli Intensity Scale *Table 17 Modified Mercalli Intensity Scale* is an alternative measure of earthquake intensity that is scaled by the impacts of the earthquake event. Earthquakes have many secondary impacts, including disrupting critical facilities, transportation routes, public water supplies and other utilities.

Table 16 - Richter Scale

Richter Scale	
Richter Magnitude	**Earthquake Effects**
Less than 3.5	Not generally felt but recorded.
3.5-5.4	Often felt, but rarely causes damage.

Richter Scale	
Richter Magnitude	**Earthquake Effects**
Under 6.0	At most, slight damage to well-designed buildings; can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas where people live up to about 100 kilometers across.
7.0-7.9	Major earthquake; can cause serious damage over large areas.
8.0 or greater	Great earthquake; can cause serious damage in areas several hundred kilometers across.

Table 17 - Modified Mercalli Intensity Scale

Modified Mercalli Intensity Scale			
Scale	**Intensity**	**Earthquake Effects**	**Richter Scale Magnitude**
I	**Instrumental**	Detected only on seismographs.	<4.2
II	**Feeble**	Some people feel it.	
III	**Slight**	Felt by people resting, like a truck rumbling by.	
IV	**Moderate**	Felt by people walking.	
V	**Slightly Strong**	Sleepers awake; church bells ring.	<4.8
VI	**Strong**	Trees sway; suspended objects swing; objects fall off shelves.	<5.4
VII	**Very Strong**	Mild alarm, walls crack, plaster falls.	<6.1
VIII	**Destructive**	Moving cars uncontrollable, masonry fractures, poorly constructed buildings damaged.	<6.9
IX	**Ruinous**	Some houses collapse, ground cracks, pipes break open.	

Modified Mercalli Intensity Scale			
Scale	**Intensity**	**Earthquake Effects**	**Richter Scale Magnitude**
X	**Disastrous**	Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread.	<7.3
XI	**Very Disastrous**	Most buildings and bridges collapse, roads, railways, pipes, and cables destroyed, general triggering of other hazards.	<8.1
XII	**Catastrophic**	Total destruction, trees fall, ground rises and falls in waves.	>8.1

4.3.2.3 Past Occurrence

According to USGS, no known earthquakes have had an epicenter within Elk County since 1724, before which local seismology cannot be known. However, several seismic events that occurred outside the county boundary may have been felt in the region.

On August 23, 2011, a 5.9 earthquake occurred in Virginia, and a 2.2 earthquake shook Reading, Pennsylvania (Berks County), on July 19, 2019. Further, a 3.4 earthquake struck Mifflintown (Juniata County) on June 13, 2019, and Bolivar (Westmoreland County) experienced a 2.9 event on October 6, 2020. Parts of the county may have experienced some of the shock waves from these minor earthquakes and others that have occurred around the region, most notably New Jersey. The strongest recorded earthquake in Pennsylvania history (5.2) occurred on September 25, 1998, in northwestern Pennsylvania and is known as the Pymatuning Earthquake for its epicenter near Pymatuning Lake. The effects of the earthquake were felt across the commonwealth and were blamed for many wells in the epicentral region drying up, while new springs and old wells began to flow. A three-month date range revealed 120 dry household-supply wells on the ridge of Jamestown and Greenville, Pennsylvania. Declines of up to 100 feet were observed on a ridge where at least eighty of the wells resided. The degree of the damage varied. Some of the wells lost all power or could barely hold their yields and some of the water in wells turned black or began to smell of sulfur.

The most likely cause of the wells drying was because of the increase in hydraulic conductivity or "fracking" of shale rock under this area caused by the earthquake. The quake affected the existing faults and created new faults in the shale. This created more permeability

for the water to leak down from the hilltops on the ridge down to the valleys following the contours of the Meadville shale.

Because the effects of large earthquakes can be felt hundreds of miles away, the historical earthquake epicenters *near* Elk County are shown below at *Figure 15 – Pennsylvania Recorded Earthquake Events.* A wider depiction of earthquake occurrences in the northeastern United States may be found here: *https://earthquake.usgs.gov/earthquakes/map/?extent=14.26438,-141.32813&extent=56.51102,-48.60352*

4.3.2.4 Future Occurrence

Earthquake activity and intensities are difficult to predict, but a probabilistic analysis of prior earthquakes can assist in gauging the likelihood of future occurrences. *Table 18 – Recent Earthquake Trends in Northeastern United States* shows that Elk County is in a very low hazard zone for earthquake activity according to the USGS (2020), suggesting a low probability of earthquake occurrence. However, according to the USGS, there has been a recent trend increasing the frequency of magnitude three and larger earthquakes in the central and eastern U.S. (*Table 18 – Recent Earthquake Trends in Northeastern United States)*. This uptick in seismicity is due to hydraulic fracturing activities, and specifically occurs as a result of wastewater from the fracking process being injected into the earth (Meyer, 2016). Recent studies have moved towards being able to predict such induced seismicity by looking at uplift after injections, but more work needs to be done to confirm uplift as a reliable indicator of induced seismicity (Shirzei et al., 2016). It is important to note that seismicity can occur even after wells become inactive and injection rates decline (Shirzaei et al., 2016).

Isostatic Rebound is a hypothesis for earthquake occurrence that has been conceptualized for many years, according to Charles Scharnberger, a retired professor of geology at Millersville University, who monitors the seismic station there. Scharnberger said Pennsylvania earthquakes are somewhat of a mystery, but they could have something to do with the westward shift of the North American tectonic plate. Though the plates meet in California, where most of the seismic activity occurs, that movement still causes stress, squeezing and pressure along the entire length of the plate, reverberating as far back as the East Coast. A 3.4 earthquake like the one in Mifflintown, Juniata County in 2019 is in the medium range for Pennsylvania and may occur every couple of years. According to the USGS, this was the strongest earthquake felt or originating in Pennsylvania that year. It was followed by a 1.3 aftershock.

The chances of a devastating earthquake are low, but do exist, according to Scharnberger, His calculations on the probability of a severe earthquake based on the historic record indicate it is about a one in 200 chance in any given year.

Table 18 - Recent Earthquake Trends in Northeastern United States

Earthquake Trends in Northeastern U.S.	
Year	**Number of Magnitude 3+ Earthquakes**
2015	0
2016	3
2017	4
2018	0
2019	5
2020	3
Source: USGS, 2020	

Climate change has the potential to increase the earthquake activity felt in the United States, including in Elk County. Although not a direct cause of earthquakes, climate change can worsen droughts and their duration. Droughts can exacerbate the fault lines in an area, resulting in a greater potential for seismology events. During droughts, groundwater is also increasingly pumped, which could cause changes in fault areas. This effect is more common on the west coast of the United States, but with climate change, these impacts can become more common across the country and the world.

4.3.2.5 Vulnerability Assessment

According to the U.S. Geological Society Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect a resident's normal activities. For Elk County, this could include surface faulting, ground shaking, landslides, liquefaction, dried up or rejuvenated water wells, tectonic deformation, and seiches (sloshing of a closed body of water from earthquake shaking).

Earthquakes usually occur without warning and can impact areas a great distance from their point of origin (epicenter). Ground shaking is the greatest risk to building damage within Elk County. Risk to public safety and loss of life from an earthquake is dependent upon the severity and proximity of the event. Injury or death to those inside buildings, or people walking below building ornamentation and chimneys is a higher risk to Elk County's general public during an earthquake. Infrastructure is more at risk on the east coast than the west coast because its buildings are older.

Elk County has a moderate number of historic and cultural properties that could be adversely impacted by earthquakes. There are six historic properties in Elk County that are registered with the National Register of Historic Places.

These locations are:

- Bonifels (stone construction)
- Decker's Chapel (wooden frame construction)
- O.B. Grant House (wooden constriction, stone foundation)
- Ridgway Armory (brick construction)
- Swedish Lutheran Parsonage (wooden construction)
- John E. Weidenboerner House (brick construction)

There is also a historic district in Elk County. This area is located in Johnsonburg Borough and is called the Johnsonburg Commercial Historic District. This area includes approximately thirty-two structures that are of cultural significance and aesthetic to Elk County. These building in the cultural district are primarily made of brick construction.

There are 373 bridges published by the Pennsylvania Department of Transportation that could be damaged and made unusable by a major earthquake event. These locations are evenly distributed throughout the county and damage to any of them would be detrimental to transportation and emergency response in Elk County.

Municipalities with high risk due to earthquake:

- Benezette Township
- Fox Township
- Highland Township
- Horton Township
- Jay Township
- Johnsonburg Borough
- Jones Township
- Millstone Township
- Ridgway Borough
- Ridgway Township
- Spring Creek Township
- City of St Marys

As seen in *Table 3 – Population Change in Elk County*, ten of the twelve municipalities in Elk County have experienced a population loss since the previous 2010 US Census. However,

Benezette Township (4.4% or a total of nine people) and Millstone Township (15.9% or a total of thirteen people) saw a minor population growth over the same period. Based on this information, it can be speculated that these two municipalities may have an increased risk of earthquakes due to the increase in population; however, all municipalities would have a risk of earthquakes.

Land use may factor into the potential impact of earthquakes for municipalities that have had a population change with increased building construction. With only two municipalities seeing minor population changes between the 2010 and the 2020 US Census there has not been an increase in residential construction within Elk County.

Figure 13 - Pennsylvania Earthquake Hazard Zones

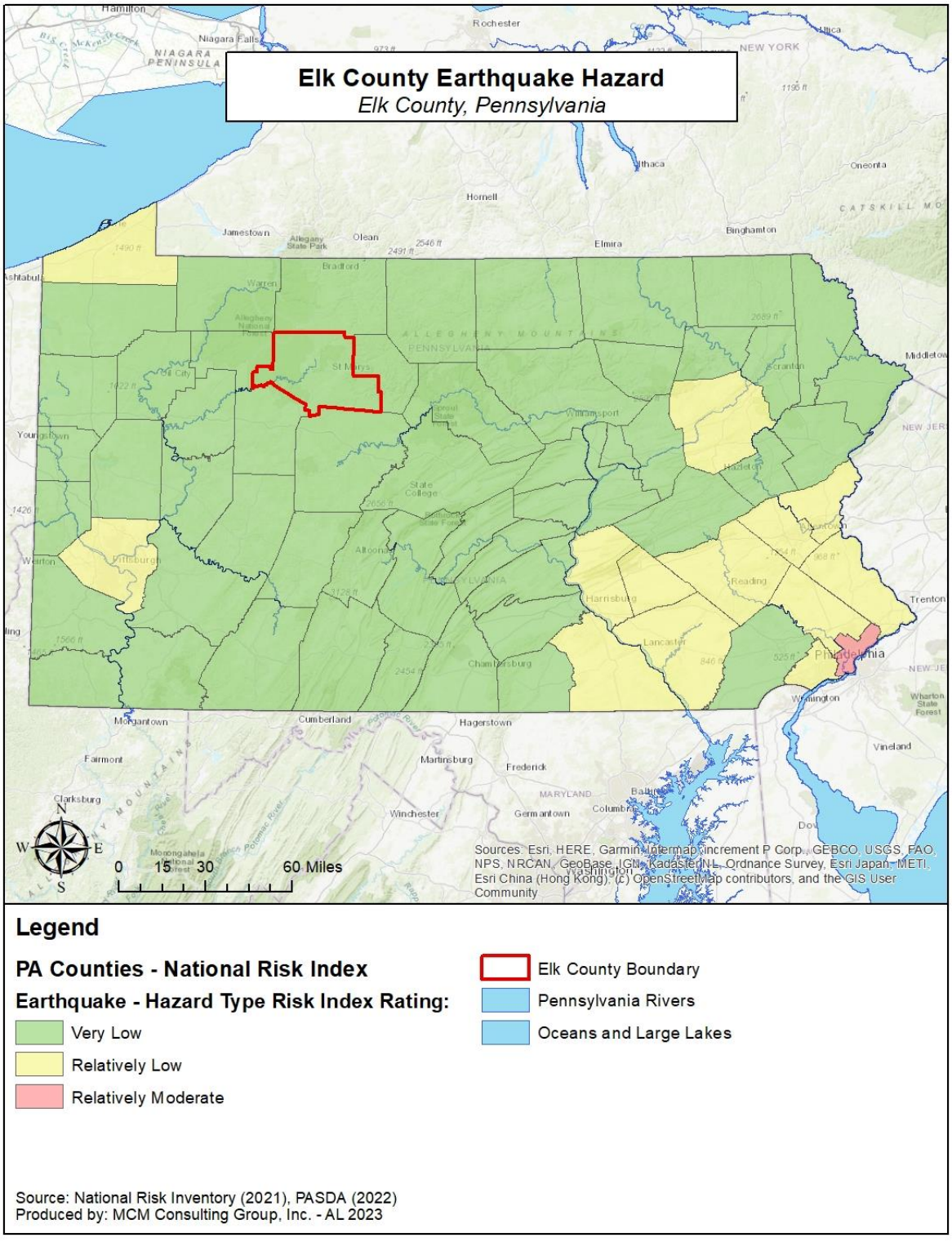


Figure 14 - Pennsylvania Oil and Gas Geology

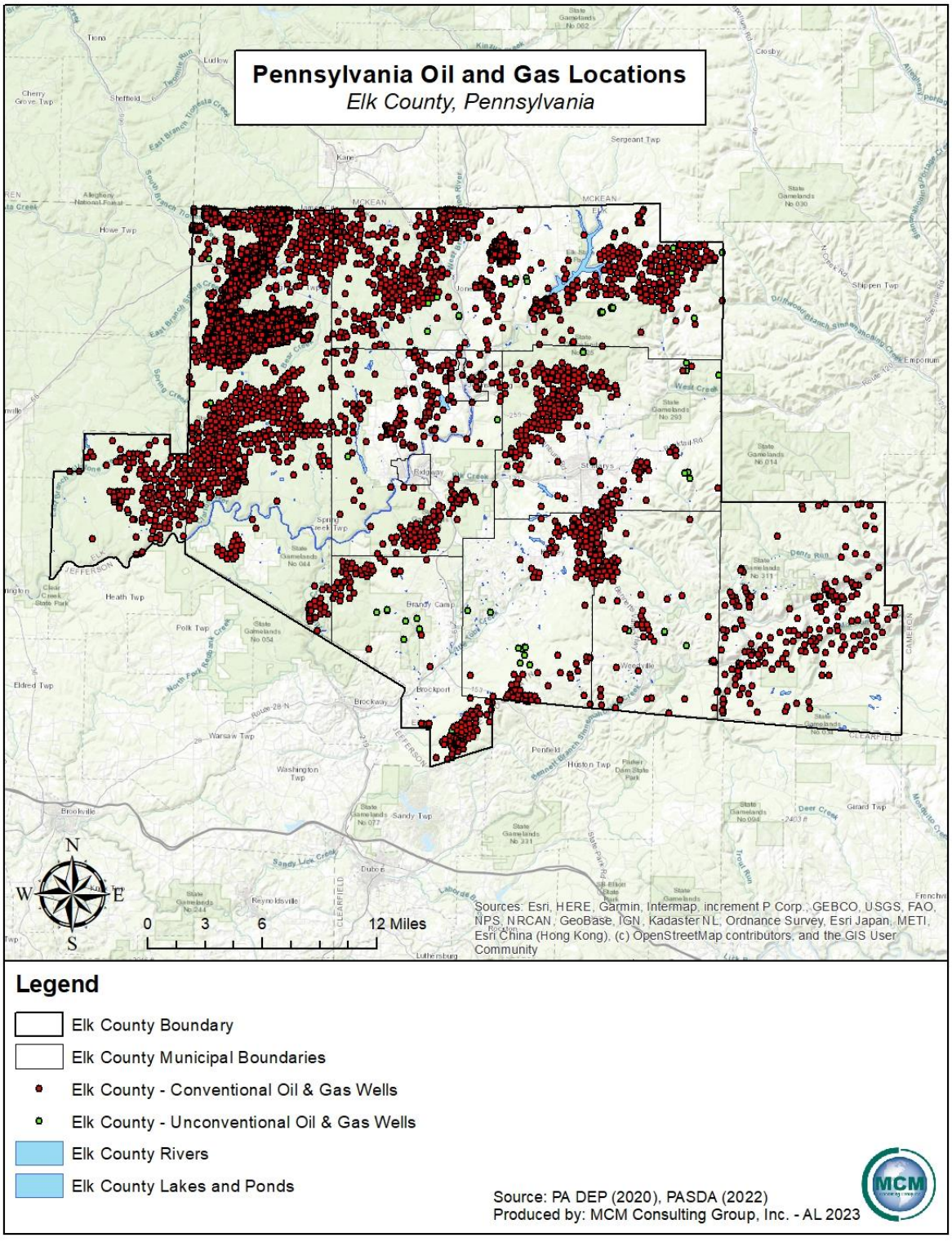
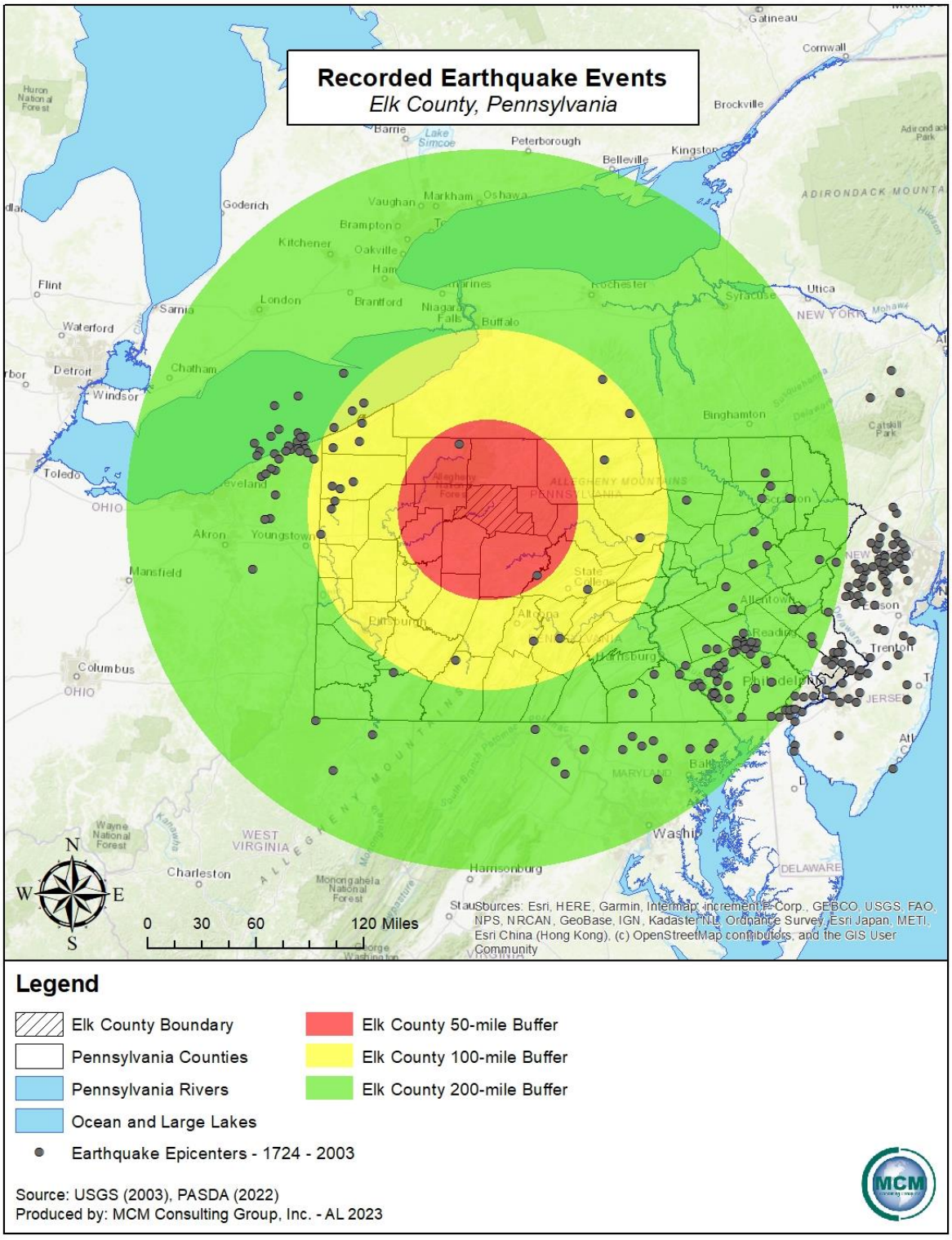


Figure 15 - Pennsylvania Recorded Earthquake Events



4.3.3. Flooding, Flash Flooding, and Ice Jam Flooding

4.3.3.1 Location and Extent

Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all hazards in Pennsylvania. Flooding events are generally the result of excessive precipitation. General flooding is typically experienced when precipitation occurs over a given river basin for an extended period. Flash flooding is usually the result of heavy, localized precipitation falling in a short period of time over a given location, often in mountain streams and mountainous regions, and in urban areas where much of the ground is covered in impervious surfaces. Flash floods are relatively common in Elk County and the severity of those flood events is dependent upon a combination of creek, stream, and river basin topography and physiography, hydrology, precipitation, and weather patterns. Present soil conditions, the degree of vegetative clearing, and the presence of impervious cover must also be considered when determining the severity of a flood or flood event.

Winter flooding can include ice jams, which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams. All forms of flooding can damage infrastructure.

Floodplains are lowlands adjacent to rivers, streams, and creeks that are subject to recurring floods. The size of the floodplain is described by the recurrence interval of a given flood event. Flood recurrence intervals are explained in more detail in section 4.3.3.4. However, in assessing the potential spatial extent of flooding, it is important to know that a floodplain associated with a flood that has a 10% chance of occurring in a given year is smaller than a floodplain associated with a flood that has a 0.2% chance of occurring.

The National Flood Insurance Program (NFIP) publishes digital flood insurance rate maps (DFIRMs). These maps identify the 1% annual chance of flood area. The special flood hazard area (SFHA) and base flood elevations (BFE) are developed from the 1% annual chance flood event as seen in *Figure 16 – Flooding and Floodplain Diagram*. Structure located within the SFHA have a 26% chance of flooding in a thirty-year period. The SFHA serves as the primary regulatory boundary used by FEMA, the Commonwealth of Pennsylvania, and the Elk County local government. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply to the following high-risk special flood hazard areas in *Table 19 – Flood Hazard High Risk Zones*. Appendix D of this hazard mitigation plan includes a flooding vulnerability map for each municipality in Elk County with vulnerable structures and community lifeline facilities identified using the most current DFIRM data for Elk County.

Past flooding events have been primarily caused by heavy rains, which cause small creeks and streams to overflow their banks, often leading to road closures. Flooding poses a threat to

community lifeline facilities, agricultural areas, and those who reside or conduct business in the floodplain. The most significant hazard exists for facilities in the floodplain that process, use, or store hazardous materials. A flood could potentially release and transport hazardous materials throughout the area. Most flood damage to a property and structure located in the floodplain is caused by water exposure to the interior, high velocity water, and debris flow.

Figure 16 - Flooding and Floodplain Diagram

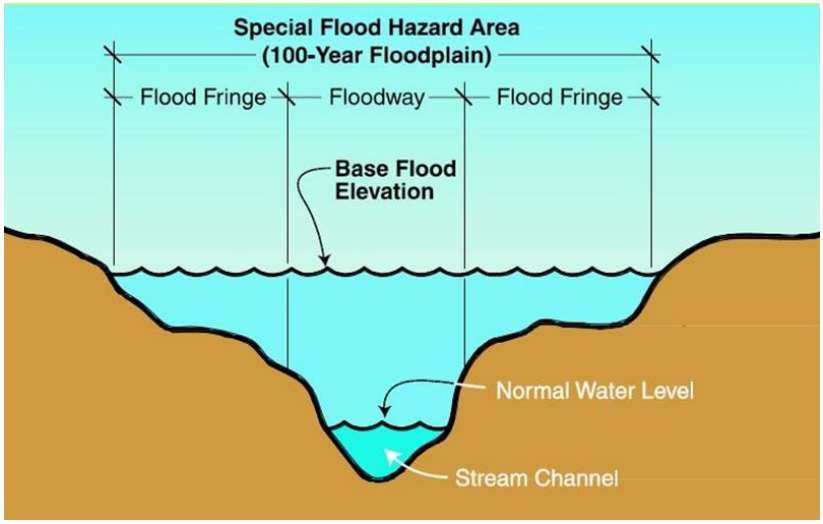


Table 19 - Flood Hazard High Risk Zones

Flood Hazard High Risk Zones	
Zone	**Description**
A	Areas subject to inundation by the 1% annual chance flood event. Because detailed hydraulic analysis has not been performed, no base flood elevations or flood depths are shown.
AE	Areas subject to inundation by the 1% annual chance flood event determined by detailed methods. BFEs are shown within these zones.
AH	Areas subject to inundation by the 1% annual chance shallow flooding (usually areas of ponding) where average depths are 1 – 3 feet. BFEs derived from detailed hydraulic analysis are shown in this zone.
AO	Areas subject to inundation by the 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are 1 – 3 feet. Average flood depths derived from detailed hydraulic analysis are shown within this zone.
AR	Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection.
Source: FEMA, 2017	

4.3.3.2 Range of Magnitude

The Allegheny River Basin has caused significant flooding in Elk County, specifically on the following streams, creeks, and their tributaries:

- Clarion River
    - Bennett Branch Sinnemahoning Creek
    - East Branch Clarion River
    - Little Toby Creek
    - Trout Run
    - West Branch Clarion River

Several factors determine the severity of floods, including rainfall intensity and duration, topography, ground cover, and the rate of snowmelt. Water runoff is greater in areas with steep slopes and little to no vegetative ground cover. The mountainous terrain of Elk County can cause more severe floods as runoff reaches receiving water bodies more rapidly over steep terrain. The is of particular concern for areas along steep slopes and on the edges of valleys throughout Elk County.

Urbanization typically results in the replacement of vegetative ground cover with impermeable surfaces like asphalt and concrete, increasing the volume of surface runoff and stormwater, particularly in areas with poorly planned stormwater drainage systems. A large amount of rainfall over a short time span can cause flash flood events. Flash floods can occur very quickly and with little warning. A flash flood can also be deadly because of the rapid rise in water levels and devastating flow velocities. The more developed areas in the county can be easily susceptible to flash floods because of the significant presence of impervious surfaces, such as streets, sidewalks, parking lots, and driveways. Additionally, small amounts of rain can cause floods in locations where the soil is still frozen, saturated from a previous wet period or if the areas is largely covered in impermeable surfaces such as parking lots, paved roadways, and other developed areas. The county occasionally experiences intense rainfall from tropical storms in late summer and early fall, which can potentially cause flooding as well.

Severe flooding can cause injuries and deaths and can have long-term impacts on the health and safety of citizens. Severe flooding can also result in significant property damage, potentially disrupting the regular function of community lifeline facilities and can have widespread negative effects on local economies. Industrial, commercial, and public infrastructure facilities can become inundated with flood waters, threatening the continuity of government and business. The vulnerable populations must be identified and located in flooding situations, as they are often home bound. Mobile homes and manufactured structures are especially vulnerable to high water levels. Flooding can have significant environmental impacts when the flood water release and/or transport hazardous materials.

Severe flooding also comes with secondary effects that could have long lasting impacts on the population, economy, and infrastructure within Elk County. Power failures are the most common secondary effect associated with flooding. Coupled with a shortage of critical services and supplies, power failures could cause a public health emergency. Community lifelines, such as sewage and water treatment facilities, can fail, causing sewage overflows and the contamination of groundwater and drinking water. Flooding also has the potential to trigger other hazards, such as landslides, hazardous material spills, and dam failures.

The maximum threat of flooding for Elk County is estimated by looking at the potential loss data and repetitive loss data, both analyzed in the risk assessment section of the hazard mitigation plan. In these cases, the severity and frequency of damage can result in permanent population displacement, and businesses may close if they are unable to recover from the disaster.

Estimation of potential loss is completed through FEMA's HAZUS software, A level two HAZUS scenario was performed for the entirety of Elk County. The FEMA Global Flood Risk Report and other reports generated by the software at the end of the scenario were utilized to estimate the amount of damage and loss from a flood. The total building loss for a 100-year flood based on a HAZUS level two scenario is displayed in *Table 20 – HAZUS Building Economic Loss Figures*. The total business interruption values occurring from a proposed 100-year flood based on FEMA HAZUS data is illustrated in *Table 21 – HAZUS Business Interruption Economic Loss Figures*. *Figure 17 – Loss by Occupancy Type* illustrates the breakdown of economic losses by either residential, commercial, industrial, or other use type.

Table 20 - HAZUS Building Loss Figures

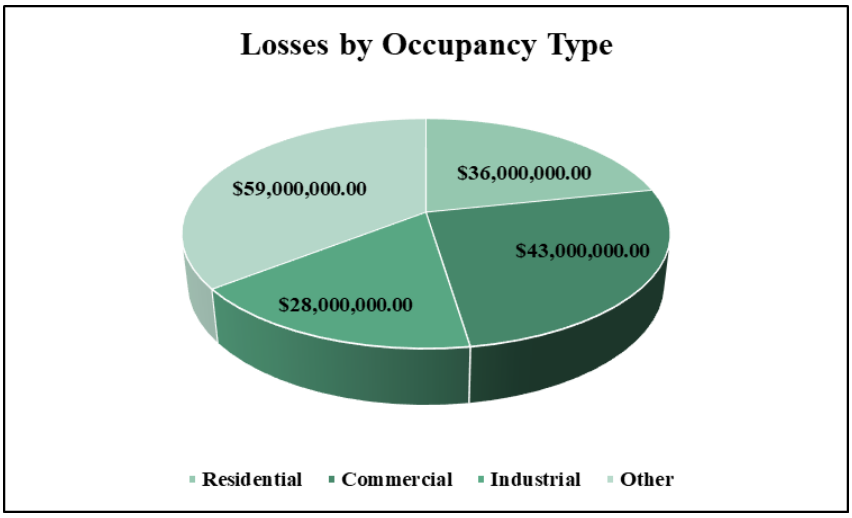
HAZUS Building Economic Loss Figures					
	Residential	**Commercial**	**Industrial**	**Other**	**Total**
Building:	$18,100,000.00	$3,960,000.00	$5,750,000.00	$1,070,000.00	**$28,880,000.00**
Content:	$8,170,000.00	$14,150,000.00	$15,310,000.00	$6,100,000.00	**$43,730,000.00**
Inventory:	$0.00	$540,000.00	$1,770,000.00	$10,000.00	**$2,320,000.00**
Subtotal:	$26,270,000.00	$18,650,000.00	$22,830,000.00	$7,180,000.00	**$74,930,000.00**
Source: HAZUS, 2023					

Table 21 - HAZUS Business Interruption Economic Loss Figures

HAZUS Business Interruption Economic Loss Figures					
	Residential	**Commercial**	**Industrial**	**Other**	**Total**
Income:	$20,000.00	$7,940,000.00	$1,970,000.00	$1,530,000.00	**$11,460,000.00**
Relocation:	$7,300,000.00	$3,340,000.00	$1,190,000.00	$1,360,000.00	**$13,190,000.00**
Rental Income:	$2,290,000.00	$2,410,000.00	$270,000.00	$250,000.00	**$5,220,000.00**

HAZUS Business Interruption Economic Loss Figures					
	Residential	**Commercial**	**Industrial**	**Other**	**Total**
Wage:	$50,000.00	$11,150,000.00	$1,290,000.00	$48,700,000.00	**$61,190,000.00**
Subtotal:	$9,660,000.00	$24,840,000.00	$4,720,000.00	$51,840,000.00	**$91,060,000.00**
Source: HAZUS, 2023					

Figure 17 - Loss by Occupancy Type



Source: HAZUS, 2023.

Although floods can cause deaths, injuries, and damage to property, they are naturally occurring events that benefit riparian systems which have not been disrupted by human actions. Such benefits include groundwater recharge and the introduction of nutrient rich sediments which improve soil fertility. However, human development often disrupts natural riparian buffers by changing land use and land cover, and the introduction of chemical or biological contaminants that often accompany human presence and can contaminate habitats after flood events.

4.3.3.3 Past Occurrence

Elk County has experienced numerous flooding, flash flooding, and ice jam events in the past. The flooding and flash flooding were caused by a variety of heavy storms, inclement weather, tropical storms, and other issues. A summary of recent flood event history for Elk County from January 1996 to February 2022 is found in *Table 22 – Past Flood and Flash Flood Events*. Details of each event can be found in NOAA's National Center for Environmental Information (NCEI) database. Additional data was also acquired by examining Elk County's WebEOC information from 2004 to 2022.

Table 22 - Past Flood and Flash Flood Events

Past Flood and Flash Flood Events			
Event Location	**Event Date**	**Event Type**	**Property Damage Estimate**
St. Mary's City	07/12/2004	Flash Flood	$0.00*
Elk County (Entire County)	09/09/2004	Flood	$0.00*
Elk County (Entire County)	09/17/2004	Flood	$0.00*
Elk County (Entire County)	09/17/2004	Flood	$0.00*
Elk County (Entire County)	09/18/2004	Flood	$0.00*
Ridgway Borough	01/25/2010	Flood	$0.00*
Highland Township	12/01/2010	Flood	$200,000.00*
Ridgway Borough	05/21/2014	Flash Flood	$0.00*
Elk County (Entire County)	06/25/2019	Flood	$0.00*
Elk County (Entire County)	05/10/2021	Flood	$0.00*
Elk County (Entire County)	02/24/2022	Flood	$0.00*
		Total:	**$200,000.00***

Source: NCEI NOAA, 2023
*Property Damage Values are estimated and are not exact figures. Data from NCEI and WebEOC

The National Flood Insurance Program (NFIP) identifies properties that frequently experience flooding. Repetitive loss properties are structures insured under the NFIP which have had at least two paid flood losses of more than $1,000 over any ten-year period since 1978. The hazard mitigation assistance (HMA) definition of a repetitive loss property is a structure covered by a contract for flood insurance made available under the NFIP that has incurred flood-related damage on two occasions, in which the cost of repair, on average, equaled or exceeded 25% of the market value of the structure at the time of each such flood event; and at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage. *Table 23 – Repetitive Loss Properties* illustrates the communities that have repetitive loss properties, the total building payments, the contents payments, and the number of losses. There are thirty-two repetitive loss properties in Elk County. *Table 24 – Summary of Type of Repetitive Loss Properties by Municipality* illustrates the breakdown of type of repetitive loss properties in Elk County.

A property is considered a severe repetitive loss property either when there are at least four losses each exceeding $5,000 or when there are two or more losses where the building payments exceed the property value. *Table 25 – Severe Repetitive Loss Properties* illustrates the communities within Elk County that have severe repetitive loss properties, the total building

payments, the contents payments, and the number of losses. The data used in the table is based on data provided by PEMA.

Most municipalities in Elk County participate in the NFIP. Information on each participating municipality can be found in *Table 26 – Municipal NFIP Policies & Vulnerability*.

Table 23 - Repetitive Loss Properties

Repetitive Loss Properties					
Community Name	**Community Number**	**Cumulative Building Payment**	**Cumulative Contents Payment**	**Sum of Total Paid**	**Losses**
Horton Township	421610	$8,334.68	$0.00	$8,334.68	2
Jay Township	421611	$45,426.32	$15,928.32	$60,724.64	3
Johnsonburg Borough	420443	$53,700.00	$0.00	$53,700.00	3
Johnsonburg Borough	420443	$21,413.07	$10,408.78	$31,821.85	2
Jones Township	421612	$33,585.00	$30,705.25	$64,290.25	4
Ridgway Borough	420444	$9,079.25	$0.00	$9,079.25	2
Ridgway Borough	420444	$50,192.76	$8,351.57	$58,544.33	4
Ridgway Borough	420444	$21,465.38	$7,034.68	$28,500.06	4
Ridgway Borough	420444	$40,346.60	$0.00	$40,346.60	4
Ridgway Borough	420444	$34,393.40	$3,800.00	$38,193.40	3
Ridgway Borough	420444	$68,261.43	$5,455.47	$73,716.90	3
Ridgway Borough	420444	$81,524.30	$17,414.57	$98,938.87	4
Ridgway Borough	420444	$47,520.19	$0.00	$47,520.19	2

Repetitive Loss Properties					
Community Name	**Community Number**	**Cumulative Building Payment**	**Cumulative Contents Payment**	**Sum of Total Paid**	**Losses**
Ridgway Borough	420444	$43,615.37	$7,358.40	$50,972.77	2
Ridgway Borough	420444	$32,505.63	$0.00	$32,505.63	2
Ridgway Borough	420444	$47,538.01	$17,200.00	$64,738.01	2
Ridgway Borough	420444	$37,333.57	$0.00	$37,333.57	2
Ridgway Borough	420444	$24,140.29	$0.00	$24,140.29	2
Ridgway Borough	420444	$83,646.16	$0.00	$83,646.16	2
Ridgway Borough	420444	$47,298.52	$0.00	$47,298.52	2
Ridgway Borough	420444	$150,335.41	$500,000.00	$650,335.41	2
Ridgway Township	420445	$85,392.73	$0.00	$85,392.73	4
Ridgway Township	420445	$13,501.06	$2,986.49	$16,487.55	5
Ridgway Township	420445	$23,157.73	$6,820.37	$29,978.10	2
St. Marys City	420446	$29,596.86	$1,867.54	$31,464.40	4
St. Marys City	420446	$53,268.97	$36,400.00	$89,668.97	3
St Marys City	420446	$69,800.4	$30,627.22	$100,427.62	2
	Total:	**$1,256,373.09**	**$702,358.66**	**$1,958,100.75**	**76**

Source: FEMA, 2023
One property on FEMA listing was listed as “Unknown” for location and not included.

Table 24 - Summary of Type of Repetitive Loss Properties by Municipality

Summary of Type of Repetitive Loss Properties by Municipality					
Municipality	**Type**				
	Non-Residential	**2-4 Family**	**Single Family**	**Condo**	**Other Residential**
Horton Township	0	0	1	0	0
Jay Township	2	0	1	0	0
Johnsonburg Borough	1	0	1	0	0
Jones Township	0	0	1	0	0
Ridgway Borough	4	0	15	0	0
Ridgway Township	0	0	3	0	0
St. Marys, City of	3	0	0	0	0
Source: FEMA, 2023					

Table 25 - Severe Repetitive Loss Properties

Severe Repetitive Loss Properties					
Community Name	**Community Number**	**Cumulative Building Payments**	**Cumulative Contents Payments**	**Sum of Total Paid**	**Losses**
Jay Township	421611	$72,941.55	$72,762.69	$145,704.24	4
Jay Township	421611	$50,417.51	$10,327.27	$152,744.78	4
Ridgway Borough	420444	$93,624.92	$15,241.44	$108,866.36	4
Ridgway Borough	420444	$59,614.38	$0.00	$59,614.38	4
Ridgway Borough	420444	$32,860.07	$0.00	$32,860.07	1
	Total:	**$309,458.43**	**$98,331.40**	**$499,789.83**	**17**
Source: FEMA, 2023					

Table 26 - Municipal NFIP Participation

Municipal Participation in the National Flood Insurance Program	
Municipal Name	**Community Number**
Horton Township	421610
Jay Township	421611
Johnsonburg Borough	420443
Jones Township	421612
Ridgway Borough	420444
Ridgway Township	420445
St. Marys, City of	420446
Source: FEMA, 2023	

4.3.3.4 Future Occurrence

Flooding is a frequent problem throughout the Commonwealth of Pennsylvania. Elk County will certainly be impacted by flooding events in the future, as Elk County experiences some degree of flooding annually. The threat of flooding is compounded in the late winter and early spring months, as melting snow can overflow streams, creeks, and tributaries, increasing the amount of groundwater, clogging stormwater culverts and bridge openings. The NFIP recognizes the 1% annual chance flood, also known as the base flood of a one-hundred-year flood, as the standard for identifying properties subject to federal flood insurance purchase requirements. A 1% annual chance flood is a flood which has a 1% chance of occurring in a given year or is likely once every one-hundred years. The digital flood insurance maps (DFIRMs) are used to identify areas subject to the 1% annual chance of flooding.

A property's vulnerability to a flood is dependent upon its location in the floodplain. Properties along the banks of a waterway are the most vulnerable. The property within the floodplain is broken into sections depending on its distance from the waterway. The ten-year flood zone has a 10% chance of being flooded every year. However, this label does not mean that this area cannot flood more than once every ten years. This label simply designates the probability of a flood of this magnitude every year. Further away from this area is the fifty-year floodplain. This area includes all of the ten-year floodplain plus additional property. The probability of a flood of this magnitude occurring during a one-year period is 2%. A summary of flood probability is shown in *Table 27 – Flood Probability Summary*.

Table 27 - Flood Probability Summary

Flood Probability Summary	
Flood Recurrence Intervals	**Annual Chance of Occurrence**
10-year	10.00%
50-year	2.00%
100-year	1.00%
500-year	0.20%
Source: FEMA, 2009	

The future occurrences of flooding, flash flooding, and ice jam flooding in Elk County are expected to increase due to the rate of climate change in the Commonwealth of Pennsylvania, and the world. Climate change will include ocean temperature rise, which will result in more intense hurricane and tropical storm seasons in the Atlantic Ocean. This intensity could result in an increase in the number of hurricanes and tropical storms that could impact Pennsylvania and Elk County. These hurricanes and tropical storms could result in a large volume of precipitation occurring over a short period of time, resulting in a flood or flash flood event. It is important to note that these impacts are the secondary result of other hazards, increased by climate change, that could result in flooding events.

4.3.3.5 Vulnerability Assessment

Riverine and Stream Flooding

Elk County is vulnerable to stream and river flooding on an annual basis. Flooding puts the entire population at some level of risk, whether through flooding of homes, businesses, places of employment, roadways, sewers, and water infrastructure. Flooding can cause significant power outages and poor road conditions that can lead to heightened transportation accident risk.

County community lifelines are the most vulnerable buildings and services when riverine and stream flooding is considered. Community lifeline facilities are facilities that, if damaged, would present an immediate threat to life, public health, and safety. Facilities that use and store hazardous materials pose a potential threat to the environment during flooding events if flooding causes a leak, inundation, or equipment failure. Appendix D of this hazard mitigation plan includes a flooding vulnerability map for each municipality in Elk County, with vulnerable structures and community lifeline facilities that are located within the special flood hazard area.

Table 28 – Expected Damage to Essential Facilities (HAZUS) illustrates the estimated damage levels to certain essential facilities based on classifications in the HAZUS General Building

Stock. There are four facilities that are estimated to be at least moderately damaged by a 100-year flooding event in the HAZUS Level Two scenario that was completed for Elk County. Of those four facilities that are estimated to be moderately damaged by the scenario, two of those facilities will undergo a loss of use. One fire station will experience a loss of use, as well as one police station within the county. The hospital located in Elk County will not experience a loss of use, but plans should still be made to assist in the treatment of patients at alternate facilities if a flooding event of the magnitude above the one used in this scenario occurs. No schools in the county will experience any damage from this scenario. Plans for such an event, and the damage that would result to community lifelines, critical facilities, and essential facilities must be in place to successfully mitigate the potential disruption to community lifeline facilities. Approximately 92.83% of the buildings in this scenario are related to residential housing in Elk County and 68.49% of the building value is related to residential housing.

Table 28 - Expected Damage to Essential Facilities (HAZUS)

Expected Damage to Essential Facilities				
Classification	**Number of Facilities**			
	Total:	**At Least Moderate:**	**At Least Substantial:**	**Loss of Use:**
Emergency Operations Center	1	0	0	0
Fire Stations	13	3	0	1
Hospitals	1	0	0	0
Police Stations	5	1	0	1
Schools	14	0	0	0
Source: HAZUS, 2023.				

The HAZUS scenario in this plan also provides direct economic loss figures for transportation related features like roads, bridges, tunnels, and transportation maintenance facilities. For this scenario in Elk County, there is an estimated $22,160.00 in damages to highway bridges. Other aspects of transportation that are evaluated in the direct economic loss for transportation are highway miles, railway and railroad features, light rail features, bus facilities for the local jurisdiction, ports, ferries, and airports. As there are no ports or ferries in Elk County, there is no direct economic loss figures for those items. Also, there are no economic figures for airports because that location is not in an area prone to flooding.

Direct economic loss figures can also be extrapolated for utilities within Elk County. The direct economic loss figures for utilities analyzes the following items:

- Potable Water Facilities and Pipelines

- Wastewater Facilities and Pipelines
- Oil System Facilities and Pipelines
- Natural Gas Facilities and Pipelines
- Electric Power Facilities and Conduit
- Communication Facilities and Conduit

With this in mind, the total direct economic loss for utilities in Elk County is $27,895,670.00 directly related to wastewater facilities within Elk County.

Table 29 - County Structures Within Special Flood Hazard Area shows the number of site structure address points within the Special Flood Hazard Area as well as the community lifeline facilities. This information was compiled using the Special Flood Hazard Area and GIS data provided by the Elk County GIS Department.

Table 29 - County Structures Within Special Flood Hazard Area

County Structures Within Special Flood Hazard Area		
Municipality	**Site Structure Address Points Within Flood Area**	**Community Lifelines within Flood Area**
Benezette Township	151	1
Fox Township	11	0
Highland Township	64	0
Horton Township	56	1
Jay Township	84	1
Johnsonburg Borough	99	5
Jones Township	35	2
Millstone Township	260	0
Ridgway Borough	45	7
Ridgway Township	0	1
Spring Creek Township	157	0
St. Mary's City	40	4
Totals:	**1,002**	**22**
Source: Elk County, 2023; HAZUS, 2023		

Table 30 – Community Lifeline Facilities Additional Information illustrates the additional information the municipality, and the type of facility for each community lifeline facility that falls within the Special Flood Hazard Area for Elk County. This information was compiled using Elk County's GIS information with the assistance of the Elk County GIS Department. The total breakdown of community lifelines by type in the special flood hazard area are as follows:

- Fire Stations (4)

- Gas Stations (4)
- Homeless Assistance Facilities (1)
- Municipal Buildings (3)
- Police Departments (1)
- Post Offices (1)
- Power Substations (3)
- Sewage Treatment Plants (3)
- Toxic Release Inventory (TRI) Locations (2)

Table 30 - Community Lifeline Facilities Additional Information

Community Lifeline Facilities Additional Information	
Municipality:	**Type of Facility:**
Benezette Township	Municipal Building (1)
Horton Township	Municipal Building (1)
Jay Township	Sewage Treatment Plant (1)
Johnsonburg Borough	Fire Station (1)
	Gas Station (1)
	Police Department (1)
	Power Substation (1)
	Sewage Treatment Plant (1)
Jones Township	Fire Station (1)
Ridgway Borough	Municipal Buildings (1)
	Fire Station (2)
	Gas Station (2)
	Homeless Assistance Facility (1)
	Power Substation (1)
	Toxic Release Inventory Location (1)
Ridgway Township	Sewage Treatment Plant (1)
St. Mary's City	Gas Station (1)
	Post Office (1)
	Power Substation (1)
	Toxic Release Inventory Location (1)

In addition to the items listed above, there are two properties that are considered historic and cultural for Elk County that are registered with the National Register of Historic Places and are in the Special Flood Hazard Area. These properties are the O.B. Grant House and the Ridgway Armory. These locations are at an increased risk of flooding due to annual flood events unless mitigated.

Flash Flooding

Flash flooding is a common occurrence in Elk County and can occur anywhere in the county. A large portion of flash flooding occurs in populated areas that have increased impervious ground cover. During the risk assessment process, numerous resources were utilized to determine flash flooding locations in Elk County. Municipalities were asked to identify locations within the municipality that were prone to frequent flash flooding. The National Climatic Data Center was also queried to determine flash flood vulnerable areas. This data is reflected in *Table 22 – Past Flood and Flash Flood Events* above.

Locations that are identified as vulnerable to flash flooding in Elk County are as follows:

- Highland Township
- Jay Township
- Ridgway Borough
- St. Mary's City

Although the above locations were identified as vulnerable areas in Elk County, they are not the only locations that are vulnerable to flash flooding. The Elk County Hazard Mitigation Team will continue to work with municipalities to identify vulnerable flash flooding locations and identify vulnerable populations and community lifelines.

Municipalities with an increased risk to flooding, flash flooding, and ice jam flooding (due to areas of Special Flood Hazard Areas):

- Benezette Township
- Fox Township
- Highland Township
- Horton Township
- Jay Township
- Johnsonburg Borough
- Jones Township
- Millstone Township
- Ridgway Borough
- Ridgway Township
- Spring Creek Township
- City of St Marys

Land use, in the form of a built environment, such as residential expansion, can cause flooding, flash flooding, and ice jam flooding impact severity to increase. Impact severity increases

because as the built environment expands and becomes more complex, the impact the event will have on that area also increases, since there is an influx of people, infrastructure, and critical infrastructure in harm's way.

Impacts of flooding, flash flooding, and ice jam flooding can also be increased by population change. Two municipalities in Elk County have experienced population growth between the 2010 and 2020 US Census, as seen in *Table 3 – Population Change in Elk County*, these are Benezette Township and Millstone Township.

4.3.4. Invasive Species

4.3.4.1 Location and Extent

An invasive species is a species that is not indigenous to a given ecosystem and that, when introduced to a non-native environment, tends to thrive. The spread of an invasive species often alters ecosystems, which can cause environmental and economic harm and pose a threat to human health. Often, an invasive species spreads and reproduces quickly. Invasive species are not limited to organisms that come from a foreign country. Invasive species can come from a different region in the United States. The main instigator of invasive species is human activity. Either intentionally or unintentionally, other species may accompany people when they travel, introducing the stowaway species to a novel ecosystem. In a foreign ecosystem, a transported species may thrive, potentially restructuring the ecosystem and threatening its health. Common pathways for invasive species introduction to Pennsylvania include but are not limited to:

- Contamination of internationally traded products
- Hull fouling
- Ship ballast water release
- Discarded live fish bait
- Intentional release
- Escape from cultivation
- Movement of soil, compost, wood, vehicles or other materials and equipment
- Unregulated sale of organisms
- Smuggling activities
- Hobby trading or specimen trading

The Governor's Invasive Species Council of Pennsylvania (PISC), the lead organization for invasive species threats, recognizes two types of invasive species: Aquatic and Terrestrial.

Aquatic Invasive Species (AIS) are nonnative invertebrates, fishes, aquatic plants, and microbes that threaten the diversity or abundance of native species, the ecological stability of the infested waters, human health and safety, or commercial, agriculture, or recreational activities dependent on such waters.

Terrestrial Invasive Species (TIS) are nonnative plants, vertebrates, arthropods, or pathogens that complete their lifecycle on land instead of in an aquatic environment and whose introduction does or is likely to cause economic/environmental damage or harm to human health.

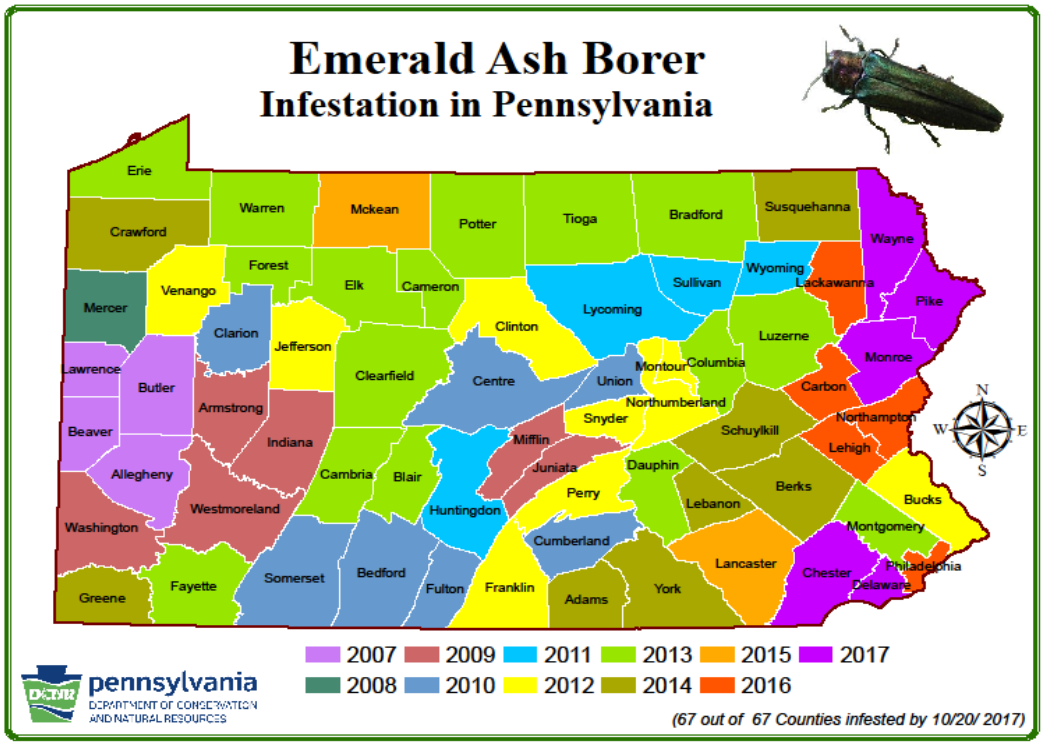
The location and extent of invasive threats is dependent on the preferred habitat of the species, as well as the species' ease of movement and establishment. For example, kudzu vine is an aggressive vascular plant. With wide ecological parameters and ease of spread, the vine is a more widespread invasive species threat. Other species' spread, such as the spotted lantern fly, has

been limited by state agency activity. First discovered in Berks County in 2014, the spotted lantern fly was placed under a quarantine by the Pennsylvania Department of Agriculture in thirteen counties. *Table 31 - Prevalent Invasive Species* lists invasive species that have been found in Elk County.

4.3.4.2 Range of Magnitude

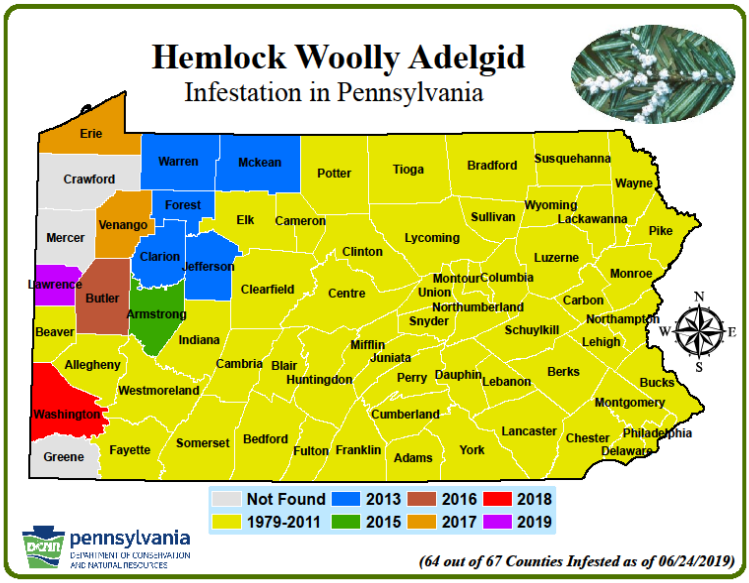
The magnitude of invasive species threats ranges from nuisance to widespread killer. Some invasive species are not considered agricultural pests, and do not harm humans or cause significant ecological problems. For example, Brown Marmorated Stink Bugs are not considered to be an agricultural pest and do not harm humans. Other invasive species can have many negative impacts and cause significant changes in the composition of ecosystems. For example, the Emerald Ash Borer creates a 99% mortality rate in any ash tree it infects. The aggressive nature of many invasive species can cause significant reductions in biodiversity by crowding out native species. This can affect the health of individual host organisms as well as the overall well-being of the affected ecosystem. An example of a worst-case scenario for invasive species in Pennsylvania is the Emerald Ash Borer in Elk County and the surrounding region (see *Figure 18 - Emerald Ash Borer Infestation in Pennsylvania*).

Figure 18 - Emerald Ash Borer Infestation in Pennsylvania



Another example of an invasive pest is the hemlock woolly adelgid. Hemlock woolly adelgid is a fluid-feeding insect that feeds on hemlock trees throughout eastern North America, including Pennsylvania. The egg sacs of these insects look like the tips of cotton swabs clinging to the undersides of hemlock branches. Hemlock woolly adelgid was introduced from Asia into the Pacific Northwest in 1924. It is likely to have been introduced into the northeastern United States in the 1950s, and it was first discovered in Pennsylvania in 1967. To date, sixty-four counties in Pennsylvania, including Elk County, have been infested with this insect. See *Figure 19 - Hemlock Woolly Adelgid Infestation in Pennsylvania*. Currently, Crawford, Mercer, and Greene counties are the three counties in the commonwealth not reporting an infestation. Eastern hemlock (Pennsylvania's state tree) and Carolina hemlocks (found further south in the Smoky Mountain sections of the Appalachians) are more susceptible to hemlock woolly adelgid damage than Asian and western hemlock trees due to feeding tolerance and predators that protect the latter species. Hemlock woolly adelgid sucks fluid from the base of hemlock needles. It may also inject toxins into the tree as it feeds, accelerating needle drop and branch dieback. Although some trees die within four years, trees often persist in a weakened state for many years. Hemlocks that have been affected by hemlock woolly adelgid often have a grayish-green appearance (hemlocks naturally have a shiny, dark green color).

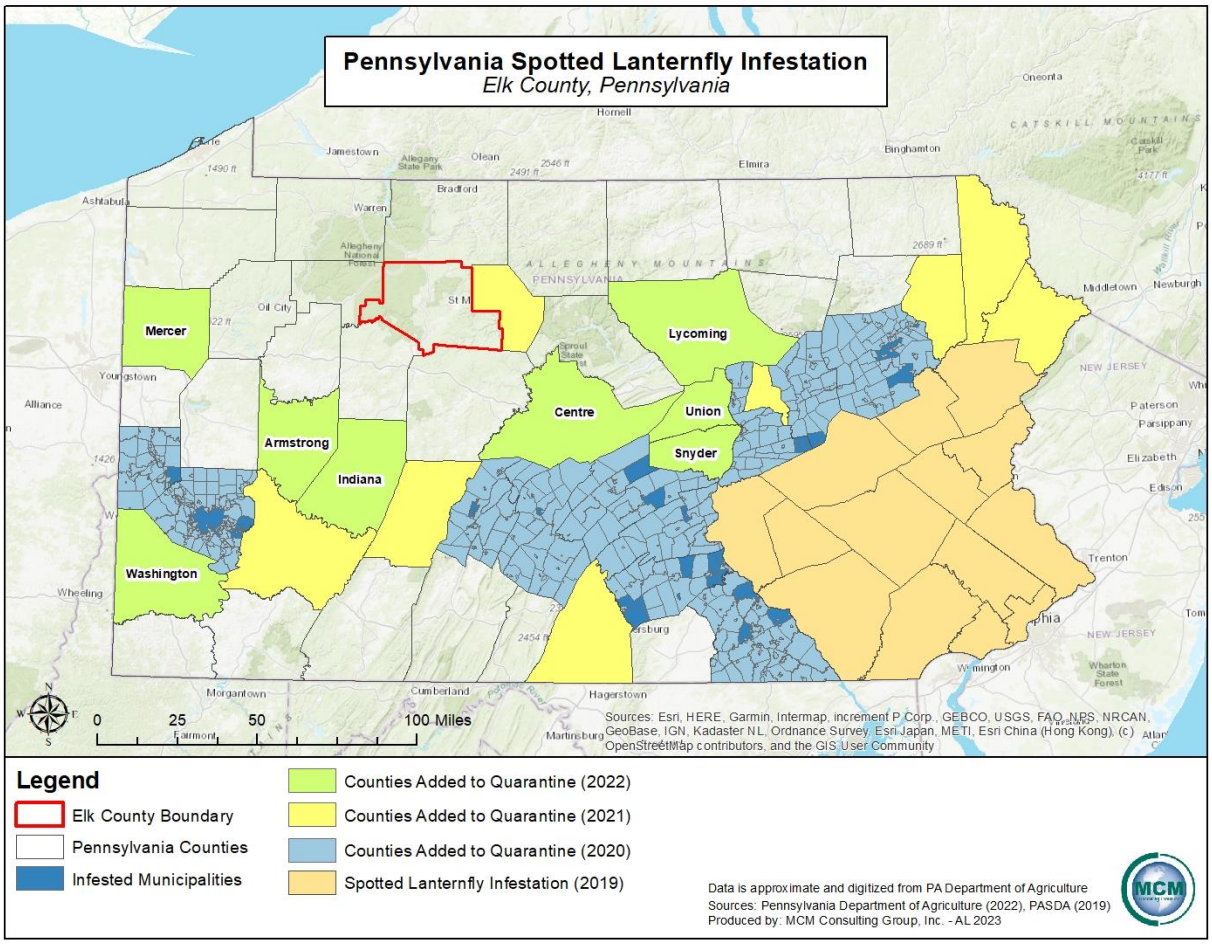
Figure 19 - Hemlock Woolly Adelgid Infestation in Pennsylvania



A final example of an invasive species is the Spotted Lanternfly. The Spotted Lanternfly is a harmful invasive species which feeds on plants, damaging or destroying them. This can negatively impact the areas of Pennsylvania known for outdoor scenery and activities. According to the Penn State Extension, the Spotted Lanternfly is a significant threat to Pennsylvania agriculture, landscapes, and natural ecosystems, including grape, tree-fruit, hardwood, and

nursery industries, which collectively are worth nearly $18 billion to the state's economy, outdoor recreation, and biodiversity. The Spotted Lanternfly has not yet been firmed in Elk County, though adjacent Cameron County, to the east, is on the quarantine list. However, the Spotted Lanternfly is undoubtedly continuing to spread. The State Department of Agriculture gives the total number of infected counties as forty-five, as of 2022. *Figure 20 – Pennsylvania Spotted Lanternfly Infestation* illustrates the counties in Pennsylvania that are considered to be in the quarantine zone for this pest.

Figure 20 - Pennsylvania Spotted Lanternfly Infestation



The magnitude of an invasive species threat is generally amplified when the ecosystem or host species is already stressed, such as in times of drought. The already weakened state of the native ecosystem causes it to succumb to an infestation more easily. A worst-case example could be the Hemlock Woolly Adelgid causing reduced biodiversity, increased wildfire potential, and thermal harm to small stream cold water fisheries and habitats.

4.3.4.3 Past Occurrence

Invasive species have been entering Pennsylvania since the arrival of European settlers, but not all occurrences required government action. Elk County is known for its great number of geographic features. There are various state game lands within the area which include state game lands 14, 25, 28, 34, 44, 293, and 311. The Elk State Forest, Moshannon State Forest, Elk State Park, Clear Creek State Park, and Bendigo State Park are other well-known areas in the county that have significant amounts of forest land and lakes which species may invade. Due to the vast area of forests, there are many invasive terrestrial species that have been widespread in Elk County that are common problems throughout the Commonwealth. Some of the most popular problematic species in Elk County include:

- Glossy buckthorn
- Reed canarygrass
- Western bean cutworm
- Japanese barberry

Many of the extreme problematic species have been around for many years. However, the most recent problematic species are the Emerald Ash Borer, Hemlock Wooly Adelgid, and the Spotted Lanternfly. In 2007, both the Emerald Ash Borer and Hemlock Wooly Adelgid were both newly spotted species that caused extreme damage. Even more recently than 2007, the Spotted Lanternfly appeared in Elk County. In 2014, the spotted lanternfly was found in the commonwealth, however, Elk County has not entered the quarantine zone for the Spotted Lanternfly infestation as of 2022.

Table 31 – Prevalent Invasive Species lists problematic non-native species that are established in Elk County. While all species listed here are not native to Elk County, those species with the most reports pose the most severe ecological threat than some of the others. While not listed in the table, the spotted lanternfly is an increasing problem in Elk County.

Table 31 - Prevalent Invasive Species

Prevalent Invasive Species in Elk County		
Common Name	**Scientific Name**	**Number of Records**
glossy buckthorn	Frangula alnus	51
reed canarygrass	Phalaris arundinacea	21
western bean cutworm	Striacosta albicosta	20
Japanese barberry	Berberis thunbergii	16
multiflora rose	Rosa multiflora	10
spongy moth (formerly gypsy moth)	Lymantria dispar	10

Prevalent Invasive Species in Elk County		
Common Name	**Scientific Name**	**Number of Records**
spruce beetle	Dendroctonus rufipennis	9
large aspen tortrix	Choristoneura conflictana	9
Japanese knotweed	Reynoutria japonica	9
hemlock woolly adelgid	Adelges tsugae	8
watercress	Nasturtium officinale	8
white pine blister rust	Cronartium ribicola	8
bull thistle	Cirsium vulgare	7
common periwinkle	Vinca minor	6
garlic mustard	Alliaria petiolata	6
marsh-pepper smartweed	Persicaria hydropiper	5
true forget-me-not	Myosotis scorpioides	5
white clover	Trifolium repens	4
spotted knapweed	Centaurea stoebe ssp. micranthos	4
Dalmatian toadflax	Linaria dalmatica	4
emerald ash borer	Agrilus planipennis	4
Canada thistle	Cirsium arvense	4
autumn olive	Elaeagnus umbellata	4
barnyardgrass	Echinochloa crus-galli	3
big chickweed	Cerastium fontanum ssp. vulgare	3
birdsfoot trefoil	Lotus corniculatus	3
bittersweet nightshade	Solanum dulcamara	3
goatsrue	Galega officinalis	3
orange hawkweed	Pilosella aurantiaca	3
hairy vetch	Vicia villosa	3
Japanese beetle	Popillia japonica	3
ladysthumb	Persicaria maculosa	3
roughstalk bluegrass	Poa trivialis	3
perennial ryegrass	Lolium perenne	3
perennial sowthistle	Sonchus arvensis	3
redtop	Agrostis gigantea	3
spearmint	Mentha spicata	3
stinking chamomile	Anthemis cotula	2
sulfur cinquefoil	Potentilla recta	2
sweet vernalgrass	Anthoxanthum odoratum	2

Prevalent Invasive Species in Elk County		
Common Name	**Scientific Name**	**Number of Records**
tall buttercup	Ranunculus acris	2
tall lettuce	Lactuca canadensis	2
tall oatgrass	Arrhenatherum elatius	2
tumble mustard	Sisymbrium altissimum	2
Virginia pepperweed	Lepidium virginicum	2
Tatarian honeysuckle	Lonicera tatarica	2
tawny daylily	Hemerocallis fulva	2
thymeleaf sandwort	Arenaria serpyllifolia	2
thymeleaf speedwell	Veronica serpyllifolia	2
timothy	Phleum pratense	2
waterpurslane	Ludwigia palustris	2
white campion	Silene latifolia	2
white poplar	Populus alba	2
wild buckwheat	Fallopia convolvulus	2
wild four-o'clock	Mirabilis nyctaginea	2
wild mustard	Sinapis arvensis	2
wild parsnip	Pastinaca sativa	2
perilla mint	Perilla frutescens	2
pale smartweed	Polygonum lapathifolium	2
paradise apple	Malus pumila	2
pineapple-weed	Matricaria discoidea	2
cypress spurge	Euphorbia cyparissias	2
Norway maple	Acer platanoides	2
purple deadnettle	Lamium purpureum	2
scarlet pimpernel	Anagallis arvensis	2
Scotch broom	Cytisus scoparius	2
shepherd's-purse	Capsella bursa-pastoris	2
Sirex woodwasp	Sirex noctilio	2
small hop clover	Trifolium dubium	2
smooth bedstraw	Galium mollugo	2
spotted spurge	Euphorbia maculata	2
quackgrass	Elymus repens	2
Queen Anne's lace, wild carrot	Daucus carota	2
red clover	Trifolium pratense	2

Prevalent Invasive Species in Elk County		
Common Name	**Scientific Name**	**Number of Records**
red fescue	Festuca rubra	2
red sorrel	Rumex acetosella	2
yellow rocket	Barbarea vulgaris	2
yellow sweet-clover	Melilotus officinalis	2
yellow toadflax	Linaria vulgaris	2
yellow woodsorrel	Oxalis stricta	2
lambsquarters	Chenopodium album	2
Japanese stiltgrass	Microstegium vimineum	2
Kentucky bluegrass	Poa pratensis	2
hedge mustard	Sisymbrium officinale	2
helleborine	Epipactis helleborine	2
henbit	Lamium amplexicaule	2
hop clover	Trifolium aureum	2
orchardgrass	Dactylis glomerata	2
oxeye daisy	Leucanthemum vulgare	2
motherwort	Leonurus cardiaca	2
mugwort	Artemisia vulgaris	2
multicolored Asian lady beetle	Harmonia axyridis	2
meadow fescue	Festuca pratensis	2
meadow hawkweed	Hieracium caespitosum	2
moist sowthistle	Sonchus arvensis ssp. uliginosus	2
large crabgrass	Digitaria sanguinalis	2
large hop clover	Trifolium campestre	2
ground ivy	Glechoma hederacea	2
hairy galinsoga	Galinsoga quadriradiata	2
giant knotweed	Reynoutria sachalinensis	2
field pennycress	Thlaspi arvense	2
field sowthistle	Sonchus arvensis ssp. arvensis	2
European red raspberry	Rubus idaeus	2
eastern white pine	Pinus strobus	2
false spiraea	Sorbaria sorbifolia	2
field brome	Bromus arvensis	2
curly dock	Rumex crispus	2
curly dock	Rumex crispus ssp. crispus	2

Prevalent Invasive Species in Elk County		
Common Name	**Scientific Name**	**Number of Records**
dandelion	Taraxacum officinale	2
dog rose	Rosa canina	2
dotted smartweed	Persicaria punctata	2
black medic	Medicago lupulina	2
bladder campion	Silene vulgaris	2
bouncingbet	Saponaria officinalis	2
broadleaf dock	Rumex obtusifolius	2
broadleaf plantain	Plantago major	2
broomsedge bluestem	Andropogon virginicus	2
Canadian horseweed	Erigeron canadensis	2
cheatgrass, downy brome	Bromus tectorum	2
buckhorn plantain	Plantago lanceolata	2
bird vetch	Vicia cracca	2
annual bluegrass	Poa annua	2
beech bark disease	Neonectria faginata	2
bald brome	Bromus racemosus	2
balsam poplar	Populus balsamifera	2
alsike clover	Trifolium hybridum	2
American burnweed	Erechtites hieraciifolius	2
common selfheal	Prunella vulgaris	2
common St. Johnswort	Hypericum perforatum	2
common tansy	Tanacetum vulgare	2
common valerian	Valeriana officinalis	2
common velvetgrass	Holcus lanatus	2
common viper's bugloss, blueweed	Echium vulgare	2
corn speedwell	Veronica arvensis	2
creeping bentgrass	Agrostis stolonifera	2
chicory	Cichorium intybus	2
cinnamon rose	Rosa cinnamomea	2
colonial bentgrass	Agrostis capillaris	2
coltsfoot	Tussilago farfara	2
common barberry	Berberis vulgaris	2
common burdock, lesser burdock	Arctium minus	2
butternut canker	Ophiognomonia clavigignenti-juglandacearum	2

Prevalent Invasive Species in Elk County		
Common Name	**Scientific Name**	**Number of Records**
Canada bluegrass	Poa compressa	2
common chickweed	Stellaria pallida	2
common groundsel	Senecio vulgaris	2
common mallow	Malva neglecta	2
common mouse-ear chickweed	Cerastium fontanum	2
common mullein	Verbascum thapsus	2
common dandelion	Taraxacum officinale ssp. officinale	1
common caraway	Carum carvi	1
common chickweed	Stellaria media	1
creeping buttercup	Ranunculus repens	1
cucurbit downy mildew	Pseudoperonospora cubensis	1
common yarrow	Achillea millefolium	1
common teasel	Dipsacus fullonum	1
common speedwell	Veronica officinalis	1
common pine shoot beetle, larger pine shoot beetle	Tomicus piniperda	1
common pokeweed	Phytolacca americana	1
common ragweed	Ambrosia artemisiifolia	1
common reed	Phragmites australis	1
American mannagrass	Glyceria grandis var. grandis	1
Amur honeysuckle	Lonicera maackii	1
bark beetle	Hylastes opacus	1
beech leaf disease	Litylenchus crenatae mccannii	1
biennial wormwood	Artemisia biennis	1
asparagus	Asparagus officinalis	1
alfalfa	Medicago sativa	1
bush honeysuckles (exotic)	Lonicera spp.	1
chestnut blight or canker	Cryphonectria parasitica	1
brown marmorated stink bug	Halyomorpha halys	1
bittersweets	Celastrus spp.	1
black locust	Robinia pseudoacacia	1
eastern poison-ivy	Toxicodendron radicans	1
curly leaf pondweed	Potamogeton crispus	1
dames rocket	Hesperis matronalis	1
field horsetail	Equisetum arvense	1

Prevalent Invasive Species in Elk County		
Common Name	**Scientific Name**	**Number of Records**
elongate hemlock scale	Fiorinia externa	1
European sticktight	Lappula squarrosa	1
fall panicum	Panicum dichotomiflorum	1
forest tent caterpillar	Malacosoma disstria	1
foxglove	Digitalis purpurea	1
garden catchfly	Silene armeria	1
field pepperweed	Lepidium campestre	1
giant chickweed	Myosoton aquaticum	1
giant ragweed	Ambrosia trifida	1
giantseed goosefoot	Chenopodium simplex	1
gingermint	Mentha x gracilis	1
little starwort	Stellaria graminea	1
live-forever stonecrop	Hylotelephium telephium	1
longleaf speedwell	Pseudolysimachion longifolium	1
low cudweed	Gnaphalium uliginosum	1
Morrow's honeysuckle	Lonicera morrowii	1
musk mallow	Malva moschata	1
nimblewill	Muhlenbergia schreberi	1
pale dock	Rumex altissimus	1
horsenettle	Solanum carolinense	1
hemp dogbane	Apocynum cannabinum	1
harlequin blueflag	Iris versicolor	1
hedge bindweed	Calystegia sepium	1
Japanese pachysandra	Pachysandra terminalis	1
spotted waterhemlock	Cicuta maculata	1
smooth crabgrass	Digitaria ischaemum	1
purple loosestrife	Lythrum salicaria	1
poison hemlock	Conium maculatum	1
prostrate knotweed	Polygonum aviculare	1
purple crown-vetch	Securigera varia	1
peppermint	Mentha x piperita	1
perennial cornflower	Centaurea montana	1
periwinkle	Vinca	1
wirestem muhly	Muhlenbergia frondosa	1

Prevalent Invasive Species in Elk County		
Common Name	**Scientific Name**	**Number of Records**
witch's moneybags	Hylotelephium telephium ssp. telephium	1
woodland strawberry	Fragaria vesca	1
yellow foxtail	Setaria pumila	1
white cockle	Silene latifolia ssp. alba	1
thymeleaf speedwell	Veronica serpyllifolia ssp. serpyllifolia	1
water knotweed	Polygonum amphibium	1
water mint	Mentha aquatica	1
tall thistle	Cirsium altissimum	1
splitlip hempnettle	Galeopsis bifida	1
star-mustard	Coincya monensis	1
sticky groundsel	Senecio viscosus	1
Source: EDDMaps, 2023		

4.3.4.4 Future Occurrence

According to the Pennsylvania Invasive Species Council (PISC), the probability of future occurrence for invasive species threats is growing due to the increasing volume of transported goods, increasing efficiency and speed of transportation, and expanding international trade agreements. Expanded global trade has created opportunities for many organisms to be transported to and establish themselves in new counties and regions. In 2017, Pennsylvania alone imported over $83 billion in goods from abroad, including agricultural, forestry, and fishery goods that commonly carry unknow pests. Climate change is contributing to the introduction of new invasive species. As maximum and minimum seasonal temperatures change, pests can establish themselves in previously inhospitable climates. This also gives introduced species an earlier start and increases the magnitude of their growth, possibly shifting the dominance of ecosystems in the favor of non-native species. In order to combat the increase in future occurrences, the PISC released the Invasive Species Management Plan in April 2010 and updated the plan in 2017. The plan outlines the Commonwealth's goals for managing the spread of nonnative invasive species and creates a framework for responding to threats through research, action, and public outreach and communication. More information can be found here: https://www.agriculture.pa.gov/Plants_Land_Water/PlantIndustry/GISC/Pages/default.aspx.

There are several invasive species that are found near Elk County but have not yet been detected inside the county (see *Table 32 – Future Vulnerable Species*). Especially in cases like this, control efforts, heightened awareness, and public outreach and education can help prevent an invasive species from becoming established in the future. Once a species is established, it is

more difficult to eradicate it from an ecosystem, so prevention is very important. The development of appropriate plans will assist the county in reducing the possibility of a future encounter with any of these species. Working toward keeping these species from entering the area would be beneficial to the forests of Elk County.

Table 32 - Future Vulnerable Species

Future Vulnerable Species		
Scientific Name	**Common Name**	**Type**
Lonicera maackii	Amur Honeysuckle	Plant
Corbicula fluminea	Asian Clam	Animal
Litylenchus crenatae mccannii	Beech leaf disease nematode	Disease
Lotus corniculatus	Bird's Foot Trefoil	Plant
Aegopodium podagraria	Bishop's Goutweed	Plant
Rumex obtusifolius	Bitter Dock	Plant
Brassica nigra	Black Mustard	Plant
Typha x glauca	Blue Cattail, Hybrid Cattail	Plant
Reynoutria x bohemica	Bohemian Knotweed	Plant
Saponaria officinalis	Bouncing-bet	Plant
Najas minor	Brittle Naiad	Plant
Linaria vulgaris	Butter-and-eggs	Plant
Cichorium intybus	Chicory	Plant
Cipangopaludina chinensis	Chinese Mysterysnail	Animal
Wisteria sinensis	Chinese Wisteria	Plant
Solanum dulcamara	Climbing Nightshade	Plant
Stellaria media	Common Chickweed	Plant
Coronilla varia	Common Crown-vetch	Plant
Hydrocharis morsus-ranae	Common Frogbit	Plant
Verbascum thapsus	Common Mullein	Plant
Hypericum perforatum	Common St. John's-wort	Plant
Lysimachia nummularia	Creeping Jenny	Plant
Polygonum caespitosum var. longisetum	Creeping Smartweed	Plant
Rorippa sylvestris	Creeping Yellowcress	Plant
Rumex crispus	Curly Dock	Plant
Hesperis matronalis	Dame's Rocket	Plant
Didymosphenia geminata	Didymo	Diatom
Epipactis helleborine	Eastern Helleborine	Plant
Hedera helix	English Ivy	Plant

Future Vulnerable Species		
Scientific Name	**Common Name**	**Type**
Plantago lanceolata	English Plantain	Plant
Myriophyllum spicatum	Eurasian Water-milfoil	Plant
Alnus glutinosa	European Alder	Plant
Convallaria majalis	European Lily-of-the-valley	Plant
Akebia quinata	Five-leaf Akebia	Plant
Craspedacusta sowerbyi	Freshwater Jellyfish	Animal
Agrostis gigantea	Giant Bentgrass	Plant
Galium mollugo	Great Hedge Bedstraw	Plant
Glechoma hederacea	Ground Ivy; Gill-over-the-ground	Plant
Lonicera spp	Honeysuckle	Plant
Cipangopaludina japonica	Japanese Mysterysnail	Animal
Microstegium vimineum	Japanese Stiltgrass	Plant
Syringa reticulata	Japanese Tree Lilac	Plant
Amynthas-Metaphire spp.	Jumping Worms	Animal
Poa pratensis	Kentucky Bluegrass	Plant
Reynoutria spp.	Knotweed	Plant
Ranunculus ficaria	Lesser Celandine	Plant
Phleum pratense	Meadow Timothy	Plant
Persicaria perfoliata	Mile-a-minute-weed	Plant
Albizia julibrissin	Mimosa	Plant
Typha angustifolia	Narrowleaf Cattail	Plant
Hemerocallis fulva	Orange Daylily	Plant
Hieracium aurantiacum	Orange Hawkweed	Plant
Celastrus orbiculatus	Oriental Bittersweet	Plant
Mentha x piperita	Peppermint	Plant
Ligustrum spp.	Privet	Plant
Lythrum salicaria	Purple Loosestrife	Plant
Daucus carota	Queen Anne's Lace	Plant
Scardinius erythrophthalmus	Rudd	Animal
Faxonius rusticus	Rusty Crayfish	Animal
Quercus acutissima	Sawtooth Oak	Plant
Rumex acetosella	Sheep Sorrel	Plant
Trachemys scripta	Slider	Animal
Bromus inermis	Smooth Brome	Plant
Lymantria dispar	Spongy Moth	Animal

Future Vulnerable Species		
Scientific Name	**Common Name**	**Type**
Hypochaeris radicata	Spotted Cat's-ear	Plant
Centaurea stoebe ssp. micranthos	Spotted Starthistle	Plant
Anthoxanthum odoratum	Sweet Vernal Grass	Plant
Melilotus officinalis	Sweetclover	Plant
Acorus calamus	Sweetflag, Calamus	Plant
Lonicera tatarica	Tatarian Honeysuckle	Plant
Cardamine impatiens	Touch-me-not Bittercress	Plant
Ailanthus altissima	Tree-of-Heaven	Plant
Myosotis scorpioides	True Forget-me-not	Plant
Trapa natans	Water Chestnut	Plant
Rorippa nasturtium-aquaticum	Watercress	Plant
Procambarus acutus	White River Crayfish	Animal
Melilotus albus	White Sweet-clover	Plant
Salix alba	White Willow	Plant
Anthriscus sylvestris	Wild Chervil	Plant
Pastinaca sativa	Wild Parsnip	Plant
Dipsacus fullonum	Wild Teasel	Plant
Iris pseudacorus	Yellow Iris	Plant
Dreissena polymorpha	Zebra Mussel	Plant
Source: EDDMaps, 2021		

4.3.4.5 Vulnerability Assessment

Elk County's vulnerability to invasion depends on the species in question. Human activity and mobility are ever increasing, and combined with the prospects of climate change, invasive species are becoming increasingly threatening. Invasive species can have adverse economic effects by impacting agriculture and logging activities. Natural forest ecosystems provide clean water, recreational opportunities, habitat for native wildlife, and places to enjoy the tranquility and transcendence of nature. The balance of forest ecosystems and forest health are vulnerable to invasive species threats. While there is significant acreage of wetlands, waterways, state parks, and game lands in Elk County where forest managers can impact invasive species, private lands can provide refuge for invasive species if landowners are unaware of or apathetic towards the threat.

Since there are large swatches of public land in Elk County, there is a risk of future damage from invasive species that are present in the area. With about 529,280 acres of total land in Elk County, there is vulnerability to various land sites and waterways. If an invasive species were to invade the popular terrestrial areas or waterways in Elk County, a negative impact could occur.

The invasion from an invasive species could cause damage to the scenic and natural resources needed in the county. Additionally, tourism for the county is vulnerable to the invasive species as well and would be affected if the parks were destroyed. Therefore, a great amount of land and native wildlife within Elk County are at risk with the presence of invasive species.

An interesting facet of the invasive species problem in Pennsylvania is that deer do not eat many invasive plants, giving invasive species a competitive advantage over the native species that deer prefer. As such, the management of deer populations in Elk County has a significant impact on the vulnerability of an ecosystem to invasive species, where overpopulation of deer favors invasive species.

The Governor's Invasive Species Council of Pennsylvania (PISC) has identified over 100 species threats that are or could potentially become significant in Pennsylvania. Of these threats, county and municipal leaders believe that the most significant are invasive forest pests like the Emerald Ash Borer, Hemlock Woolly Adelgid, the Spotted Lanternfly, and plants like the Tree-of-Heaven which have all been identified in *Table 31 - Prevalent Invasive Species.*

Due to the past experiences with invasive plants in the county, there are five primary components which help with managing invasive plants to lower vulnerability:

Prioritize: Public use areas such as state parks and other healthy forest ecosystems should be prioritized over developed and private areas. Locations with lower densities of invasive plants are often easier to control and should be given quick attention. Locations where humans are disturbing the landscape opens up niche space, and often times the aggressive invasive species move in faster than native species. Such locations include areas around road work, ditch/culvert work, logging activities, stream improvement/stabilization and bridge work. Some species pose a higher risk than others - invasive species are easiest to control before they become widespread and established in an area, and for that reason, species that are less widespread should be prioritized for management.

Locate: Detailed locations should be recorded for invasive plants so sites can be easily relocated, treated, and monitored.

Delineate: The scale and extent of the infestation should be recorded and mapped so that the progress of the infestation can be monitored.

Control: Methods of control depend on the specific infestation, but the most common approaches are mechanical (cutting and hand-pulling) and chemical (herbicide treatments).

Monitor: Identified sites should be monitored and revisited as often as several times in a growing season (depending on the location/species). Monitoring can allow for early detection of spreading infestations. Most importantly, it prevents a relapse towards full-blown infestation.

It is best to act before a species can become established in the county, so forest management such as park rangers should be aware of invasive species found nearby Elk County, but not yet present in the county (priority species in *Table 32 – Future Vulnerable Species*). Public outreach and education are important to increase knowledge of these species to improve identification and prevention of invasion. Without action, due to the instances and extent of the current infestations, it is reasonable to project that the county's vulnerability will increase.

Municipalities with an increased risk to invasive species:

- Benezette Township
- Fox Township
- Highland Township
- Horton Township
- Jay Township
- Johnsonburg Borough
- Jones Township
- Millstone Township
- Ridgway Borough
- Ridgway Township
- Spring Creek Township
- City of St Marys

Land use changes in Elk County could be a factor in the potential impact invasive species have on native species.

4.3.5. Landslides

4.3.5.1 Location and Extent

Rock falls and other slope failures can occur in areas of Elk County with moderate to steep slopes. Many slope failures are associated with precipitation events – periods of sustained above-average precipitation, specific rainstorms, or snowmelt events. Rockfalls, rockslides, rock topples, block slides, debris flows, mud flows, and mud slides are all forms of landslides. Areas experiencing erosion, decline in vegetation cover and earthquakes are also susceptible to landslides. Human activities that contribute to slope failure include altering the natural slope gradient, increasing soil and water content, and removing vegetation cover. Areas where this type of human activity is common are areas that were excavated along highways and other roadways.

The Pennsylvania Department of Conservation and Natural Resources (PA DCNR) describes landslide susceptibility in Elk County as generally a mix of 1) high along lake bluffs and stream banks and 2) high to moderate. *Figure 21 – Landslide Hazard Areas* shows areas of landslide susceptibility in Elk County. The entirety of Elk County is located in the Appalachian Plateaus physiographic province which is known for moderate to high vulnerability to all forms of landslides. Steep slopes are evenly spread throughout the county and there are locations that can be prone to landslides in almost every municipality.

4.3.5.2 Range of Magnitude

Landslides cause damage to transportation routes, utilities, and buildings. They can also create travel delays and other side effects for transportation of people and material. Fortunately, death and injuries due to landslides are relatively rare in Pennsylvania. Almost all of the known deaths due to landslides have occurred when rocks fall or other slide along highways involve vehicles. Storm-induced debris flows are the only other type of landslide likely to cause injuries. As residential and recreational development increase on and near steep mountain slopes, the hazard from these rapid events will also increase. Most Pennsylvania landslides are moderate to slow moving and damage objects and buildings, rather than people.

The Pennsylvania Department of Transportation (PennDOT) and large municipalities incur substantial costs due to landslide damage and to additional construction costs for new roads in known landslide-prone areas. A 1991 estimate showed an average of $10 million per year is spent on landslide repair contracts across the Commonwealth of Pennsylvania and a similar amount is spent on mitigation costs for grading projects (DCNR, 2009). A number of highway sites in Pennsylvania need temporary or permanent repair at an estimated cost of between $300,000.00 and $2 million each. Similar landslide events that affect traffic and roadways throughout the commonwealth occur intermittently throughout the year. A 7,500-pound rockslide

closed down parts of Pennsylvania State Route 11 in Montour County, Pennsylvania in November of 2020 for a number of weeks. Events of similar magnitude can and have occurred in and around Elk County.

The 2018 Pennsylvania Hazard Mitigation Plan lists Elk County as having a: 1) moderate incidence, 2) low incidence/high susceptibility, and 3) moderate incidence/high susceptibility. Elk County landowners and real estate developers must know the magnitude of susceptibility within the county prior to the start of development.

4.3.5.3 Past Occurrence

No comprehensive list of landslide incidents in Elk County is available, and there is no formal reporting system in place. PennDOT and municipal departments are responsible for slides that inhibit the flow of traffic or damage roads and bridges, but they generally only repair the road and the adjacent right-of-way areas.

The United States Geologic Survey utilizes legacy landslide inventory maps and published them for use through a link and webpage with the Pennsylvania Department of Conservation and Natural Resources. There are approximately thirteen past landslide events listed on the quadrangle for St. Mary's in Elk County. These events are shown on a map and do not have any underlying attribute information but offer a visualization for past events.

A major landslide event occurred in Elk County on February 8th, 2017, when a portion of compressed garbage at a landfill in Fox Township collapsed and resulted in the death of one employee of the landfill company. Although not considered a natural landslide, it is still a major landslide event worth examining.

More landslides are likely to have occurred in Elk County, but those events may have been too small or too rural to be noticed and cataloged.

4.3.5.4 Future Occurrence

Historically, significant landslide events are likely to occur on average once every four years in Elk County. Mismanaged development in steeply sloped areas could increase the frequency of occurrence. Road cuts are the most common development that puts an area at an increased probability of a slide. The Pennsylvania Department of Environmental Protection (PA DEP) has an Erosion and Sediment (E & S) program that sets requirements intended to mitigate erosion associated with development projects of a certain scale. The guidelines offered in this program are similar to landslides prevention practices.

Climate change could increase the frequency of landslides in Elk County, due to increasing rain and runoff. With climate change, hurricanes and tropical storms could become more frequent and more intense. This higher volume of precipitation, falling in a shorter time period, could dramatically increase the number of landslide events. This is related to flash flooding events as well. Soil movement will likely increase with a higher volume of precipitation.

4.3.5.5 Vulnerability Assessment

Landslides are often precipitated by other natural hazards such as earthquakes or floods. A significant landslide can cause millions of dollars in damage. Continued enforcement of floodplain management and proper road and building construction can mitigate the vulnerability to landslides. Floodplain management is important where mining has occurred within proximity to watercourses and associated flat-lying areas. Surface water may permeate into areas that still have open fractures and the build-up of surface water in those fractures could lead to unexpected flood events and landslide events.

A comprehensive database of land highly prone to erosion and landslides is difficult to produce. The potential for erosion and landslides should be considered when planning construction projects in Elk County. There are several general factors that can be indicators of landslide prone areas including:

- Locations on or close to steep hills.
- Areas of steep road cuts or excavations.
- Steep areas where surface run-off is channeled.
- Fan shaped areas of sediment and rock accumulations.
- Evidence of past sliding such as tilted utility line, tilted trees, cracks in the ground and irregularly, surfaced ground.

All the municipalities in Elk County are vulnerable to landslides. *Table 33 – Structure Vulnerability Data* illustrates the number of site structure address points per municipality and the number of structures in high slope areas. Elk County has four structures that are in the slope vulnerable area. These structures include two in Benezette Township and two in Ridgway Borough. Landslide events are most likely to occur in steeply sloped areas and in places where landforms have been altered for purposes of highway construction or other development. This is especially true if development is located at the base or crest of cliffs or near large highway cut-outs. These areas should be considered vulnerable to landslides, particularly if mitigation measures have not been implemented.

Table 33 - Structure Vulnerability Data

Structure Vulnerability Data		
Municipality	**Number of Addressable Structures Per Municipality**	**Number of Structures in Slope Area**
Benezette Township	1,127	2
Fox Township	2,014	0
Highland Township	717	0
Horton Township	827	0
Jay Township	1,434	0
Johnsonburg Borough	1,361	0
Jones Township	1,437	0
Millstone Township	414	0
Ridgway Borough	2,167	2
Ridgway Township	1,452	0
Spring Creek Township	6,564	0
St. Mary's, City	674	0
Totals:	**20,888**	**4**

There is only one historic or cultural property in Elk County that is registered with the National Register of Historic Places and is within a slope areas of greater than 23°. That location is Bonifels located in Ridgway Township. No other cultural or historic properties are at an increased risk of landslide due to their place and area of construction.

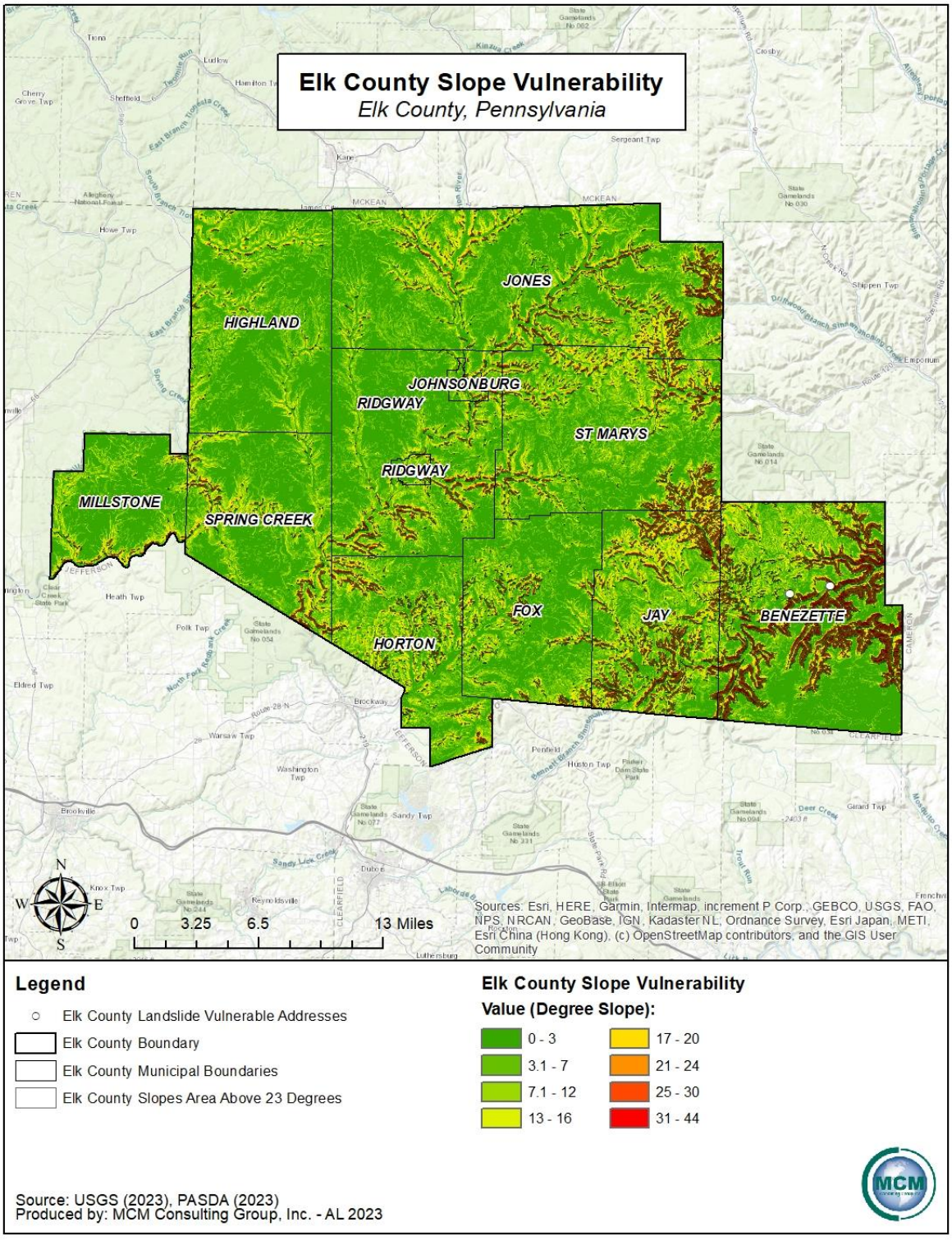
Municipalities with an increased risk to landslide (due to slope areas over 23°):

- Benezette Township
- Fox Township
- Highland Township
- Horton Township
- Jay Township
- Johnsonburg Borough
- Jones Township
- Millstone Township
- Ridgway Borough
- Ridgway Township
- Spring Creek Township
- City of St Marys

Population change can increase the impacts of landslides in Elk County, especially the two out of twelve municipalities that have shown a population increase between the 2010 and 2020 US Census. These municipalities are Benezette and Millstone townships. This population change can also be seen in *Table 3 – Population Change in Elk County*.

Another impact on landslides could be land use changes. As trees are harvested for farmland, the potential for landslides increases in the municipalities listed above that have an increased risk due to slope areas over 23º.

Figure 21 - Landslide Hazard Areas



4.3.6. Pandemic, Epidemic, Endemic, and Infectious Disease

4.3.6.1 Location and Extent

Epidemic

An epidemic occurs when an infectious disease spreads more quickly than expected by medical and healthcare authorities. It is characterized by widespread growth or extent that spreads quickly and incurs a greater rate of novel or endemic cases than baseline estimates would initially project. When an epidemic occurs, it typically impacts a larger area than a localized outbreak. Epidemics often include multiple countries, although they do not always spreading to different continents. In short, epidemics are regional.

Pandemic

A pandemic is a disease outbreak that spreads across countries or continents, which affects the population of a vast area. When a pandemic occurs, the event usually affects more people and takes more lives than an epidemic. Pandemics are described as an extensive epidemic. Generally, pandemic diseases cause sudden illness in all age groups on a global scale. Pandemics are continuous events in third-world countries but do not frequently affect the United States. A pandemic is measured and defined by the spreading of a disease rather than the fatalities with which it is associated. The characteristics of a pandemic outbreak include large and rapid scale spread, overload of healthcare systems, inadequate medical supplies, disruption of economy/society, and medical supply shortages. While a pandemic may be characterized as a type of epidemic, an epidemic is not a type of pandemic. Additionally, pandemics travel more efficiently than epidemics. In the event a pandemic occurs in the eastern United States, the entirety of Elk County would likely be impacted.

Endemic

An endemic is described as a disease that is present in a community at all times but occurs in a relatively low frequency and is not spreading at a rapid rate. An endemic can be a previous pandemic such as influenza, or coronavirus (COVID-19), or a more regionalized virus such as Ebola virus in Africa. An endemic can become a pandemic if the disease mutates into a more virulent strain.

Infectious Disease

Infectious diseases are illnesses caused by pathogenic organisms such bacteria, viruses, fungi, or parasites. Organisms become harmful and cause disease under certain conditions. The sources of infectious disease may originate from contaminated food or waterways, infected animals/livestock, or infection from biological vectors such as mosquitoes, etc. Infectious

diseases include influenza, rabies, Middle East Respiratory Syndrome (MERS), West Nile virus, Lyme Disease, Zika virus, and Ebola virus.

Pandemic and infectious disease events cover a wide geographical area and can affect large populations, potentially including the entire population of the Commonwealth of Pennsylvania. The exact size and extent of an infected population is dependent upon how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more populated and urban areas where there are large concentrations of people. The transmission rate of infectious disease will depend on the mode of transmission of a given illness. Pandemic events can also occur after other natural disasters, particularly floods, when there is the potential for bacteria to grow in, and contaminate, standing water.

4.3.6.2 Range of Magnitude

Public health emergencies typically occur on a regional basis. The magnitude of pandemic or infectious disease threat in the Commonwealth will range significantly depending on the aggressiveness of the virus in question, factors within the community that are impacted (medical care access, population density, etc.), and the ease of transmission. For example, the West Nile virus produces clinically asymptomatic cases less than 80% of the time. Therefore, approximately 20% of the cases result in mild infection, also known as West Nile fever. However, there is a small percentage of cases that could result in severe neurological disease and even death.

Pandemic influenza has a higher transmission rate from person-to-person compared to the West Nile virus. Advances in medical technologies have greatly reduced the number of deaths caused by influenza over time. In the early 1900s, flu pandemics historically caused tens of millions of deaths, while the 2009 Novel H1N1, known as swine flu, caused fewer than 20,000 deaths world-wide. Many people infected with swine flu in 2009 recovered without needing medical treatment. Without recent medical inventions and technologies, modern influenza would be associated with higher morbidity rates. About 70% of those who were hospitalized during the 2009 H1N1 flu virus in the United States belonged to a high-risk group. However, with the COVID-19 pandemic, the transmission rates were much higher than any previous outbreaks related to other members of the coronavirus family such as SARS-CoV and MERS-CoV.

In the past 100 years, humanity did not face a microbial pandemic similar in scale to the COVID-19 pandemic. The worldwide transmission rate of COVID-19 from human to human rapidly advanced in 2020 and 2021. Of the six global outbreaks of viral infections, three were caused by coronaviruses (SARS, MERS, and COVID-19).

While there are limited secondary hazards related to public health emergencies, an outbreak can cause a variety of cascading hazards. Civil disorder due to supply shortages is the most common cascading hazard to result from pandemic, epidemic, or infectious disease. Additional potential effects could include: a shortage of medical supplies and personnel, hoarding of household paper and cleaning supplies, school and business disruption, government closings, government restrictions on travel, low attendance at places of employment, slowed productivity, and widespread economic instability.

The World Health Organization (WHO) developed an alert system to help inform the world about the seriousness of a pandemic. The alert system has six phases, with Phase 1 being the lowest risk and Phase 6 being the greatest risk of pandemic. The phases were developed in 1999, but then revised in 2005 and 2009 to provide a global framework and aid countries in pandemic preparedness and response planning. These phases of alert systems were used during the COVID-19 pandemic. These phases are listed below in *Table 34 - Pandemic Influenza Phases*.

Table 34 - Pandemic Influenza Phases

Pandemic Influenza Phases	
Phase	**Characteristics**
Phase 1	No animal influenza virus circulating among animals has been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a specific potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Phase 4	Human-to-human transmission (H2H) of an animal or human-animal influenza virus able to sustain community-level outbreaks has been verified.
Phase 5	The same identified virus has caused sustained community level outbreaks in two or more countries in one WHO region.
Phase 6	The pandemic phase is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.

Pandemic Influenza Phases	
Phase	**Characteristics**
Post-Peak Period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Possible New Wave	Level of pandemic influenza activity in most countries with adequate surveillance rising again.
Post-Pandemic Period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance.
Source: WHO, 2009	

4.3.6.3 Past Occurrence

Pandemic & Epidemic

Several pandemic influenza outbreaks have occurred over the past 100 years that not only affected Elk County but the United States as a whole. *Table 35 - Past Pandemic Events in the United States* illustrates the various past pandemic events that have occurred since the late 1800's. Prior to COVID-19, the worst recorded pandemic was the Spanish Flu, due to the amount of infection spread that was present in the world. The two most recent pandemics that have occurred in Elk County and the United States are the swine flu/Novel H1N1 and COVID-19 pandemics, with COVID-19 being the most current and having the highest transmission rates.

Spanish Flu

An estimated 1/3 of the world's population was infected and had clinically apparent illnesses during the 1918 - 1919 influenza pandemic. Pennsylvania experienced severe effects from the Spanish Flu. It claimed 500,000 lives in the United States, which included individuals in Elk County. There is a lack of data which provides exact numbers of deaths that occurred in Elk County from the Spanish Flu, however there were a total of 60,000 deaths in Pennsylvania. Deaths occurring in Elk County are included in this number. There were approximately 47,000 reported cases and 12,000 deaths in Philadelphia in just over four weeks. In the first six months, there were about half a million cases and 16,000 deaths of the Spanish Flu in Philadelphia. The factors of high population density including crowded and unhygienic conditions contributed to higher numbers of cases and death rates across Pennsylvania.

Swine Flu/Avian Flu/H1N1

Each year, different strains of influenza are labeled as potential pandemic threats. Strains of influenza, or the flu, are highly contagious as they commonly attack the respiratory tract in humans. Influenza pandemic planning began in response to the H5N1 (avian) flu outbreak in Asia, Africa, Europe, the Pacific, and the Near East in the late 1990s and early 2000s. Avian flu did not reach pandemic proportions in the United States, but the country began planning for flu outbreaks.

Elk County was impacted by the H1N1 virus during 2009. The Pennsylvania Department of Health (PA DOH) set up clinics throughout the county to administer vaccines to at-risk populations. A total of 10,940 cases and seventy-eight deaths occurred in Pennsylvania from this pandemic but there is insufficient data to determine the exact number of cases and deaths from swine flu in Elk County.

COVID-19

Elk County was directly impacted by the COVID-19 pandemic. As of March 2023, Pennsylvania had an estimated 2,893,272 million total cases and 50,398 deaths related to the COVID-19 pandemic. Elk County, by comparison, had an estimated number of 8,605 total cases and 121 deaths related to the COVID-19 pandemic. The first cases in Pennsylvania were reported on March 6, 2020, in Delaware and Wayne counties. The first confirmed case of COVID-19 in Elk County was on April 7, 2020, as reported by the Courier Express in Dubois, PA. Beginning in December of 2020, there was a large-scale vaccination effort to combat COVID-19. Municipalities in Elk County indicated an increase in the pandemic and infectious disease section of the risk factor assessment municipal comparison.

Table 35 - Past Pandemic Events in the United States

Past Pandemic Events in the United States	
Year(s)	**Common Name**
1889	Russian Flu
1918	Spanish Flu/H1N1
1957	Asian Flu/H2N2
1968	Hong Kong Flu/H3N2
2009	Swine flu/Novel H1NI
2020	COVID-19
Sources: WHO & CDC, 2020	

Infectious Disease

Not only has Elk County experienced pandemic events, but the county has also experienced infectious disease events. The two major infectious disease events experienced across Elk County and Pennsylvania as a whole are the West Nile Virus and Lyme Disease. Due to the climatic traits of Pennsylvania these infectious diseases thrive in Elk County. Both diseases are transmitted by the biological vector of an insect which is found throughout the county.

West Nile Virus

West Nile virus reached the United States in 1999 and a year later was detected in Pennsylvania when mosquito pools, dead birds, and/or horses in nineteen counties tested positive for the virus. By 2003, all counties in the Commonwealth had confirmed cases. A comprehensive network has been developed in Pennsylvania that includes trapping mosquitoes, collecting dead birds, and monitoring horses, people and, in past years, sentinel chickens. Although West Nile Virus positive cases are few in Elk County, 2018 had the most positive cases in Elk County from 2017 to 2022. Over the past five years, no human has tested positive for West Nile Virus in Elk County. *Table 36 - West Nile Virus Control Program in Elk County since 2017* outlines the West Nile Virus within Elk County from 2017 to 2022. Data for 2023 was not published by the Pennsylvania Department of Environmental Protection at the time of this writing.

Table 36 - West Nile Virus Control Program in Elk County since 2017

West Nile Virus Control Program in Elk County Since 2017				
Year	**Total Positives**	**Human Positives**	**Mosquito Positives**	**Bird Positives**
2017	0	0	0	0
2018	4	0	3	1
2019	0	0	0	0
2020	0	0	0	0
2021	0	0	0	0
2022	0	0	0	0
Source: PA Department of Environmental Protection, 2023				

Lyme Disease

Lyme Disease has been present in the United States and Elk County for many years. More wooded areas have higher cases due to ticks being the main biological vector. Lyme disease is found in all sixty-seven counties within Pennsylvania. Elk County has an overall approximate 444 confirmed cases of Lyme disease from 2015 until 2020, although actual totals may be significantly higher due to under reporting. Elk County as a whole has a moderately high positive

total for Lyme Disease in the county, especially over the past several years. It is possible that numbers have risen dramatically due to lack of testing in previous years. Elk County experienced the highest number of positive cases in 2016 at 113 cases. Lyme disease case counts have been consistently falling over the past several years since 2016. The yearly average from 2015 to 2020 was approximately 74 positive cases per year. It should be noted that information represented for each county may vary due to reporting practices. Hence these figures represent a rough estimate of the Lyme disease burden in Elk County. *Table 37 - Lyme Disease Data for Elk County* outlines the total positive cases of Lyme Disease within Elk County from 2015 to 2020. Data after 2020 was not available for this report.

Table 37 - Lyme Disease Data for Elk County

Lyme Disease Data for Elk County	
Year	**Total Positives**
2015	63
2016	113
2017	90
2018	67
2019	75
2020	36
Source: PA Department of Environmental Protection, 2023	

Zika Virus

The Zika virus is another infectious disease that is spread by mosquito bites, and it is related to West Nile virus. Zika virus can also be spread through sexual intercourse, blood transfusion, or passed from mother to child in the womb. The virus was first identified in 1947, but largely came to the attention of the United States in 2015 when there was an outbreak of Zika in Brazil. The direct illness caused by Zika can include fever, red eyes, joint pain, headache, and a rash, or sometimes no symptoms at all. Zika is problematic for pregnant mothers as the virus can result in microcephaly or cause other problems for brain development. For adults, the virus can be linked to increased incidence of Guillain-Barré syndrome.

4.3.6.4 Future Occurrence

Pandemic & Epidemic

The probability of a widespread public health emergency affecting Elk County is approximately once every ten years. Minor outbreaks of less serious communicable disease, such as influenza, will occur much more frequently. The occurrence of pandemic influenza outbreaks is unpredictable, and complete avoidance of the events is unlikely. Therefore, future occurrences of

pandemics and infectious disease events are very likely. Pandemics may also emerge from other diseases, especially invasive pathogens for which Elk County and Pennsylvania as a whole lack natural immunity.

Influenza

It is estimated that 5% to 25% of Pennsylvanians get the flu each year, and 120 to 2,000 individuals die from complications of influenza. The CDC recommends that everyone six months and older get a flu vaccine every season to prevent future cases from rising. People who are at a high risk of serious flu illness should take flu antiviral drugs as soon as they get sick.

Infectious Disease

Infectious diseases such as West Nile Virus and Lyme Disease have been present in Elk County for many years and are expected to perpetuate. The best way to prevent infectious disease outbreaks, including West Nile Virus and Lyme Disease, is to actively address the causes of the diseases. West Nile Virus occurrence can be reduced by removing mosquito breeding locations in stagnant water sources and Lyme Disease occurrence can be reduced by utilizing insect repellant, removing ticks promptly, applying pesticides, and reducing tick habitats. The occurrence of Zika Virus can also be reduced by removing mosquito breeding areas and areas of stagnant water. Both West Nile Virus and Lyme Disease are expected to continue occurring in Elk County in the future.

4.3.6.5 Vulnerability Assessment

Elk County is considered to be a moderate vulnerability county in regard to the pandemic events. It is extremely difficult to predict the occurrence and the magnitude of a pandemic or epidemic event. The COVID-19 pandemic disproportionately affected populations over the age of sixty-five, especially those in nursing homes. It has had disparate effects on socially vulnerable populations, including unsheltered and homeless individuals.

Elderly individuals, children and immune deficient individuals are the most vulnerable to disease. Nursing facilities, personal care facilities, daycares, schools, and hospitals are considered more vulnerable since there are often groups of these socially vulnerable individuals present at these community lifelines. Congregate living facilities, including correctional institutions and dormitories would also be at an increased risk due to the difficulties in adhering to the social distancing required to help stop the spread of a pandemic. During the COVID-19 pandemic, nursing homes and personal care homes in Pennsylvania reported high numbers of cases and deaths, and several county jails and state correctional institutions reported wide community spread.

Health-care workers and those working in direct-care (such as correctional institutions or those who cannot social distance due to their jobs) are more likely to be exposed to a pandemic disease. Those who work outdoors for extended periods of time in warm months may be more vulnerable to West Nile Virus, Lyme Disease, or the Zika virus.

The number of hospitals within the county, and availability of beds within the hospitals, determine the amount of care vulnerable and sick patients will receive. It is important for hospitals to review and exercise emergency response plans and continuity of operations plans (COOP) to ensure that there is an effective public health response.

During a public health emergency, the PA DOH may open emergency medicine centers called points of dispensing (PODs) to ensure that medicine, supplies, vaccines, and information reach Pennsylvania residents during a public health emergency. An open POD is where the general public goes to receive free emergency medicine and supplies from public health officials, while a closed POD provides free emergency medicine and supplies to a specific community, like a university, including faculty, staff, and students. Dispensing of medications/vaccines is a core function of the Strategic National Stockpile's Mass Dispensing of Medical Countermeasures Plan.

PODs are coordinated with county emergency managers by the PA DOH with the six regional healthcare districts (see *Figure 22 - Pennsylvania Department of Health Districts*). Elk County is in the Northwest District. At the time of the writing of this plan, PODs had been involved with mass vaccinations against COVID-19 and most PODs have been shut down due to lack of interest in vaccinations.

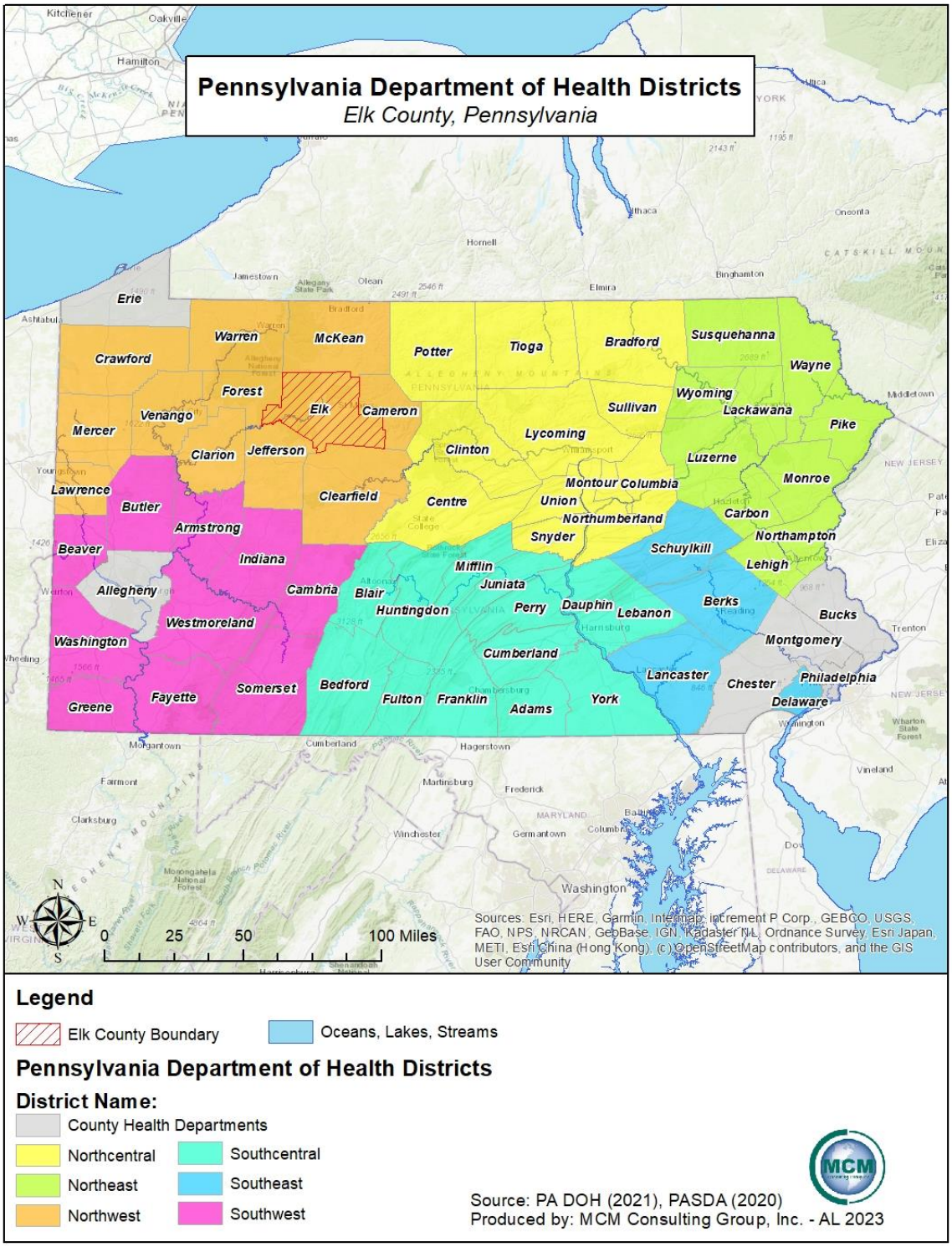
Municipalities with an increased risk to pandemic, epidemic, and infectious disease:

- Benezette Township
- Fox Township
- Highland Township
- Horton Township
- Jay Township
- Johnsonburg Borough
- Jones Township
- Millstone Township
- Ridgway Borough
- Ridgway Township
- Spring Creek Township
- City of St Marys

Land use and land development could directly impact the vulnerability of Elk County to pandemic, epidemic, and infectious disease. Development of forested and rural areas could result in populations coming into direct contact with vectors for infectious disease including, most prominently, Lyme Disease and West Nile Virus. When rural and natural habitats for wildlife are developed, those vectors that live along and with wildlife have the potential to encounter the individuals developing the properties, and the populations that will occupy or live in those areas. An increase in development could also lead to an increase in the number of individuals living in Elk County, increasing the county's vulnerability to pandemic events, like COVID-19.

Population changes can directly impact the vulnerability of Elk County to pandemic events, like COVID-19. With increased populations there is a greater risk of the spread of viruses, especially in areas where the population density is high. Ten of the twelve municipalities in Elk County had a population decrease between the 2010 and 2020 US Census, as shown in *Table 3 – Population Change in Elk County*. The two municipalities that did have an increase were Benezette Township (4.4% or a total of nine people) and Millstone Township (15.9% or a total of thirteen people); these increases were small, and the municipalities are rural. Elk County should monitor population growth in the City of Saint Marys and boroughs of Johnsonburg and Ridgway.

Figure 22 - Pennsylvania Department of Health Districts


Pennsylvania Department of Health Districts
Elk County, Pennsylvania
Erie
Warren
McKean
Potter
Tioga
Bradford
Susquehanna
Wayne
Crawford
Forest
Elk
Cameron
Wyoming
Sullivan
Lackawana
Pike
Venango
Mercer
Clarion
Jefferson
Clinton
Lycoming
Luzerne
Monroe
Lawrence
Butler
Clearfield
Centre
Union
Montour
Columbia
Northumberland
Carbon
Armstrong
Snyder
Schuylkill
Northampton
Beaver
Indiana
Mifflin
Lehigh
Allegheny
Cambria
Blair
Juniata
Huntingdon
Perry
Dauphin
Lebanon
Berks
Bucks
Westmoreland
Washington
Cumberland
Montgomery
Lancaster
Chester
Philadelphia
Somerset
Bedford
Fayette
Fulton
Franklin
Adams
York
Greene
Delaware
0
25
50
100 Miles
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Legend
Elk County Boundary
Oceans, Lakes, Streams
Pennsylvania Department of Health Districts
District Name:
County Health Departments
Northcentral
Northeast
Northwest
Southcentral
Southeast
Southwest
Source: PA DOH (2021), PASDA (2020)
Produced by: MCM Consulting Group, Inc. - AL 2023

4.3.7. Radon Exposure

4.3.7.1 Location and Extent

Airborne radon gas is radioactive and is a step in the radioactive decay of uranium to radium. Radon is a noble gas, cannot be seen and has no odor. Like other noble gasses, radon gas is very stable, so it does not easily combine with other chemicals. Two isotopes of radon are commonly found: 222Rn and 220Rn. The 220Rn isotope has a very short half-life, so it often only exists for fifty-five seconds, not long enough to pose a hazard to humans. The 222Rn isotope has a half-life of 3.8 days which is long enough to pose a threat to humans. Still, due to the relatively short half-life of 222Rn, it only exists in relative proximity to its radioactive parent, usually within tens of feet away. Radon is a carcinogen and when inhaled, it can lead to the development of lung cancer.

Radioactivity, caused by airborne radon, has been recognized for many years as an important component in the natural background radioactivity exposure of humans, but it was not until the 1980s that the wide geographic distribution of elevated values in houses and the possibility of extremely high radon values in houses were recognized. Radon was discovered as a significant source of natural radiation for humans in 1984 in the Reading Prong geologic province in Eastern Pennsylvania, when routine monitoring of employees leaving the not yet active Limerick nuclear power plant showed readings that a construction worker working on the plant frequently exceeded expected radiation levels despite the fact that the plant was not active. The Environmental Protection Agency (EPA) guidelines state that mitigation actions should be taken if levels exceed 4pCi/L in a home, and most uranium miners have a maximum exposure of 67 pCi/L. Subsequent testing of the Limerick power plant worker's home showed high radon levels of 2,500 pCi/L (pico Curies per Liter), triggering the Reading Prong to become the focus of the first large-scale radon scare.

Radon gas is considered ubiquitous and can be found in indoor and outdoor environments. There is no known safe level of exposure to radon. For most people in Pennsylvania, the greatest risk of radon exposure is from within their home in rooms that are below, directly in contact with, or immediately above the ground. Sources of radon include radon in the air from soil and rock beneath homes, radon dissolved in water from private wells and exsolved during water use (rare in Pennsylvania), and radon emanating from uranium-rich building materials such as concrete blocks or gypsum wallboard (also rare in Pennsylvania). Key factors in radon concentration in homes are the rates of air flow into and out of the house, the location of air inflow, and the radon content of air in the surrounding soil. Because of the flow dynamics of air inside of most houses, even a small rate of soil radon gas inflow can lead to elevated radon concentrations.

There are several factors that contribute to higher radon levels in soil gas:

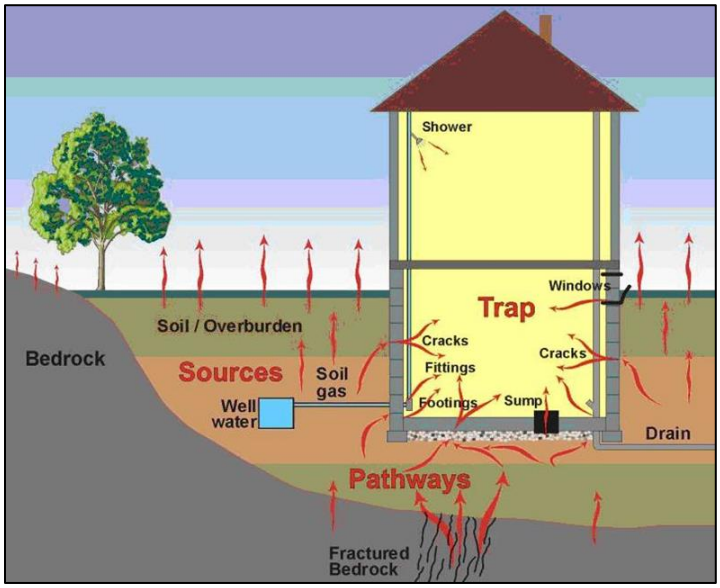
- Proximity to elevated uranium rich deposits (>50ppm). Areas within a few hundred feet of such deposits are most at risk. Such deposits are rare in Pennsylvania.
- Some more common rocks have higher than average uranium content (5 to 50 ppm), and proximity to such rocks also increases the risk of radon exposure. These rock types include black shales as well as granitic and felsic alkali igneous rocks. This is the most common source of high radon levels in Pennsylvania. The Reading Prong elevated radon levels come from Precambrian granitic gneisses.
- Other soil and bedrock properties that facilitate radon mobility. The amount of pore space in the soil and its permeability – more porous soils will allow radon to travel more easily. Limestone-dolomite soils can also be predisposed to collect radon from radium resultant from weathering of iron oxide or clay surfaces. In some cases (like State College in Centre County, PA) even with underlying bedrock having normal uranium concentrations (.5 to 5 ppm), the vast majority of locations built on limestone-dolomite soils exceed radon concentrations of 4pCi/L, and many exceeded 20 pCi/L.

The following three sources of radon in houses are now recognized (see *Figure 23 - Sketch of Radon Entry Points into a House* below):

- Radon in soil air that flows into the house
- Radon dissolved in water from private wells and exsolved during water usage; this is rarely a problem in Pennsylvania
- Radon emanating from uranium-rich building materials (e.g., concrete blocks or gypsum wallboard); this is not known to be a problem in Pennsylvania

High radon levels were initially thought to be exacerbated in houses that are tightly sealed, but it is now recognized that rates of airflow into and out of houses, plus the location of air inflow and the radon content of air in the surrounding soil, are key factors in radon concentrations. Outflows of air from a house, caused by a furnace, fan, thermal “chimney” effect, or wind effects, require that air be drawn into the house to compensate. If the upper part of the house is tight enough to impede influx of outdoor air (where radon concentration is generally <0.1 pCi/L), then an appreciable fraction of the air may be drawn in from the soil or fractured bedrock through the foundation and slab beneath the house, or through cracks and openings for pipes, sumps, and similar features. Soil gas typically contains from a few hundred to a few thousand pCi/L of radon; therefore, even a small rate of soil gas inflow can lead to elevated radon concentrations in a house.

Figure 23 - Sketch of Radon Entry Points into a House



The radon concentration of soil gas depends upon a number of soil properties, the importance of which is still being evaluated. In general, 10% to 50% of newly formed radon atoms escape the host mineral of their parent radium and gain access to the air-filled pore space. The radon content of soil gas clearly tends to be higher in soils containing higher levels of radium and uranium, especially if the radium occupies a site on or near the surface of a grain from which the radon can easily escape. The amount of pore space in the soil and its permeability for airflow, including cracks and channels, are important factors determining radon concentration in soil gas and its rate of flow into a house. Soil depth and moisture content, mineral host and form for radium, and other soil properties may also be important. For houses built on bedrock, fractured zones may supply air having radon concentrations similar to those in deep soil.

The second factor listed above is most likely the cause of high radon levels in Elk County. The data show that most reported zip codes in the county have high basement radon level test results. The areas and test results are shown in more detail in the past occurrence section.

4.3.7.2 Range of Magnitude

According to the EPA, about 21,000 lung cancer deaths each year in the U.S. are related to radon. It is the second leading cause of lung cancer after smoking and the number one cause of lung cancer among nonsmokers. Radon causes lung cancer by continuing to radioactively decay after being inhaled, and turning into a daughter product (218Po, 214Pb, 214Bi) which may become attached to lung tissue and induce lung cancer due to the continued radioactive decay.

The EPA reports that the national average radon concentration of indoor air of homes is about 1.3 pCi/L, and they recommend that homes be fixed if the radon level is 4pCi/L or more. There is however no safe level of radon exposure, so the EPA also recommends considering fixing a home if the radon level is between 2 pCi/L and 4 pCi/L.

Table 38 - Radon Risk for Smokers and Nonsmokers shows the relationship between various radon levels, probability of lung cancer, comparable risks from other hazards, and action thresholds. As seen in *Table 38 - Radon Risk for Smokers and Nonsmokers* below, a smoker exposed to radon has a much higher risk of lung cancer.

Table 38 - Radon Risk for Smokers and Nonsmokers

Radon Risk for Smokers and Nonsmokers			
Radon Level (pCi/L)	**If 1,000 People Were Exposed to this level over a lifetime…***	**Risk of cancer from radon exposure compares to...*****	**Action Threshold**
SMOKERS			
20	About 260 people could get lung cancer	250 times the risk of drowning	Fix Structure
10	About 150 people could get lung cancer	200 times the risk of dying in a home fire	
8	About 120 people could get lung cancer	30 times the risk of dying in a fall	
4	About 62 people could get lung cancer	5 times the risk of dying in a car crash	
2	About 32 people could get lung cancer	6 times the risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 20 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	About 3 people could get lung cancer	(Average outdoor radon level)	
NON-SMOKERS			
20	About 36 people could get lung cancer	35 times the risk of drowning	Fix Structure

Radon Risk for Smokers and Nonsmokers			
Radon Level (pCi/L)	**If 1,000 People Were Exposed to this level over a lifetime…***	**Risk of cancer from radon exposure compares to...*****	**Action Threshold**
10	About 18 people could get lung cancer	20 times the risk of dying in a home fire	
8	About 15 people could get lung cancer	4 times the risk of dying in a fall	
4	About 7 people could get lung cancer	The risk of dying in a car crash	
2	About 4 people could get lung cancer	The risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 2 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	-	(Average outdoor radon level)	
*Note: Risk may be lower for former smokers * Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003). ** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.*			

4.3.7.3 Past Occurrence

In 1984, the Pennsylvania Radon Bureau responded to the newly detected high radon levels with a massive radon monitoring, educational, and remediation effort. In the start of November 1986, over 18,000 homes had been screened for radon and approximately 59% were found to have radon daughter levels in excess of the 0.020 Working Level (WL) guideline. Radon daughter levels ranged up to 13 WL or 2600 pCi/L or radon gas.

The Pennsylvania Department of Environmental Protection (PA DEP) provides information for homeowners about how to test for radon in their homes, and when they receive a test result over 4 pCi/L, the PA DEP Bureau of Radiation Protection works to help homeowners repair the home and mitigate the hazard. The DEP has estimated that the national average indoor radon concentration is 1.3 pCi/L and the level for action is 4.0 pCi/L; however, they have estimated that the average indoor concentration in Pennsylvania basements is about 7.1 pCi/L and 3.6 pCi/L on the first floor. The PA DEP records all the tests they receive and categorize them in a searchable database by zip code. There are currently 2,174 zip codes in Pennsylvania, but the zip

code radon test data only covers for 986 zip codes. The missing zip codes that report in the data base as "N/A" for insufficient data either had fewer than thirty test results or no test results at all.

Table 39 – Radon Test Results in Elk County shows a total of twenty-two zip codes in Elk County where tests were reported to the PA DEP to report their findings; there were eight zip codes that reported no available data and were not included in the table. The highest average radon level was reported from the 15857-zip code, which is in the south-central area of the county, with an average reading of 452.2 pCi/L within location of the basement. Most reporting zip codes in Elk County have average basement Radon levels significantly above the suggested EPA action level of 4 pCi/L. The average basement reading for reporting zip codes in the county is 8.8 pCi/L, and the average first floor reading is 6.03 pCi/L.

Table 39 - Radon Test Results in Elk County

Radon Level Test Results (PA DEP, 2020)				
Zip Code	**Postal Community**	**Location**	**Max Result pCi/L**	**Average Result pCi/L**
15801	Dubois, PA	Basement	299.3	11
		First Floor	48.6	5.5
15823	Brockport, PA	Basement	36.3	4.9
		First Floor	0	0
15824	Brockway, PA	Basement	171.6	8.4
		First Floor	63.6	4
15834	Emporium, PA	Basement	161.4	10.1
		First Floor	0	0
15845	Johnsonburg, PA	Basement	208.2	13.4
		First Floor	0	0
15846	Kersey, PA	Basement	432.2	11.8
		First Floor	66	10
15849	Penfield, PA	Basement	12.6	5.1
		First Floor	0	0
15853	Ridgway, PA	Basement	98.4	6

Radon Level Test Results (PA DEP, 2020)				
Zip Code	**Postal Community**	**Location**	**Max Result pCi/L**	**Average Result pCi/L**
		First Floor	63.2	8.7
15857	Saint Marys, PA	Basement	452.2	12.3
		First Floor	33.9	4
15868	Weedville, PA	Basement	65.4	9.6
		First Floor	0	0
15870	Wilcox, PA	Basement	18.9	5.2
		First Floor	0	0
16239	Marienville, PA	Basement	152.3	11.7
		First Floor	24.9	3.5
16347	Sheffield, PA	Basement	84.2	4.1
		First Floor	0	0
16735	Kane, PA	Basement	282.4	9.6
		First Floor	138.1	6.5

4.3.7.4 Future Occurrence

Radon exposure is likely given the geologic and geomorphic conditions in Elk County. The EPA and USGS have mapped radon potential in the US to help target resources and assist local governments in determining if radon-resistant features are applicable for new construction. The designations are broken down in three zones and are assigned by county, as shown in *Figure 24 – Pennsylvania Radon Levels*. Each zone reflects the average short-term measurement of radon that can be expected in a building without radon controls. Elk County is located within Zone 2 with counties of moderate potential for radon which indicate an intermediate likelihood of occurrence in the future.

1. Zone 1 has the highest potential and readings can be expected to exceed the 4 pCi/L recommended limit.
2. Zone 2 has a moderate potential for radon with levels expected to be between 2 and 4 pCi/L and

3. Zone 3 has a low potential with levels expected to be less than 2 pCi/L.

Due to the moderate likelihood of future occurrence, the level of radon daughters should be monitored. Radon daughters are the concentration of decay products of radon in the uranium chain. Fortunately, the presence of radon daughters can be monitored through the means as radon gas. *Table 40 - Suggested Actions and Time Frame for Exposure to Radon Daughters* provides suggested actions and time frames for varying levels of exposure to radon daughters.

Table 40 - Suggested Actions and Time Frame for Exposure to Radon Daughters

Suggested Actions and Timeframe for Exposure to Radon Daughters		
Exposure Level*	Suggested Action**	Timeframe For Plan
more than 5.0 WL***	Residents should either promptly relocate or undertake temporary remedial action to lower levels as far below 5.0 WL as possible. Smoking in high areas discouraged.	Within 2-3 days
1.0 to 5.0 WL	Residents should undertake temporary remedial action to lower levels as far below 1.0 WL as possible. Smoking in high areas discouraged.	Within 1 week
0.5 to 1.0 WL	Residents should undertake temporary remedial action to lower levels as far below 0.5 WL as possible.	Within 2 weeks
0.1 to 0.5 WL	Residents should undertake temporary remedial action to lower levels as far below 0.1 WL as possible. Higher exposure levels require action to be taken in a shorter	3 weeks to 3 months
0.02 to 0.1 WL	Residents should undertake temporary and/or permanent remedial action to lower levels below 0.02 WL. Higher exposure levels require action to be taken in a shorter	4 to 15 months

Climate change will have very minor impacts on the future occurrence of radon exposure in Elk County. If bedrock and geological strata are exposed to air and weathering due to weather pattern changes from climate change, there exists the possibility of increased radon exposure. This is considered unlikely but not out of the realm of possibility for Elk County. There are many unknowns related to specific weather patterns and how they will be impacted by climate change.

4.3.7.5 Vulnerability Assessment

Proper testing for radon levels should be conducted across Elk County, especially in the areas of higher incidence levels, and for those individuals and households that face the contributing risks. This testing will determine the level of vulnerability that residents face in their homes, as well as in their businesses and schools.

Elk County is in the EPA Radon Hazard Zone 2, meaning there is a moderate risk of radon exposure. Smokers can be up to ten times more vulnerable to lung cancer from high levels of radon depending on the level of radon they are exposed to. Additionally, older homes that have crawl spaces or unfinished basements are more vulnerable to having high radon levels. Average basement radon levels for homes who reported their results to the PA DEP are often found to be above the EPA action level of 4 piC/L. *Figure 25 – Radon Levels by Zip Code* shows the best available data from the EPA about the percentage of homes with radon levels at or above the EPA action level. The EPA estimates that an average radon mitigation system costs approximately $1,200.00. The PA DEP Bureau of Radiation Protection provides short- and long-term tests to determine radon levels, as well as information on how to mitigate high levels of radon in a building. The 2018 PA HMP estimates that there are 15,578 vulnerable buildings in Elk County that are in areas with high radon test results, and the cost to mitigate the most impacted of those buildings (an estimated 20% of them or 3,116 buildings) would be $3,738,720.00.

There are two historic or cultural properties registered with the National Register of Historic Places that are at an increased vulnerability of radon exposure if they have not already been mitigated for radon. These locations are Decker's Chapel in the City of St Marys and the John E. Weidenboerner House in the City of St Marys. These locations are in areas between 12 and 13 pCi/L.

Municipalities with an increased risk of radon exposure (with areas with a basement pCi/L over 12):

- Fox Township
- Jay Township
- Johnsonburg Borough
- Ridgway Township
- City of St Marys

Municipalities without an increased risk of radon exposure (with areas with a basement pCi/L under 12):

- Benezette Township
- Highland Township
- Horton Township
- Jones Township
- Millstone Township
- Ridgway Borough
- Spring Creek Township

If land use and land development changes occur, the risk and vulnerability of radon exposure in Elk County could increase. With an increase in development there could be a rise in the number of individuals living in Elk County with basements, thereby increasing their exposure to radon.

Population changes, especially an increase, in Elk County pose a risk and vulnerability of radon exposure to individuals in each municipality. Between the 2010 and 2020 US Census two of the twelve municipalities in Elk County experienced population growth; Benezette Township (4.4%) and Millstone Township (15.9%). These increases in population accounted for nine and thirteen people respectively, see *Table 3 – Population Change in Elk County*. Another risk to radon exposure due to population changes could occur from people moving into structures with basements that have sat empty for extended periods of time or converting camps into homesteads. Education about the dangers of radon exposure should occur at the municipal level when existing homes are purchased. New construction can be built with radon prevention systems in place. Radon prevention systems can cost between $500.00 to $2,000.00 per building.

Figure 24 - Pennsylvania Radon Levels

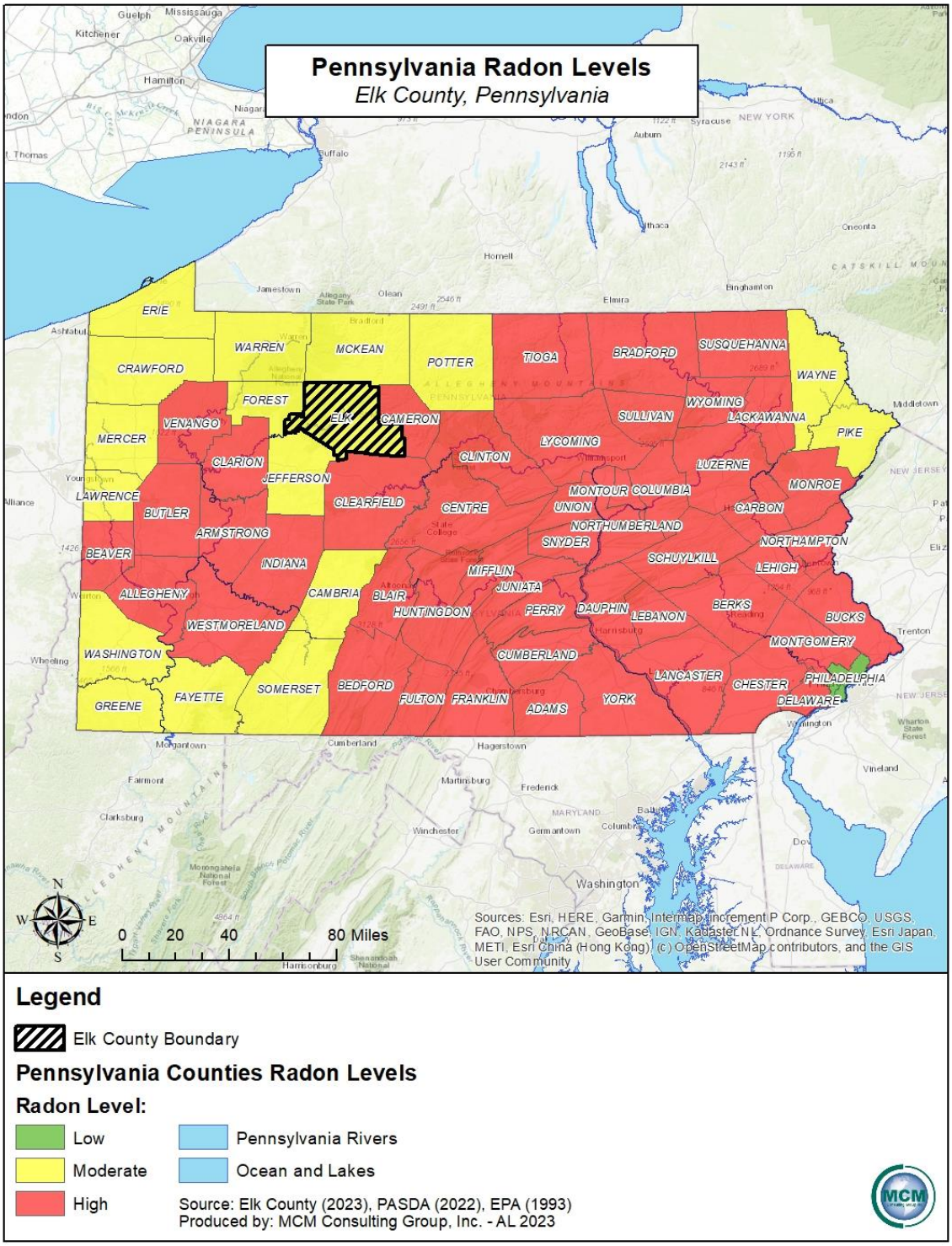
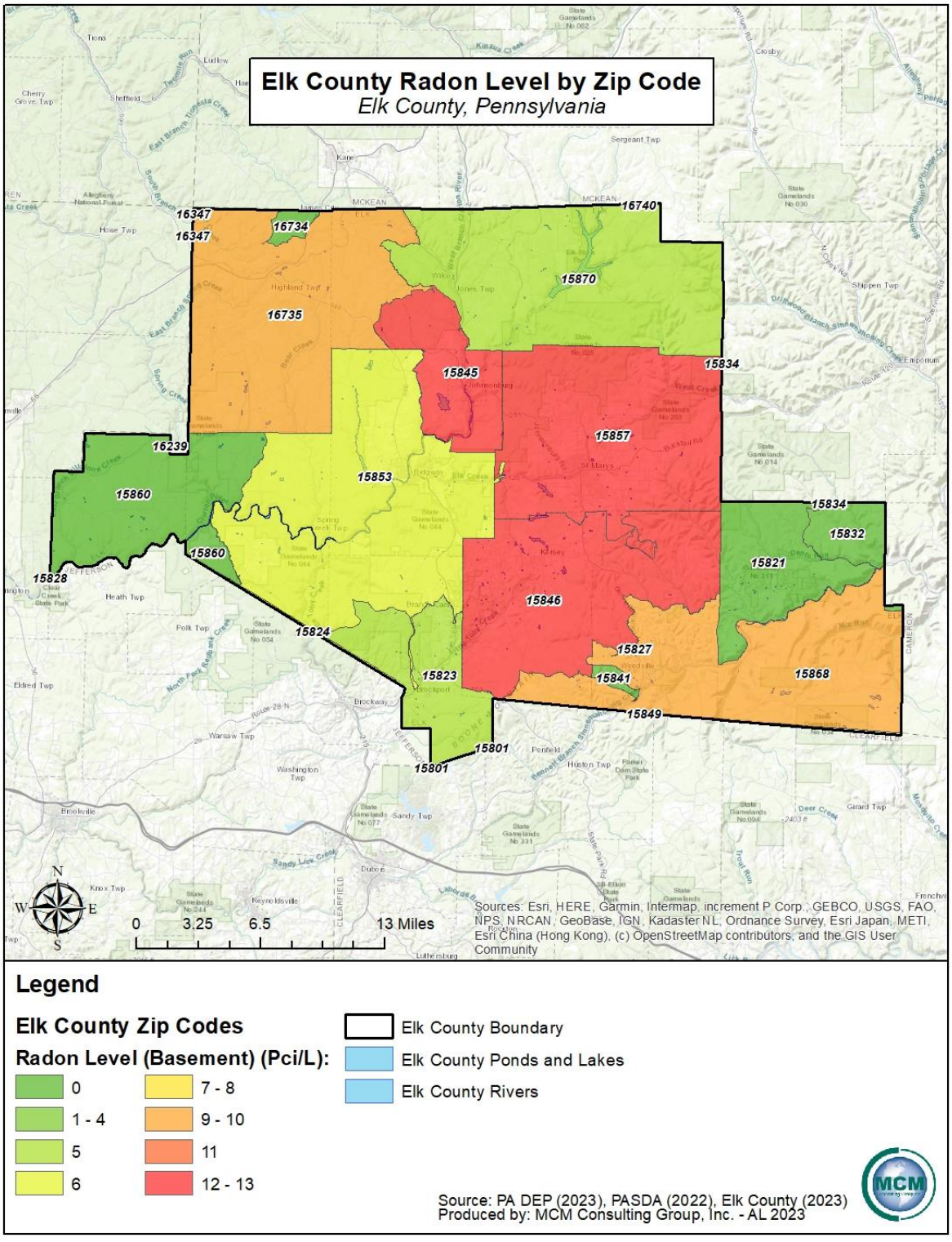


Figure 25 - Radon Levels by Zip Code



4.3.8. Subsidence and Sinkhole

4.3.8.1 Location and Extent

Subsidence is the sinking movement of the earth's surface; the result of this movement is commonly referred to as a sinkhole. There are two common causes of subsidence in Pennsylvania: 1) dissolution of carbonate rock such as limestone or dolomite and 2) mining activity. In the first case, water passing through naturally occurring fractures and bedding planes dissolves bedrock leaving voids below the surface. Eventually, overburden on top of those voids collapses, leaving surface depressions resulting in what is known as karst topography. Characteristic structures associated with karst topography include sinkholes, linear depressions, and cases. Often, sub-surface solution of limestone will not result in the immediate formation of karst features. Collapse sometimes occur only after a large amount of activity, or when a heavy burden is placed on overlying material. The bedrock geology is found mostly in the south-central and eastern portions of the Commonwealth of Pennsylvania, and Elk County is not located in a karst vulnerable area. Subsidence in Elk County is primarily due to mining activity. This plan will focus on mining activity.

Mining activity is concentrated in the southwestern region of the state. The majority of sub-surface (i.e., underground) extraction of materials such as oil, gas, coal, metal ores (i.e., copper, iron, and zinc), clay, shale, limestone, or water can result in slow-moving or abrupt shifts in the ground surface and these areas have a higher potential to be impacted by sinkholes and subsidence. Sinkholes often develop where the cover above a mine is thin. Sinkhole development normally occurs where the interval to the ground surface is less than three to five times the thickness of the extracted seam and the maximum interval is up to ten times the thickness of the extracted seam. In western Pennsylvania, most sinkholes develop where the soil and rock above a mine are less than fifty feet thick.

Human activity can also result in subsidence or sinkhole events. Leaking water pipes or structures that convey storm-water runoff may result in areas of subsidence as the water dissolves substantial amounts of rock over time. Poorly managed stormwater can be an exacerbating factor in subsidence events. In some cases, construction, land grading, or earthmoving activities that cause changes in stormwater flow can trigger sinkhole events.

4.3.8.2 Range of Magnitude

No two subsidence areas or sinkholes are exactly alike. Variations in size and shape, time period under which they occur (i.e., gradually, or abruptly), and the proximity to development ultimately determine the magnitude of damage incurred. Events could result in minor elevation changes or deep, gaping holes in the surface. Subsidence and sinkhole events can be addressed before significant damage occurs.

Primarily, problems related to subsidence include the disruption of utility services and damages to private and public property including buildings, roads, and underground infrastructure. Isolated incidents of subsidence throughout the coal regions over the past years have affected houses, garages, and trees that have been swallowed up by subsidence holes. Lengths of local streets and highways, and countless building foundations have been damaged.

If long-term subsident or sinkhole formation is not recognized and mitigation measures are not implemented, fractures or complete collapse of building foundations and roadways may result. The worst-case scenario of a mine subsidence event for Elk County would be similar to an event in Allegheny County in 2013, when sixty-nine homes in Hyde Park sustained mine subsidence damage. The Pennsylvania Department of Environmental Protection responded to the subsidence by filling the mine voids at a cost of $3.7 million. If mitigation measures are not taken, the cost to fill in and stabilize sinkholes can be significant although sinkholes are limited in range of magnitude.

Voids in the earth's subsurface are created where coal was previously mined and removed. The condition removes a significant portion of the support of the overlying rock strata that usually causes the rock strata to fall or subside into the voids that may damage dwellings or other surface structures above the affected areas. Mining locations across the county should be carefully noted and avoided as sites for new construction unless the proper measures are taken to ensure the mine's soundness.

The Elk County local planning team assigned a risk factor assessment score of 1.3 to subsidence and sinkhole formation. This places the hazard at a low risk factor. *Figure 26 – Sinkhole Susceptibility in Pennsylvania* illustrates the portions of the Commonwealth of Pennsylvania where sinkholes and subsidence are common. The hazard for subsidence and sinkholes in these regions is very high. Elk County has a large portion of mining areas and is therefore one of these regions.

4.3.8.3 Past Occurrence

There is no comprehensive list of mine subsidence in Elk County. The Pennsylvania Department of Conservation and Natural Resources (PA DCNR) provides an online sinkhole inventory database, which lists a total of 3,619 identified sinkholes in Pennsylvania as of 2022. Of these sinkholes none fall within Elk County. The fact that no sinkholes were identified does not necessarily mean there are no sinkholes in Elk County. Additionally, the Pennsylvania Department of Environmental Protection indicates that some small incidences of sinkholes occur several times per week and cause limited damage and that many of these are related to failing infrastructure like water main breaks or collapsed pipes.

4.3.8.4 Future Occurrence

There is currently no reliable information regarding the probability of future occurrence of subsidence or sinkholes in Pennsylvania. One way of estimating the probability of future occurrences would be to project the historical trends into the future, but there is no comprehensive documentation of previous events in Elk County. The PA DEP has noted that mine subsidence events are constant though they vary in intensity and damage. Based on geological conditions and mining activities in Elk County, the annual occurrence of subsidence and sinkholes near karst topography and where mining occurs is considered likely. Although precise locations of future occurrences is difficult to predict due to site-specific conditions that contribute to sinkhole development, there are several signs that can signal potential development.

The signs include:

- Slumping or falling fence posts, trees, or foundations.
- Sudden formation of small ponds.
- Wilting vegetation.
- Discolored well water.
- Structural cracks in walls and/or floors.

Based on geological conditions and mining activity, subsidence events are likely to occur in Elk County. If land development and mining were to occur in an area that is unstable or unsafe, a subsidence event or sinkhole is likely to form. *Figure 28 – Unsuitable Areas for Mining in Pennsylvania* illustrates the areas of Pennsylvania where mining could potentially cause a subsidence event or a sinkhole. A significant number of these areas that are unsuitable for mining are located in and around Elk County. *Figure 29 – Elk County Unsuitable Areas for Mining* shows the areas in more detail in Elk County where the land is unsuitable for future development. These areas in Elk County include portions of both Fox and Jay Townships. These locations of unsuitable mine areas include the potential for adverse impacts on water qualities for communities and increased runoff in Byrnes Run Watershed.

Climate change may increase the frequency of subsidence in Elk County. Climate change could result in more intense rainfall from more frequent hurricanes and tropical storms, and it could result in hot, dry areas becoming increasingly dry. The increase in precipitation could result in ground swelling, due to soils that contain clay minerals absorbing the rainfall. This swelling is seen as an increase in vertical land motion, while shrinking is the decrease in vertical land motion. Shrinking occurs when there are high temperatures that cause the land to dry out, resulting in more movement of the soil, which can be seen as a gradual settling or sudden sinking of Earth’s surface. The combination of shrinking and swelling could increase with climate change and ultimately increase the frequency of subsidence and sinkholes in Elk County.

4.3.8.5 Vulnerability Assessment

Areas of the county where commercial mining operations take place are the most vulnerable to subsidence and sinkhole hazards. Natural subsidence and sinkholes have never been reported in Elk County. A mined area may be differentially prone to subsidence based on its geology and depth of mineral seam, but reliable information about the different locations of varying depths of seams are not available. Geologists agree that all areas that are mined are prone to subsidence; therefore, coal mined areas are shown as vulnerable to mine subsidence. Moist of the mining that has occurred in Elk County was superficial mining of natural resources. The mine sites were abandoned after extraction can potentially become areas susceptible to subsidence events. These areas can be seen in *Figure 27 – Abandoned Mined Sites in Elk County*. Subsidence cannot be ruled out as a potential hazard for Elk County. There are no state or county critical infrastructure facilities at risk in the county due to sinkholes. There is one private critical facility within the area in Elk County that is unsuitable for mining. That location is a powdered metal producer and is listed as a toxic release inventory location for Elk County. There are no historic or culturally preserved properties in Elk County that are within abandoned mine areas of areas that are unsuitable for mining that would put them at an increased risk of subsidence or sinkholes.

Municipalities with the highest risk of subsidence or sinkholes (abandoned mine areas and areas unsuitable for mining):

- Fox Township, Jay Township

Municipalities with an increased risk of subsidence or sinkholes (abandoned mine areas):

- Benezette Township, Fox Township, Horton Township, Jay Township, Ridgway Borough, Ridgway Township, City of St Marys

Municipalities without an increased risk of subsidence or sinkholes (no abandoned mine areas):

- Highland Township, Johnsonburg Borough, Jones Township, Millstone Township, Spring Creek Township

Population change can increase the impacts of subsidence or sinkholes in Elk County. Elk County has two out of twelve municipalities that had a population increase between the 2010 and 2020 US Census. This population change can also be seen in *Table 3 – Population Change in Elk County*. The two municipalities were Benezette Township (4.4%) and Millstone Township (15.9%). With the possibility of climate change bringing more precipitation to the county, and

with more individuals living in a municipality the populations risk to subsidence or sinkholes increases.

Current land use in Elk County can be seen in *Table 6 – Elk County Land Cover by Acres*, which outlines the residential and institutional/industrial/commercial land use broken down by 5-30%, 31-74% and greater than 74% impervious. Impervious surfaces allow pollutants from aerial and terrestrial sources to accumulate. During stormwater runoff, these pollutants will run into stormwater drains and directly to local waterbodies. When impervious surfaces increase so does the quantity, speed, temperature, and pollutant load of the stormwater runoff.

Figure 26 - Sinkhole Susceptibility in Pennsylvania

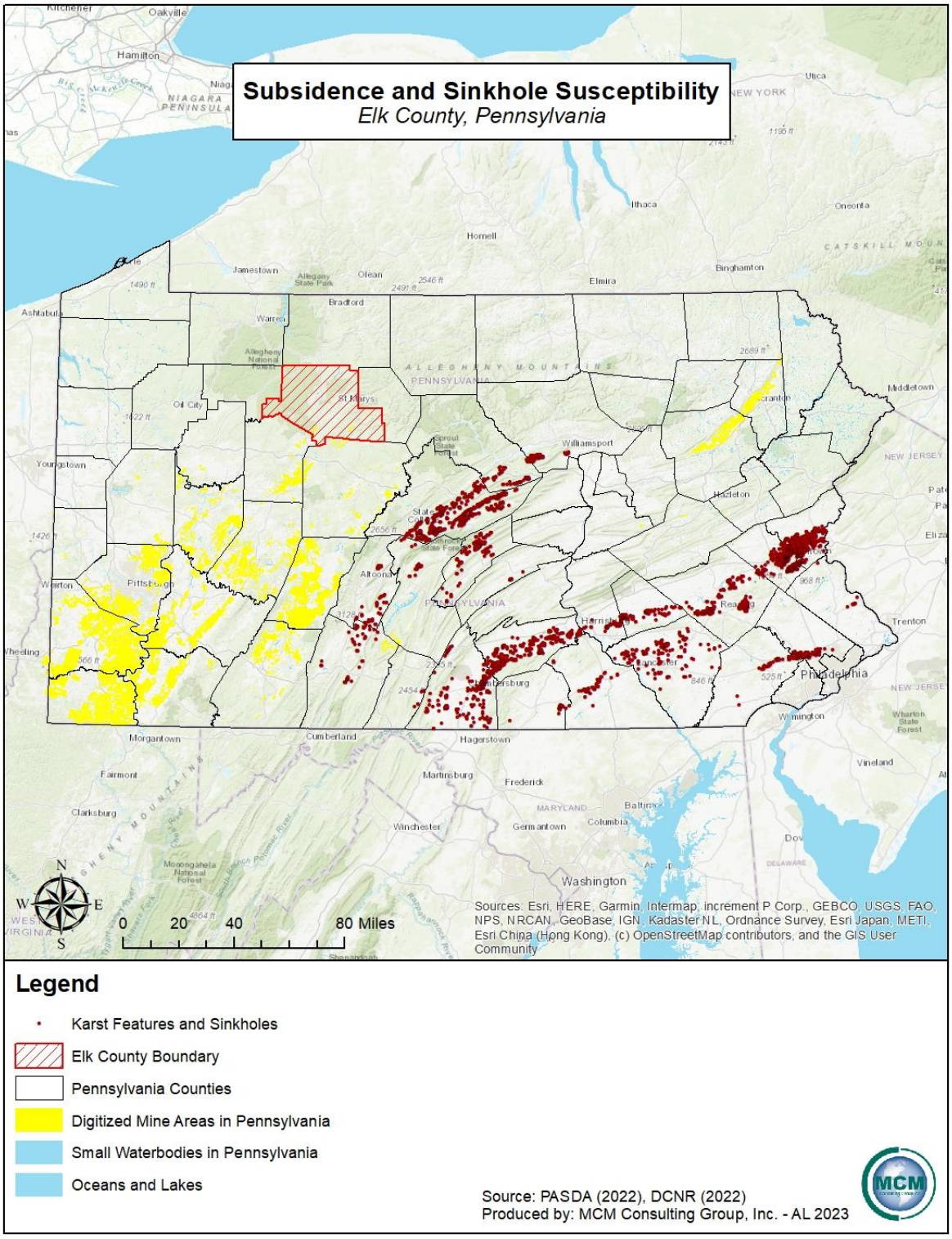


Figure 27 - Abandoned Mined Sites in Elk County

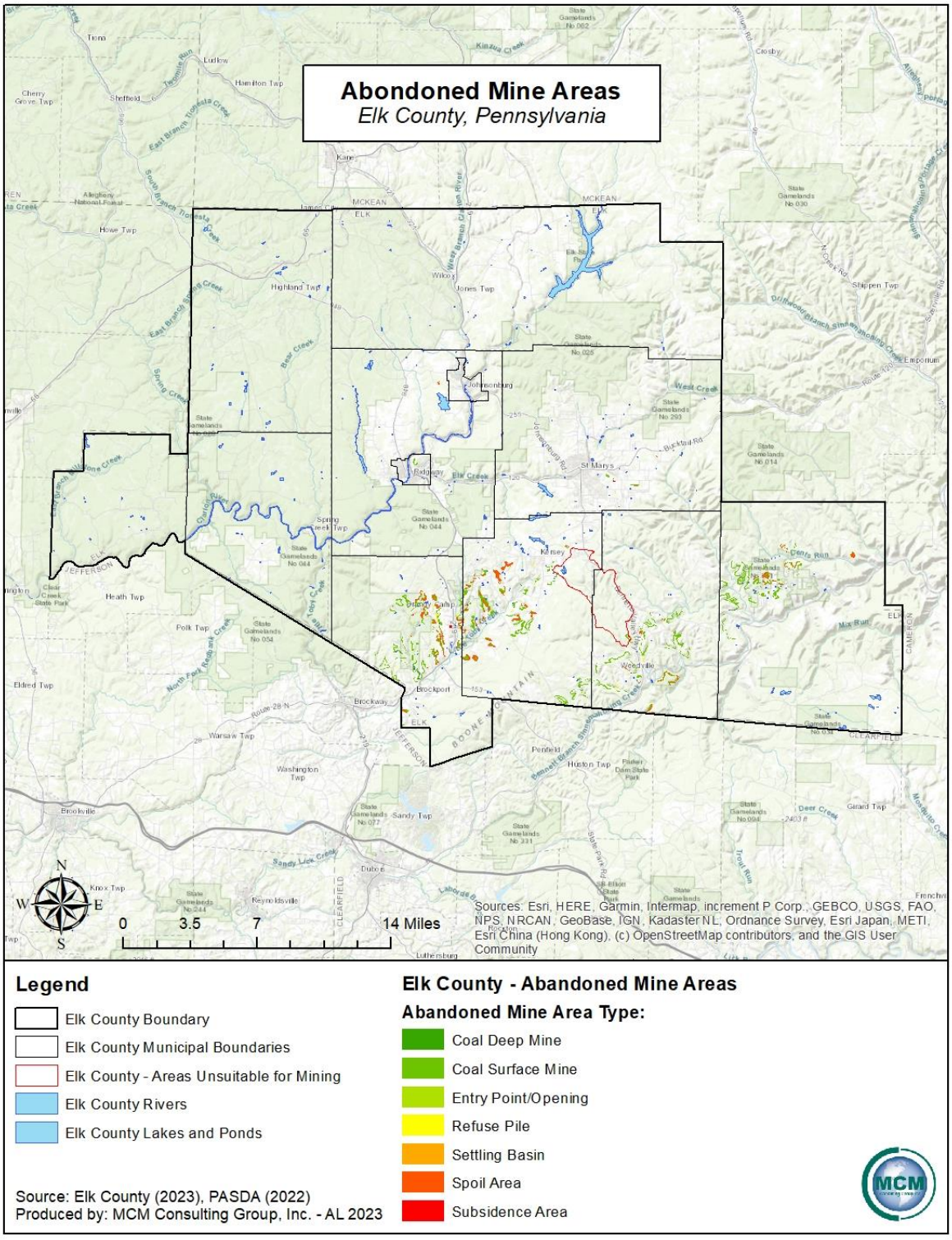


Figure 28 - Unsuitable Areas for Mining in Pennsylvania

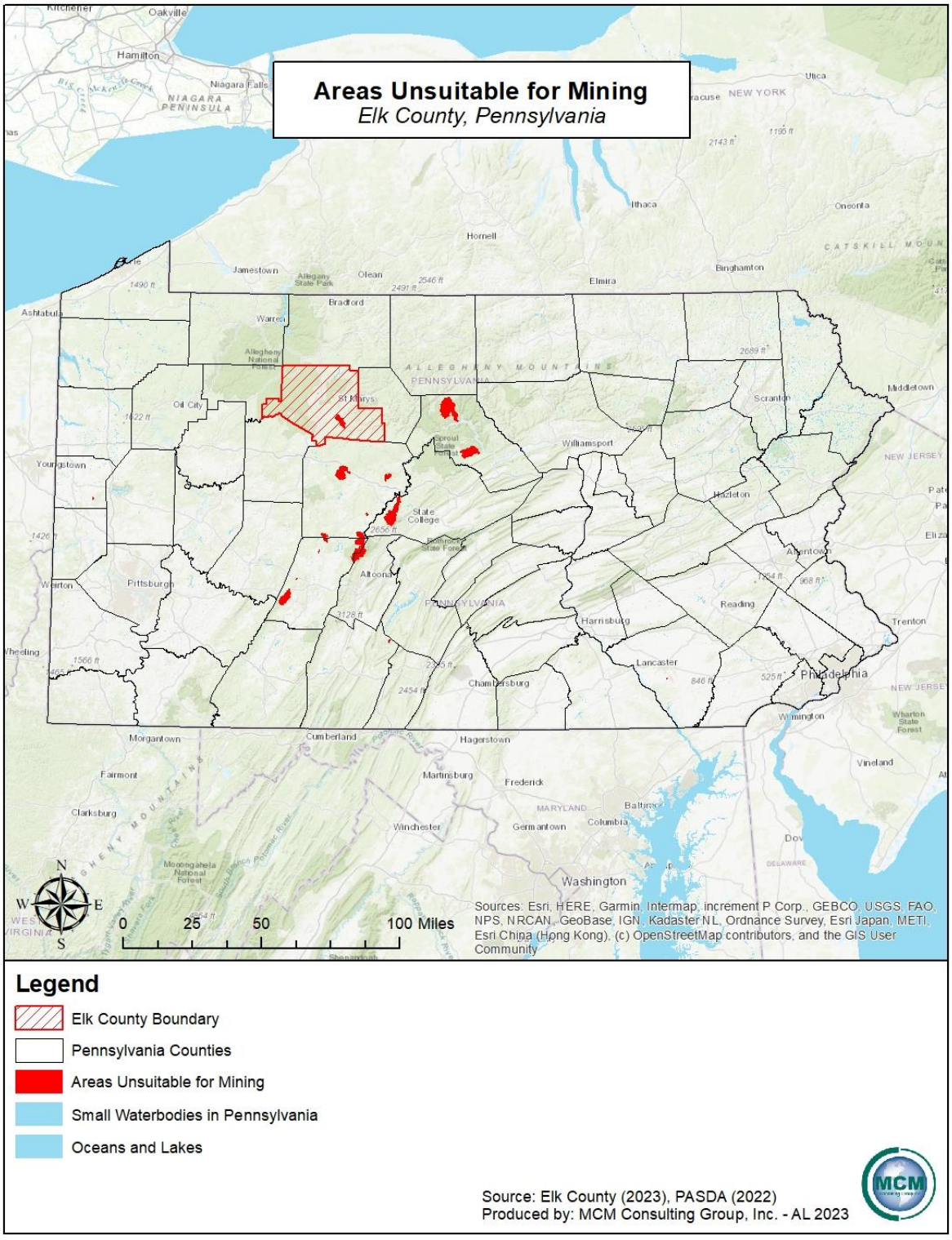
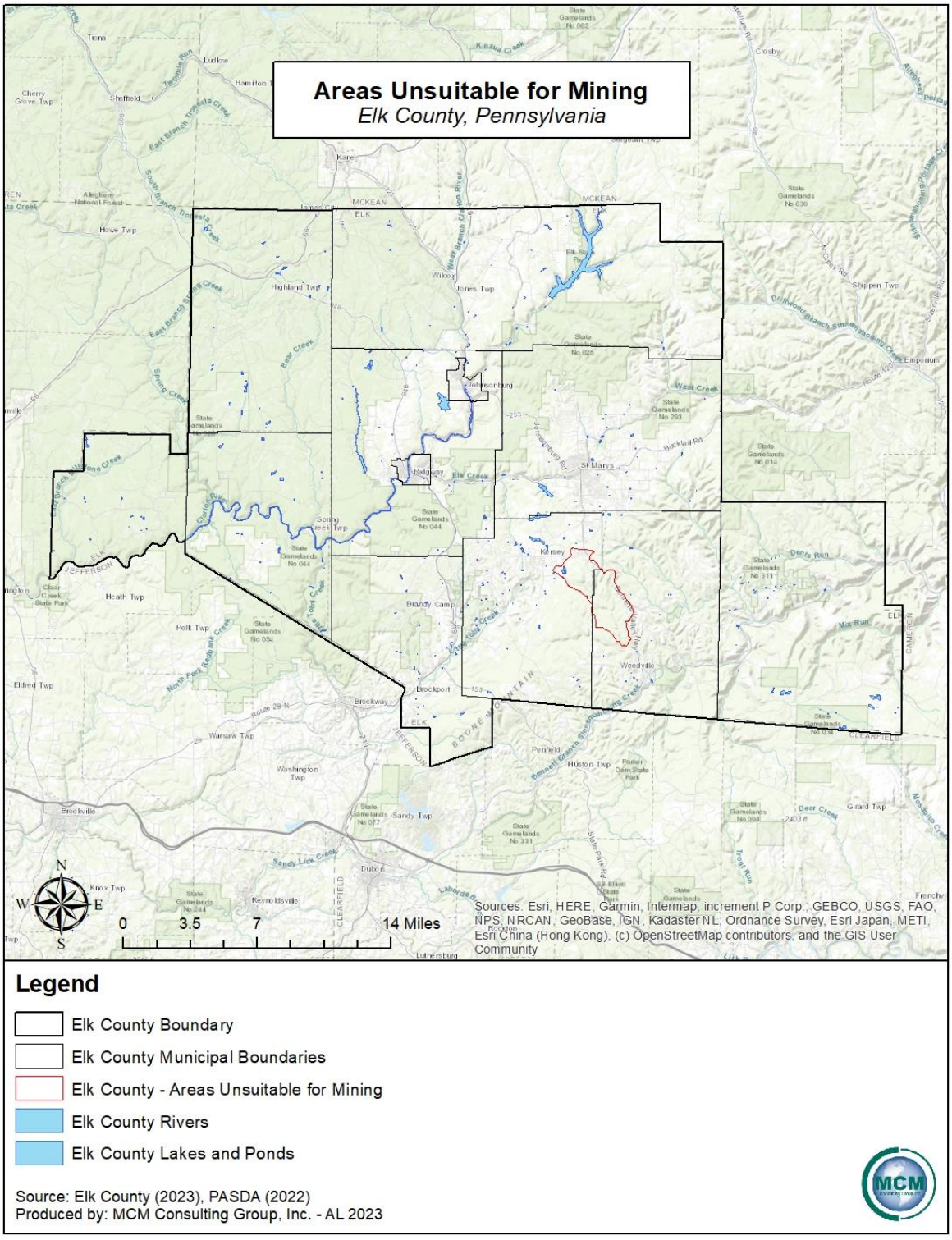


Figure 29 - Elk County Unsuitable Areas for Mining



4.3.9. Tornadoes/Windstorm

4.3.9.1 Location and Extent

Tornadoes and windstorms can occur throughout Elk County and are usually localized in their location and extent. Severe thunderstorms may result in conditions favorable for the formation of windstorms, including tornadoes. Tornadoes are nature's most violent storms and can cause fatalities and devastation to neighborhoods and municipalities within the county and region. Tornadoes can occur at any time during the day or night but are most frequent during the late afternoon and early evening, which are typically the warmest hours of the day. Tornadoes are most likely to occur in the spring and summer.

Tornadoes

There are two main types of tornadoes: supercell and non-supercell. Supercell tornadoes are the most common and often the most dangerous type of tornado. A rotating updraft is key to the development of a supercell and, eventually, a tornado. Once the updraft is rotating and being fed by warm air, a tornado is formed. The other type of tornado is categorized as non-supercell, which is not as common as a supercell tornado. One type of non-supercell tornado is the "Quasi-Linear Convective Systems" (QLCS). The QLCS tornadoes typically arise during the late night or early morning hours and are typically weaker and shorter-lived than supercell tornadoes. However, QLCS are more difficult to detect effectively. Another type of non-supercell tornado is a landspout. These tornadoes are narrow, rope-like funnels that form when a thundercloud grows without a rotating updraft, which causes the spinning motion common with tornadoes to appear near the ground.

Windstorms

Windstorms are experienced on a region-wide scale. The most frequent cause of windstorms in Pennsylvania are thunderstorms, although they may also be caused by hurricanes and winter storms. Windstorms are defined as sustained wind speeds of 40 mph or greater, lasting for at least one hour, or winds of 58 mph or greater lasting for any duration. There are a wide variety of windstorm events that can take place in Elk County.

4.3.9.2 Range of Magnitude

Tornadoes

Each year tornadoes account for $1.1 billion in damages and cause over eighty deaths nationally. Thus far, 2011 was the second worst year on record for deadly tornadoes behind 1936. The number of tornado reports has increased since 1950. While the extent of tornado damage is usually localized, the vortex of extreme wind associated with a tornado can result in some of the most destructive forces on Earth. The damage caused by a tornado is a result of the high-wind velocity and windblown debris, also accompanied by lightning or large hail. The most violent

tornadoes have rotating winds of 250 mph or more and are capable of causing extreme destruction and turning normally harmless objects into deadly projectiles.

Tornado movement is characterized in two ways: direction/speed of spinning winds and the forward movement of the tornado, also known as the storm track. The rotational wind speeds can range from 65 to more than 200 miles per hour (mph). The speed of forward motion can range from 0 mph to 50 mph. Forward motion of a tornado path can be a few to several hundred miles in length. Widths of tornadoes vary from less than 100 feet in diameter to more than a mile wide in regard to the largest tornadoes on record. The National Centers for Environmental Information (NCEI) reports that, "the maximum winds in tornadoes are often confined to extremely small areas and vary tremendously over short distance," which explains why one house in a tornado's path may be completely demolished while a neighboring house could remain untouched. Some tornadoes never touch the ground and remain short lived, while others may touch the ground or "jump" along its path.

The destruction from tornadoes can range from minor to severe depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light-weight construction, such as mobile homes. The Enhanced Fujita Scale, also known as the "EF-Scale", measures tornado strength and associated damages. The EF-Scale is an update to the earlier Fujita Scale, also known as the "F-Scale", that was published in 1971. These scales classify U.S. tornadoes into six intensity categories based upon the estimated maximum winds occurring within the wind vortex. This scale can be seen in *Table 41 – Enhanced Fujita Scale*. The EF-Scale became effective on February 1, 2007. Since its implementation by the National Weather Service in 2007, the EF-Scale has become the definitive metric for estimating wind speeds within tornadoes based upon damage to buildings and structures. Previously recorded tornadoes are reported with the older F-Scale values, but *Table 41 – Enhanced Fujita Scale* shows F-Scale categories with corresponding EF-Scale wind speeds.

Figure 30 – Pennsylvania Wind Zones identifies wind speeds that could occur across the state, which may be used as the basis for design and evaluation of the structural integrity of shelters and critical facilities. The majority of Pennsylvania falls within Zone III, meaning that the design of shelters and critical facilities should be able to withstand a three-second gust of up to 200 mph, regardless of whether the gust is a result of a tornado, hurricane, tropical storm, or windstorm incident. The western portion of the state falls within Zone IV, which indicates shelters can withstand up to 250 mph winds, while the eastern side falls within Zone II where shelters should be designed to withstand up to 160 mph.

Since Elk County falls within Zone III, shelters and critical facilities should be designed to withstand up to 200 mph winds, regardless of whether the gust is the result of a tornado, coastal storm, or windstorm event. While it is difficult to pinpoint the exact locations at the greatest risk

of a tornado, the southeast, southwest, and northwest sectors of the commonwealth are more prone to tornadoes.

Tornadoes/windstorms of all types have caused the following problems in Elk County:

- Power failures lasting four hours or longer.
- Loss of communications networks lasting four hours or more.
- Residents requiring evacuation or provision of supplies or temporary shelter.
- Severe crop loss or damage.
- Trees down or snapped off high above the ground/tree debris-fire fuel.
- Toppled high profile vehicles, including those containing hazardous materials.

Table 41 - Enhanced Fujita Scale

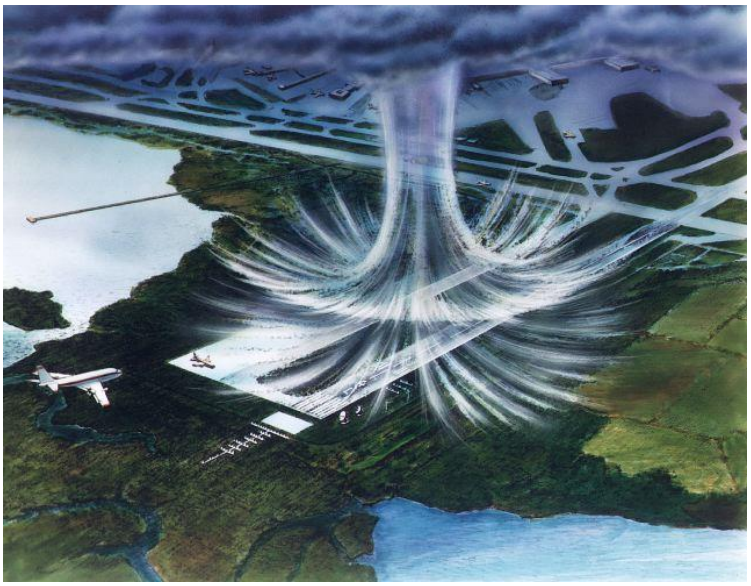
Enhanced Fujita Scale			
EF-Scale Number	**Wind Speed (MPH)**	**F-Scale Number**	**Description of Potential Damage**
EF0	65–85	F0-F1	**Minor damage**: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	86-110	F1	**Moderate damage**: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111–135	F1-F2	**Considerable damage**: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136–165	F2-F3	**Severe damage**: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.

Enhanced Fujita Scale			
EF-Scale Number	**Wind Speed (MPH)**	**F-Scale Number**	**Description of Potential Damage**
EF4	166–200	F3	**Devastating damage**: Well-constructed houses and whole frame houses completely leveled; cars thrown, and small projectiles generated.
EF5	>200	F3-F6	**Extreme damage**: Strong frame houses leveled off foundations and swept away; automobile-sized projectiles fly through the air in excess of 100 m (300 ft.); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation.
Source: NWS, 2007			

Most of the tornadoes that have struck Elk County have occurred in the Hallton or Brockport areas. In 1985, a total of twenty-three confirmed tornadoes touched down across Eastern Ohio, Southwestern New York, and Central/Western Pennsylvania. This outbreak remains the worst in recorded history for this area. Of these twenty-three tornadoes, eight were of violent intensity (F4 or F5) with estimated wind speeds over 200 mph. Elk County was impacted by the 1985 outbreak. There were two tornados on May 31, 1985, in Elk County, one was an F2 and the other was an F4. There were no reports of injuries, deaths, or property damage during these tornado events.

Windstorms

Windstorms can be broken down into multiple categories. Straight-line winds are the most common wind event and are different from tornadic winds. It is a ground level, non-rotational, wind that comes out of a thunderstorm. Downdrafts are columns of air that rapidly sinks toward the ground and are classified as either a microburst or microburst. A macroburst is the outward burst of strong winds that are near or at the surface with horizontal dimensions greater than 2 ½ miles. Macrobursts winds may begin over a smaller area and then spread out to a wider area, sometimes producing damage similar to a tornado. On the other hand, microbursts are smaller outward bursts of strong winds near or at the surface. Microbursts are less than 2 ½ miles in horizontal dimension and are typically short-lived winds that last a maximum of ten minutes, with windspeeds reaching up to 100 mph. Microburst events can be wet or dry events. Wet microbursts are typically associated with heavy precipitation at the surface. Dry microbursts do not have precipitation associated with them and are commonly found in the western portion of the United States.



A gust front is characterized by wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Derecho is a long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho contains various downbursts and microbursts. If the wind damage is more than 240 miles and includes wind gusts of at least 58 mph, the event would then be classified as a derecho.

4.3.9.3 Past Occurrence

Elk County has experienced fifteen tornado events since 1954, and 135 wind incidents (high winds, strong winds, and thunderstorm winds) between 2000 and 2022. The most recent of these events are shown in *Table 42 – Elk County Tornado History* and *Table 43 – Elk County High Wind History*. Numerous sources provide information in regard to past occurrences and losses associated with tornadoes/windstorms in Elk County and the commonwealth as a whole. Due to the number of sources available with information, specific number of events and losses could vary slightly between sources. Tornado data was only present until 2021, while windstorm data was only available until 2019, even though more recent events could have possibly occurred. Historically, the county has experienced both severe windstorms and tornadoes.

The most recent tornado impacted Hallton on October 16, 2021. There was one reported injury and $20,000.00 in property damage associated with this EF1 tornado.

Table 42 - Elk County Tornado History

Elk County **Tornado History**					
Location	**Date**	**Magnitude (F/EF Scale)**	**Deaths**	**Injuries**	**Property Damage**
Brockport	06/20/2001	F1	0	0	10K
Highland Corners	08/19/2001	F1	0	0	0K
Ketner	07/26/2009	EF1	0	0	5K
Force	08/-9/2009	EF1	0	0	0K
Hallton	05/01/2017	EF2	0	0	0K
Dahoga	05/01/2017	EF1	0	0	0K
Brockport	08/21/2018	EF1	0	0	5K
Kylers Corners	10/02/2018	EF0	0	0	0K
Byrnedale	05/04/2021	EF1	0	0	0K
Hallton	10/16/2021	EF1	0	1	20K
Source: NOAA NCEI, 2023 Estimated Values are marked* There were no reported crop damages associated with any of the events listed above.					

Table 43 - Elk County High Wind History

Elk County **High Wind History**				
Location	**Date**	**Magnitude (knots)**	**Injuries**	**Property Damage**
Countywide	12/12/2000	Unknown	0	13.9K
Countywide	01/10/2001	Unknown	0	5.55K
Countywide	03/09/2002	50kts. E	0	0K
Countywide	12/01/2004	60kts. EG	0	0K
Countywide	02/17/2006	52kts. EG	0	0K
Countywide	12/01/2006	45kts. ES	0	0K
Countywide	01/30/2008	52kts. EG	0	0K
Countywide	09/14/2008	50kts. EG	0	0K
Countywide	10/07/2009	43kts. EG	0	5K
Countywide	04/04/2018	52kts. EG	0	0K
Countywide	02/24/2019	52Kts. EG	0	0K
Source: NOAA NCEI, 2023 Estimated Values are marked* There were no reported crop damages associated with any of the events listed above.				

4.3.9.4 Future Occurrence

In the United States, tornado activity has increased in variability, with a general decrease in the number of days a year on which activity occurs, but an increase in the number of tornadoes on those days. This indicates an increase in tornado outbreaks. The future probability of a disastrous tornado occurring in Elk County is ranked as possible, but not highly likely. While the chance of being hit by a tornado in Elk County is small, the damage that results when the tornado arrives can be devastating. An EF-5 tornado, with a 0.019% annual probability of occurring, can carry wind velocities of 200 mph, resulting in a force of more than 100 pounds per square foot of surface area. This is a "wind load" that exceeds the design limits of most buildings in Pennsylvania. As jurisdictions within the county grow, and as residential and commercial construction continues, the number of people and properties will be greatly affected by tornadoes and windstorms as they increase accordingly.

Based on historic patterns, tornadoes are unlikely to remain on the ground for long distances, especially in areas of the country with hilly terrain, such as the majority of Pennsylvania. However, the high historical number of windstorms with winds at or over 50 knots indicates that the annual chance of a windstorm in the county is uniquely high. The annual tornado season has begun to lengthen, with the season starting earlier than it has historically and ending later. Pennsylvania had, for example, a record number of tornadoes in April and May of 2019 compared to any other April and May on record. Climate change is causing temperatures and air moisture to increase, increasing the frequency and intensity of tornadoes and windstorms. There remains some uncertainty regarding the recurrence of tornadoes. Therefore, the number of future tornadoes and windstorm events could potentially increase due to known and unknown factors.

Based on historical incidents, there are three zones in Pennsylvania that can either experience less than one, one to four, or five to ten of EF-2 or above tornadoes per 3,700 square miles. Communities in Elk County, as shown in *Figure 31 – Tornado Activity in Pennsylvania* and *Figure 32 – Tornado Activity in Elk County* below, are expected to have zero to four tornados annually as a future occurrence, depending upon geographic area. The approximation of zero to four tornados annually assists with determining the rate of future tornado occurrences within Elk County. Future tornadoes will be similar to those that affected the county in past events.

Windstorm events occur on a more frequent basis compared to tornadoes. Elk County, specifically, experiences windstorm events more commonly than tornadoes, which causes power failure, loss of communication networks, and residents requiring temporary shelters and provision of supplies. Therefore, unlike tornadoes, this hazardous event has a highly likely probability for future events to occur within the county.

Climate change and its relationship with tornado outbreaks is hard to identify. Some recent studies suggest that as average temperatures begin to rise, so will the intense storms that often lead to the creation of tornadoes. Warm, moist air is the most important aspect for developing strong tornadoes. Climate change can exacerbate this, and it could potentially lead to an increase in frequency and the severity of the events. Although not yet proven, this is one of the most prevalent theories on how climate change can impact tornado frequency and intensity.

4.3.9.5 Vulnerability Assessment

The frequency of windstorms and minor tornadoes is expected to remain relatively constant; vulnerability increases in more densely developed areas. Factors that impact the amount of damage caused by a tornado include the strength of the tornado, the time of day, and the area of impact. Usually, such distinct funnel clouds are localized phenomena impacting a small area. However, the high winds of tornadoes make them one of the most destructive natural hazards. There can be many cascading impacts of tornadoes and windstorms including, but not limited to, transportation accidents, hazardous material spills, flooding, and power outages. A proper warning system is vital for the public to be informed of what to do and where to go during such events.

Additional dangers that accompany tornado-associated thunderstorms, and which increase the vulnerability of Elk County, include:

- Flash floods – 146 deaths annually nationwide.
- Lightning – 75 to 100 deaths annually nationwide.
- Damaging straight-line winds – reaching 140 mph wind speed.
- Large hail – can reach the size of a grapefruit and can cause several million in damages annually to property and crops

The economy of Elk County is highly vulnerable to tornadoes. While there may be severe impact on financial and commercial systems of the economy, these storms, and the damage they cause, can disrupt business long-term. The local economy is vulnerable due to the possibility of being crippled by tornadoes and windstorms and their cascading effects when buildings and supporting infrastructure are destroyed in a storm. Power outages can create work stoppages, while transportation accidents and road closures can limit transportation of goods and services. Additionally, flooding cannot be discounted as it can destroy physical structures, merchandise, and equipment essential for business operation.

Elk County's environment is also vulnerable to tornado events. However, since tornado events are typically localized, environmental impacts are rarely widespread. The impact of windstorms

on the environment typically takes place over a large area. In either case, where these events occur, severe damage to plant species is likely. This includes uprooting or total destruction of trees and an increased threat of wildfire in areas where dead trees are not removed. Most notably, hazardous material spills can pollute ground water systems and vegetation. In the case of hazardous material spills, the local environment can be negatively impacted and can cause extensive cleanup and mitigation efforts. Elk County is considered a rural county with a great amount of tourism that occurs in the surrounding hills, mountains, and state parks. Not only is the environment at risk to tornadoes and windstorms, but hikers, tourists, and hunters are also at risk when out in the environment. Consequently, in the event of a tornado or severe storm, these tourists have limited emergency notification measures which result in high vulnerability. A storm has the ability, potentially, to destroy structures, damage private and public property, and injure citizens and tourists to the area. People with disabilities, the elderly, functional needs, and non-English speaking residents are more vulnerable to tornadoes, windstorms, and their cascading effects. Without assistance to evacuate and/or seek shelter, and with potential difficulty understanding information, these at-risk populations may be unable to prepare themselves, or their homes and other possessions, to safely endure the storm.

Tornado, windstorm, and cascading events may affect a small portion, or the entirety, of the county. Therefore, it is important to identify specific critical facilities and assets that are most vulnerable to this hazard. Critical facilities are highly vulnerable to windstorms and tornado events. While many severe storms can cause exterior damage to structures, tornadoes can destroy structures, along with their surrounding infrastructure, immediately halting their function. Tornadoes are often accompanied by severe storms which can be threatening to critical facilities within the county. Many secondary effects from these disasters can jeopardize the operation of these critical facilities as well. Critical facilities are particularly vulnerable to power outages which can leave facilities functionless, potentially crippling infrastructure supporting the population of the county. Due to Pennsylvania Uniform Construction Code Act 45, trailers and mobile homes built before 2004, because of their lightweight construction and often unanchored design, are more vulnerable to high winds/tornadoes and will generally sustain more damage than will mobile homes built after 2004.

There are no historic or cultural properties that are listed with the National Register of Historic Places that are at an increased risk of tornadoes in Elk County. This analysis was run off of the previous tornado paths in the county and 500 feet vulnerability zones. These locations are where hurricanes have previously developed and may develop again.

All of the critical infrastructure and community lifeline facilities are vulnerable to tornado events. Some of the critical infrastructure can be considered at a higher risk due to the life safety

missions that they serve. Facilities that are within 500 feet of previous tornado tracks can be considered at high risk of tornados.

Critical infrastructure and community lifelines at high risk:

- Jones Township municipal building
- Ridgway Borough police department
- Ridgway Borough post office

Municipalities with an increased risk of tornadoes (previously impacted):

- Highland Township
- Horton Township
- Jay Township
- Jones Township
- Ridgway Borough
- Ridgway Township
- Spring Creek Township
- City of St Marys

Municipalities without an increased risk of tornadoes (not previously impacted):

- Benezette Township
- Fox Township
- Johnsonburg Borough
- Millstone Township

Two of the twelve municipalities in Elk County have experienced a population gain between the 2010 and 2020 US Census. These municipalities are Benezette and Millstone townships and can also be seen in *Table 3 – Population Change in Elk County*.

Land use, in the form of a built environment, such as residential expansion, can cause tornado impact severity to increase. Impact severity increases when built environment expansion provides an influx of people, infrastructure, and critical infrastructure in harm's way.

Figure 30 - Pennsylvania Wind Zones

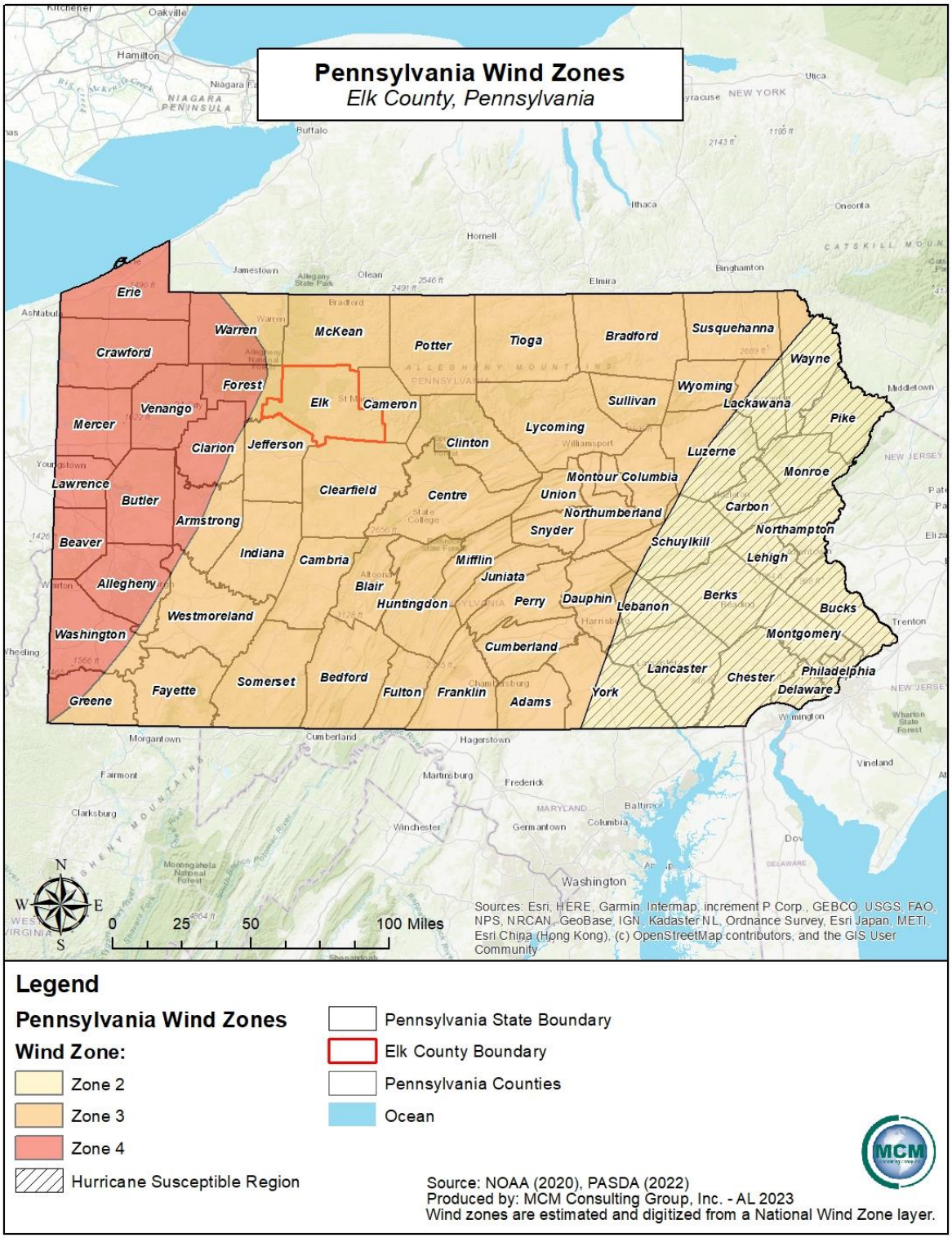


Figure 31 - Tornado Activity in Pennsylvania

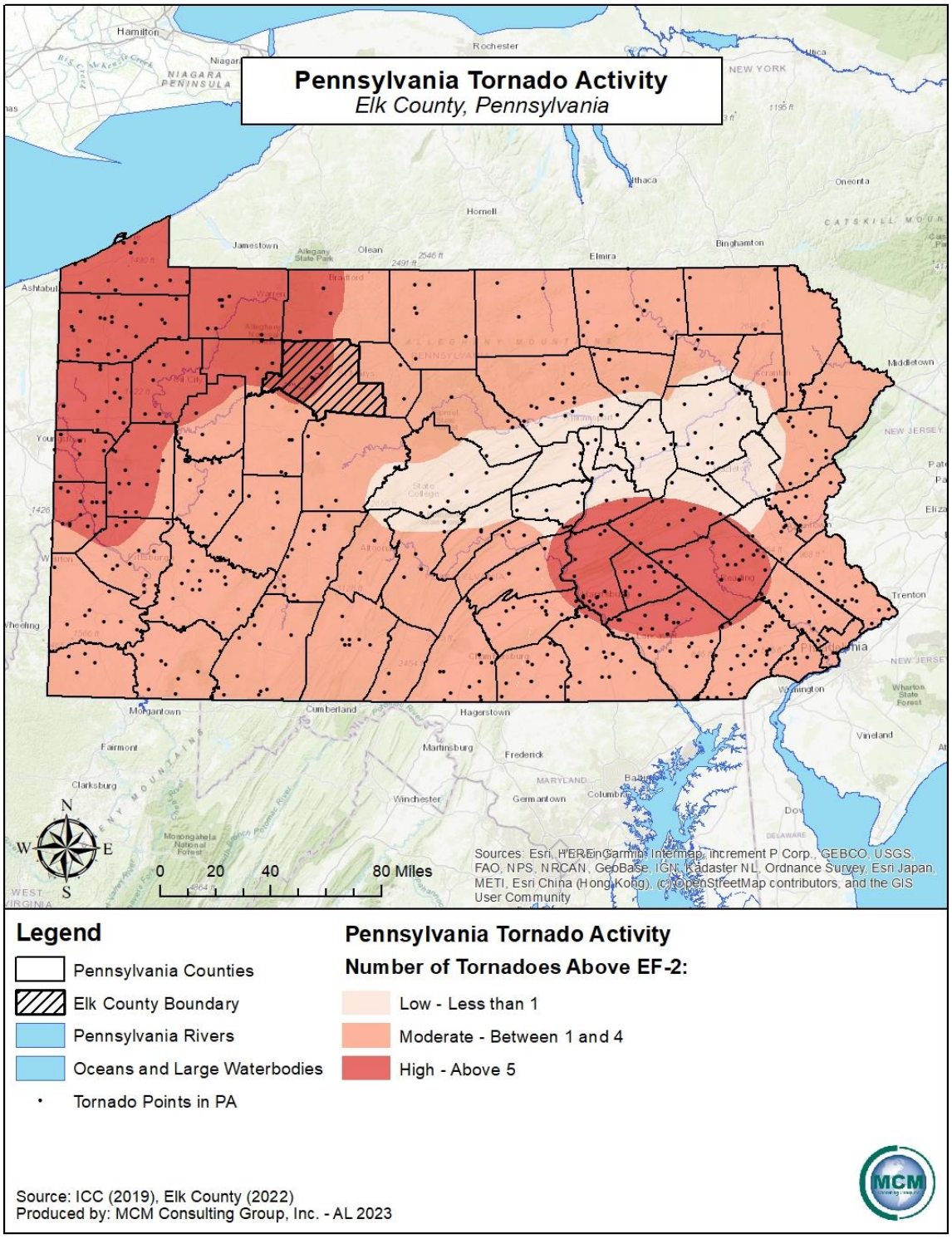
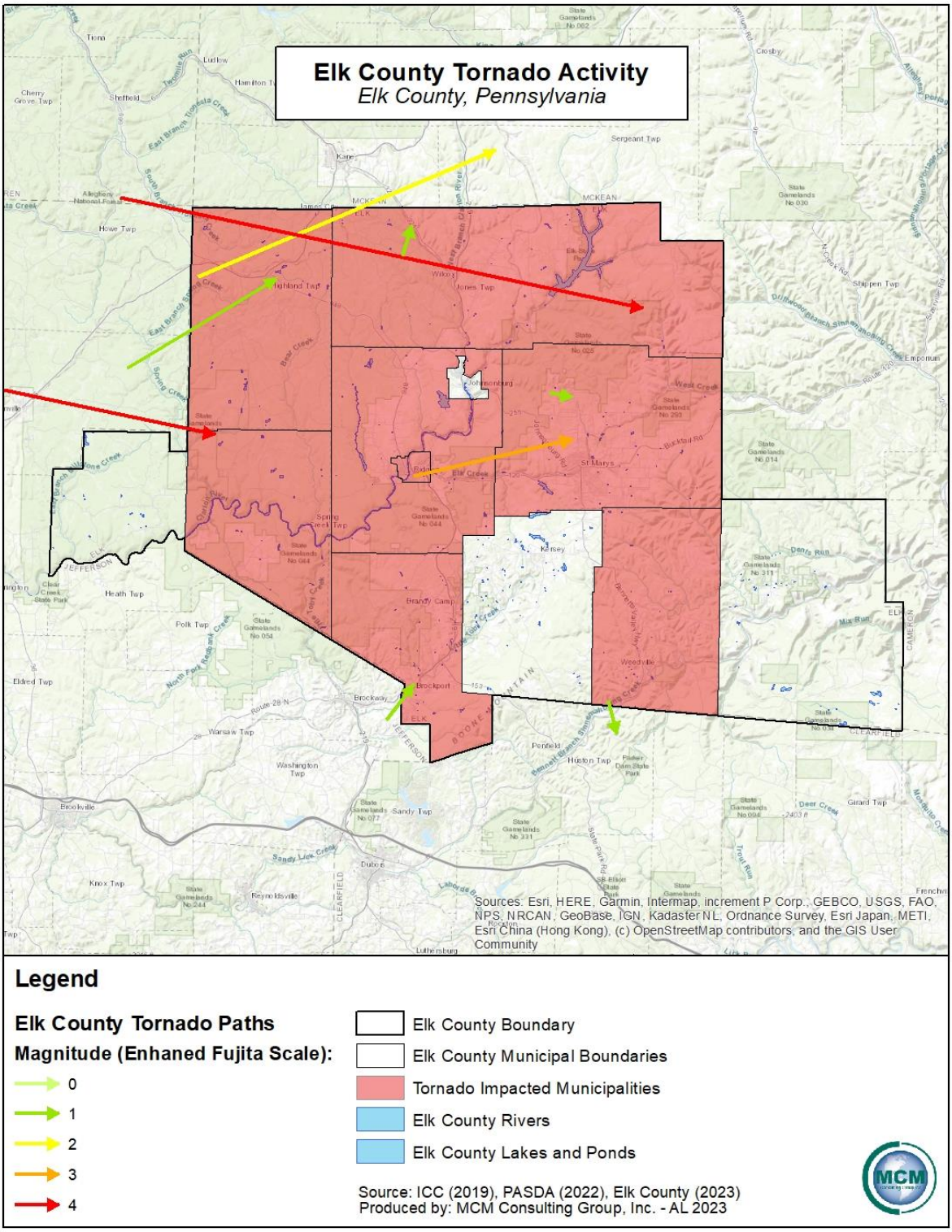


Figure 32 - Tornado Activity in Elk County



4.3.10. Wildfire

4.3.10.1 Location and Extent

The most prevalent causes of devastating wildfires are droughts, lighting strikes, arson, human carelessness, and in rare circumstances, spontaneous combustion. Most fires in Pennsylvania are caused by anthropogenic fires such as debris burns that spread and get out of control. A fire, started in somebody's backyard, could travel through dead grasses and weeds into bordering woodlands starting a wildfire. Major urban fires can cause significant property damage, loss of life, and residential or business displacement. While wildfires are a natural and essential part of many native Pennsylvania ecosystems (e.g., pitch pine and scrub oak woodlands), wildfires can also cause devastating damage if they are undetected and allowed to propagate unfettered. Wildfires most often occur in less developed areas such as open fields, grass, dense brush, or forests where they can spread rapidly by feeding off vegetation and combustible fuels. Wildfires are most prevalent under prolonged dry and hot spells, or general drought conditions.

A large portion of Elk County is covered by either farmland or forested areas, increasing the geographic extent of wildfire vulnerability in the county. Under dry conditions or droughts, wildfires have the potential to burn forests as well as croplands. For recreational enjoyment, the county boasts several local parks and natural areas that include a series of trail systems – all of which are at risk for wildfires.

4.3.10.2 Range and Magnitude

Forested areas, croplands and properties that are at the interface between wild lands and human development are most at risk for being impacted by and causing wildfires. If an urban fire or wildfire is not contained, secondary impacts including power outages may result. Other negative impacts of wildfires can include death of people, livestock, fish, and wildlife, and destruction of valuable property, timber, forage, recreational and scenic values. Wildfires can also cause severe erosion, silting of stream beds and reservoirs, and flooding due to a loss of ground cover.

Almost all the wildfires in the county occur in remote areas or areas away from residential structures. Unlike the wildland fires that occur in other parts of the country and affect vast areas of land and residential communities, most fires in Elk County are contained before they cause damage or extensive property loss. However, the county recognizes that wildfires of some magnitude will continue to occur in Elk County and will have more detrimental effects if development in and/or around the natural areas increases.

The United States Forest Service utilizes the Forest Fire Assessment System to classify the dangers of wildfire. *Table 44 – Wildland Fire Assessment System* identifies each threat classification and provides a description of the level.

Table 44 - Wildland Fire Assessment System

Wildland Fire Assessment System *(U.S. Forest Service)*	
Rank	**Description**
Low (L)	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.
Moderate (M)	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy.
High (H)	All fine dead fuels ignite readily, and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme (E)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes, or the fuel supply lessens.

4.3.10.3 Past Occurrence

The Pennsylvania Department of Conservation and Natural Resources (DCNR) has an extensive history of reported wildfires in its state forestry system and districts. Historically, Elk County experiences between one and two of these types of fires annually with all fires being relatively small. However, due to the many acres of farmland, forested areas, and open space in the county, under the right conditions the potential exists for a significant wildfire. A majority of Elk County

lies within District 13 of the DCNR's Bureau of Forestry. District 13 encompasses portions of Cameron, Elk, and McKean counties. Portions of Elk County also lie within District 8 and District 9. For the purposes of this hazard profile, District 13 will be used as a basis for analysis. In 2021, there was a total of nine wildfires in District 13 that were responsible for destroying 19.1 acres. Across the entire Commonwealth, there were four fatalities and seventeen injuries for the 2021 wildfire season. Data from 2021 is the most recent reporting year for wildfire data in Pennsylvania at the time of this writing.

District 13 reports the following twenty-two-year wildfire summary based on observed and reported wildfires. *Table 45 – Annual Summary of Wildfire Events* illustrates the number of acres burned in a certain number of fires for District 13 from the year 2000 to the year 2021.

Table 45 - Annual Summary of Wildfire Events

Annual Summary of Wildfire Events			
Year	**Number of Fires**	**Acres**	**Increase or Decrease**
2000	18	95.6	-
2001	26	112.2	⇧
2002	11	26.6	⇩
2003	7	43.1	⇧
2004	0	0.0	⇩
2005	3	50.5	⇧
2006	2	11.4	⇩
2007	15	19.5	⇧
2008	5	15.0	⇩
2009	10	281.3	⇧
2010	7	18.9	⇩
2011	0	0.0	⇩
2012	8	252.0	⇧
2013	7	380.9	⇩
2014	5	123.7	⇧
2015	3	45.6	⇩
2016	4	101.6	⇧
2017	3	0.5	⇩
2018	4	5.6	⇧
2019	5	4.4	⇩
2020	22	19.0	⇧
2021	9	19.1	⇧
Totals:	**174**	**1626.5**	**⇧ 11/ ⇩10**
Source: PA DCNR, 2023			

In recent years, the number of prescribed burns in Pennsylvania has been increasing. This corresponds to an understanding of the need for fire in many natural ecosystems and management strategies for reducing vulnerability to wildfire; it also improves hunting opportunities. In 2022 there were sixty-three prescribed burns that were carried out by the Pennsylvania Department of Conservation and Natural Resources (DCNR). This number is up by seventeen prescribed burns from the total number of reported prescribed burns in 2021 by the DCNR only, with a total of forty-six.

4.3.10.4 Future Occurrence

Annual occurrence of urban fires and wildfires in Elk County are expected. Urban fires are most often the result of human errors, outdated wiring and occasionally, malintent (arson). The occurrence of large scale and intense wildfires is somewhat unpredictable and highly dependent on environmental conditions and human response. Weather conditions play a major role in the occurrence of wildfires, so in the event of drought conditions, wildfire caution should be heightened. Any fire without the quick response or attention of firefighters, forestry personnel, or visitors to the forest, has the potential to become a wildfire.

Climate change is expected to bring an elongated wildfire season and more intense and long-burning fires (Pechony & Shindell, 2010). In some regions of the United States, this is a very real concern. Northern California has experienced unprecedented devastating wildfires in 2017, 2018, 2019, 2020, 2021, and 2022. The fires that have been occurring in California are thought to be burning faster and hotter due to worsening drought conditions caused by increased climate change (Cvijanovic et al., 2017). Wildfire conditions in Pennsylvania are not nearly as severe as in Northern California, but the intensification is a signal that the changes brought by climate change are relevant to wildfires. In Pennsylvania, higher air temperatures and earlier warming in the spring are expected to continue, resulting in more wildfire prone conditions in the summer and fall (Shortle et al., 2015).

4.3.10.5 Vulnerability Assessment

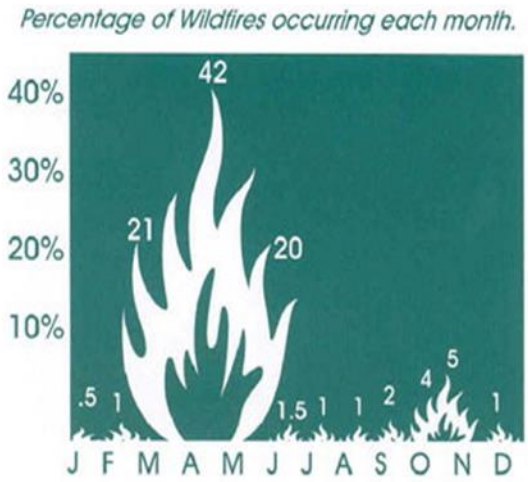
The size and impact of a wildfire depends on its location, climate conditions, and the response of firefighters. If the right conditions exist, these factors may often mitigate the effects of wildfires; however, during a drought, wildfires can be devastating. The highest risk for wildfires in Pennsylvania occurs during the spring (March to May) and the fall (October to November) months and 99% of all wildfires in Pennsylvania are caused by people. Approximately 83% of all Pennsylvania wildfires occur in the months outlined above. In the spring, bare trees allow sunlight to reach the forest floor, drying fallen leaves and other ground debris and increasing wildfire vulnerability. In the fall, the surplus of dried leaves is fuel for fires. *Table 46 – Seasonal*

Wildfire Percentage shows the wildfire percentage occurrence during each month in Pennsylvania.

Firefighters and other first responders can encounter life-threatening situations due to forest and wildfires. Traffic accidents during a response and the impacts of fighting the fire once on scene are examples of first responder vulnerabilities.

The Wildland Urban Interface (WUI) was nationally mapped by a United States Department of Agriculture Forest Service effort in 2015 that used data from 1990-2010 to develop a robust dataset that related housing density and vegetative density. The dataset provides a way to identify locations where larger numbers of people are living in or near natural areas that could be at risk in the event of a wildfire. The WUI defines two types of communities – interface and intermix. Intermix refers to areas where housing and wildland vegetation intermingle, and interface refers to areas where housing is in the vicinity of a large area of dense wildland vegetation. The WUI was the fastest-growing land use type in the United States between 1990 and 2010. Factors behind the growth include population shifts, expansion of cities into the wildlands, and the expansion of new vegetation growth. The primary cause has been the migration of people, not vegetation growth.

Table 46 - Seasonal Wildfire Percentage



Pennsylvania is among the states with the largest WUI and the most housing units in a WUI designated area. Pennsylvanians desire the proximity of natural beauty in their daily lives, and the growth in WUI housing noted above illustrates this. *Figure 33 – Wildland Urban Interface* shows the extent of Elk County and the critical infrastructure facilities, functional needs facilities, and fire stations. Wildfire hazard is defined by conditions that affect wildfire ignition and/or behavior such as fuel, topography, and local weather. The many addressable structures in the Wildland Urban Interface and Intermix zones are broken up by assessed parcel use codes.

Within the Wildland Urban Interface for Elk County, there are approximately two historic and cultural properties that are located in an area with an area of high-density interface or high-density intermix. Those locations are the Ridgway Armory and the John E. Weidenboerner House. Also potentially impacted due to their location in an areas of high-density interface or high-density intermix are five critical facilities or community lifeline facilities. The breakdown

of these locations include one fire station, one grocery store, one homeless assistance facility, one police department, and one toxic release inventory location.

There are seven fire departments that serve Elk County, a list of which can be seen in *Table 61* of the emergency services profile. Each fire department conducts its own schedule of in-house training sessions for its members.

The response of firefighters is integral to the containment of wildfires in the county. There is a potential for fire stations and services to close, which affects response to a wildfire in Elk County**.** *Figure 34 – Fire Stations Locations* illustrates the position of fire stations and the location of state game lands, state forests, and natural areas within Elk County. It is recommended that each municipality assess vulnerabilities to department closures by building a relationship with their local providers and planning accordingly for if a local service were to close.

At the time of the writing of this plan, it is possible that the continuing COVID-19 pandemic will impact the availability of firefighters and their response times. Many fire departments have created and begun to enforce new regulations regarding responding to emergencies during the pandemic.

Municipalities with high risk due to wildfires (with areas of high-density interface or intermix):

- Fox Township
- Highland Township
- Horton Township
- Jay Township
- Johnsonburg Borough
- Jones Township
- Ridgway Borough
- Ridgway Township
- City of St Marys

Municipalities with lower risk due to wildfires (no areas of high-density interface or intermix):

- Benezette Township
- Millstone Township
- Spring Creek Township

As seen in *Table 3 – Population Change in Elk County*, ten of the twelve municipalities in Elk County have experienced a population loss since the previous 2010 US Census. However, Benezette Township (4.4% or a total of nine people) and Millstone Township (15.9% or a total of thirteen people) saw minor total population growth over the same period. Based on this information, it can be speculated that these two municipalities may have an increased risk of wildfire conditions, since 2010, due to the increase in population.

Elk County promotes fishing, hunting, camping, hiking, canoeing, and other outdoor activities, the risk of these land use events can increase the risk of wildfires starting. Approximately ninety percent of land use in Elk County is forest areas. There are four state game lands, two state forests, and one national forest that make up a large portion of the county, see *Table 6 – Elk County Land Cover by Acres*. Conditions of drought or invasive species that could damage forested areas can lead to wildfires. Wildfires can lead to devastation which can foster landslides and flash flood events.

Figure 33 - Wildland Urban Interface

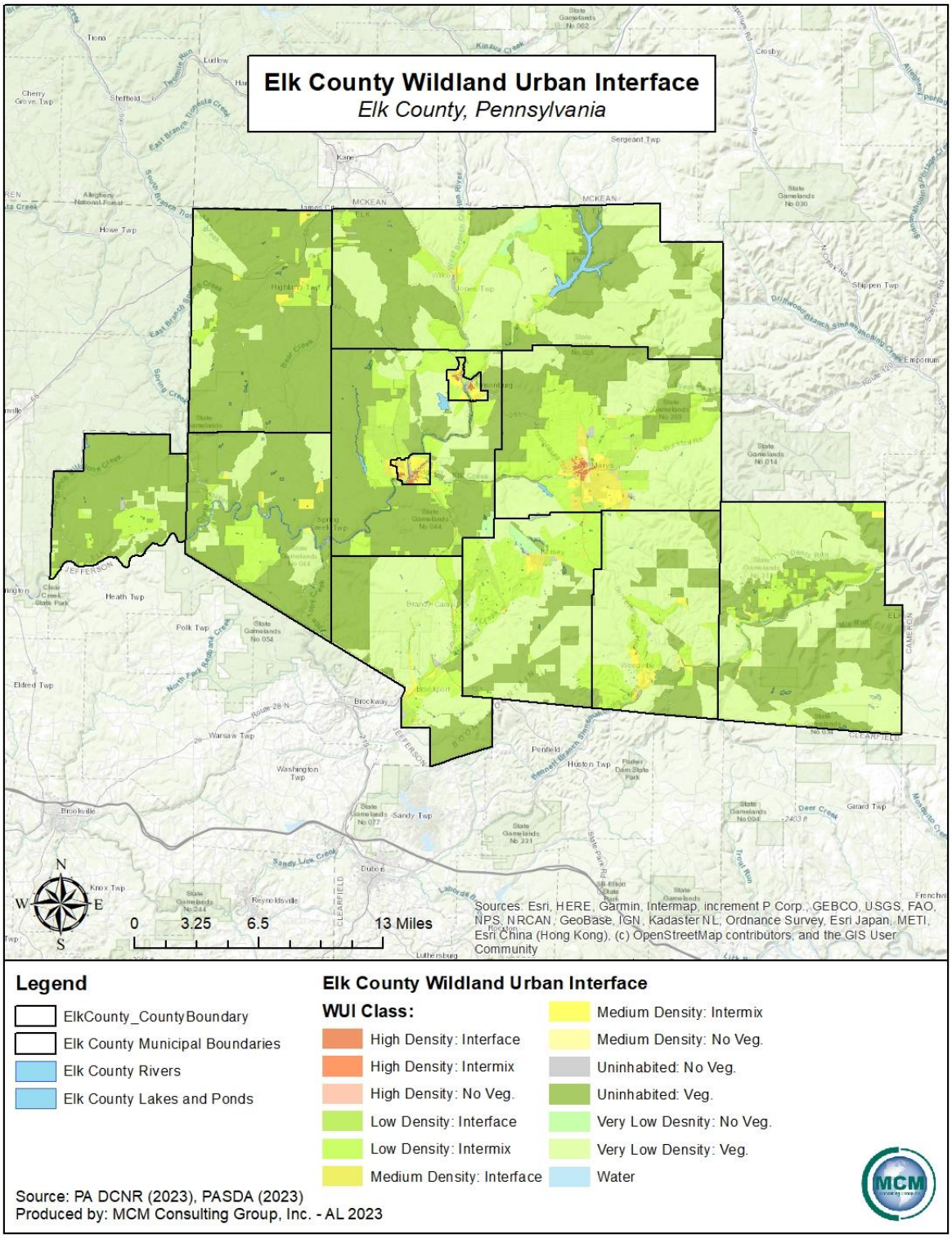
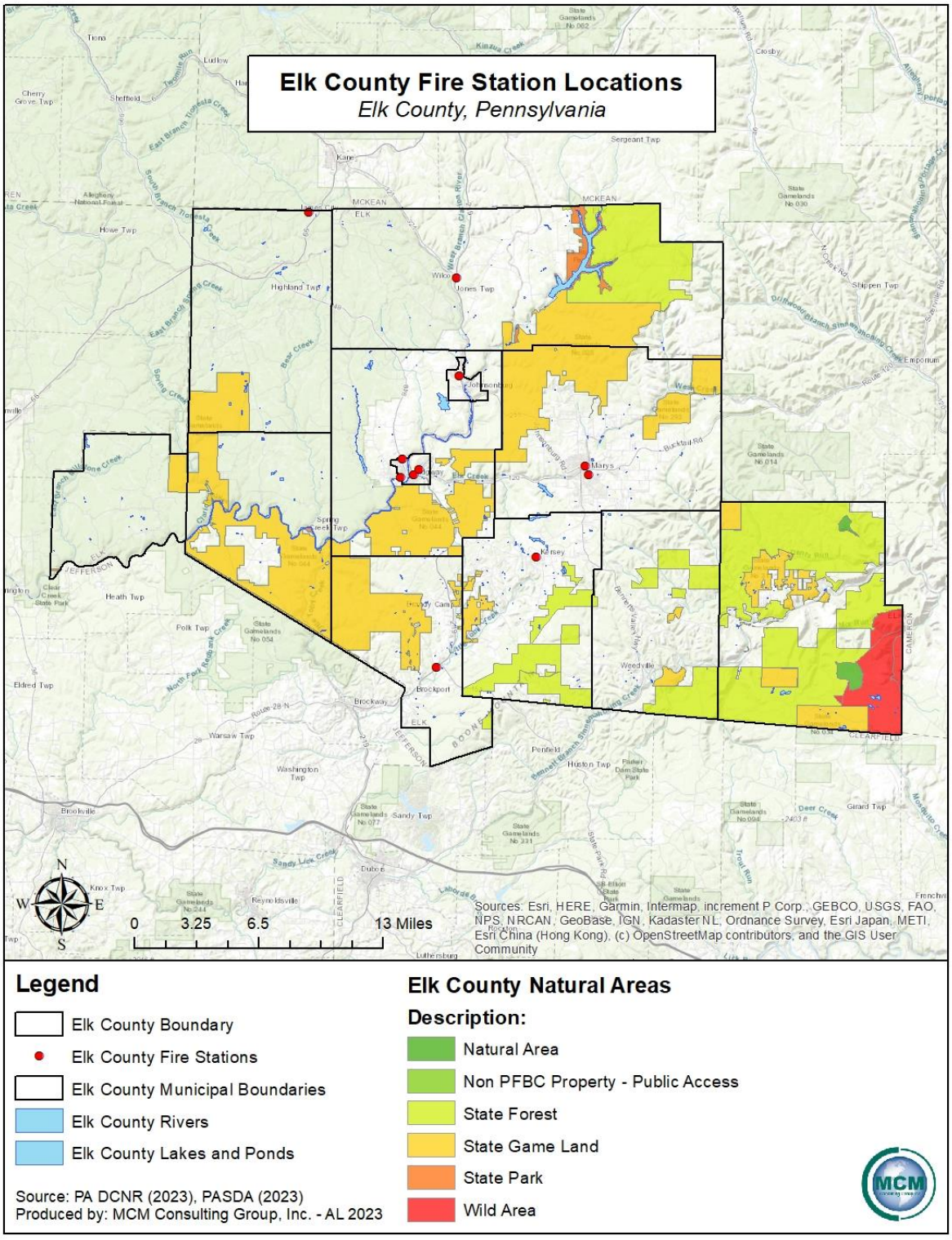


Figure 34 - Fire Station Locations



4.3.11. Winter Storm

4.3.11.1 Location and Extent

Most severe winter storm hazards include heavy snow (snowstorms), blizzards, sleet, freezing rain, and ice storms. Since most extra-tropical cyclones (mid-Atlantic cyclones locally known as Northeasters or Nor'easters), generally take place during the winter weather months, these hazards have also been grouped as a type of severe winter weather storm. According to the Pennsylvania State Hazard Mitigation Plan (PA HMP), winter storms are frequent events for the Commonwealth and occur from late October until mid-April. These types of winter events or conditions are further defined below.

- **Heavy Snow:** According to the National Weather Service (NWS), heavy snow is generally snowfall accumulating to four inches or more in depth in twelve hours or less; or snowfall accumulating to six inches or more in depth in twenty-four hours or less. A snow squall is an intense but limited duration, period of moderate to heavy snowfall, also known as a snowstorm, accompanied by strong, gusty surface winds and possibly lightning.
- **Blizzard:** Blizzards are characterized by low temperatures, wind gusts of thirty-five miles per hour (mph) or more and falling and/or blowing snow that reduces visibility to 1/4-mile or less for an extended period of time (three or more hours).
- **Sleet of Freezing Rainstorm:** Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground and other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground.
- **Ice Storm:** An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous and can create extreme hazards to motorists and pedestrians.
- **Extra-Tropical Cyclone:** Sometimes called mid-latitude cyclones, are a group of cyclones defined as synoptic scale, low pressure, weather systems that occur in the middle latitudes of the Earth. These storms have neither tropical nor polar characteristics and are connected with fronts and horizontal gradients in temperature and dew point otherwise known as "baroclinic zones". Extra-tropical cyclones are everyday weather phenomena which, along with anticyclones, drive the weather over much of the Earth. These cyclones produce impacts ranging from cloudiness and mild showers to heavy gales and thunderstorms. Tropical cyclones often transform into extra-tropical cyclones at the end of their tropical existence, usually between 30˚ and 40˚ latitude, where there is insufficient force from upper-level shortwave troughs riding the westerlies (weather systems moving west to east) for the process of extra-tropical transition to begin. A

shortwave trough is a disturbance in the mid or upper part of the atmosphere which induces upward motion ahead of it. During an extra-tropical transition, a cyclone begins to tilt back into the colder air mass with height, and the cyclone's primary energy source converts from the release of latent heat from condensation to baroclinic processes.

4.3.11.2 Range of Magnitude

The magnitude or severity of a severe winter storm depends on several factors including a region's susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and time of occurrence during the day (e.g., weekday versus weekend), and time of season. The extent of a severe winter storm can be classified by meteorological measurements, such as those above, and by evaluating its societal impacts.

The Northeast Snowfall Impact Scale (NESIS) categorizes snowstorms in this manner. Unlike the Fujita Scale (tornado) and Saffir Simpson Scale (hurricanes), there is no widely used scale to classify snowstorms. NESIS was developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service and rank high impact, northeast snowstorms. These storms have large areas of ten-inch snowfall accumulations and greater. NESIS has five ranking categories: Notable (1), Significant (2), Major (3), Crippling (4), and Extreme (5). These ranking can be seen in *Table 47– NESIS Winter Storm Rankings*. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus, NESIS gives an indication of a storm's societal impacts. This scale was developed because of the impact of northeast snowstorms can have on the rest of the country in terms of transportation and economic impact.

Table 47 - NESIS Winter Storm Rankings

NESIS Winter Storm Rankings			
Category	**Description**	**NESIS Range**	**Definition**
1	Notable	1.0 – 2.49	These storms are notable for their large areas of 4-inch accumulations and small areas of 10-inch snowfall.
2	Significant	2.5 – 3.99	Includes storms that produce significant areas of greater than 10-inch snows while some include small areas of 20-inch snowfalls. A few cases may even include relatively small areas of very heavy snowfall accumulations (greater than 30 inches).
3	Major	4.0 – 5.99	This category encompasses the typical major Northeast snowstorm, with large areas of 10-inch snows (generally between 50 and 150 x 103 mi^2 – roughly one to three times the size of New York

NESIS Winter Storm Rankings			
Category	**Description**	**NESIS Range**	**Definition**
			State with significant areas of 20-inch accumulations.
4	Crippling	6.0 – 9.99	These storms consist of some of the most widespread, heavy snows of the sample and can be best described as crippling to the northeast U.S, with the impact to transportation and the economy felt throughout the United States. These storms encompass huge areas of 10-inch snowfalls, and each case is marked by large areas of 20-inch and greater snowfall.
5	Extreme	10+	The storms represent those with the most extreme snowfall distributions, blanketing large areas and populations with snowfalls greater than 10, 20, and 30 inches. These are only storms in which the 10-inch accumulations exceed 200 X 103 mi^2 and affect more than 60 million people.
Source: Kocin and Uccellini, 2004			

The climate of Pennsylvania is marked by abundant snowfall. Winter weather can reach Pennsylvania as early as October and is usually in full force by late November with average winter temperatures between 20- and 40-degrees Fahrenheit. Elk County receives an average of about 12.56 inches of snowfall a year. Most areas of Elk County experience the effects of winter storms frequently. The general indication of the average annual snowfall map shows areas that are subject to a consistent risk for large quantities of snow. *Figure 35 - Pennsylvania Average Snowfall by County* illustrates the long-term trends for snowfall accumulation in Pennsylvania over three decades.

4.3.11.3 Past Occurrence

Figure 36 – Winter Storm Events by County in Pennsylvania shows the number of winter storm events from 1950 – 2013 for the Commonwealth of Pennsylvania. Elk County had between twenty-five and forty-one such events. *Table 48– Recent Annual Snowfall Estimates* shows recent annual snowfall measurements as stated by NOAA. Overall, Elk County has experienced a moderate decrease on the annual estimated average of snowfall with the exception of the 2020-2021 season. The 2020-2021 season saw almost double in average snowfall, related to heavy snows in December of 2020 and February of 2021. On average, the annual snowfall totals have

decreased in the time periods from 2018 to 2023. A list of additional Elk County winter storms, and other related events is outlined in *Table 49 – Elk County Winter Weather History*.

Table 48 - Recent Annual Snowfall Estimates

Recent Annual Snowfall Estimates	
Time Span	**Average Snowfall Estimates (inches)**
2010 – 2011	21.43
2011 – 2012	8.20
2012 – 2013	12.30
2013 – 2014	20.20
2014 – 2015	16.80
2015 – 2016	8.60
2016 – 2017	11.43
2017 – 2018	15.80
2018 – 2019	10.20
2019 – 2020	9.60
2020 – 2021	18.20
2021 - 2022	9.37
Source: NOAA, 2023	

Table 49 - Elk County Winter Weather History

Elk County Winter Weather History		
Location	**Date**	**Event Type**
Elk County (Entire County)	02/01/2015	Winter Storm
Elk County (Entire County)	02/14/2015	Extreme Cold/Wind Chill
Elk County (Entire County)	02/19/2015	Extreme Cold/Wind Chill
Elk County (Entire County)	02/23/2015	Extreme Cold/Wind Chill
Elk County (Entire County)	02/15/2016	Winter Storm
Elk County (Entire County)	01/05/2018	Extreme Cold/Wind Chill
Elk County (Entire County)	11/15/2018	Winter Storm
Elk County (Entire County)	01/19/2019	Winter Storm
Elk County (Entire County)	01/20/2019	Extreme Cold/Wind Chill
Elk County (Entire County)	01/30/2019	Extreme Cold/Wind Chill
Elk County (Entire County)	12/16/2020	Winter Storm
Elk County (Entire County)	02/15/2021	Winter Storm
Elk County (Entire County)	01/09/2022	Winter Weather
Elk County (Entire County)	01/16/2022	Winter Storm
Elk County (Entire County)	03/09/2022	Heavy Snow

Elk County Winter Weather History		
Location	**Date**	**Event Type**
Elk County (Entire County)	03/28/2022	Winter Weather
Source: NOAA NCEI, 2023		

4.3.11.4 Future Occurrence

Winter storm hazards in Pennsylvania are guaranteed yearly since the state is located at a relatively high latitudes resulting in winter temperatures that range between 0- and 32-degrees Fahrenheit for a good deal of the fall through early spring season (later October until mid-April). In addition, the state is exposed to large quantities of moisture from both the Great Lakes and the Atlantic Ocean. While it is almost certain that a number of significant winter storms will occur during the winter and fall season, what is not easily determined is how many such storms will occur during that time frame. Based on historical snow related disaster declaration occurrences, the Commonwealth of Pennsylvania can expect a snowstorm of disaster declaration proportions, on average, once every three to five years. Similarly, for ice storms, based on historical disaster declarations, it is expected that on average, ice storms of disaster proportions will occur once every seven to ten years within the state.

Climate change could increase the intensity of winter storms in the northeastern United States and Elk County, Pennsylvania. With warmer air temperatures, more moisture will be held in the air, and if the temperatures on the ground are below freezing, this could result in more snow falling during a weather event like a winter storm. These events may become less frequent as the climate warms, but they could be more intense.

4.3.11.5 Vulnerability Assessment

Severe winter storms are of significant concern to Elk County because of their frequency and magnitude in the region. Additionally, they are of significant concern due to the direct and indirect costs associated with these events; delays caused by the storms and impacts on the people and facilities of the region related to snow and ice removal, health problems, cascade effects such as utility failure and traffic accidents, and stress on community resources.

Every year, winter weather indirectly and deceptively kills hundreds of people in the United States, primarily from automobile accidents, over exertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding win-drive snow, drifting snow, extreme cold temperatures, and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. Heavy accumulations of ice can bring down trees and powerlines, disabling electrical power and communications for days or weeks. Heavy snow can immobilize a region and

paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services. The economic impact of winter weather each year is quite large, with costs for snow removal, damage, and loss of business in the millions each year. Heavy snow can immobilize and strand commuters as well as stopping the flow of supplies through an area or transportation corridor. In rural areas, homes and farms may be isolated for days and unprotected livestock may be lost. Bridges and overpasses are particularly dangerous because they freeze before other transportation surfaces. For the purposes of this Hazard Mitigation Plan, the entire population of Elk County (30,990) is exposed to severe winter storm events. The elderly are considered the most susceptible to this hazard due to their increased risk of injury and death from falls, overexertion, and or attempts to clear ice and snow. The elderly population is also more vulnerable to utility outages in winter, especially when they are paired with winter storm events. See the table below for a breakdown of the elderly and very young population of Elk County.

Population per Municipality under 5 Years or 65 Years or Older				
Municipality	**Number of People under 5 years of age**	**Percent of Population**	**Number of People 65 years or older**	**Percent of Population**
Benezette Township	0	-	88	49.7%
Fox Township	87	2.4%	665	18.6%
Highland Township	13	3.7%	116	32.6%
Horton Township	77	5.5%	292	21.0%
Jay Township	228	9.7%	441	18.8%
Johnsonburg Borough	83	3.6%	484	21.2%
Jones Township	92	5.9%	349	22.4%
Millstone Township	4	3.5%	44	38.3%
Ridgway Borough	217	5.4%	613	15.2%
Ridgway Township	75	3.3%	454	19.9%
Spring Creek Township	7	5.1%	74	54.4%
St Marys, City of	667	5.2%	3,229	25.3%
Total:	**1,550**	**5.0%**	**6,849**	**22.1%**
Source: United States Census Bureau (USCB), American Community Survey (ACS), 2023				

Table 50 – Utility Outages in Elk County in Winter shows the number of power outages, phone outages, and 911 outages, that have occurred in the county during winter months. Vulnerable populations within Elk County may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). The unsheltered populations of an area are at most risk of winter storm events.

Table 50 - Utility Outages in Elk County in Winter

Utility Outages in Elk County in Winter		
Location	**Date**	**Event**
Elk County (No Area Defined)	02/15/2019	Water Shortage / Outage
Elk County (No Area Defined)	11/22/2019	Water Shortage / Outage
Elk County (No Area Defined)	01/15/2021	Phone / Communication Outage
Source: WebEOC, 2023		

The entire general building stock inventory in Elk County is exposed and vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roof and building frames, rather than building content. There was no historical information available that identified property damage within Elk County due to a single severe winter storm event. Current modeling tools are not available to estimate specific losses for this hazard. A specific area that is vulnerable to the severe winter storm hazard is the floodplain. At risk general building stock and infrastructure in floodplains are presented in the flood profile due to snow and ice melt. Generally, losses from flooding associated with severe winter storms should be less than those associated with a 100-year or 500-year flood.

Full functionality of critical facilities such as police, fire, and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Backup power is recommended critical infrastructure and facilities due to the potential for power interruption. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires infrastructure to clear roadways and alert citizens to dangerous conditions. In spring, this type of roadway damage must be repaired. Additionally, freezing rain and ice storms impact utilities (i.e., power lines and overhead utility wires) causing power outages for hundreds to thousands of residents.

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. However, because severe winter storms are a regular occurrence in this area, Elk County is generally well-prepared for snow and ice removal each season.

Municipalities with an increased risk to winter storms:

- Benezette Township
- Fox Township
- Highland Township

- Horton Township
- Jay Township
- Johnsonburg Borough
- Jones Township
- Millstone Township
- Ridgway Borough
- Ridgway Township
- Spring Creek Township
- City of St Marys

Figure 35 - Pennsylvania Average Snowfall by County

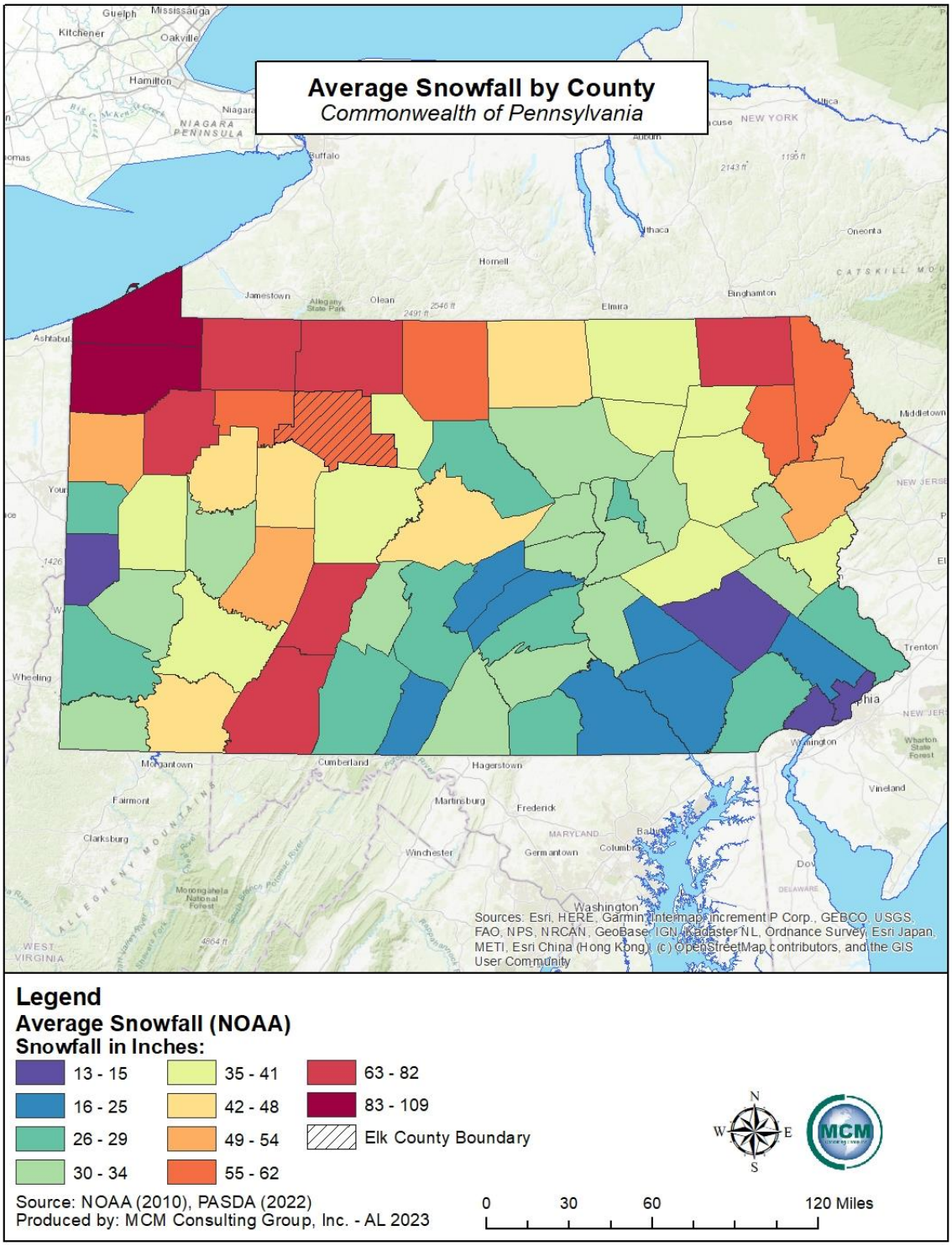
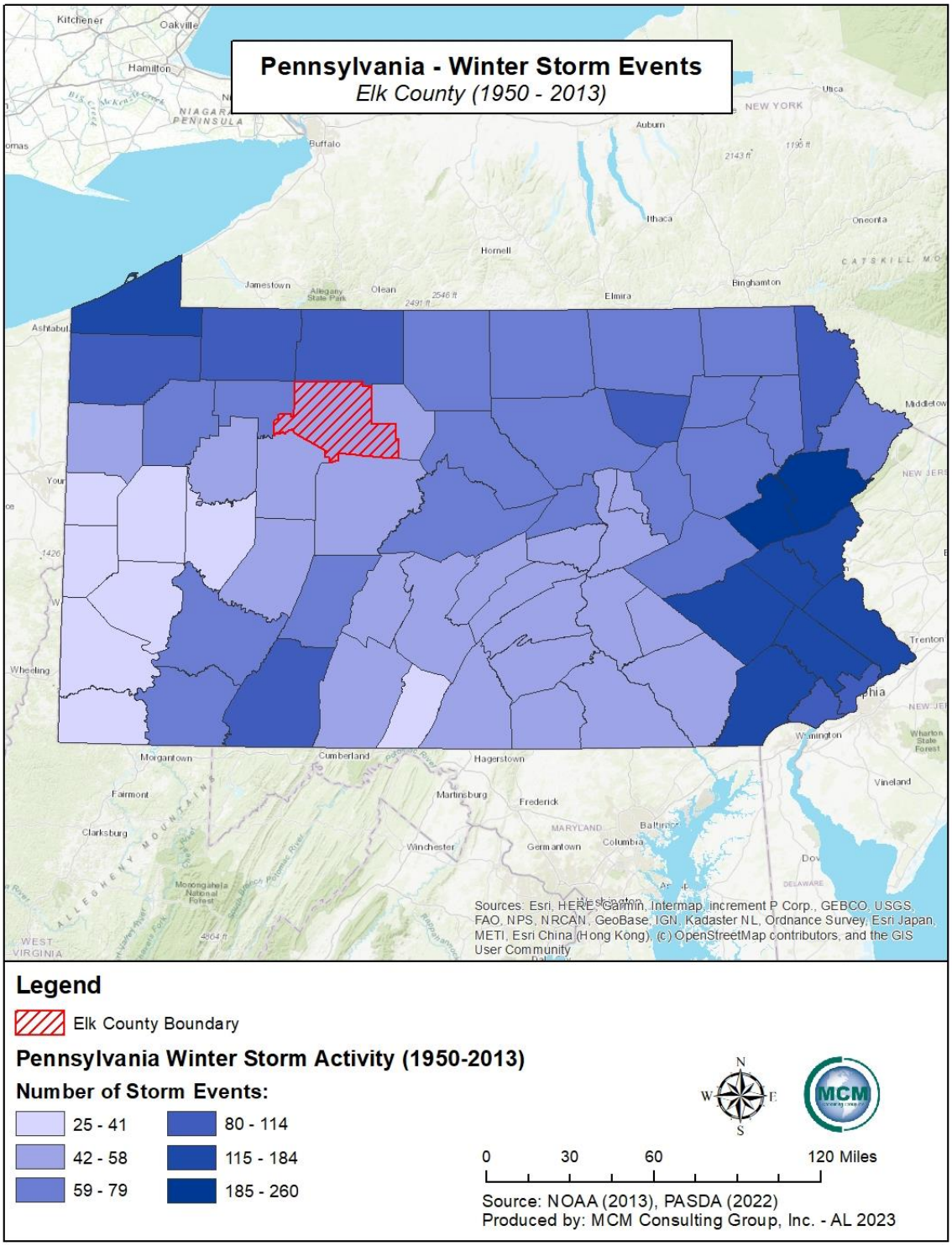


Figure 36 - Winter Storm Events by County in Pennsylvania



4.3.12. Civil Disturbance

4.3.12.1 Location and Extent

Civil disturbance refers to mass acts of disobedience where participants can become hostile to authority and there is a threat to maintaining public safety and order. Such disturbances can often be forms of protest in the face of socio-political problems. Riots have not been frequent occurrences throughout the history of the Commonwealth, however when they occur, they can cause significant property damage, injury and even loss of life. The scale and scope of civil disturbance events varies widely. Government facilities, local landmarks, prisons, and universities are common sites where crowds and mobs may gather.

Criminal activity refers to all criminality, including enemy attack, sabotage, physical or information break of security, workplace or school violence, harassment, discrimination, and other crimes. Criminal activity is a very broad hazard category and similar to civil disturbance, the scale and scope of incidents or events vary widely.

4.3.12.2 Range of Magnitude

Civil disturbances can take the form of small gatherings or large groups blocking or impeding access to a building or disrupting normal activities by generating noise and intimidating people. They can range from a peaceful sit-in to a full-scale riot, in which a mob burns or otherwise destroys property and terrorizes individuals. Even in its more passive forms, a group that blocks roadways, sidewalks, or buildings interferes with public order. There are two types of large gatherings typically associated with civil disturbances: a crowd and a mob. A crowd may be defined as a casual, temporary collection of people without a strong, cohesive relationship. Crowds can be classified into four categories:

Casual Crowd: A casual crowd is merely a group of people who happen to be in the same place at the same time. Violent conduct does not occur.

Cohesive Crowd: A cohesive crowd consists of members who are involved in some type of unified behavior. Members of this group are involved in some type of common activity, such as worshipping, dancing, or watching a sporting event. Although they may have intense internal discipline, they require substantial provocation to arouse into action.

Expressive Crowd: An expressive crowd is one held together by a common commitment or purpose. Although they may not be formally organized, they are assembled as an expression of common sentiment or frustration. Members wish to be seen as a formidable influence. One of the best examples of this type is a group assembled to protest.

Aggressive Crowd: An aggressive crowd is comprised of individuals who have assembled for a specific purpose. This crowd often has leaders who attempt to arouse the members or motivate them to action. Members are noisy and threatening and will taunt authorities.

They may be more impulsive and emotional and require only minimal stimulation to arouse violence. Examples of this type of crowd could include demonstrators and strikers, though not all demonstrators and strikers are aggressive.

A mob can be defined as a large disorderly crowd or throng. Mobs are usually emotional, loud, tumultuous, violent, and lawless. Similar to crowds, mobs have different levels of commitment and can be classified into four categories:

Aggressive Mob: An aggressive mob is one that attacks, riots, and terrorizes. The object of violence may be a person, property, or both. An aggressive mob is distinguished from an aggressive crowd only by lawless activity. Examples of aggressive mobs are the inmate mobs in prisons and jails, mobs that act out their frustrations after political defeat, or violent mobs at political protests or rallies.

Escape Mob: An escape mob are those groups which attempt to flee from something such as a fire, bomb, flood, or other catastrophe. Members of escape mobs are generally difficult to control and can be characterized by unreasonable terror.

Acquisitive Mob: An acquisitive mob is one motivated by a desire to acquire something. Riots caused by other factors often turn into looting sprees. This mob exploits a lack of control by authorities in safeguarding property.

Expressive Mob: An expressive mob is one that expresses fervor or revelry following some sporting event, religious activity, or celebration. Members experience a release of pent-up emotions in highly charged situations.

In the event of a significant civil disturbance or criminal activity incident, local government operations and the delivery of services in the community may experience short-term disruptions. The greatest secondary effect is the impact on the economic and financial conditions of the affected community, particularly in relation to the property, facilities, and infrastructure damaged as a result of the disturbance. More serious acts of vandalism may result in limited power failure or hazardous material spills, leading to a possible public health emergency. Altered traffic patterns may increase the probability of a transportation accident.

Elk County's greatest likelihood for civil disturbance is in the large urban areas of the City of St. Marys, Johnsonburg Borough, and Ridgway Borough, the county seat. Citizens, property, and infrastructure could be affected if a large-scale disorder were to take place. Typically, government facilities, landmarks, prisons, and universities are common sites where crowds or mobs may gather. There are no facilities of higher education in Elk County, Pennsylvania.

4.3.12.3 Past Occurrences

The county has not experienced any *significant* civil disturbance events.

Following the death of George Floyd in Minneapolis, Minnesota in May 2020 at the hands of law enforcement, civil unrest erupted across the nation.

According to the Pennsylvania Attorney General's Office Pennsylvania Uniform Crime Reporting System, the 2018 violent crime total for Elk County was reported at fifty-three violent criminal offenses. This total was lower than the totals for the previous two years, 2016 and 2017. This information is the most up to date, publicly available crime reporting information from the state of Pennsylvania for Elk County. This information can be seen in *Table 51 – Elk County Reported Violent Crime*.

Table 51 - Elk County Reported Violent Crime

Elk County Reported Violent Crimes (2014 – 2018)	
Year	**Number of Reported Violent Crimes**
2014	52
2015	49
2016	74
2017	82
2018	53

4.3.12.4 Future Occurrence

While unlikely, civil disturbances may occur in Elk County, and it is difficult to accurately predict the probability of future occurrence for civil disturbance events over the long-term. However, *Table 52 - Civil Disturbance Events Reported to PEMA 2012-2018*, depicts the range of potential civil disturbances in Pennsylvania and gives the county some background for consideration of future occurrences.

Table 52 - Civil Disturbance Events Reported to PEMA 2012-2018

Table 4.3.18-2 Civil disturbance events reported to PEMA-KC, 2012-2018 (PEMA, 2018).							
EVENT TYPE	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Demonstration	1	3	9	3	3	3	3
Juvenile Detention Center	0	0	0	0	0	0	1
Prison Disturbance	0	2	0	0	0	1	0
Detainee Escape	2	4	3	4	0	2	1
Protest	4	24	49	35	64	78	13
Large Crowd Gathering	0	1	0	4	2	3	2
Riot	0	0	0	1	0	0	0
School Threat	1	2	0	2	0	2	0
Assault	2	8	2	2	3	4	0
Gun/Bomb Incident	3	15	3	7	2	3	0
Civil Disorder - totals	***13***	***59***	***66***	***58***	***74***	***96***	***20***
**Events totaled through 2018*							

According to the Pennsylvania State Hazard Mitigation Plan, from 2012 to 2018, the commonwealth experienced an average of fifty-five civil disturbance events each year. While that number is relatively low and the occurrences in Elk County are rare, the local planning team (LPT) decided civil disturbance should be regarded as a low-risk hazard due to the current political trends and frictions across the country.

4.3.12.5 Vulnerability Assessment

All municipalities in Elk County can be vulnerable to civil disturbance and criminal activity; however. the anticipated impact from such events is minimal. These events may be sparked for varying reasons and the seriousness of the event may well be exacerbated by how authorities handle the crowd. At the writing of this plan, the political temperature of the country as a whole continues to run high, making this hazard vulnerability one for consistent monitoring by public safety officials.

4.3.13. Dam and Levee Failure

4.3.13.1 Location and Extent

Dams

A dam restricts the flow of water or underground streams and often creates reservoirs for water storage. The reservoirs created by these barriers not only suppress floods but also provide water for activities such as irrigation, human consumption, industrial use aquaculture, and navigability.

Dam failures occur usually as a secondary effect of massive amounts of rainfall and flooding, causing too much water to enter the spillway system. This type of failure occurs with little to no warning. Spring thaws, severe thunderstorms, and heavy rainfall are also contributing factors to potential dam failures. Depending on the size of the body of water where the dam is constructed, additional water may come from distant upstream locations. Water contributions may also come from dam failures in adjoining counties that are along the same riverine or water features.

FEMA considers the following to be the most frequent causes of dam failures:

- Overtopping caused by floods that exceed the capacity of the dam
- Deliberate acts of sabotage
- Structural failure of materials used in dam construction
- Movement and/or failure of the foundation supporting the dam
- Settlement and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate maintenance and upkeep

Poor engineering or poor maintenance may also cause dam failure. The Pennsylvania Department of Environmental Protection (PA DEP) and the United States Army Corps of Engineers (USACE) awards permits for dams and also share inspection responsibilities. Inspection results are characterized as either safe or unsafe.

The National Inventory of Dams (NID) is a registry that captures information about structures that are greater than or equal to 25 feet in height or impound 50-acre-feet or more of water (an acre-foot is equal to 325,851 gallons of water); it includes structures above 6 feet in height where failure would potentially cause damage downstream. The dams are classified in terms of hazard potential as “High”, “Significant”, or “Low”, with high-hazard dams requiring emergency action plans (EAPS) There are six high-hazard and low-hazard dams in Elk County that are both publicly and privately owned and are registered with the USACE in the NID. There is also one dam with a hazard classification as significant. There are five dams within the county that are high-hazard and require an emergency action plan. *Table 54 – Elk County Dam Inventory*

illustrates the dams located in Elk County. *Table 53 – High-Hazard Dams Municipal Summary* summarizes the high-hazard dams in Elk County by municipality. The municipalities not listed do not have high-hazard dams. *Table 55 – Dam Name and Purpose* lists the dams located in Elk County and their purpose code, and the description of purpose based on the Pennsylvania DEP codes.

Table 53 - High-Hazard Dams Municipality Summary

High-Hazard Dams – Municipal Summary (NID 2023)	
Municipality	**Number of High-Hazard Dams**
Benezette Township	0
Fox Township	0
Highland Township	0
Horton Township	1
Jay Township	0
Johnsonburg Borough	0
Jones Township	1
Millstone Township	1
Ridgway Borough	0
Ridgway Township	1
Spring Creek Township	0
St. Mary's, City	1
Total:	**5**

Table 54 - Elk County Dam Inventory

Elk County Dams (NID 2023)							
Dam Name	**River**	**Owner Name**	**Year Completed**	**Dam Height (feet)**	**Drainage Area (Sq. Miles)**	**Hazard**	**EAP**
Buzzard Swamp No. 6	Muddy Fork	Pennsylvania Game Commission	1971	29	2.7	H	Y
East Branch Dam	Clarion River	USACE – Pittsburgh District	1952	184	72	H	Y
H.B. Norton	Big Mill Creek	Ridgway Borough	1932	37	30.1	H	Y
Laurel Run Reservoir	Laurel Run	St. Marys Joint Water Authority	1970	84	8.8	H	Y
Leachate Equalization Impoundment	TR Sawmill Run	Thad Sorg	1992	95	2.02	L	NR

Elk County Dams (NID 2023)							
Dam Name	**River**	**Owner Name**	**Year Completed**	**Dam Height (feet)**	**Drainage Area (Sq. Miles)**	**Hazard**	**EAP**
Twin Lakes	Hoffman Run	USDA FS	1936	29	5	S	NR
Whetstone No. 2 Storage	Little Toby Creek	Brockway Borough Municipal Authority	1962	36	1.6	H	Y

Table 55 - Dam Name and Purpose

Elk County Dams and Purposes (PA DEP 2019 & NID 2023)		
Dam Name	**Purpose Code**	**Purpose Code Description**
Buzzard Swamp No. 6	R	Recreation
East Branch Dam	C	Flood Risk Reduction
H.B. Norton	S	Water Supply
Laurel Run Reservoir	S	Water Supply
Leachate Equalization Impoundment	O	Other
Twin Lakes	R	Recreation
Whetstone No. 2 Storage	S	Water Supply

The Pennsylvania Department of Environmental Protection defines a high-hazard dam as “Any dam so located as to endanger populated areas downstream by its failure”. High-hazard dams receive two inspections each year, once by a professional engineer on behalf of the owner and once by a PA DEP inspector (DEP, 2008).

Levees

Levee failures have the potential to place large numbers of people and property at risk. Unlike dams, levees are built parallel to a river or another body of water to protect the population and structures behind it from risks of damage during a flooding event. Levees do not serve a purpose beyond flood protection, unlike dams, which can serve to store water or generate energy in addition to protecting areas from flooding. The National Levee Database (NLD), like its counterpart of the National Inventory of Dams (NID), is maintained by the USACE and tracks levees across the United States. Elk County is home to one levee section, which is detailed in *Table 56 – Elk County Levee Inventory*.

Table 56 - Elk County Levee Inventory

Elk County Levee Inventory (National Levee Database, 2023)				
Levee Name	**Flood Source**	**Levee Type**	**Levee Bank Side**	**Levee Length (miles)**
Johnsonburg – Right Bank – West Branch Clarion River	West Branch – Clarion River	Concrete Flood Wall	Right Bank	0.46

4.3.13.2 Range of Magnitude

Dams

Dam failures can pose a serious threat to communities located downstream from major dams. The impact of a dam failure is dependent on the volume of water impounded by the dam and the amount of population or assets located downstream. Catastrophic failures are characterized by the sudden, rapid, and uncontrolled release of impounded water from a dammed impoundment or water body. *Figure 37 – Elk County Dams* shows the location of dams within Elk County as well as their hazard designation.

Levees

Levee failure can be caused by a number of factors, and they can also cause catastrophic effects. Damage to the area beyond a levee, if it fails, could be more significant than if the levee was not present. Levees are designed to provide a specific level of protection, so flooding events could overtop the levees if these events exceeded the levee specifications. Additionally, levees can also fail if they are allowed to deteriorate or decay. Regular maintenance of levees is critical. *Figure 38 – Elk County Levee Locations* illustrates areas protected by the Elk County levee systems. The figure following *Figure 38 – Elk County Levee Locations* illustrate areas around Johnsonburg Borough that are heavily protected by levees. This can be seen in *Figure 39 – Levee Locations – Johnsonburg, PA.*

A Levee failure of breach causes flooding in landward areas adjacent to the structure. The failure of a levee or other flood protection structure could be devastating, depending on the level of flooding for which structure is designed and the amount of landward development present. Large volumes of water may be moving at high velocities, potentially causing severe damage to buildings, infrastructure, trees, and other large objects. Levee failures are generally worse when they occur abruptly with little warning and result in deep, fast-moving water through highly developed areas.

4.3.13.3 Past Occurrence

Dams

There have been no past occurrences of dam failure or major incidence occurring at the locations of dams within Elk County. Smaller incidents have occurred but have not had significant impacts in the county.

There have been a few historically destructive dam failures in Pennsylvania over the course of the past two hundred years. The most destructive dam failure in United States history took place in Johnstown, Pennsylvania (Cambria County) in 1889, claiming 2,209 lives. Another significant dam failure took place in Austin, Pennsylvania (Potter County) in 1911, claiming seventy-eight lives. Similarly, a dam failure in West Taylor Township, Pennsylvania (Cambria County) claimed the lives of forty people when the Laurel Run Dam, No. 2 failed during the Johnstown Flood in the early morning hours of July 20th, 1977.

Levees

The National Levee Database (NLD) lists no occurrence of levee failures or major incidents occurring in Elk County.

Some of the worst levee failures in the history of the United States have occurred in the American South, along parts of the Mississippi River delta. Levee failures in New Orleans, Louisiana during Hurricane Katrina from August 23 to August 31, 2005, resulted in an enormous amount of property damage and loss of lives. There were approximately fifty-three levee failures in constructed levees around the City of New Orleans. Hurricane Katrina precipitated the creation of more strict levee requirements for inspection and construction on the local, state, and federal level.

4.3.13.4 Future Occurrence

Dams

Although dam failures can occur at any time, given the right circumstances, the likelihood of a dam failure in Elk County is considered to be unlikely.

The presence of structural integrity and inspection programs significantly reduces the potential for major dam failure events to occur. The PA DEP inventories and regulates all the dams that meet or exceed the following criteria (PA, DEP, 2008):

- Impound water from a drainage area of greater than 100 acres
- Have a maximum water depth greater than 15 feet
- Have a maximum storage capacity of 50 acre-feet or greater

The construction, operation, maintenance, and abandonment of dams is reviewed and monitored by the PA DEP Division of Dam Safety. Dams are evaluated based on those categories such as slope stability, undermining seepage, and spillway adequacy. With more strict construction and design procedures in place, the future occurrence of a dam failure is increasingly small. The new procedures and rules protect public safety and both public and private property. Newly constructed dams are thoroughly examined by professional engineers to prevent future dam failure events.

Levees

Although levee failures can occur at any time, given the right circumstances, the future occurrence of levee failures in Elk County can be considered unlikely. Most levees are designed to meet a specified level of flooding. While FEMA focuses on mapping levees that will reduce the risk of a 1% annual chance flood, other levees may be designed to protect against both smaller and larger floods.

4.3.13.5 Vulnerability Assessment

Dams

Property and populations located downstream from any dams are vulnerable to dam failures. The Pennsylvania Code (§105.91 Classification of dams and reservoirs) classifies doth dams by size and the amount of loss of life and economic loss expected in a failure event. *Table 57 – Dam Classification* displays the dam classification guide for the Commonwealth of Pennsylvania. Although the size of a dam may result in varying impacts, the hazard potential classification of category one dams is a more important indicator, since that will indicate the level of potential substantial loss of life and excessive economic loss.

Table 57 - Dam Classification

Dam Classification (PA Code 1980)		
Dam Size Classification		
Class	**Impoundment Storage (Acre-Feet)**	**Dam Height (Feet)**
A	Equal to or greater than 50,000	Equal to or greater than 100
B	Less than 50,000 but greater than 1,000	Less than 100 but greater than 40
C	Equal to or less than 1,000	Equal to or less than 40
Dam Damage Classification		

Dam Classification (PA Code 1980)		
Dam Size Classification		
Category	**Loss of Life**	**Economic Loss**
1	Substantial	Excessive
2	Few	Appreciable
3	None Expected	Minimal

Dam failures can cause significant environmental effects, as the resulting flood from a dam failure is likely to disperse debris and hazardous materials downstream that can damage local ecosystems. Debris carried downstream can block roads, cause traffic accidents, disrupt traffic patterns, and delay the delivery of essential services along major traffic corridors. Debris flow can also cause landslides along steep slopes and embankments with low slope stability. The economic and financial impact from damage and recovery ranges from minimal to severe, depending on the magnitude of damage and scale of failure event.

Emergency action plans are developed by the owners of high-hazard dams. These plans are then disseminated to first responders and other planning partners within the county. Vulnerable populations are those residents and businesses located downstream from a high-hazard dam within the inundation area. The emergency action plan identifies a call list to notify downstream at-risk populations. Emergency action plan exercises are held every five to seven years depending on local policy.

The characteristics of the five high-hazard dams in Elk County vary greatly. The East Branch Dam, located in Jones Township, has the largest drainage area with a total of seventy-two square miles. The dams that were constructed most recently are the Leachate Run Reservoir, located in Fox Township, which was constructed in 1992, and the Buzzard Swamp No. 6 Dam in Milestone Township, which was constructed in 1971. The dam that is the oldest in the county is H.B. Norton Dam, which was constructed in 1932. The East Branch Dam is the tallest in the county with a height of 194 feet. Each of the dams in Elk County are owned by a different owner. There are no owners in the county who own multiple dams. The dams in Elk County are owned by a mix of public and private owners and vary in almost every aspect. The county dams are distributed relatively evenly throughout the county and municipalities, with an even mix of high and low hazard dams in the municipalities.

The failure or partial failure of a high-hazard potential dam can have impacts that affect many different jurisdictions across Elk County and counties adjacent to Elk County. A failure at any of the dams in Elk County would result in some inundation in at least those municipalities adjacent to the dam in question. A more comprehensive examination of risk inundation areas from high-

hazard potential dams can be conducted in future iterations of the Elk County Hazard Mitigation Plan. This dataset was not readily accessible at the time of this writing. However, each of the municipalities that could be affected by the failure of a high-hazard potential dam could result in the inundation of critical infrastructure facilities and community lifeline facilities.

Elk County is at risk when high-hazard potential dams are considered. There are three types of risk related to high-hazard potential dams and they are listed in the table below:

High-Hazard Potential Dams Risk Types	
Type of Risk	**Description**
Incremental Risk	The risk (likelihood and consequences) to the pool area and downstream floodplain occupants that can be attributed to the presence of the dam should the dam breach prior or subsequent to overtopping, or undergo component malfunction or mis-operation, where the consequences considered are over and above those that would occur without dam breach. The consequences typically are due to downstream inundation, but loss of the pool can result in significant consequences in the pool area upstream of the dam.
Non-Breach Risk	The risk in the reservoir pool area and affected downstream floodplain due to 'normal' dam operation of the dam (e.g., large spillway flows within the design capacity that exceed channel capacity) or 'overtopping of the dam without breaching' scenarios.
Residual Risk	The risk that remains after all mitigation actions and risk reduction actions have been completed. With respect to dams, FEMA defines residual risk as "risk remaining at any time" (FEMA, 2015, p A-2). It is the risk that remains after decisions related to a specific dam safety issue are made and prudent actions have been taken to address the risk. It is the remote risk associated with a condition that was judged to not be a credible dam safety issue.
Source: "Rehabilitation of High Hazard Potential Dams Grant Program Guidance," June 2020	

At this time, insufficient information is available to conduct a substantive analysis of incremental, non-breach and residual risk relative to Elk County's high hazard potential dams. However, it is acknowledged that incremental risk is "the risk (likelihood and consequences) to the pool area and downstream floodplain occupants that can be attributed to the presence of the dam should the dam breach prior or subsequent to overtopping, or undergo component malfunction or mis-operation, where the consequences considered are over and above those that would occur without dam breach;" non-breach risk is "the risk in the reservoir pool area and

affected downstream floodplain due to 'normal' dam operation of the dam (e.g., large spillway flows within the design capacity that exceed channel capacity) or 'overtopping of the dam without breaching' scenarios;" and residual risk) is "the risk that remains after decisions related to a specific dam safety issue are made and prudent actions have been taken to address the risk. It is the remote risk associated with a condition that was judged to not be a credible dam safety issue" (FEMA, 2020 Rehabilitation of High Hazard Potential Dams Grant Program Guidance)

The risk of high-hazard potential dams in Elk County is present but at the time of this writing, there is insufficient data to identify in exact detail the vulnerable populations and assets in inundation areas for the high-hazard potential dams. The areas downstream from the high-hazard potential dams are more vulnerable to inundation than areas that are upstream from said dams. There are current datasets to address high-hazard potential dam impacts in greater detail, but these datasets are still in development from the Pennsylvania Department of Environmental Protection, Pennsylvania Emergency Management Agency, the United States Army Corp of Engineers, and the Federal Emergency Management Agency.

Specifically, vector GIS boundary data for dam inundation areas would allow for more comprehensive damage overlays and damage analysis. Vector GIS information would allow for inundation areas to be mapped along with community lifelines and critical facilities to see what specific facilities could be impacted by a failure at a high-hazard potential dam, including type and use of those facilities impacted. This inundation data could also lead to greater analysis on the construction type of the buildings impacted, including what materials are used for building and what the physical characteristics of the buildings are made of that may be impacted. While useful for vulnerability assessment, these datasets would have to be carefully regulated in regard to access to ensure that no unauthorized individuals or organizations have the ability to see or use the data. Dam inundation maps could also be used if GIS boundary data is not available or able to be released.

Once these datasets have been published and inundation data is easier to acquire, this information will be used to develop more details risk assessment and vulnerability assessments for dam failure at the high-hazard potential dams. Continued collaboration with state and federal partners will occur to ensure that any data created or made available is utilized for vulnerability assessment for high-hazard potential dams.

Levees

The levee that is located in Elk County is unique and has unique characteristics when compared to other levees in the Commonwealth. The Johnsonburg – Right Bank Levee is approximately 0.46 miles in length. The levee is made up of a concrete flood wall and earthen works.

The entire leveed areas for Elk County protect a total of forty-eight structures within the county. There are no facility points protected by Elk County levees and that includes community lifeline facilities (municipal buildings, hospitals, police/fire/EMS, schools, childcare centers, and nursing/care homes) facilities. Each levee in Elk County is a mainline levee and protects along a variety of land features. A failure of the levee in the urban areas in Elk County would be catastrophic to life and property. The total property value of the buildings in the leveed area is approximately $10.8 million (USACE, 2023).

There are a large number of community lifeline facilities within the levee protection areas for the levees around Elk County. *Table 58 – Number of Vulnerable Structures within Leveed Areas* shows the number of addressable structures and facility type points in the largest levee protection areas within Elk County based on NLD information from 2023. The features included in the table are particularly vulnerable to levee failure because they are protected by the system. Should the levee systems fail, the structures would be at an increased risk by their flood sources.

Table 58 - Number of Vulnerable Structures within Leveed Areas

Number of Vulnerable Structures within Leveed Areas		
Leveed Area Name	**Addressable Structures in Leveed Area**	**Facility Type Points in Leveed Area**
Johnsonburg – Right Bank – West Branch Clarion River	0	0
Totals:	**0**	**0**

Figure 37 - Elk County Dams

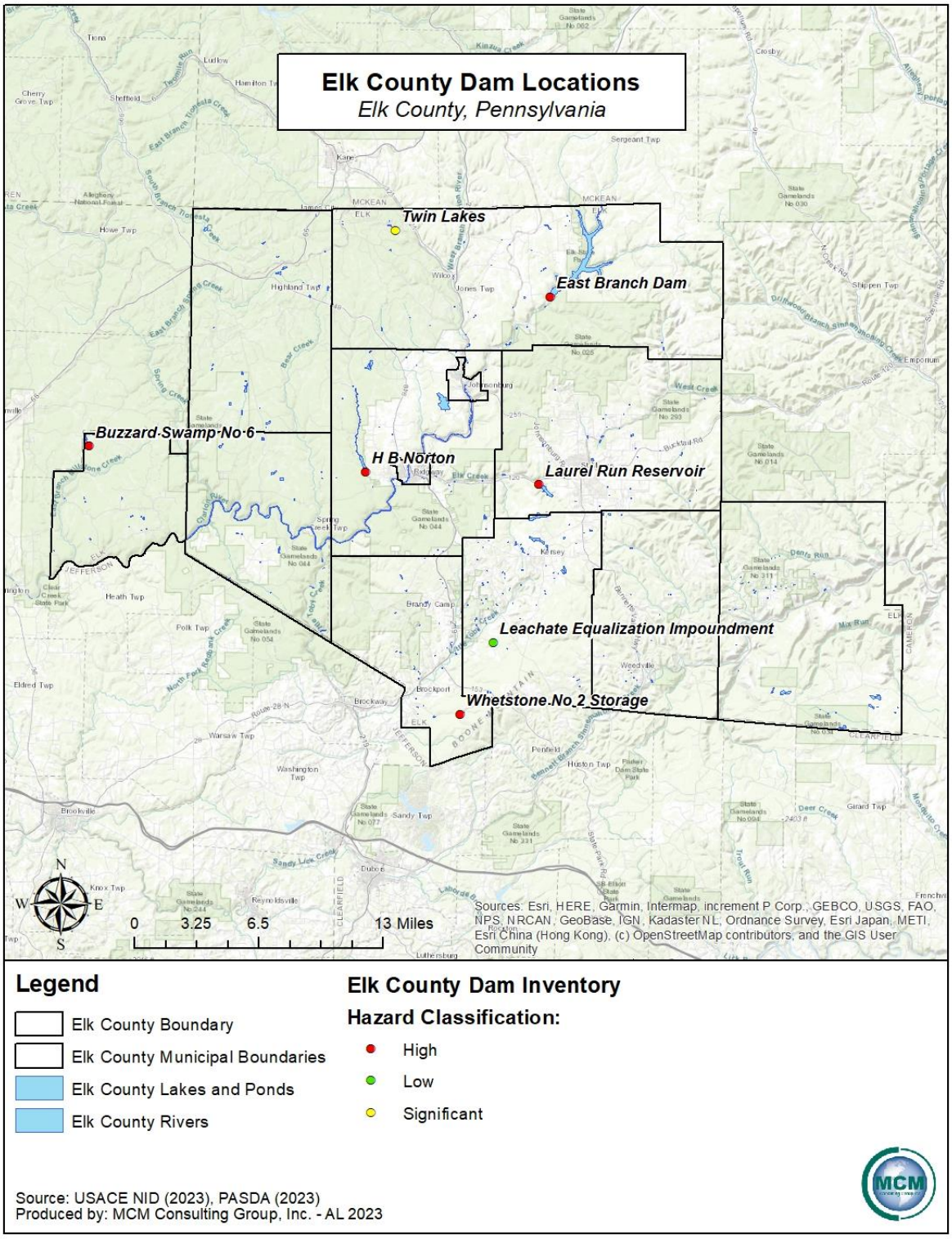


Figure 38 - Elk County Levee Locations

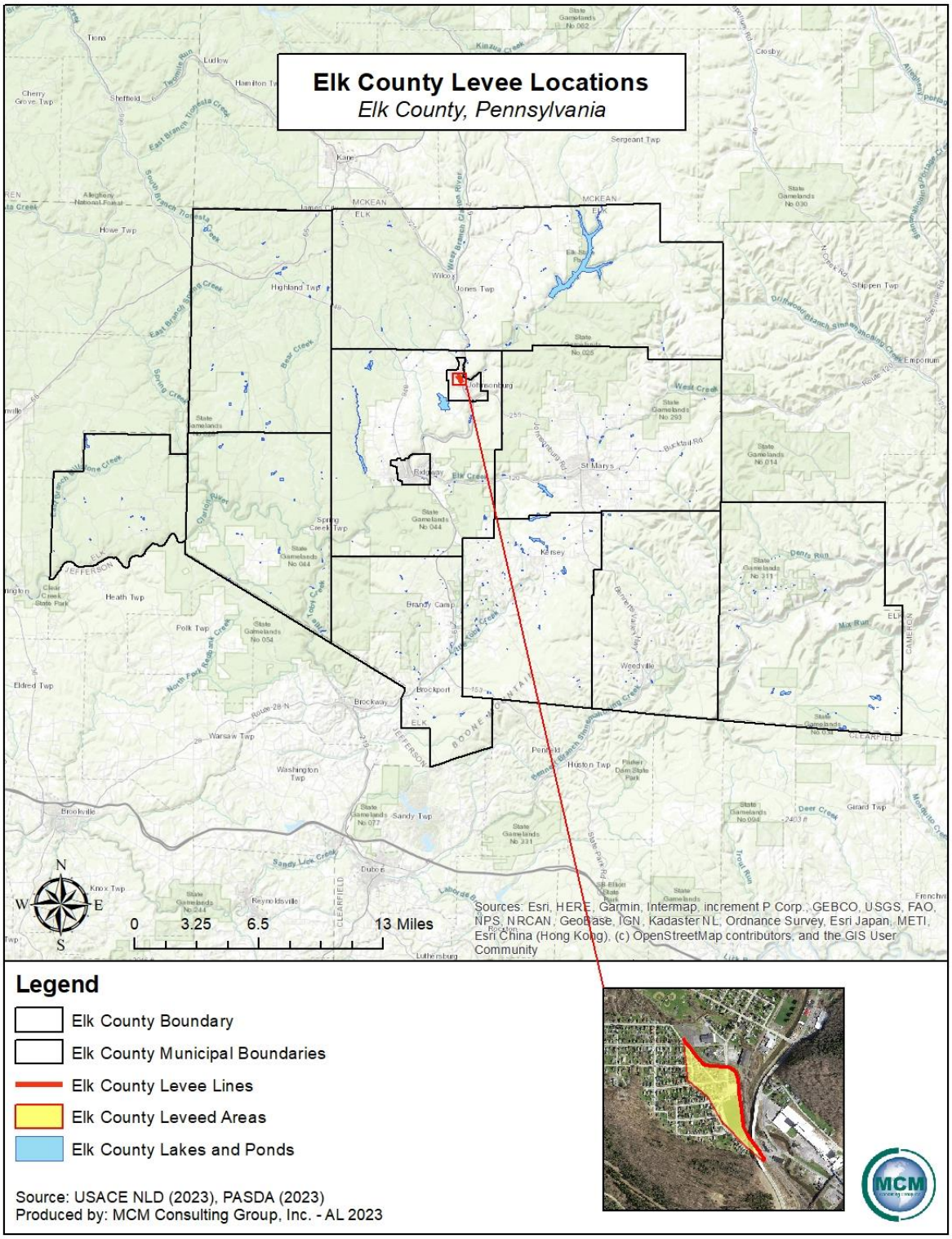


Figure 39 - Levee Locations - Johnsonburg, PA

4.3.14. Emergency Services

4.3.14.1 Location and Extent

Fire, emergency medical services (EMS), local emergency management coordinators (LEMC), and law enforcement service agencies are defined per municipality in Elk County. In addition to the local services, the county hosts numerous special teams. Regional and state-wide services are also available.

With the exception of law enforcement, most areas are served by volunteers instead of career personnel, which increases response time due to volunteer availability. Volunteers provide emergency services above separately from their regular careers. Often agencies struggle with the availability of skilled personnel and resources at certain times of the day. The number of responders in general has decreased, in part due to issues including funding and retention of personnel.

Additionally, the time and expense obligations of required training are a factor in the decrease in the number of responders. The initial training time for fire, EMS, and law enforcement can take several months to complete. Emergency medical services require a regular schedule of continued education to maintain certification. In the fire service, after the initial training, there are specialty courses offered, which are recommended, but not required. For law enforcement, skills such as firearms proficiency must be maintained, and updates to new laws and regulations continues throughout the officer's career.

4.3.14.2 Range of Magnitude

Finances, changing political climates, leadership, or a significant high-profile event can trigger a system to be declared as "success" or "failure". In some cases, a combination of these factors can create a perfect storm. Unfortunately, many "failed" systems are measured by recent events, no matter how successful they may have been in the past. Although financial problems are often blamed on poor leadership, they may have many root causes. Labor rates, benefits, poor productivity, operational design, insurance reimbursements, and market regulation all have a significant direct impact on the financial viability of an organization.

Two fundamental, yet misunderstood, topics are the financial and economic variables that drive emergency service systems. These systems typically generate revenue through tax subsidies, memberships, direct sales, diversification into other lines of business, grants, or fundraising. They spend most of these revenues on direct and indirect labor, and benefits. The remaining dollars go into infrastructure, fuel, medical supplies, insurances, fleet maintenance, dispatch, and other essential items, with hopefully, some left over for recapitalization or fund balance development. The range of the issues related to emergency service shortages are felt across the

entire United States of America and the Commonwealth of Pennsylvania. Elk County has felt emergency shortages and these shortages have had adverse effects on emergency response in the county.

4.3.14.3 Past Occurrence

There have been no official records kept on shortages of emergency services. However, there has been a decrease in the number of new volunteers in the fire service for several years. Most agencies are private organizations that lack local funding and exist based on tax dollars, fund raising, and donations received from their community. The need for fund raising adds to availability issues of volunteers. Most services past practices are not sustaining the current needs for funding and manpower. Without financial support from the communities, services may not be able to remain in operation to serve those same communities. Recruitment and personnel retention are the keys to success.

Elk County has had multiple events that were caused by emergency service shortages, most significantly from 2020 to 2022, exacerbated by the COVID-19 pandemic. Elk County has experienced some form of shortages in emergency services since the beginning of 2020. However, the shortages have not been caused exclusively by the COVID-19 pandemic and were occurring before the pandemic throughout Elk County and the Commonwealth of Pennsylvania.

4.3.14.4 Future Occurrence

Historically, it has been difficult for small communities to have a paid fire or EMS service, therefore requiring volunteers. Fewer volunteers to perform the tasks associated with fire, medical, and rescue operations, can negatively affect a service's ability to respond to emergencies. Additionally, operational needs are impacted if there are fewer volunteers to raise funds. Without fundraising and community support these fire departments and volunteer EMS agencies will experience broader challenges. Municipalities can help offset some of the financial burdens to their local fire company with a fire tax.

There are also challenges for individuals who volunteer, including dedicating time beyond their current employment, family, and community commitments to dedicate to training, responding, and fundraising. Training is essential to provide for the general knowledge and safety of volunteers. Becoming certified as a volunteer firefighter requires hundreds of hours of training. With a decrease in the numbers of new volunteers, many current volunteers are aging and unable to perform at the same levels they once were.

Fire departments and EMS agencies often are tasked with responding to a variety of emergencies, including not only fire and medical emergencies, but also incidents requiring

rescue, containment of hazardous materials, or assistance to law enforcement. Volunteers need to be well trained and able to respond to different scenarios as needed.

The future occurrence of emergency service shortages is likely to continue in Elk County and across the Commonwealth of Pennsylvania. With a lack of new recruits and officers for emergency services, response will continue to be hindered and response times will continue to be high. Institutional change is the most efficient way to decrease the likelihood of emergency service shortages in Elk County, but that type of change is slow and often long-term.

4.3.14.5 Vulnerability Assessment

The possibility that EMS agencies and fire services could fail creates a vulnerability to all Elk County communities. Occasionally, residents of communities mistakenly think that their local fire department is a paid service. Most municipal fire departments are volunteer agencies and need the support of their communities to maintain their departments.

Personnel shortages have been occurring in law enforcement for several reasons. More students are pursuing other professional careers instead of becoming public safety professionals than previously. This trend could be an effect of the recent changes in the social climate toward law enforcement, the increased number of college students pursuing graduate school degrees, or many other factors. As with any profession, becoming a law enforcement officer requires a commitment of time and money for training at local, state, or federal levels. The selection of law enforcement officers includes not only physical and mental aptitudes, but also a comprehensive physiological screening.

If any current public service agency fails to provide enough personnel to perform their required duties, then those duties must be provided for by another service agency that may be many miles away, creating an increased response time. An increased response time could lead to additional or greater severity in injury or property damage. Many communities in Pennsylvania have already experienced the closure of emergency response agencies.

It is recommended that each municipality assess their own vulnerabilities by maintaining and building relationships with their local providers and working with them to make plans accordingly for if a local service were to close its operations. Consolidation of services is a possible solution for agencies that are struggling to maintain operations. Statistics, response times, and all times associated with units dispatched are easily obtainable from the county 911 center. Municipalities should research all the factors which would be part of a consolidation of emergency services with neighboring communities.

The emergency services departments in Elk County need to be supported to create and or discover new ways to not only recruit but to retain volunteers. If left unattended, the issue will

continue and the lack of response will grow, leaving communities more vulnerable to loss of life and loss of property. Community education is a key factor in the maintenance of emergency response agencies. In addition, continued support, and efforts to inform the legislature could all prove to be important in assuring that these services remain in operation into the future. At the time of the writing of this plan, a number of bills have been introduced in both the House of Representative and the Senate as a result of a two-year study initiated by Senate Resolution 6 (SR6). The final report can be found here: http://pehsc.org/wp-content/uploads/2014/05/SR-6-REPORT-FINAL.pdf.

Emergency response agencies that currently provide services within Elk County are identified in the following tables, *Table 59 – Elk County Fire Departments* identifies the municipalities served. All fire departments in Elk County are volunteer. Sigel Volunteer Fire Department, Jefferson County provides fire and quick response service to Millstone Township, Elk County. *Table 60 – Elk County EMS Agencies* identifies each emergency medical service agency and the municipalities served. *Table 61 – Elk County Law Enforcement Agencies* identifies each police department to include the Pennsylvania State Police (PSP) and the municipalities served. This information was provided by the Elk County Department of Emergency Services.

A shortage of emergency response personnel and equipment can directly relate to the vulnerability of Elk County to other hazards including urban fires and explosions. A discussion on the urban fire and explosion risk in the county, and the vulnerability related to those events can be found in the Urban Fire and Explosion hazard profile of this hazard mitigation plan. See Section 4.3.19.

Table 59 - Elk County Fire Departments

Elk County Fire Departments	
Station name	**Municipalities covered**
Elk Fire Company 1 – Saint Marys	City of Saint Marys
Elk Fire Company 2 – Johnsonburg	Johnsonburg Borough and north Ridgway Township
Elk Fire Company 3 – Kersey	Fox Township
Elk Fire Company 4 – Ridgway	Ridgway Borough, south Ridgway Township, and Spring Creek Township
Elk Fire Company 5 – Byrnedale	Jay Township and Benezette Township
Elk Fire Company 6 – Wilcox	Jones Township
Elk Fire Company 7 – Horton	Horton Township
Elk Fire Company 8 – Highland	Highland Township

Table 60 - Elk County EMS Agencies

Elk County EMS Agencies	
Station name	**Municipalities covered**
Bennetts Valley Ambulance	Fox Township, Jay Township
Elk County EMS	City of Saint Marys
Fox Township Ambulance	Fox Township, surrounding municipalities
Ridgway Ambulance	Ridgway Borough, surrounding municipalities
Saint Marys Ambulance	City of Saint Marys, surrounding municipalities

Table 61 - Elk County Law Enforcement Agencies

Elk County Police Departments	
Station name	**Municipalities covered**
Elk County Sheriff's Department	Elk County
Johnsonburg Police Department	Johnsonburg Borough
Pennsylvania State Police	Elk County
Ridgway Police Department	Ridgway Borough
St Marys Police Department	City of St Marys (Surrounding Municipalities)

4.3.15. Environmental Hazards/HazMat

4.3.15.1 Location and Extent

Transportation

Environmental hazards are most commonly due to hazardous materials incidents occurring when such materials are manufactured, used, stored, or transported. Most hazardous materials incidents are unintentional, however hazardous materials could also be released in a criminal or terrorist act. A release, whether it is intentional or accidental, can result in injury or death and may contaminate air, water and/or soils. Hazardous materials incidents can be generally broken down into the subcategories of transportation and fixed facility. This section will focus on environmental hazards and how they relate to transportation of hazardous materials.

Tanker trucks, tractor trailers, and rail cars often are used to transport hazardous materials. When there are transportation incidents involving these types of vehicles, hazardous materials can be released in significant quantities. *Figure 41 – Environmental Hazard Transportation Vulnerability* shows major transportation routes through Elk County, including US 219, PA 66, PA 120, P 153, PA 321, PA 555, PA 948, and PA 949.

Fixed Facility

Hazardous materials incidents can be broken down into the subcategories of transportation and fixed facility. This section of the report focuses on environmental hazardous materials at fixed facilities.

In Pennsylvania, facilities that use, manufacture, or store hazardous materials must comply with Title III of the federal Superfund Amendments and Reauthorization Act (SARA), and the Commonwealth's reporting requirements under the Hazardous Materials Emergency Planning and Response Act (1990-165), as amended. There are ninety-four SARA Title III facilities in Elk County. These facilities listed as SARA sites should not be considered an exhaustive and comprehensive list of all locations where hazardous materials reside in the county.

Fixed facilities are also monitored by the Environmental Protection Agency (EPA). The EPA has identified hazardous materials sites, not regulated by SARA Title III, and are known as Toxic Releases Inventory (TRI) sites. Facilities which employ ten or more full time employees, and which manufacture or process more than 25,000 pounds (or use more than 10,000 pounds) of any SARA Section 313-listed toxic chemical during a calendar year are required to report TRI information to the EPA. The EPA is the federal enforcement agency responsible for SARA Title III and PEMA classifications. As of 2021, there are twenty-four TRI facilities in Elk County, mostly located around St. Marys.

Oil and gas extraction facilities can also be sources of hazardous material release. Most wells in the county are active, but there are also many inactive and abandoned wells. *Figure 40 – Oil &*

Gas Well Locations shows the location of all oil and gas wells in the county along with their proximity to surface waters.

4.3.15.2 Range of Magnitude

Transportation

While often accidental, releases can occur because of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, environmental hazards are known as secondary events. Hazardous materials can include toxic chemicals, radioactive materials, infectious substances, or hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

Hazardous material release can contaminate air, water, and soil, and can possibly cause injuries, poisonings, or deaths. Hazardous materials fall into nine hazards classes. These hazard classes are as follows:

- Class #1: Explosives
- Class #2: Gases (flammable, non-flammable, non-toxic, and toxic)
- Class #3: Flammable and Combustible Liquids
- Class #4: Flammable Solids (spontaneously combustible and dangerous when wet materials/water reactive substances)
- Class #5: Oxidizing substances and organic peroxides
- Class #6: Toxic Substances and Infectious Substances
- Class #7: Radioactive Materials
- Class #8: Corrosive Substances
- Class #9: Miscellaneous Hazardous Materials / Substances

All nine hazard classes can be found in transportation incidences.

Fixed Facility

All nine hazard classes can be found at fixed facilities. Certain conditions can exacerbate release incidents and these events include fixed facilities:

- Micrometeorological effects of buildings and terrain which alters the dispersion of hazardous materials.
- Proximity to surface water and ground water resources.
- Compliance with applicable codes (e.g., building or fire codes) and maintenance failures (e.g., fire protection and containment features can substantially increase the damage to the facility itself and to surrounding buildings.

The type of material released, distance, and related response time of emergency responders also significantly impact severity and scope of hazardous material releases and clean-up efforts.

Areas most proximal to the release are usually at the greatest level of risk, but depending on the material, a release can travel great distances or remain present in the environment for long periods of time (centuries or millennia for some radioactive materials) resulting in chronic and extensive impacts on people and the environment.

Oil and gas well drilling can have a variety of effects on the environment. Abandoned oil and gas wells, not properly plugged, can contaminate groundwater and consequently drinking water wells. Surface waters and soil are sometimes polluted by brine, a salty wastewater product of oil and gas well drilling, and from oil spills occurring at the drilling site or from a pipeline breach. A pipeline breach or an accidental dispersal can spoil public drinking water supplies and can be particularly detrimental to vegetation and aquatic animals, making water safety an important factor in oil and gas extraction. In some cases, associated with hydraulic fracturing (fracking), methane has been found contaminating drinking water in surrounding areas.

Natural gas fires occur when natural gas is ignited at the well site. Often, these fires erupt during drilling when a spark from machinery or equipment ignites the gas. The initial explosion and resulting flames have the potential to seriously injure or kill individuals in the immediate area. These fires are often difficult to extinguish due to the intensity of the flame and the abundant fuel source.

4.3.15.3 Past Occurrence

Transportation

More recent events are recorded in the WebEOC and the reporting software of PIERS (Pennsylvania Emergency Incident Reporting System) and are summarized in *Table 62 – Hazardous Material Incidents*. Transportation accidents that involved hazardous materials were included in the table below.

Table 62 - Hazardous Material Incidents

Hazardous Material Incidents		
Municipality	**Date**	**Event**
Elk County	11/01/2018	Diesel fuel spill
Elk County	06/19/2020	Tanker rollover with large fuel spill
Elk County	02/18/2021	NRC reporting a discharge of three gallons of diesel
Elk County	10/25/2021	Fuel spill from a motor vehicle accident
Elk County	01/08/2022	Hydrogen leak
Elk County	02/17/2022	Fuel leak
Elk County	05/07/2022	Fuel leak
Elk County	10/24/2022	Engine oil spill
Elko Glenn Highrise	11/24/2022	Natural gas odor

Hazardous Material Incidents		
Municipality	**Date**	**Event**
Source: PIERS, Elk County Reporting System, 2023		

Hazardous materials can be transported by air, sea, and land (over the road or through pipelines). Transportation accidents along roadways is a regular occurrence and a large number of hazardous materials are transported by roadway every day.

Fixed Facility

There have been a number of hazardous material incidents in Elk County in the past with only a few of those events related to fixed facilities in the county. More recent events are recorded in WebEOC and the reporting software of PIERS (Pennsylvania Emergency Incident Reporting System) and are summarized in *Table 62 – Hazardous Material Incidents*.

The EPA tracks the management of hazardous materials in facilities that handle significant amounts of hazardous materials. The twenty-four toxic release inventory (TRI) facilities in Elk County as of 2021 are summarized in *Table 63 – TRI Facilities*. Production-related waste managed is a collective term to refer to how much of a chemical is recycled, combusted for energy recovery, treated for destruction, or disposed of, or otherwise released on and off site.

Table 63 - TRI Facilities

Toxic Release Inventory (TRI) Facilities				
Name	**Address**	**Industry Sector**	**Releases on-site**	**Production-related Waste Managed (lbs)**
Advantage Metal Powders Inc.	Ridgway	Fabricated metals	10	10
Allegheny Coatings	Ridgway	Fabricated metals	500	1,250
Alpha Precision Group	Ridgway	Fabricated metals	0	98,196
Amphenol Thermometrics Inc.	St. Marys	Computers and electronic products	1	182
Contact Technologies Inc.	St. Marys	Electrical equipment	5	5,086
Domtar-Johnsonburg Mill	Johnsonburg	Paper	263,172	12,350,913
Eastern Sintered Alloys Inc.	St. Marys	Fabricated metals	0	19,559

Toxic Release Inventory (TRI) Facilities				
Name	**Address**	**Industry Sector**	**Releases on-site**	**Production-related Waste Managed (lbs)**
Elco Sintered Alloys Co. Inc.	Kersey	Fabricated metals	0	0
GKN Sinter Metals	Kersey	Fabricated metals	0	37,966
Hoeganaes Corp.	Ridgway	Fabricated metals	11	213,720
Keystone Powdered Metal Co.	St. Marys	Fabricated metals	27	680
Mersen USA GS Corp.	St. Marys	Electrical equipment	312	131,039
Metaldyne Sintered	St. Marys	Fabricated metals	15	37,310
Metaldyne Sintered Components	Ridgway	Fabricated metals	15	135,946
Metco Industries Inc.	St. Marys	Fabricated metals	0	4,313
Modern Industries	Kersey	Fabricated metals	6,822	6,822
Morgan Advanced Materials	St. Marys	Electrical equipment	46	4,317
MPP – Ford Rd. Div.	St. Marys	Fabricated metals	0	29,193
MPP - Washington St. Div.	St. Marys	Fabricated metals	0	26,781
Rebco Inc.	Kersey	Fabricated metals	0	13,206
SGL Carbon LLC	St. Marys	Electrical equipment	569	124,000
Sinterite Products Div. of GPI	St. Marys	Machinery	92	12,184
Speer Carbon Co.	St. Marys	Electrical equipment	26	26
St. Marys Carbon Co. Inc.	St. Marys	Electrical equipment	1,435	13,492

As of 2023, Elk County is home to 2,908 active natural gas wells.

4.3.15.4 Future Occurrence

Transportation

While many incidents involving hazardous material releases have occurred in Elk County in the past, they are generally difficult to predict. The nature of traffic accidents is that there is little to

no warning for their occurrence, and they can have disastrous results. An occurrence is largely dependent upon the accidental or intentional actions of a person or group.

Fixed Facility

Hazardous material release incidents are generally difficult to predict, but the presence of such dangerous materials warrants preparation for accidental or intentional release events. Emergency response agencies in Elk County should be prepared to handle the types of hazardous materials housed and used in the SARA Title III facilities, TRI facilities, and oil and gas wells that are located within the county. The Federal Superfund Amendments and Reauthorization Act (SARA) is also known as the Emergency Planning and Community Right-to-Know Act (EPCRA), and the Local Emergency Planning Committees (LEPCs) are designed by EPCRA to ensure that state and local communities are prepared to respond to potential chemical accidents.

4.3.15.5 Vulnerability Assessment

Transportation

Quick response to transportation accidents involving hazardous materials minimizes the volume and concentration of hazardous materials that are transported and dispersed through the air, water, and soil. Every municipality within Elk County is vulnerable to a hazardous materials incident caused along a transportation route. These incidents can occur along highways, railways, and pipelines. *Figure 41 – Environmental Hazard Transportation Vulnerability* identified the 2,000-foot hazard corridor for all major highways in Elk County. *Figure 42 – Annual Truck Traffic Percentages* identifies the annual truck traffic percentages for all of the roadways in Elk County.

Fixed Facility

Populations, critical infrastructure, and natural habitats within 1.5 miles of SARA Title III and Toxic Release Inventory sites are vulnerable to hazardous material incidents.

Private water suppliers such as domestic drinking water wells in the vicinity of oil and gas wells are at risk of contamination from brine and other pollutants, including methane, which can pose a fire and explosive hazard. Ideally, vulnerability of private drinking well owners would be established by comparing the distance of drinking water wells to known oil and gas well locations, but this extensive detailed data is not readily available. Private drinking water is largely unregulated and information on these wells is voluntarily submitted to the Pennsylvania Topographic and Geologic Survey by water well drillers, and the existing data is largely incomplete and/or not completely accurate. *Table 64 – Oil and Gas Wells & Drinking Water Wells* illustrates the type of well and the local domestic drinking water wells for each municipality.

Table 64 - Oil and Gas Wells & Drinking Water Wells

Oil & Gas Wells in Elk County					
Municipality	**Type of Well**				**Domestic Drinking Water Wells**
	Active	**Abandoned**	**Inactive**	**Proposed**	
Benezette Township	59	8	92	7	149
Fox Township	59	0	42	10	72
Highland Township	1,764	2	10	28	38
Horton Township	84	3	0	1	74
Jay Township	13	1	5	3	88
Johnsonburg Borough	2	0	0	0	33
Jones Township	441	12	102	7	138
Millstone Township	78	0	1	2	41
Ridgway Borough	0	0	0	0	18
Ridgway Township	89	3	2	1	89
Spring Creek Township	159	2	5	0	70
St. Marys City	160	3	0	3	266
Total:	**2,908**	**34**	**259**	**62**	**1,076**
Source: PA DEP, 2023, PA GWIS, 2023					

Figure 40 - Oil and Gas Well Locations

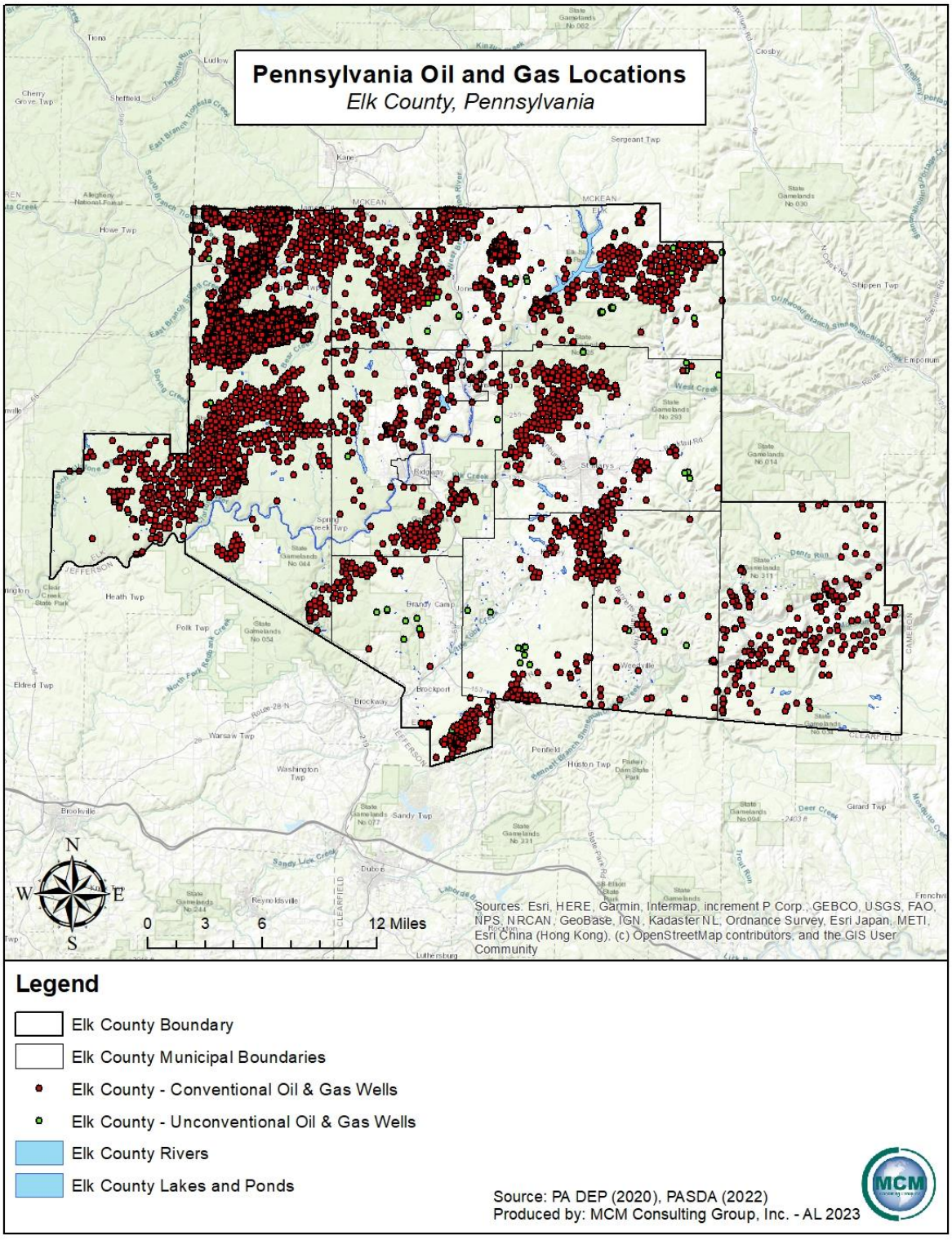


Figure 41 - Environmental Hazard Transportation Vulnerability

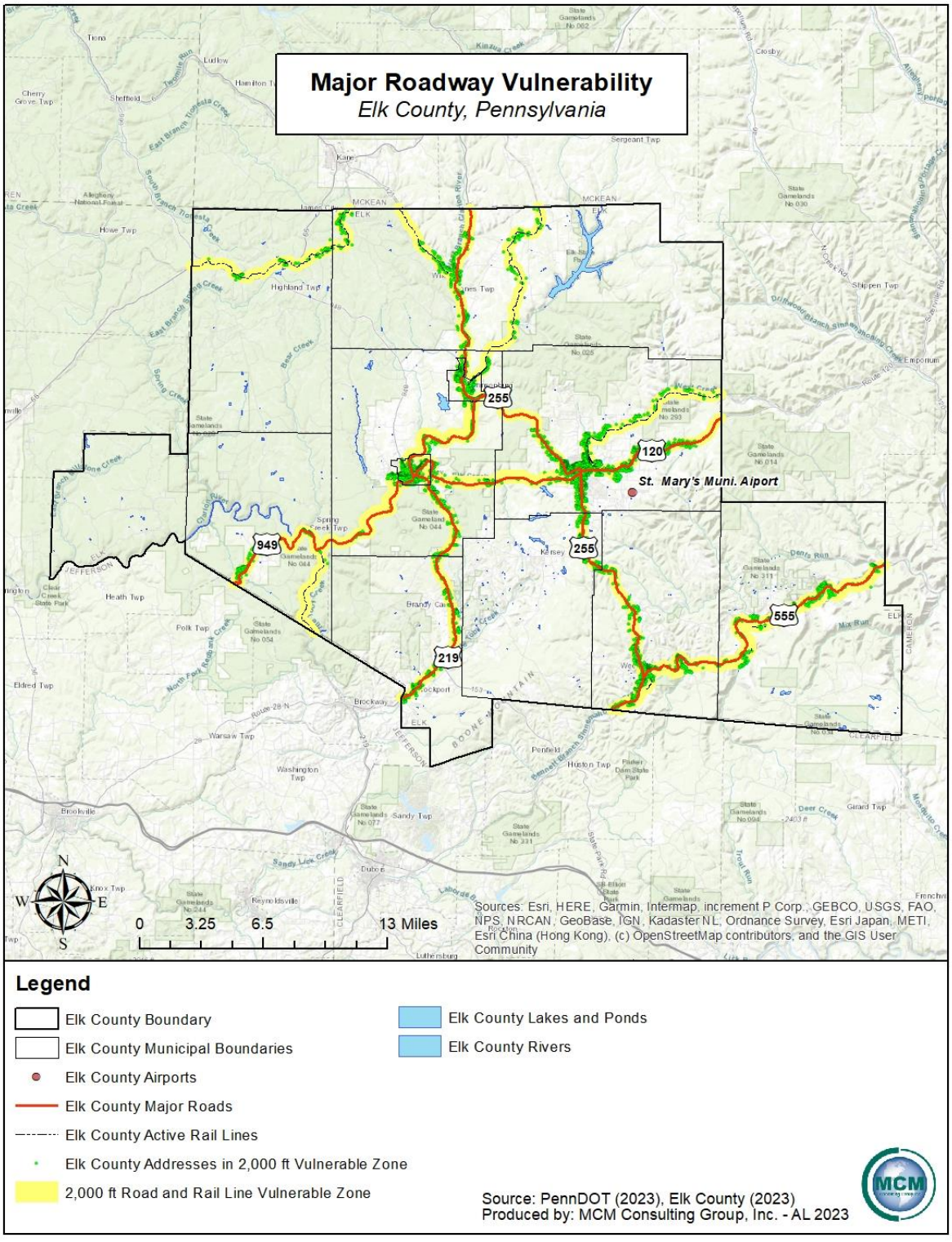
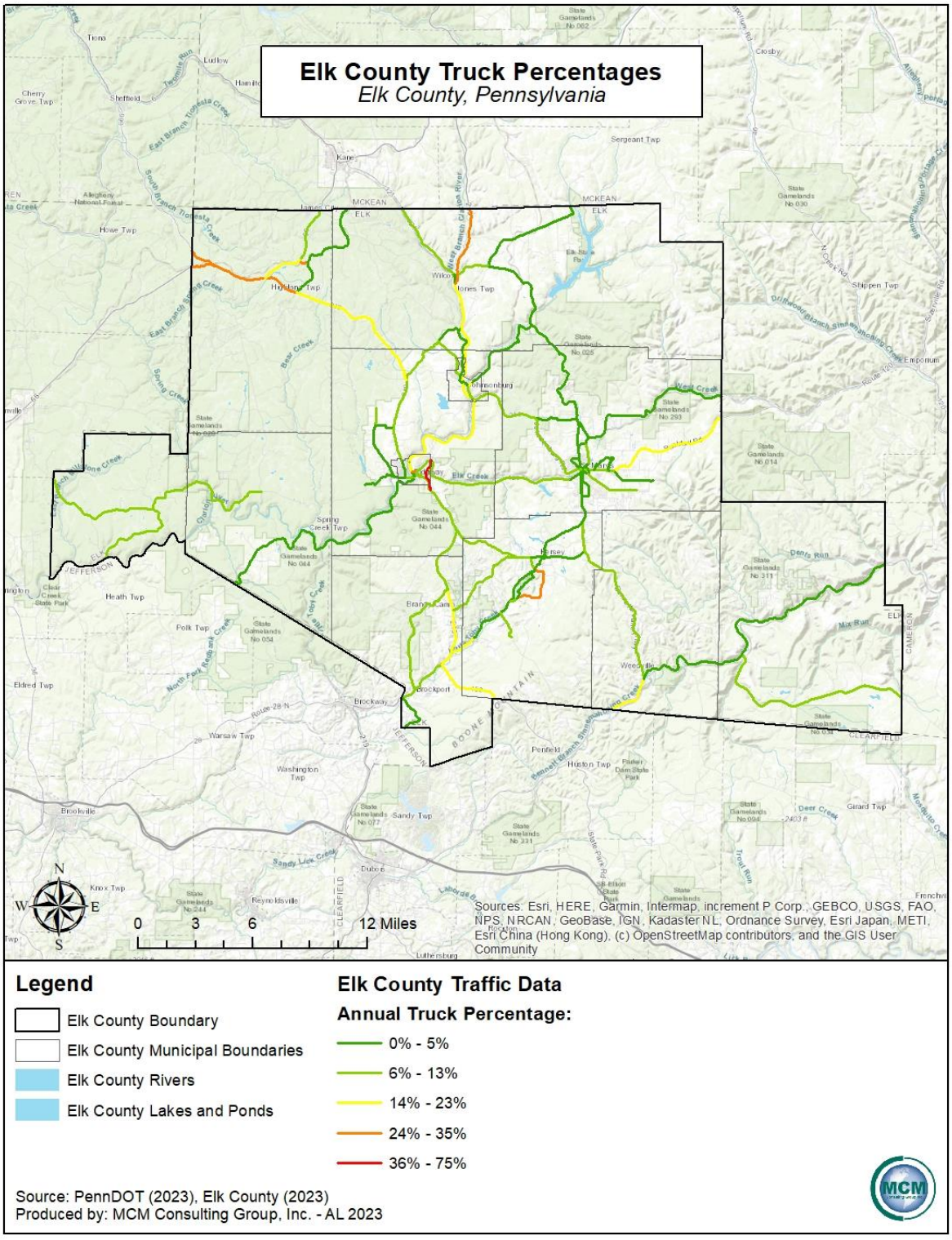


Figure 42 - Annual Truck Traffic Percentages



4.3.16. Opioid Epidemic

4.3.16.1 Location and Extent

Pennsylvania and the United States at large have been experiencing an epidemic of opioid drug abuse. According to the Pennsylvania Department of Health, the opioid overdose epidemic is the worst public health crisis in Pennsylvania. It affects Pennsylvanians across the state, from big cities to rural communities. Opioid addiction has increased drastically over the last year due to the hardships faced from the COVID-19 pandemic. Opioid use has increased since the beginning of the COVID-19 pandemic which is being attributed to the uncertainty people are feeling due to the pandemic.

Opioids, mainly synthetic opioids (other than methadone), are currently the main driver of drug overdose deaths. According to the Center for Disease Control and Prevention (CDC), 72.9% of opioid-involved overdose deaths involved synthetic opioids. Opioid addiction occurs when an individual becomes physically dependent on opioids. Opioids are a class of drug that reduces pain by interacting with receptors on nerve cells in the body and brain. The use of opioids is a broad term and includes opiates, which are drugs naturally extracted from certain types of poppy plants, and narcotics. Opioids can also be synthetically made to emulate opium. Opioid drugs are highly addictive and typically result in increasing numbers of overdose deaths both prescribed (e.g., fentanyl) and illicit (e.g., heroin) opioids. Overdose deaths from opioids occur when a large dose slows breathing, which can occur when opioids are combined with alcohol or antianxiety drugs. While generally prescribed with good intentions, opioids can be over-prescribed, resulting in addiction.

According to the Drug Enforcement Administration (DEA), opioids come in various forms such as tablets, capsules, skin patches, powder, chunks in various colors from white to brown/black, liquid form for oral or injection use, syrups, suppositories, and lollipops. The Centers for Disease Control and Prevention (CDC) defines the following as the three most common types of opioids:

- **Prescription Opioids**: Opioid medication prescribed by doctors for pain treatment. These can be synthetic oxycodone (OxyContin), hydrocodone (Vicodin), or natural (morphine).
- **Fentanyl**: A powerful synthetic opioid that is 50 to 100 times more powerful than morphine and used for treating severe pain; illegally made and distributed fentanyl is becoming more prevalent.
- **Heroin**: An illegal natural opioid processed from morphine which is becoming more commonly used in the United States.

Opioids are highly addictive. They block the body's ability to feel pain and can create a sense of euphoria. Additionally, individuals often build a tolerance to opioids, which can lead to misuse and overdose.

While other addictive substances such as methamphetamines and alcohol can be problematic for the health of individuals in Elk County, this profile focuses on opioid drugs and the opioid epidemic. The opioid crisis was declared to be a public health emergency on October 26, 2017. While the declaration provides validation for the scope and severity of the problem, it was not accompanied by any release of funding for mitigating actions. On January 10, 2018, Governor Tom Wolf declared the opioid epidemic to be a statewide public health disaster emergency for Pennsylvania. The declaration is intended to enhance response and increase access to treatment.

4.3.16.2 Range of Magnitude

Opioid addiction can lead to overdose, which can be fatal. This type of addiction can affect others that are not the user themselves. The most dangerous side effect of an opioid overdose is depressed breathing. The lack of oxygen to the brain causes permanent brain damage, leading to organ failure, and eventually death. Signs and symptoms include respiratory depression, drowsiness, disorientation, pinpoint pupils, and clammy skin. Opioid addiction can also be passed from mother to child in the womb. This condition, known as neonatal abstinence syndrome, has increased five-fold, according to the National Institute on Drug Abuse (NIDA). This results in an estimated 22,000 babies in the United States born with this condition. First responders such as paramedics, police officers, and firefighters are also affected by the opioid addiction crisis. First responders face exposure risk due to an increase in emergency calls due to an increase in the crisis, particularly to synthetic fentanyl. Two to three milligrams of fentanyl can cause an induced respiratory depression, arrest, and possibly death to occur. Since fentanyl is indistinguishable from several other narcotics and powdered substances, first responders must take extra precaution when dealing with calls related to drug abuse. A worst-case scenario with the opioid epidemic in Elk County would be a high number of overdoses between residents and/or first responders throughout the county.

According to the Center for Disease Control and Prevention (CDC), more than 192 Americans die every day from an opioid overdose. In 2021, a total of 5,343 deaths related to opioid use occurred in Pennsylvania. From February 2020 to February 2021, there has been a 3.34% increase across the commonwealth of Pennsylvania. This could indicate a significant increase in opioid overdoses in Pennsylvania. Heroin and fentanyl are the two drugs most often found in overdose deaths, and they are considered to be highly available and nearly ubiquitous in Pennsylvania.

4.3.16.3 Past Occurrence

In 2021, there was an estimated total of 107,622 drug-related overdose deaths in the United States. This is the highest number of overdose deaths ever recorded in a 12-month period, according to the recent provisional date from the CDC. Elk County experienced a total of at most eighty-one drug related deaths from 2015 – 2020. There was a total of between one and nine overdose deaths in each calendar year from 2015 to 2020. Elk County experienced 13 overdose deaths in 2021 but the finalized data was not available at the time of this writing, due to delays caused by the COVID-19 pandemic. More recently, Jones Township recorded five deaths from January to February 2023. The most common age group for opioid abuse in Elk County is the 35-44 years of age demographic. In Elk County the overdose rate of males is greater than the overdose rate of females. The most used opioids in Elk County are fentanyl, heroin, cocaine, benzodiazepines, and Rx opioids.

Table 65 - Drugs Present in 2020 Pennsylvania Overdose Deaths

Drugs Present in 2020 PA Overdose Deaths	
Drug Category	**Percent Reported Among 2020 Decedents**
Cannabis	25%
Cocaine	20%
Heroin	15%
Fentanyl	14%
Methamphetamine	10%
Prescription Opioids	5.5%
Cathinones	5.5%
Benzodiazepines	5%
Source: DEA, 2020	

4.3.16.4 Future Occurrence

Both Elk County, and Pennsylvania as a whole, have seen a steady rise in opioid related deaths over the last several years, with drug-related death rates increasing at a high percentage. Future occurrences of opioid addiction and overdose are unclear as the state moves forward with overdose prevention initiatives through the use of Naloxone, alternative pain treatments, improvement of tools for families and first responders, and expansion of treatment access. The Wolf Administration has taken various approaches to help with the prevention of mass future occurrences across the Commonwealth. To help prevent future drug abuse and protect individual health among communities in Pennsylvania, the Pennsylvania's Prescription Drug Monitoring Program (PA PDMP) collects information on all filled prescriptions for controlled substances.

This information helps health care providers safely prescribe controlled substances and helps patients get correct treatment. The PA PDMP also has drug take-back boxes located in the counties for an easy, convenient location where anyone can dispose of their unused, expired, or unwanted prescriptions to help lower potential drug overuse. In Elk County, there are five drug take-back boxes located throughout the county. The drug take-back box locations include the City of Saint Marys Police Department, the Elk County Sheriff's Office, the Johnsonburg Borough Police Department, the Ridgway Police Department, and the Pennsylvania State Police-Troop C/Ridgway Barracks. These locations help reduce future occurrences of opioid use by offering safe disposal of unused medications.

The addresses for these locations are listed below:

- City of Saint Marys Police Department - 319 Erie Ave, Saint Marys, Pennsylvania, 15857
- Elk County Sheriff's Office - 250 Main St, Ridgway, Pennsylvania, 15853
- Johnsonburg Borough Police Department - 100 Main St, Johnsonburg, Pennsylvania, 15845
- Ridgway Police Department - 108 Main St, Ridgway, Pennsylvania, 15853
- Pennsylvania State Police-Troop C/Ridgway Barracks - 48 Servidea Dr, Ridgway, Pennsylvania, 15853

In the event of an opioid overdose, death can sometimes be prevented with the use of the drug naloxone. Pennsylvania Secretary of Health, Dr. Rachel Levine, previously signed updated standing order prescriptions of naloxone. The updated standing orders include the 2mg dose auto injector which has recently become available. Naloxone is a medication that can reverse an overdose that is caused by an opioid drug (i.e., prescription pain medication or heroin). Naloxone is used to block the effects of opioid and is sold under the brand name of Narcan. When administered during an overdose, naloxone blocks the effects of opioids on the brain and restores breathing within two to eight minutes. Naloxone has been used safely by medical professionals for more than 40 years and has only one function to reverse the effects of opioids on the brain and respiratory system in order to prevent death. Emergency medical responders have access to the treatment, and as of 2015, naloxone is available without a prescription in Pennsylvania. Also, with the January 10, 2018, disaster declaration, emergency medical technicians (EMTs) are now allowed to leave naloxone behind at a scene, further increasing the distribution and accessibility of the lifesaving medication. According to a study published in September 2018, drug users reported that users often have multiple overdoses in the course of their drug use, and availability of naloxone has saved many lives. While the introduction of naloxone has been a significant benefit to the fight against opioid abuse, efforts to prevent future overdoses are still underway. Naloxone is another way to reduce future occurrences of the opioid epidemic from occurring in Elk County.

Opioid drugs have been a problematic and addictive method for patients to deal with pain. Employing alternative approaches to pain management could prevent patients from ever being introduced to addictive opioids, especially considering the most common overdose drugs in Elk County have been prescription opioids. A possible alternative pain treatment comes from hemp extracted cannabidiol, or CBD. Unlike THC (the psychoactive constituent of cannabis), CBD is non-psychoactive and does not have the same intoxicating effect as THC; however, CBD can provide relief from pain, inflammation, anxiety, and even psychosis. CBD is legal without a prescription throughout the United States of America.

4.3.16.5 Vulnerability Assessment

Opioid overdoses have resulted in many tragic deaths in Pennsylvania and many people have been affected by the epidemic through the loss of either a family member, a close friend, or member of their community. Opioid addiction is a direct detriment to the personal wellbeing of addicts, a burden to their families and communities, and a strain to the emergency response system that cares for overdose victims. In general, jurisdictions that are more densely populated are more vulnerable to opioid addiction threats as access to the drugs increases. However, rural communities in general experience larger per-capita opioid-related deaths. Jurisdictional losses in the opioid addiction crisis stem from lost wages, productivity, and resources rather than losses to buildings or land. Many counties across the Commonwealth, including Elk County, have seen an increase of time and resources devoted to the opioid epidemic as overdose and response increase.

The vulnerability in the county depends on the number of additional risk factors on the vulnerable population such as genetic, psychological, and environmental factors that play a role in addiction. The known risk factors of opioid misuse and addiction include poverty, unemployment, family and/or personal history of substance abuse, history of criminal activity, history of severe depression or anxiety, and prior drug/alcohol rehabilitation. In addition, women have a unique set of risk factors for opioid addiction. Women are more likely than men to have diagnosed chronic pain. Compared with men, women are also more likely to be prescribed opioid medications, to be given higher doses, and to use opioids for longer periods of time. Women may also have biological tendencies to become dependent on prescription pain relievers more quickly than men. Therefore, if the county were to have a population with a great amount of these risk factors, the county would be very vulnerable to the opioid epidemic.

The COVID-19 pandemic and its periods of quarantine caused vulnerability in opioid users throughout Elk County. It is likely that the emergence of COVID-19 and subsequent disruptions in health care and social safety nets combined with social and economic stressors has fueled the opioid epidemic. The COVID-19 pandemic has challenged vulnerable populations, including

those with opioid use disorders. The opioid epidemic and COVID-19 pandemic are intersecting and presenting unprecedented challenges for families and communities. Opioid use affects respiratory and pulmonary health which may make those with opioid use disorders more susceptible to COVID-19. In addition, chronic respiratory disease is already known to increase overdose mortality risk among people taking opioids, and decreased lung capacity from COVID-19 could lead to similar health effects. Secondary impacts from the COVID-19 pandemic, including disruptions of treatment and recovery services, limited access to mental health services and peer support, disrupted routines, loss of work, and stress, may lead to increased opioid use and risk of relapse for those in recovery. Risk factors also arise from indirect factors including housing instability and incarceration. Those with opioid use disorders are at higher risk for housing insecurity, homelessness, and incarceration. Congregate living facilities such as homeless shelters, jails, and prisons are high-risk environments for coronavirus transmission, and there are challenges in implementing recommendations from the CDC such as social distancing and quarantine. Additionally, the pandemic took away the attention from the media, from legislators, and from public health agencies that were being focused on the opioid crisis. The opioid epidemic in Pennsylvania increased 22.9% since the beginning of the pandemic.

Additionally, first responders and medical personnel are also a very vulnerable population when dealing with the opioid epidemic. Fentanyl and related substances are hazardous materials, which cause the environment and the people around the substance to be vulnerable. Contact with fentanyl can impact first responders and others that are related to the opioid user. Depending on the potency of the drug, it can take as little as the equivalent of few grams of table salt to cause health complications. There have been several reports nationally of first responders accidentally overdosing on fentanyl through brief skin contact or the drug becoming airborne. It is best for first responders to err on the side of caution to avoid any potential exposure. The American College of Medical Toxicology (ACMT) and the American Academy of Clinical Toxicology (AACT) suggest that nitrile gloves provide sufficient protection for handling fentanyl, and for "exceptional circumstances where the drug particles or droplets suspended in the air, an N95 respirator provides sufficient protection". Other environmental structures such as streams, rivers, and lakes have been known to contain traces of opioids and other drugs within them. These traces come from human urine, feces, or medications that have been discarded in the bathroom. The Environmental Protection Agency (EPA) suggests that while the risks of pharmaceuticals found in wastewater, ambient water, and drinking water are low, further research is needed. State facilities are not at risk to the opioid crisis, but there are some occupation-specific risks that may make some employees more vulnerable. State employees working in direct patient care are vulnerable to fentanyl exposure. However, the physical plant and facilities of the Commonwealth and Elk County are not likely to experience losses from the opioid addiction crisis. Absenteeism

associated with an opioid addiction in state facilities located in high-risk areas could lead to economic loss through lost productivity and increased medical costs. *Figure 43 – Opioid Overdose Deaths in Pennsylvania 2020* and *Figure 44 – Opioid Overdose Deaths in Pennsylvania 2021* illustrate the number of deaths per county in the state of Pennsylvania.

Figure 43 - Opioid Overdose Deaths in Pennsylvania 2020

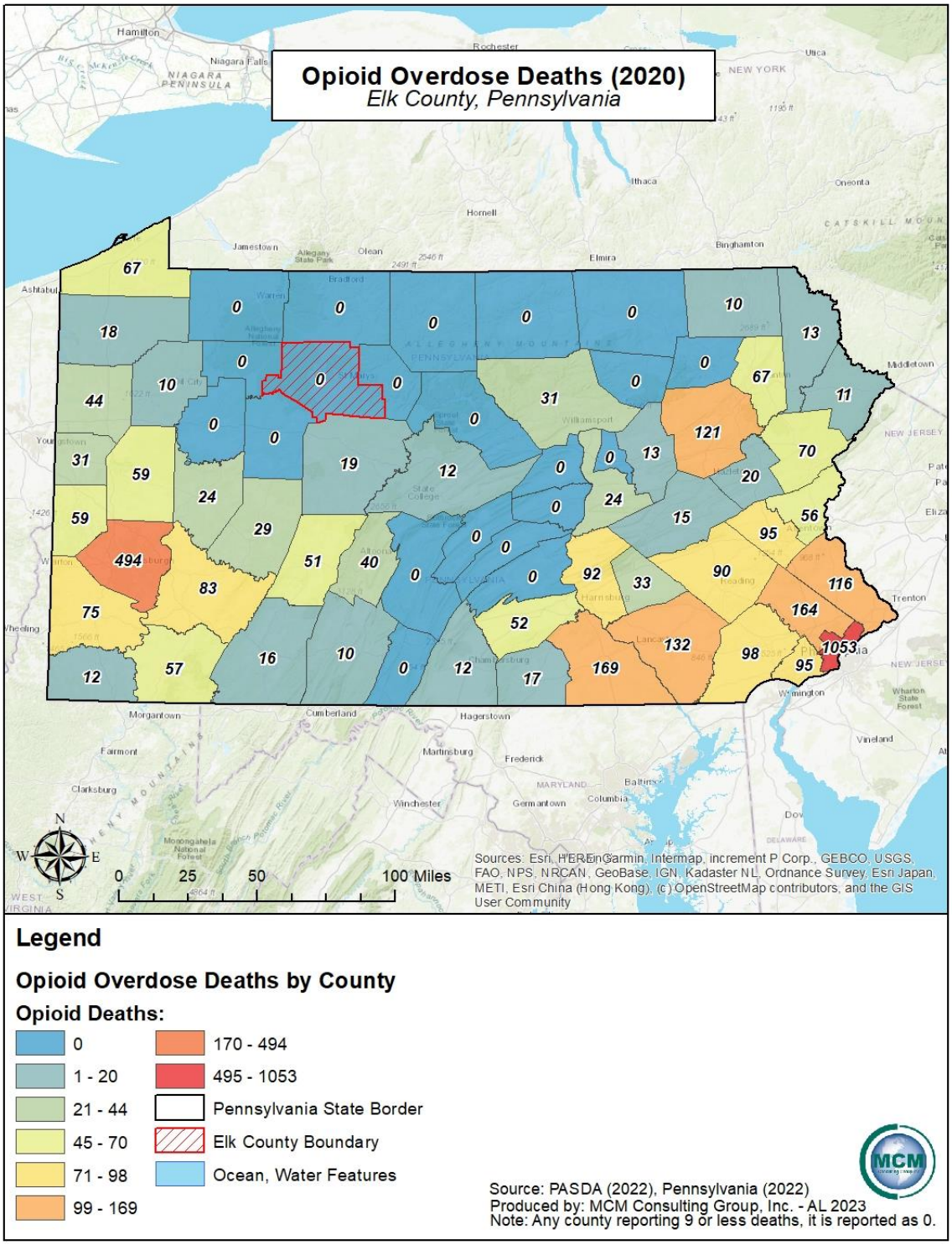
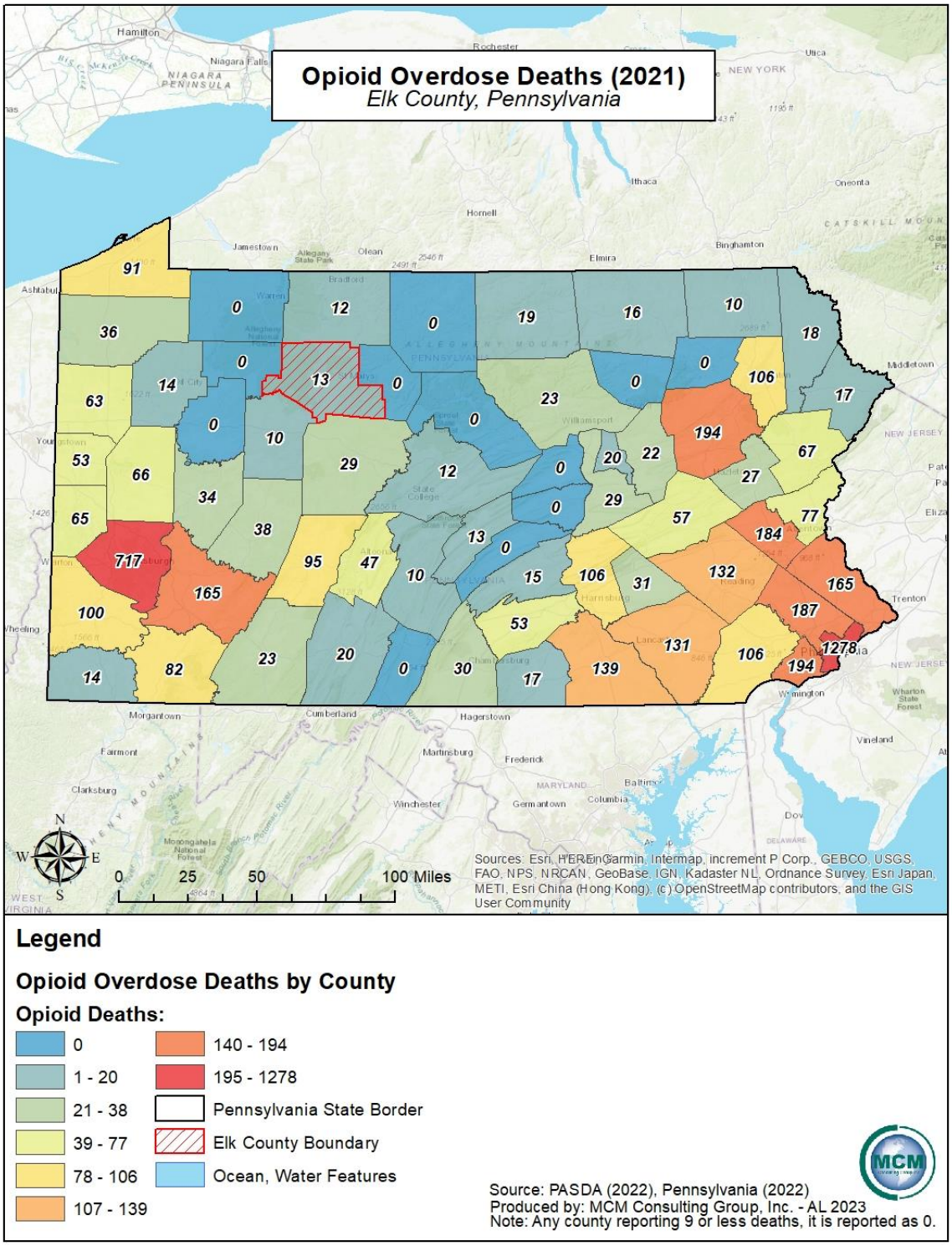


Figure 44 - Opioid Overdose Deaths in Pennsylvania 2021



4.3.17. Terrorism/Cyberterrorism

4.3.17.1 Location and Extent

Following several serious international and domestic terrorist incidents during the 1990s and early 2000s, citizens across the United States paid increased attention to the potential for deliberate, harmful actions of individuals or groups. The term "terrorism" refers to intentional, criminal, malicious acts. The functional definition of terrorism can be interpreted in many ways. Officially, terrorism is defined in the Code of Federal Regulations as "…the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives." (28 CFR §0.85)

Cyber-terrorism is the unlawful use of force and violence over technological methods to cause harm to financial security, identity information, personal information, and attacking personal computers, mobile phones, gaming systems, and other Bluetooth or wirelessly connected devices. Cyber-terrorism can be just as damaging to infrastructure as conventional terrorism, due to the large amount of business that is carried out over the internet, through wirelessly connected devices, or from employees of companies working remotely.

The Federal Bureau of Investigations (FBI) further characterizes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. Often, the origin of the terrorist or person causing the hazard is far less relevant to mitigation planning than the hazard itself and the consequences. However, it is important to consider that the prevalence of homegrown violent extremists (HVEs) has increased in recent years, with individuals able to become radicalized on the internet. In a speech on August 29, 2018, addressed to the 11th annual Utah National Security and Anti-Terrorism Conference, FBI Director Christopher Wray describes HVEs as "the primary terrorist threat to the homeland here today, without question."

Community lifeline facilities are either in the public or private sector that provide essential products and/or services to the general public. Community lifeline facilities are often necessary to preserve the welfare and quality of life in the county, or fulfill important public safety, emergency response, and/or disaster recovery functions. Community lifeline facilities identified in the county are hospitals and health care facilities, schools, childcare centers, fire stations, police departments, municipal buildings, and hazardous waste facilities. In addition to critical facilities, the county contains at risk populations that should be factored into a vulnerability assessment. These populations include not only the residents and workforce in the county, but also the tourists that visit the area on a daily basis, those that are traveling through the county on

any major highway and marginalized groups such as LGBTQ persons and racial, religious, or other minorities.

Potential targets include:

- Commercial facilities
- Family planning clinics/organizations associated with controversial issues
- Education facilities
- Events attracting large amounts of people
- Places of worship
- Industrial facilities, especially those utilizing large quantities of hazardous materials
- Transportation infrastructure
- Historical sites
- Cultural sites
- Government facilities

4.3.17.2 Range of Magnitude

Terrorism may include use of Weapons of Mass Destruction (WMD) (including chemical, biological, radiological, nuclear, and explosive weapons) which include arson, incendiary, explosive, armed attacks, industrial sabotage, intentional release of hazardous materials, and cyber-terrorism. Within these general categories, there are many variations. There is a wide variety of agents and ways for them to be disseminated, particularly in the case of biological and chemical weapons.

Terrorist methods can take many forms including:

- Active assailant
- Agri-terrorism
- Arson/incendiary attack
- Armed attack
- Assassination
- Biological agent
- Chemical agent
- Cyber-terrorism
- Conventional bomb or bomb threat
- Hijackings
- Release of hazardous materials
- Kidnapping

- Nuclear bomb
- Radiological agent

Active assailant incidents and threats can disrupt the learning atmosphere in schools, interfere with worship services, cause traffic to be re-routed, and use taxpayer assets by deploying police, EMS and/or fire units. Elk County has six districts (public schools K through 12th grade) that include twelve primary, secondary, and high schools. There are also seven private schools in Elk County. There are no post-secondary schools located in Elk County.

The areas along major transportation routes can be susceptible to forms of public transit terrorist attacks. More populated areas of the county, including the county seat of Ridgway Borough, can be susceptible to chemical, biological, radiological, nuclear, or explosive (CBRNE) events due to the concentration and density of residential communities and government activity and buildings. Secondary effects from CBRNE incidents can be damaging as well. Mass evacuations could result in congestion of roadways and possibly result in breakdown of civil order, further exacerbating the situation. Government operations may be disrupted due to the need to displace or operate under reduced capacity. Radiation fallout, hazardous chemical introduction into the groundwater or biologic/germ agents can cause long-term environmental damage.

Cyber terrorism is becoming increasingly prevalent. Cyber terrorism can be defined as activities intended to damage or disrupt vital computer systems. These acts can range from taking control of a host website to using networked resources to directly cause destruction and harm. Protection of databases and infrastructure are the main goals for a safe cyber environment. Cyber terrorists can be difficult to identify because the internet provides a meeting place for individuals from various parts of the world. Individuals or groups planning a cyber-attack are not organized in a traditional manner, as they are able to effectively communicate over long distances without delay. The largest cyber terrorism threat to institutions comes from any processes that are networked or controlled via computers.

Ransomware continues to be the leading threat, with Maze ransomware accounting for nearly half of all known cases in 2020. Cybercriminals have increasingly begun to steal proprietary – and sometimes embarrassing – data before encrypting it. The cybercriminal will then threaten to publicly release the stolen files if the victims do not provide financial transactions.

4.3.17.3 Past Occurrence

No major terrorism or cyber terrorism events have occurred in Elk County, Pennsylvania. Cyber terrorism events are becoming more common in areas of local government, and these include counties near Elk County, PA.

Significant international terrorism incidents in the United States include the World Trade Center bombing in 1993, the bombing of the Murrow Building in Oklahoma City in 1995, and the

September 11th, 2001, attacks on the World Trade Center and the Pentagon. One of the aircrafts hijacked in the September 11th attacks crash landed in Somerset County, Pennsylvania before it reached its intended target. While fatalities and destruction at the intended target were avoided, all passengers on the flight perished.

While the largest scale terrorist incidents have often had international stimuli, many other incidents are caused by home grown actors who may have become radicalized through hate groups either in person or via the internet, and who may struggle with mental health issues. Hate groups such as the Ku Klux Klan (KKK), Aryan Nation, the New Black Panther Party, and more recently, the Alt-Right, Antifa, anarcho-communists, Proud Boys, plus conspiracy theorist believers/promoters such as QAnon, have been part of domestic terrorism in different forms. During the May 2020 George Floyd protests, anti-police individuals associated with one or more of the groups created incendiary devices to burn down the Minneapolis Third Precinct. On January 6, 2021, individuals associated with one or more of the groups, stormed the United States Capitol to disrupt the certification of the 2020 presidential election, resulting in five deaths and evacuation of Congress.

Active Shooters

An active assailant (shooter), as defined by the U.S. Department of Homeland Security, is an individual actively engaged in killing or attempting to kill people in a confined area, in most cases, active shooters use firearms and there is not necessarily a pattern or method to their selection of victims. Throughout the year in 2023, there were a total of at least 160 mass shooting incidents in the United States according to the Gun Violence Archive. Often these shooters are HVEs. Two significant events have occurred in Pennsylvania in recent history: one occurred on October 27, 2018, when eleven people were killed by a gunman in the Pittsburgh neighborhood of Squirrel Hill; the gunman was a homegrown violent extremist and attacked the congregation of the Tree of Life Synagogue in a shooting that targeted the Jewish population and was fueled by the gunman's anti-Semitic, anti-immigrant, and anti-refugee sentiments. Another event occurred in January of 2019, where a gunman killed two people and permanently injured one inside P.J. Harrigan's bar in State College and later killed a homeowner and himself. One of the most tragic recent active shooters occurred in Uvalde, Texas, where an armored and masked gunman entered the Robb Elementary School on May 24, 2022, and killed nineteen students and two teachers. Another active shooter event occurred on November 22, 2022, when an employee at a Walmart in Chesapeake, Virginia entered the breakroom of the Chesapeake Walmart and killed six individuals before taking his own life.

Other active shooter events in the United States in recent years include Virginia Tech (April 2007), Sandy Hook Elementary School (December 2012), San Bernardino, California (December 2015), an Aurora, Colorado movie theater (July 2012) a church in Charleston, South Carolina

(June 2015). An *Active Shooter Incidents 20-Year Review* by the FBI concluded that there has been a significant recent increase in frequency of active shooter incidents, and that most shooters were male. The report documents data from all the incidents, including location, commercial environments, educational environments, open spaces, military and other government properties, residential locations, houses of worship, and health care facilities (FBI, 2021). *Figure 45 – Active Shooter Incidents – 20 Year Active Shooter Summary* is one page from the report that illustrates a numerical breakdown of shooting events for those twenty years. *Figure 46 – Education Environments* and *Figure 47 – Education Environments Cont'd* shows two more summary pages from the report that detail active shooter statistics in educational environments.

Figure 45 - Active Shooter Incidents - 20 Year Active Shooter Summary

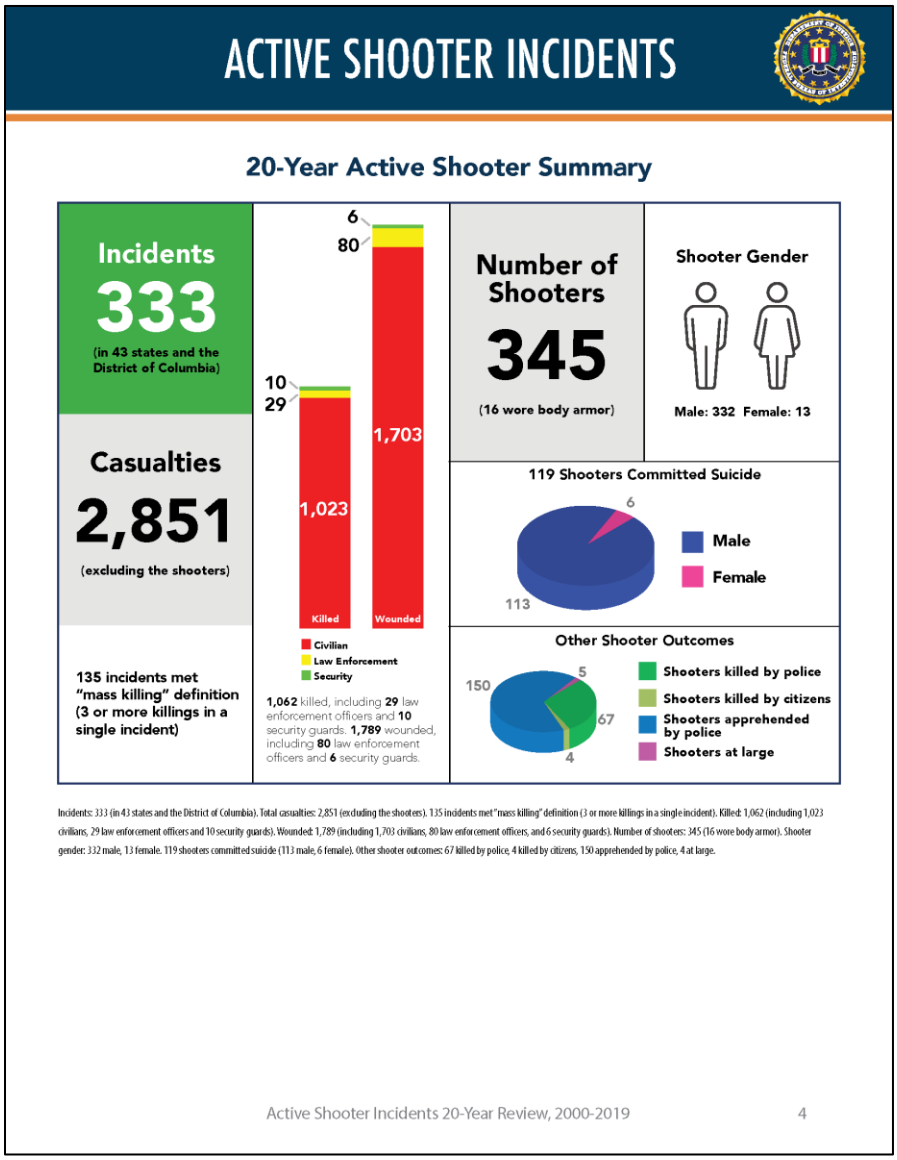


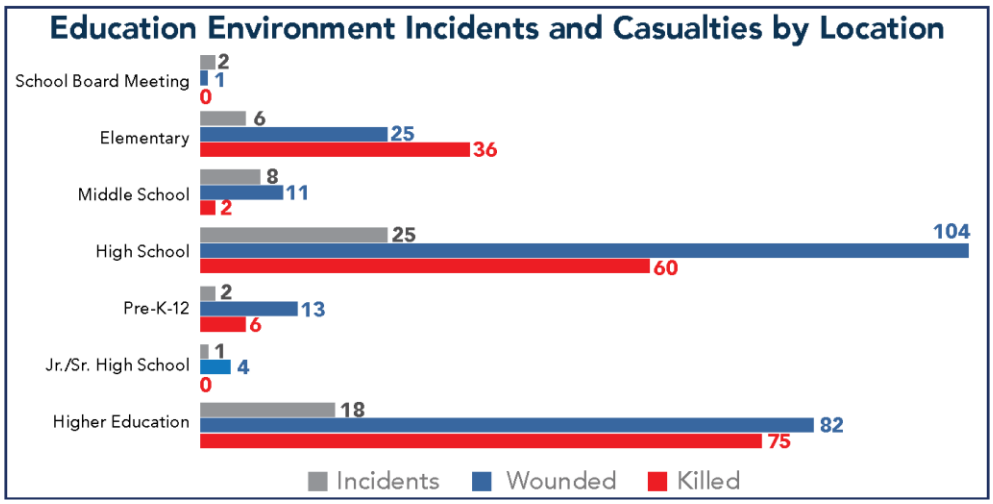
Figure 46 - Education Environments

ACTIVE SHOOTER INCIDENTS

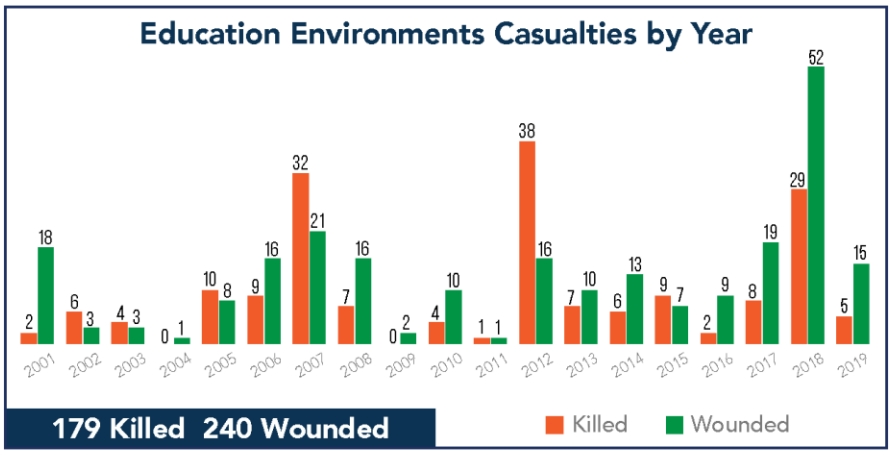
Education Environments

Quick Look:

Sixty-two incidents occurred in public and private educational settings, defined as schools covering pre-kindergarten to 12th grade, institutes of higher education, and school board meetings.



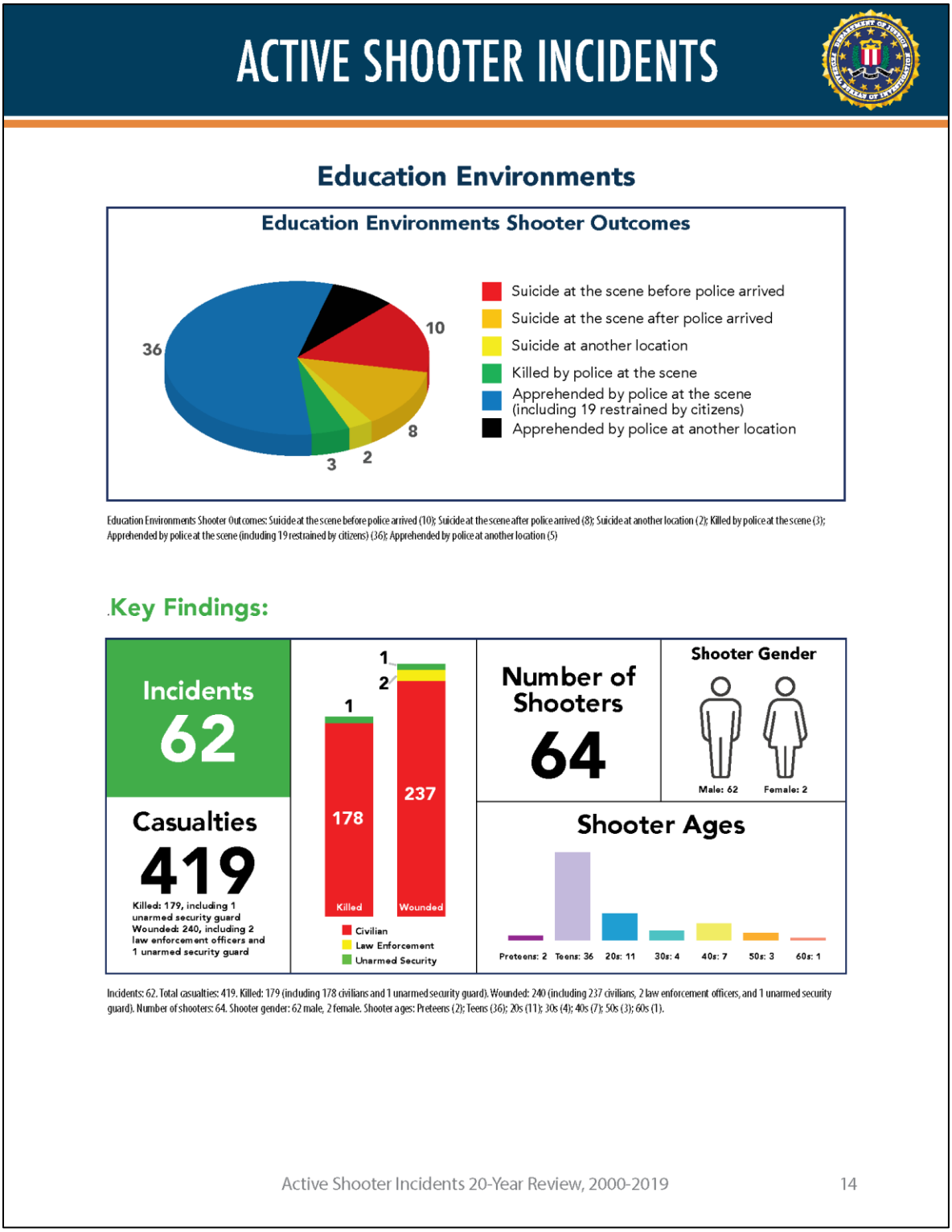
Education Environment Incidents and Casualties by Location: School Board Meeting (2 incidents, 1 wounded, 0 killed); Elementary (6 incidents, 25 wounded, 36 killed); Middle School (8 incidents, 11 wounded, 2 killed); High School (25 incidents, 104 wounded, 60 killed); Pre-K-12 (2 incidents, 13 wounded, 6 killed); Jr./Sr. High School (1 incident, 4 wounded, 0 killed); Higher Education (18 incidents, 82 wounded, 75 killed)



Education Environments Casualties by Year: 2001 (2 killed, 18 wounded); 2002 (6 killed, 3 wounded); 2003 (4 killed, 3 wounded); 2004 (0 killed, 1 wounded); 2005 (10 killed, 8 wounded); 2006 (9 killed, 16 wounded); 2007 (32 killed, 21 wounded); 2008 (7 killed, 16 wounded); 2009 (0 killed, 2 wounded); 2010 (4 killed, 10 wounded); 2011 (1 killed, 1 wounded); 2012 (38 killed, 16 wounded); 2013 (7 killed, 10 wounded); 2014 (6 killed, 13 wounded); 2015 (9 killed, 7 wounded); 2016 (2 killed, 9 wounded); 2017 (8 killed, 19 wounded); 2018 (29 killed, 52 wounded); 2019 (5 killed, 15 wounded)

Active Shooter Incidents 20-Year Review, 2000-2019 13

Figure 47 - Education Environments Cont'd



The complete report may be found here: https://www.fbi.gov/file-repository/active-shooter-incidents-20-year-review-2000-2019-060121.pdf/view.

Cyber-Threats

While Elk County has not been the target of any critical cyber terrorist events, the county has seen multiple security breaches due to online phishing and other scams, including ransomware.

One hack attack took down the largest fuel pipeline in the U.S. and led to massive gasoline shortages; it was the result of a single compromised password. Hackers gained entry into the networks of Colonial Pipeline Company on April 29, 2021 through a virtual private network account, which allowed employees to remotely access the company's computer network. On May 7, 2021, a ransom of $4.4 million was demanded by the hackers, causing Colonial to shut down the entire supply line, immediately prompting temporary gasoline shortages and panic buying up and down the East Coast. The hackers, who were an affiliate of a Russian-linked cybercrime group known as *DarkSide,* were paid the ransom. The hackers also stole nearly 100 gigabytes of data from Colonial Pipeline and threatened to leak it if the ransom was not paid, according to Bloomberg News.

Then, in early June 2021, JBS, the world's largest meat company by sales, paid an $11 million ransom to cybercriminals who temporarily knocked out plants that process roughly one-fifth of the nation's meat supply. The ransom payment, in bitcoin, was made to shield JBS meat plants from further disruption and to limit the potential impact on restaurants, grocery stores and farmers that rely on JBS, according to the company.

The attack on JBS was part of a wave of incursions using ransomware, in which companies are hit with demands for multimillion-dollar payments to regain control of their operating systems. The attacks show how hackers have shifted from targeting data-rich companies such as retailers, banks and insurers to essential-service providers such as hospitals, transport operators and food companies.

4.3.17.4 Future Occurrence

The likelihood of Elk County being a primary target for a major international terrorist attack is small and unlikely. More likely terrorist activity in Elk County includes bomb threats or other incidents at schools. Elk County has six school districts consisting of twelve public schools. Several private schools and colleges/universities are also located in Elk County. These locations are considered soft targets and may be vulnerable, especially to domestic incidents.

4.3.17.5 Vulnerability Assessment

Elk County should stay prepared for terroristic events. The existence of industrial commerce, interstate highways and freight railroad activity create soft targets that could be used to interfere with the focus of day-to-day life that the county experiences. It is important to note that the use of and exposure to biological agents can remain unknown for several days until the infected person(s), livestock, or crops begin to experience symptoms or show damages. Often such agents are contagious, and the infected person(s) must be quarantined, livestock culled, and/or crops destroyed.

Although previous events have not resulted in what are considered to be significant terrorist attacks, the severity of a future incident cannot be predicted with a total level of certainty. One of the major concerns with agroterrorism is that acts can be carried out with minimal planning, effort, or expense.

Acronis, a global technology company that develops on-premises and cloud software for backup, disaster recovery, and secure file sync and share and data access, issues an annual threat scape report on cybercrime. Entitled *The Acronis Cyberthreats Report*, it contains an in-depth review of the current threat landscape and projections for the coming year. Based on the protection and security challenges that were amplified by the shift to remote work during the COVID-19 pandemic, Acronis warns aggressive cybercrime activities will continue as criminals pivot their attacks from data encryption to data exfiltration.

The major points illustrated in the report are as follows:

- Attacks against remote workers will increase due to the movement of workers to less secure working areas.
- Ransomware will look for new victims and will become more automated.
- Legacy IT and technical solutions will struggle to keep pace with ransomware and cybercrime attacks.

According to a study carried out on the data sourced from the Federal Bureau of Investigation, Pennsylvania is ranked second worst among states when it comes to handling cyber-attacks. The study made by Information Network Associates – an international security consulting company – says an increase of 25% was witnessed in cyber-attacks between 2016 and 2017. This illustrates the amount of preparation that must occur in the commonwealth so that it can better respond to potential cybercrime attacks.

The probability of terrorist activity is more difficult to quantify than some other hazards. Instead of considering the likelihood of occurrence, vulnerability is assessed in terms of specific assets. By identifying potentially at-risk terrorist targets in communities, planning efforts can be put in

place to reduce the risk of attack. Planning should work towards identifying potentially at-risk critical infrastructure and functional needs facilities in the community, prioritizing those assets and locations, and identifying their vulnerabilities relative to known potential threats.

All communities in Elk County are vulnerable on some level, directly or indirectly, to a terrorist attack. However, communities with schools and government infrastructure like the county seat, should be considered more likely to attract terrorist activity.

4.3.18. Transportation Accidents

4.3.18.1 Location and Extent

Transportation accidents are defined as accidents involving highway, air, and rail travel. These incidents are collectively the costliest of all hazards in the Commonwealth in terms of lives lost, injuries, and economic losses. The sheer amount of roadways, coupled with the high volume of traffic, creates the potential for serious accidents along the roads and bridges. In Elk County there are 117 state maintained and six federally maintained bridges, according to PennDOT. Major transportation routes in Elk County include US route 219. Other state routes are also present in the county including PA routes 66, 120, 153, 255, 321, 555, 948, and 949. *Figure 48 – Major Transportation Routes* shows the major transportation systems in Elk County.

Elk County has one public airport which is St. Marys Municipal Airport. There exists a potential extent for air transportation accidents to occur due to the number of commercial air traffic that flyovers the county every day. However, a five-mile radius around each airport can be considered a high-risk area since most aviation incidents occur near take-off and landing sites. *Figure 49 – Airports and Vulnerability Zones*.

There are several freight rail lines in Elk County. The railroad company that operates within Elk County, is the Buffalo and Pittsburgh Railroad. With the ability of these railroad routes for interchanging with other companies, goods can be transported virtually anywhere via rail from Elk County. Rail transportation accidents are generally classified as one of these three types:

- Derailment – an accident on a railway in which a train leaves the rails
- Collision – an accident in which a train strikes something such as another train or highway motor vehicle
- Other – accidents caused by other circumstances like obstructions on rails, fire, or explosion

Rail transportation is divided into two major categories: freight and passenger. Each category can be subdivided according to carrier type: major carrier and local/regional carriers. Rail accidents can occur anywhere along the miles of rail located in Elk County. The primary railroads in Elk County run alongside Johnsonburg Borough and Ridgway Borough.

There are 3,817 oil and gas wells located in Elk County. Pipeline infrastructure is seen throughout the county. There are five major pipeline companies that transport hazardous materials in and through Elk County. These pipeline companies are Columbia Gas Transmission Company, Dominion Transmission Company, National Fuel Gas Distribution Company, National Fuel Gas Supply Company, and the Tennessee Gas Pipeline. *Figure 51 – Utility Pipelines Vulnerability* shows the various pipelines that run through Elk County.

4.3.18.2 Range of Magnitude

Significant passenger vehicle, air, and rail transportation accidents can result in a wide range of outcomes from damage solely to property to serious injury or even death. The majority of motor vehicle crashes in Pennsylvania are non-fatal, but PennDOT estimates that every hour nine people are injured in a car crash, and every seven hours someone dies as a result of a car crash. Most fatal crashes occur in May and June, but the highest number of crashes overall occur in October, November, and December. Inclement weather and higher traffic volumes and speeds increase the risk for automobile accidents.

Railway and roadway accidents have the potential to result in hazardous materials release. Railroad accidents occur with less frequency than highway accidents. However, when these types of incidents occur, they often cause extensive property damage and have the potential to cause serious injuries or deaths.

The worst-case scenario for a transportation accident impacting the county would be a road or rail accident which results in a hazardous material spill in St Marys, which is the county seat and most populous municipality in the county. Such an event would constitute an immediate health hazard to the population and require evacuation.

4.3.18.3 Past Occurrence

Table 66 – PennDOT Crash Report for Elk County shows crash statistics recorded by the Pennsylvania Department of Transportation between 2010 and 2021. Reports for 2022 and 2023 were not available at the time of this report. The years 2011 and 2016 had the most total crashes in Elk County while 2020 had the fewest total crashes. The number of total crashes has generally declined over the span of eleven years between 2010 and 2021 in the county. No fatal train crashes were reported in the county during the same year.

Table 66 - PennDOT Crash Report for Elk County

PennDOT Crash Report for Elk County								
Year	Vehicle accidents for Elk County				Vehicle Accident Deaths for Elk County			Train/Trolley with Motor Vehicle Crashes/ Fatalities
	Total	Fatal Accidents	Injury Crashes	Property Damage Only	Total Vehicle Accident Fatalities	Alcohol-Related Fatalities	Pedestrian Fatalities	
2010	290	6	140	144	6	3	1	0
2011	299	9	143	147	9	7	0	0
2012	300	4	132	164	4	2	0	0
2013	325	6	155	164	6	4	1	0

PennDOT Crash Report for Elk County								
Year	Vehicle accidents for Elk County				Vehicle Accident Deaths for Elk County			Train/Trolley with Motor Vehicle Crashes/ Fatalities
	Total	Fatal Accidents	Injury Crashes	Property Damage Only	Total Vehicle Accident Fatalities	Alcohol-Related Fatalities	Pedestrian Fatalities	
2014	327	7	140	180	7	4	0	0
2015	293	3	137	153	3	0	1	0
2016	322	9	132	181	9	1	0	0
2017	307	3	120	184	3	2	0	0
2018	298	7	129	162	7	2	0	0
2019	293	3	124	166	3	0	0	0
2020	223	1	85	137	1	1	0	0
2021	260	3	113	144	3	2	0	0

4.3.18.4 Future Occurrence

Elk County's population has decreased over the last decade, so it can be assumed that local traffic has decreased slightly as well. However, with the increasing volume of goods and trucking through the county, transportation accidents will continue to occur routinely. Hazardous material release through transportation accidents is difficult to predict but can be assumed to happen in future events as well. The U.S. Census Bureau reports the mean travel time to work for those aged 16 plus is approximately twenty-four minutes. Automobile accidents occur frequently, and typically occur more frequently than rail or aviation accidents. In the case of highway accidents, PennDOT has taken great strides to reduce the number of highway transportation accidents through programs such as the Pennsylvania Highway Safety Corridor. In this program, PennDOT designates sections of highway where traffic citation fines are doubled in the hopes that higher fines will deter unsafe driving and reduce accidents. Transportation accidents are impossible to predict accurately; however, areas prone to these hazards can be located, quantified through analysis of historical records, and plotted on countywide and municipal base maps.

4.3.18.5 Vulnerability Assessment

A transportation accident can occur anywhere in Elk County. However, severe accidents are more likely to occur on the county's major highways due to the heavier traffic volumes which make highways extremely vulnerable. The vulnerability for accidents on either highway, railway, or aviation, are directly related to the population and traffic density within the county. The vulnerability increases if there are hazardous materials involved. Hazards associated with

causing transportation accidents can include natural hazards that affect the environment, such as winter storms or heavy rains that cause slippery roadways or mud slides, to windstorms or tornadoes that cause high-profile vehicles or train cars to topple over. Loss of roadway use, and public transportation services would affect commuters, employment, delivery of critical municipal and emergency services, and day-to-day operations within the county.

With highway accidents, there is an added vulnerability that stems from the age and upkeep of bridges throughout the county. Unrepaired, deficient bridges may be more likely to break, thus leading to highway transportation damages or deaths. 4.2% of Elk County bridges are in poor condition, indicating an increased vulnerability to transportation accidents, while 39.9% remain in fair condition.

Studying traffic and potential transportation accident patterns could provide information on vulnerability of specific road segments and nearby populations. Increased understanding of the types of hazardous materials transported through the county will also support mitigation efforts. Maintaining a record of these frequently transported materials can facilitate development of preparatory measures for response to a release. *Figure 50– Average Daily Traffic on Major Highway Vulnerability* identifies all major highways and railroads within Elk County.

Figure 48 - Major Transportation Routes

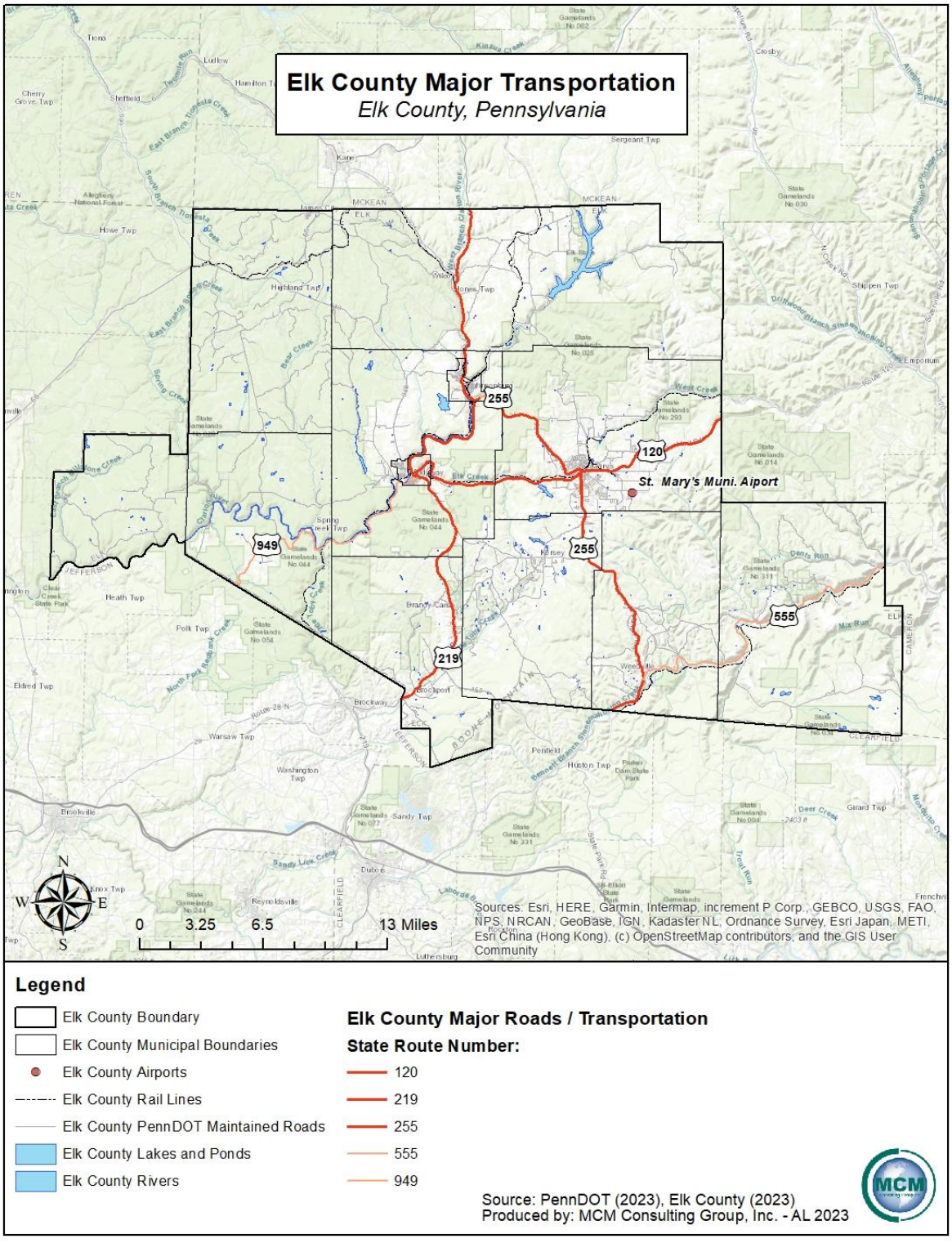


Figure 49 - Airports and Vulnerability Zones

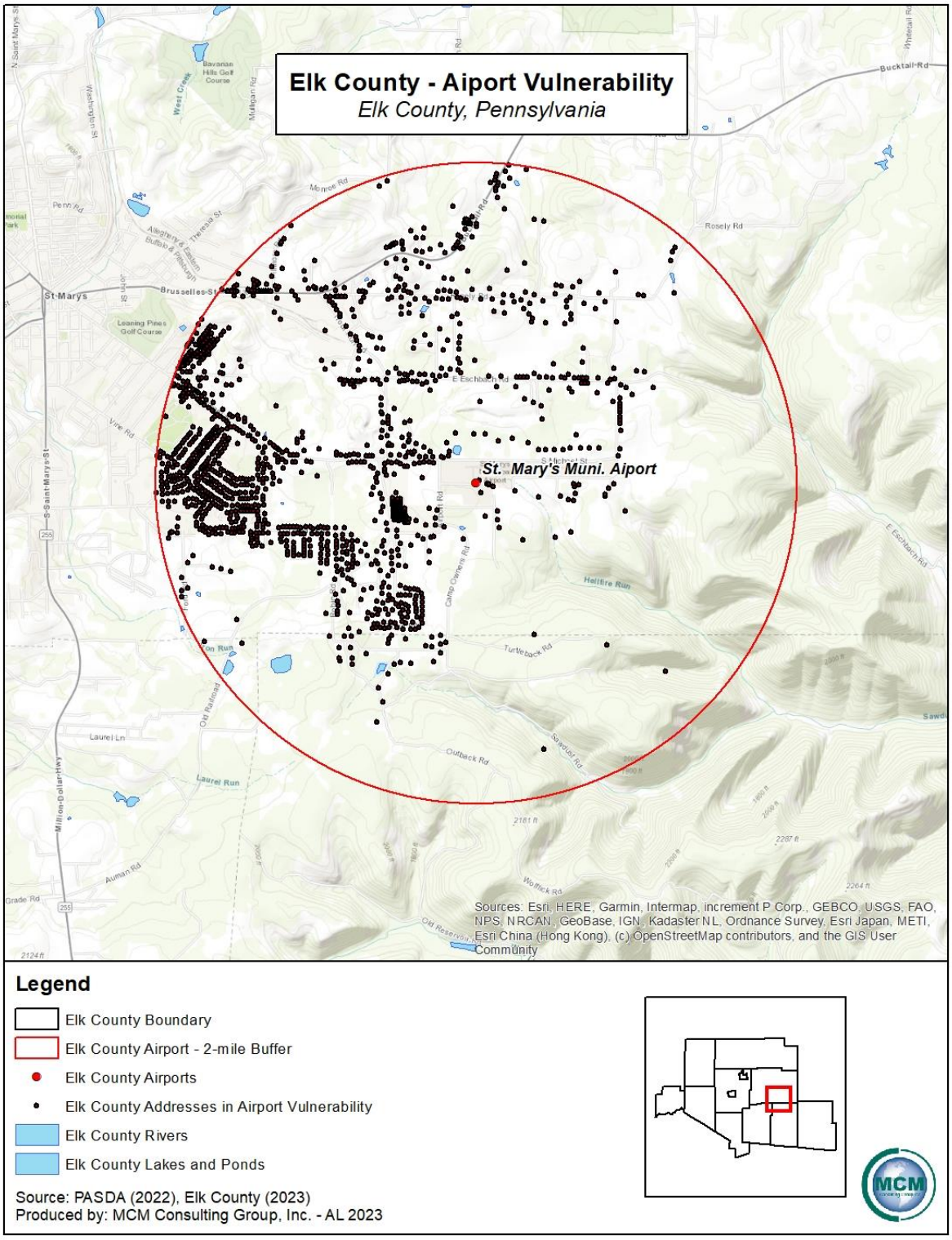


Figure 50 - Average Daily Traffic on Major Highway Vulnerability

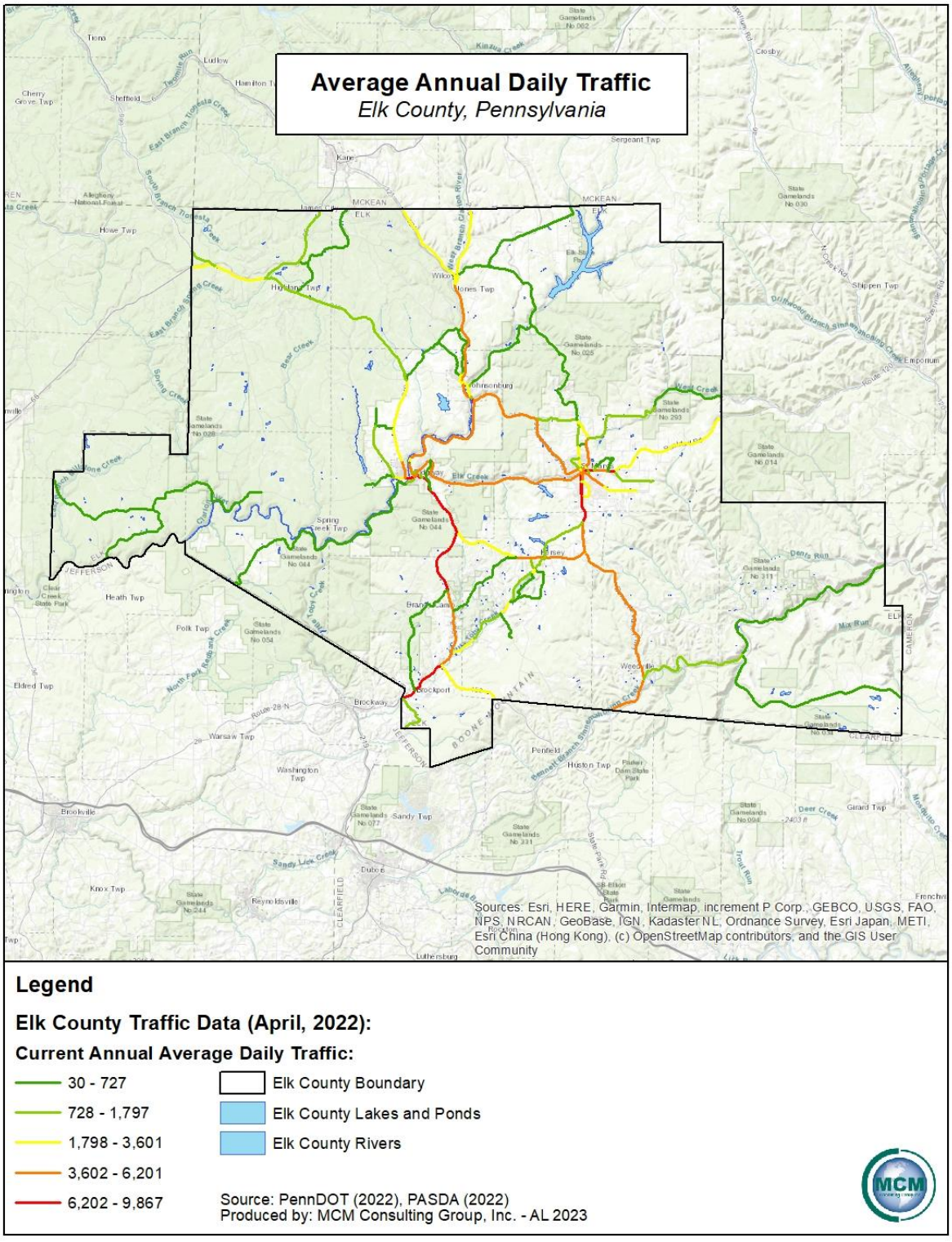
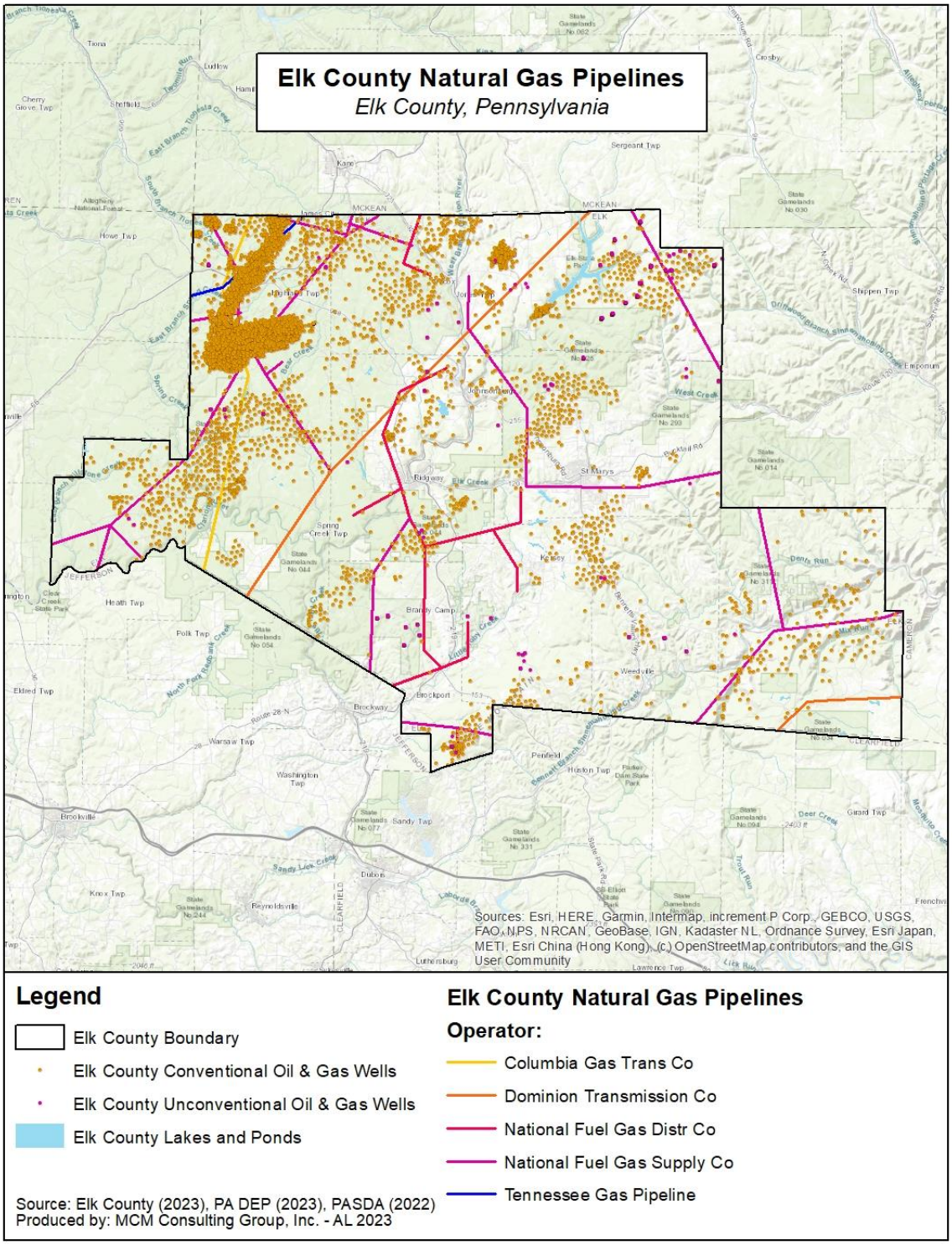


Figure 51 - Utility Pipelines Vulnerability



4.3.19. Urban Fire and Explosion

4.3.19.1 Location and Extent

Urban fire and explosion hazards incorporate vehicle and building/ structure fires, as well as overpressure ruptures, overheat explosions, or other explosions that do not ignite. Statewide, this hazard is most problematic in the denser, and more urbanized areas, occurring most often in residential structures (US Fire Administration, 2009). Urban fires can more easily spread from building to building in denser urban areas.

According to the U.S. Census Bureau, 2020 U.S. Census, Elk County has approximately 16,836 housing units. The American Community Survey, conducted by the United States Census Bureau in 2021 estimates a total of 16,952 housing units. This number will be used for the calculations used to determine the vulnerability of buildings and structures to urban fire. Buildings that were constructed fifty or more years ago are at a higher risk of urban fires due to improvement in fire safety engineering practices. See section 4.3.19.5 for a more in-depth discussion on the number of vulnerable housing units in Elk County.

Fires can start from numerous causes including human errors or electrical malfunctions. Most fires are small and have little impact on the greater community other than possibly increasing insurance rates. Oftentimes large urban fires are the result of other hazards such as storms, droughts, transportation accidents, hazardous material spills, arson, or terrorism.

Natural gas exploration and extraction sites can be associated with fires and explosion events. Well flares regularly burn off excess gas, and if improperly managed, such activities can be dangerous for the surrounding areas.

4.3.19.2 Range of Magnitude

Urban fires can occur in any populated area, and fires affecting one structure happen quite often. Urban fires are most threatening when the fire can rapidly spread from one structure to another. Elk County is largely rural/semi-rural and does not have significant expanses of dense population.

Damage from fire and explosions ranges from minor smoke inhalation and/or water damage to the destruction of buildings. A worst-case scenario for any fire and or explosion would be in injuries and/or death of the occupants of the structures and the potential of injury or death of firefighters.

In calendar year 2022 the Federal Emergency Management Agency's (FEMA) United States Fire Administration states that there were 2,284 civilian home fire fatalities nationwide, and the Commonwealth of Pennsylvania accounted for 168 of those civilian home fire fatalities. One of those fire fatalities was in Elk County in 2022, in the city of St. Marys. This is discussed in more

detail in section 4.3.19.3.

There are economic consequences related to a fire and explosion hazard, including:

- Loss in wages due to temporarily or permanently closed businesses
- Destruction and damage to business and personal assets
- Loss of tax base
- Recovery costs
- Loss related to the ability of public, private, and non-profit entities to provide post-incident relief.

The secondary effects of urban fire and explosion events relate to the ability of public, private, and non-profit entities to provide post-incident relief. Human services agencies (community support programs, health and medical services, public assistance programs and social services) can be affected by urban fire and explosion events. Effects include causing physical damage to facilities and equipment, disruption of emergency communications, loss of health and medical facilities and supplies, and an overwhelming load of victims who are suffering from the effects of the urban fire, including loss of their home or place of business.

4.3.19.3 Past Occurrence

From 1910 to 1990, the Commonwealth of Pennsylvania experienced thirteen major fires in suburban and urban settings, and ten of them occurred after 1980. Between 1978 and 1982, the average number of deaths per fire was 2.7. After October 1990, the average number of deaths per fire decreased. *Table 67 - Urban Fire Occurrence* reflects the major fires and explosions that have occurred in Elk County since the year 2018.

Table 67 - Urban Fire Occurrence

Urban Fire Occurrence – Elk County		
Event	**Date**	**Location**
Structure Fire	06/09/2020	Not defined in data
Structure Fire	12/30/2020	Not defined in data
Structure Fire	01/14/2021	Not defined in data
Apartment Fire	06/19/2022	St. Marys
Structure Fire	08/23/2022	Not defined in data
Garage Fire	02/04/2023	Jay Township

On June 19, 2022, an apartment fire resulted in the death of a 65-year-old St. Marys man. This is the only fatal fire to occur in Elk County for the calendar year 2022. This data was found using the United States Fire Administration and local news sources.

As of March 2023, there were 1,821 active natural gas wells in Elk County (PA DEP, 2023).

These locations should be closely monitored, and safety protocols should be strictly adhered to in order to avoid explosions and starting fires. Elk County utilizes a system called WebEOC for tracking of incidences within the county. This data was requested and provided by Elk County to MCM Consulting Group, Inc. for inclusion in this report.

4.3.19.4 Future Occurrence

Small urban fires occur regularly and usually cause little damage. Areas with greater population and an increased rate of population density are at greater risk for future urban fires and explosions. The more urban areas of Elk County include the city of St. Marys, Ridgway Borough, and Johnsonburg Borough.

Any new construction must comply with PA Department of Labor's statewide uniform construction codes. One requirement in the construction codes is automatic sprinkler requirements for buildings other than one- and two-family dwellings. In most cases, this requirement will contain fires to the point of origin.

4.3.19.5 Vulnerability Assessment

Fire and explosion vulnerability greatly depends on the vulnerability of other hazards. Most fires result from the secondary effect of another hazard. The probability of a fire or explosion occurring increases with population and economic growth. The natural gas industry and exploration is active in Elk County, and with it comes greater risk for fire and explosion.

Older structures are more vulnerable to urban fire, and fires can spread faster to each other in areas with higher concentrations of housing. There are a total of 12,335 housing units constructed in Elk County between 1939 or earlier to 1979. That accounts for 72.8% of the housing units in Elk County that are vulnerable to fire due to engineering practices. Buildings that are made up of more than one housing unit are also at an increased risk of urban fire/structure fire because of the close nature of architecture and the inability to control the risk of fire in an adjacent unit. There are approximately 1,133 buildings in Elk County that are made up of at least three housing units to more than twenty units. This represents 6.7% of the total building units in Elk County.

Vacant housing units are at an increased vulnerability to urban fires due to a lack of attention and active maintenance. As of 2021, there were a total of 3,453 vacant housing units in Elk County. This accounts for 20% of the total of housing units in Elk County. Mobile homes are also at an increased risk of fire, although not urban, because of construction practices that make them easier to burn, and quicker to ignite. There are an estimated 1,050 mobile homes in Elk County. A large portion of these homes are likely seasonal camps or hunting lodges/cabins. The percentages presented above do not account for seasonal property characteristics, as a large portion of hunting cabins and camps in rural Elk County are unoccupied for a majority of the

year.

Urban fire risk also increases as the use of wood burning, fuel, oil, and kerosene, and bottled tank, or LP gas as a primary heat source increases, and the use of space heaters becomes more common. Based on information provided by the United States Census Bureau, there are approximately 795 housing units using wood burning methods for their primary heat source which correlates to 5.9% of the housing units in Elk County. Fuel, oil, and kerosene are used by 595 housing units as the primary source of heat which is 4.4% of the total housing units in the county. Approximately 657 housing units used bottled, tank, or LP gas for primary heating and that accounts for 4.9% of Elk County housing units.

The very young (those younger than 5 years of age) and the elderly (those 65 years and older) tend to be more vulnerable to structure fires than other age groups, and often experience the highest number of deaths per fire. This is often due to lower mobility and a difference in awareness when an emergency event, such as a fire or explosion, occurs. In Elk County the total population under the age of 5 is 1,550 people which is 5.0% of the 2021 American Community Survey estimate. The total population over 65 years or older is 6,847 people, or 22.1% of the total population. Combined, those under the age of 5 and 65 years or older make up approximately 27.1% of the total population.

Elk County has a total of eight fire departments. More information on these locations can be found in the Emergency Services profile (Section 4.3.14) of the hazard mitigation plan. The areas for which the fire stations provide coverage are also outlined in the Emergency Services profile of this hazard mitigation plan. If the downward trend in volunteerism and emergency professional employment continues, there could be an increase in the amount of time it takes for a fire department to respond to a fire or explosion. More discussion on this topic can be found in the Emergency Services hazard profile.

Potential secondary effects of urban fires include utility interruption and hazardous material spills. When a fire department taps into a fire hydrant in response to a fire, a drop in water pressure is typical if the fire hydrant is on a shared water main with the residences in that area. This can also result in discolored water and minor water interruptions if the fire hydrant use is prolonged.

4.3.20. Utility Interruptions

4.3.20.1 Location and Extent

Utility interruptions can occur from an internal system failure or as a secondary impact of another hazard, such as windstorm, winter storm, extreme temperatures, or a traffic accident. Strong adverse weather conditions and storms can cause widespread disruptions in electric and telecommunications service due to power lines being brought down by falling tree branches across a region. Strong heat waves may result in rolling blackouts where power may not be available for an extended period, impacting air conditioning across a region. Space weather, specifically solar flares, can also pose a threat to utility services across the globe. Although uncommon, the northeastern seaboard and the north central regions of the United States are particularly susceptible to this hazard.

The age of utility infrastructure also plays a role in interruptions, causing longer periods of outages in a larger area. Natural gas, water, telecommunications, and electric capabilities can all experience disruptions. Worker strikes at power generation facilities have also been known to cause minor and temporary power outages and failures. Other causes for minor power outages include but are not limited to vehicle accidents and wire destruction due to animals or wildlife. Outages can also be caused by blown transformers or tripped circuit breakers in the electric system. Major power outages typically occur on a regional scale and can last both short term and long term.

The list of utility providers in Elk County is shown in *Table 68 – Elk County Utility Providers*.

Table 68 - Elk County Utility Providers

Elk County Utility Providers	
Utility Type	**Name of Utility Provider**
Electricity	Penelec West Penn Power
Telephone/9-1-1/Wireless	AT&T CenturyLink Comcast T-Mobile Verizon Windstream Zito Media
Natural Gas	Columbia Gas Trans. Co. Dominion Transmission Co. National Fuel Gas Distribution Co. National Fuel Gas Supply Co.

Elk County Utility Providers	
Utility Type	**Name of Utility Provider**
	Tennessee Gas Pipeline Sergeant Gas Co.
Water	Aqua Pennsylvania Treasure Lake Fox Township-Toby Water Highland Township Municipal Water Authority Jay Township Water Authority Johnsonburg Municipal Authority Jones Township Municipal Authority Ridgway Borough Ridgway Township Water Office Saint Marys Area Water Authority
Source: PA Public Utility Commission, 2023, and Elk County Planning Department	

4.3.20.2 Range of Magnitude

Utility interruptions do not typically lead to large-scale problems by themselves. Typically, human casualties are not a direct result from outages. Many utility interruptions occur during storms or other severe weather events, and they can have secondary consequences. Typical secondary effects from a power outage can include a delay in emergency response and those services arriving in a timely manner. A lack of potable drinking water can also become a major issue for areas impacted by utility interruptions.

Electricity:

Interruptions or power failures could have the following impacts:

- Public safety concerns
- Food spoilage
- Loss of heating or air conditioning
- Basement flooding due to sump pump failure
- Loss of indoor lighting
- Loss of internet service
- Stopped and stalled elevators
- Direct economic impact from retail settings

Of all the above-listed impacts, the loss of heating or air conditioning poses the greatest risk to the elderly and very young populations during times of extreme temperature. Prolonged power outages also pose a risk to residents that rely on home-based medical equipment such as home-supply oxygen units. Some of the issues that are listed above can be considered more of a

nuisance than a hazard, such as food spoilage due to long-term electrical outages. However, significant damage or harm can occur depending on the population affected, the duration, and the severity of the outage.

A worst-case scenario for the utility interruptions would be a county-wide power outage during winter months, forcing the evacuation of vulnerable populations to facilities outside of the county or to warming shelters within the county.

Fuel:

Interruptions of the transportation of gas and other products used for fuel can lead to a loss of heating and manufacturing capabilities. This can adversely affect the economic stability of a region and the production of needed products for consumption.

Telecommunications:

Interruptions to telecommunications systems include impacts to the 9-1-1 capabilities of a region, telephone, and internet service. The greatest risk in losing this utility to interruption is the risk of an emergency not being able to be reported to a public safety answering point (PSAP). Extensive loss of telephone and internet service can be detrimental to government, businesses, and to residents. With much of the country now dependent on wireless networks, signal interruptions can cause a large issue for people who are utilizing wireless telecommunications for work. There are also many concerns regarding safety and internet security due to the increase in people working over wireless networks that occurred during the COVID-19 pandemic. These interruptions and issues can be detrimental for the Elk County workforce.

4.3.20.3 Past Occurrence

Minor utility interruptions occur annually in Elk County and occur most often in conjunction with winter weather and/or windstorms. Elk County utilizes a database system called WebEOC to track incidents within the county. *Table 69 – Utility Interruptions in Elk County* illustrates the number of interruptions to electric, natural gas, telecommunications, and water services between 2019 and 2022.

Table 69 - Utility Interruptions in Elk County

Utility Interruptions in Elk County		
Date	**Event Type**	**Municipality**
02/15/2019	Boil Water Advisory	Not defined in data
07/26/2019	Boil Water Advisory	Not defined in data
08/06/2019	Boil Water Advisory	Not defined in data
08/26/2019	Boil Water Advisory	Not defined in data
11/01/2019	Boil Water Advisory	Not defined in data

Utility Interruptions in Elk County		
Date	**Event Type**	**Municipality**
11/22/2019	Boil Water Advisory	Not defined in data
06/09/2020	Boil Water Advisory	Not defined in data
06/18/2020	Boil Water Advisory	Not defined in data
07/23/2020	Boil Water Advisory	Not defined in data
07/31/2020	Boil Water Advisory	Not defined in data
01/15/2021	Phone/Communications Outage	Not defined in data
06/26/2022	Cell Phone/Landline Outage	Not defined in data
11/04/2022	Boil Water Advisory	Not defined in data
11/10/2022	Boil Water Advisory	Not defined in data
Source: WebEOC, 2023		

Of the fourteen utility interruption events listed in Elk County's past event data, twelve of the events were boil water advisories and were directly related to the water system in Elk County. There were no reported power outages, but some form of power outage occurs each year in the county. These smaller power outages were either not noticed at large or were not reported to the county for inclusion in their system. The remaining two items from the total fourteen were related to phone and communication outages. One event was focused on landlines and one event was focused on cell phones.

The Pennsylvania Public Utility Commission tracks the reliability of electric distribution companies (EDC) and outages. *Table 70 – 2018 Winter Storms Riley and Quinn Power Outages* by EDC compares the customers affected by power outage in Pennsylvania during these storm events and compares the to statistics from Nika from 2014 and Sandy from 2012. Some of the EDCs were not impacted by Winter Storm Quinn. PP&L customers experienced power outages for a duration of eight days with Winter Storm Quinn and Winter Storm Riley, whereas during Sandy in 2012, the duration was nine days. Nika in 2014 had a duration of just over three days.

Table 70 - 2018 Winter Storm Riley and Quinn Power Outages

2018 Winter Storms Riley and Quinn Power Outages			
Electric Distribution Company	**Customers affected by storms Riley and Quinn 2018 (Percentage of total customers)**	**Customers affected by Nika 2014 (Percentage of total customer)**	**Customers affected by Sandy 2012 (Percentage of total customers)**
Met-Ed	272,928 (49.22%)	144,000 (26.00%)	298,300 (54.00%)
PECO	794,969 (46.76%)	723,681 (42.00%)	845,703 (54.20%)
Penelec	90,856 (15.61%)	N/A	96,847 (16.40%)
PCLP	2,101 (47.44%)	N/A	4,487 (100.00%)

2018 Winter Storms Riley and Quinn Power Outages			
Electric Distribution Company	**Customers affected by storms Riley and Quinn 2018 (Percentage of total customers)**	**Customers affected by Nika 2014 (Percentage of total customer)**	**Customers affected by Sandy 2012 (Percentage of total customers)**
PP&L	261,341 (18.67%)	92,283 (7.00%)	523, 936 (37.50%)
Total:	**1,422,195**	**959,964**	**1,769,273**
Source: Winter Storm Riley and Quinn Report 2019			

Significant events of utility interruptions in the United States occur on a regional basis and can have varied effects related to number of impacted customers. A large water treatment plant failure occurred in Jackson, Mississippi in August of 2022 after flooding impacted the treatment facility. The city of Jackson was left without safe drinking water for close to two months until the water was deemed safe and potable in October of 2022. This event stood out as a large-scale failure of community lifelines and utilities. This event also opened discussions related to equity in infrastructure repairs, as the repairs took a significant amount of time in a vulnerable socio-economic area. An attack on an electrical grid and power substations in North Carolina in December of 2022 left almost 45,000 people without power and reliant heat during the cold temperatures of January.

4.3.20.4 Future Occurrence

Utility Interruptions are difficult to predict, and minor interruptions may occur several times a year to all utilities. Even so, utility interruptions occur more frequently as a secondary factor to severe weather events or transportation accidents.

Space weather is getting more attention as an infrastructure risk due in part to a March 2020 report by the United States Geological Survey (USGS). The report noted that geomagnetic storms caused by the dynamic action of the Sun and solar wind on the space environment surrounding the Earth can generate electric fields in the Earth's crust and mantle. These electric fields can interfere with the operation of grounded electric power-grid systems. Geomagnetic storms occur only occasionally, but when sufficiently energetic they can produce blackouts on a large scale.

As utility infrastructure ages, interruption events could occur more frequently if the maintenance of the infrastructure is not maintained. Utility providers can reduce Elk County's vulnerability to power outages by implementing improvement plans for utility infrastructure. Total replacement is not a feasible solution to the issue, but compromises can be reached to ensure that the new and old equipment along a utility line can work together efficiently.

4.3.20.5 Vulnerability Assessment

Resources such as electricity, communications, gas, and water supply are critical to ensure the health, safety, and general welfare of the citizenry. *Figure 52 – Elk County Utilities* illustrates the approximate locations of service lines and pipelines throughout Elk County.

Power outages can cause even greater detriment to at-risk and vulnerable populations, such as elderly (e.g., supplemental oxygen power needs) or those with functional and access needs to consider. All critical infrastructure is vulnerable to the effects of a power surge. The probability of a large-scale, extended utility failure is low; however, small-scale failures lasting short periods of time occur annually.

Long-term care facilities, senior centers, hospitals, and emergency medical facilities are all vulnerable to utility interruptions. Often back-up power generators are used at these facilities to offset electrical needs during extreme hot or cold temperature events. However, these back-up power generators must be maintained, and fuel supplies must be secured in advance of the utility interruption to ensure a seamless transition from the everyday grid power source to the emergency generator. When officials consider maintenance and supplies for a facility, long-term use of back-up generators should be planned.

Electricity:

Severe weather is one of the largest causes of power loss. The electric power grid infrastructure can be damaged by snow, ice, high winds, lightning, flooding, falling tree limbs, and vehicle accidents involving utility poles. Small animals can also cause minor power outages by climbing along the lines and shorting out the system.

Causes of a regional scale power outage or failure could be from infrastructure failure, sabotage, human error, or worker strikes. Community lifeline facilities are vulnerable to utility interruptions, especially the loss of power. The establishment of reliable backup power at these facilities is extremely important to provide continued support of the health, safety, and well-being of Elk County residents and visitors. Interruptions to the local power grid could also be caused by intentional attacks on electrical infrastructure including transformers, substations, transmission lines, and power generation facilities like power plants. This is unlikely but is still possible in an increasingly volatile world.

The occurrence of severe weather-related utility interruptions will increase due to climate change in the Commonwealth of Pennsylvania and the United States as a whole. Climate change will cause weather to become more severe on a more frequent basis.

Water:

Water distribution can be affected in three ways.

- The amount of water available (depends on nature)
- The quality of the water (depends on human responsibility)
- The viability of the physical components of the distribution system

Well contamination or water shortages due to drought could pose a high vulnerability to local water distribution. Drought events will continue to occur more frequently as climate change alters the available amount of ground water for consumption. This will result in greater well shortages and water utility interruptions for citizens that have well water.

Water contamination can occur naturally, by human error, or intentionally. Releases of manure and milk into the water supply can cause contamination. Overflows from sewage systems and lagoons on farms can also cause contamination of groundwater and drinking water. There are times when accidental spills and releases of hazardous materials contaminate water supplies, thereby, water supplies along transportation routes may be affected.

Gas and Liquid Pipelines:

Interruptions to natural gas distribution lines could be affected by:

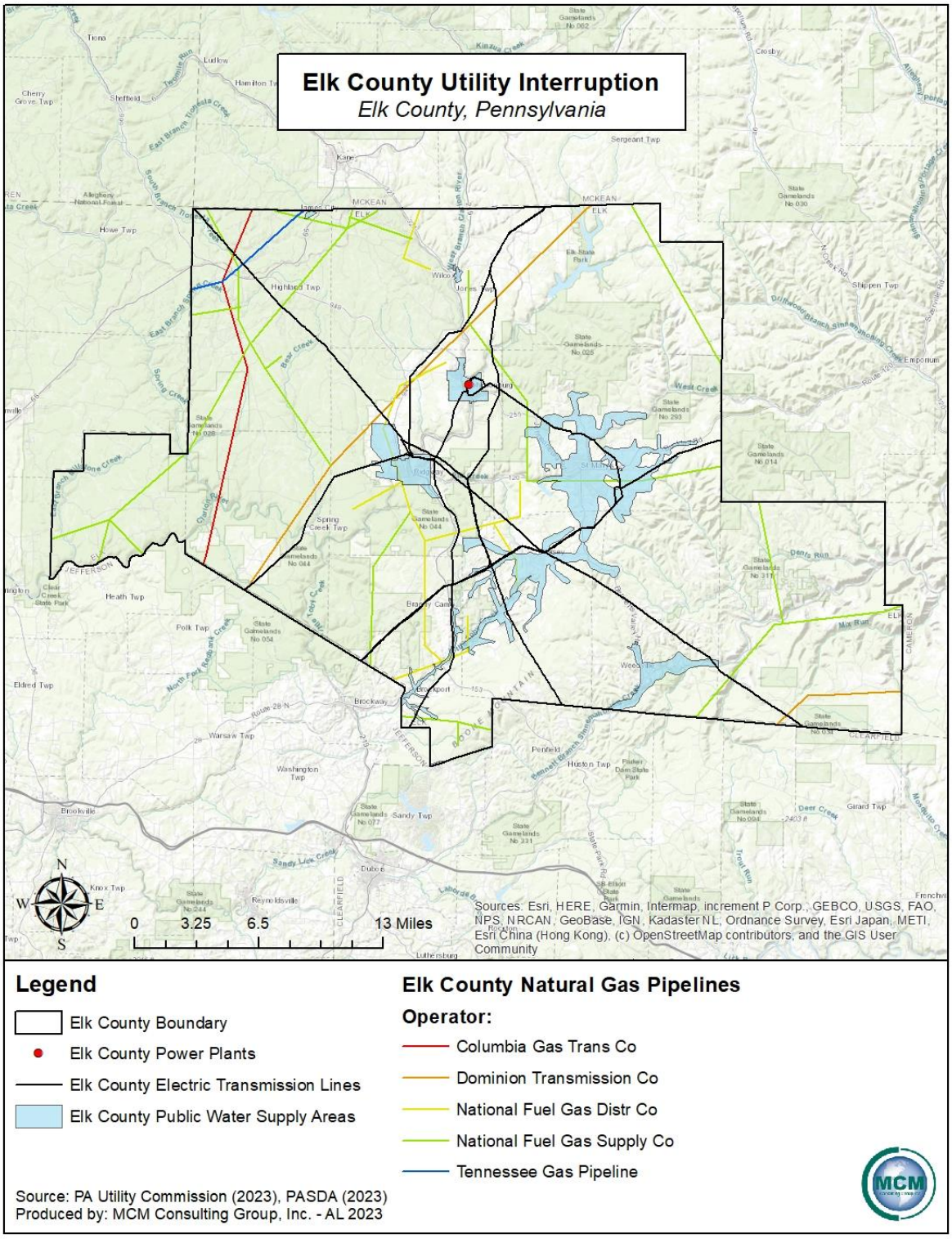
- Deterioration of line and facilities
- Puncturing the distribution lines by humans (either intentional or accidental)
- Coastal or winter storms
- Extreme heat or cold events
- Transportation accidents

Communications:

Interruptions in communications could be caused as a secondary effect of storms or high winds, infrastructure failure, or by humans (intentional or accidental). A loss of communications by emergency services would be devastating to the population of Elk County if 9-1-1 calls could not be received, or if emergency units could not be dispatched properly and/or timely.

No data regarding economic impacts from utility interruptions in Elk County is available. However, utility interruptions can cause economic impacts stemming from lost income, spoiled food and other goods, costs to the owners or operators of the utility facilities, and costs to government and community service groups.

Figure 52 - Elk County Utilities



4.4. Hazard Vulnerability Summary

4.4.1. Methodology

Ranking hazards helps communities set goals and priorities for mitigation based on their vulnerabilities. A risk factor (RF) is a tool used to measure the degree of risk for identified hazards in a particular planning area. The RF can also assist local community officials in ranking and prioritizing hazards that pose the most significant threat to a planning area based on a variety of factors deemed important by the planning team and other stakeholders involved in the hazard mitigation planning process. The RF system relies mainly on historical data, local knowledge, general consensus from the planning team and information collected through development of the hazard profiles included in Section 4.3. The RF approach produces numerical values that allow identified hazards to be ranked against one another; the higher the RF value, the greater the hazard risk.

RF values were obtained by assigning varying degrees of risk to five categories for each of the hazards profiled in the HMP update. Those categories include *probability*, *impact, spatial extent, warning time and duration*. Each degree of risk was assigned a value ranging from one to four. The weighting factor agreed upon by the planning team is shown in *Table 71 – Risk Factor Approach Summary* To calculate the RF value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the following example equation:

Table 71 - Risk Factor Approach Summary

Risk Factor Value =
[(Probability x .30) + (Impact x .30) +(Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]

Table 72 – Risk Factor Approach Summary Cont'd summarizes each of the five categories used for calculating a RF for each hazard. According to the weighting scheme applied, the highest possible RF value is 4.0.

Table 72 - Risk Factor Approach Summary Cont'd

Summary of Risk Factor Approach Used to Rank Hazard Risk.					
RISK ASSESSMENT CATEGORY	**DEGREE OF RISK**				**WEIGHT VALUE**
	LEVEL	**CRITERIA**		**INDEX**	
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	**UNLIKELY** **POSSIBLE** **LIKELY** **HIGHLY LIKELY**	LESS THAN 1% ANNUAL PROBABILITY BETWEEN 1 & 10% ANNUAL PROBABILITY BETWEEN 10 &100% ANNUAL PROBABILITY 100% ANNUAL PROBABILTY		1 2 3 4	30%
IMPACT *In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*	**MINOR** **LIMITED** **CRITICAL** **CATASTROPHIC**	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES. MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY. MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE WEEK. HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR 30 DAYS OR MORE.		1 2 3 4	30%
SPATIAL EXTENT *How large of an area could be impacted by a hazard event? Are impacts localized or regional?*	**NEGLIGIBLE** **SMALL** **MODERATE** **LARGE**	LESS THAN 1% OF AREA AFFECTED BETWEEN 1 & 10% OF AREA AFFECTED BETWEEN 10 & 50% OF AREA AFFECTED BETWEEN 50 & 100% OF AREA AFFECTED		1 2 3 4	20%
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	**MORE THAN 24 HRS** **12 TO 24 HRS** **6 TO 12 HRS** **LESS THAN 6 HRS**	SELF-DEFINED SELF-DEFINED SELF-DEFINED SELF-DEFINED	*(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1 2 3 4	10%
DURATION *How long does the hazard event usually last?*	**LESS THAN 6 HRS** **LESS THAN 24 HRS** **LESS THAN 1 WEEK** **MORE THAN 1 WEEK**	SELF-DEFINED SELF-DEFINED SELF-DEFINED SELF-DEFINED	*(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1 2 3 4	10%

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, *Table 73 – Risk Factor Assessment* lists the risk factor calculated for each of twenty-five potential hazards identified in the 2023 HMP. Hazards identified as *high* risk have risk factors greater than 2.5. Risk factors ranging from 2.0 to 2.4 were deemed *moderate* risk hazards. Hazards with risk factors 1.9 and less are considered *low* risk.

Table 73 - Risk Factor Assessment

Elk County Hazard Ranking Based on Risk Factor Assessment Methodology							
Hazard Risk	Hazard Natural (N) or Human Caused (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		Probability	Impact	Spatial Extent	Warning Time	Duration	
HIGH	Cyberterrorism	4	4	4	4	4	**4.0**
	Utility Interruption	4	3	4	4	3	**3.6**
	Emergency Services	4	3	4	1	4	**3.4**
	Windstorm	4	3	3	3	2	**3.2**
	Invasive Species	4	2	4	1	4	**3.1**
	Winter Storm	4	2	4	1	3	**3.0**
	Transportation Accidents	4	3	2	4	1	**3.0**
	Environmental Hazards: Transportation	4	2	2	4	3	**2.9**
	Dam Failure	1	4	3	3	4	**2.8**
	Flood	2	4	3	1	3	**2.8**
	Flash Flood	4	2	2	4	2	**2.8**
	Pandemic, Epidemic, and Infectious Disease	3	2	4	1	4	**2.8**
	Environmental Hazards: Fixed Facilities	2	3	2	4	3	**2.6**
	Radon Exposure	3	1	4	1	4	**2.5**
MODERATE	Drought	2	1	4	1	4	**2.2**
	Urban Fire and Explosion	2	2	2	4	2	**2.2**
	Tornado	2	2	2	4	1	**2.1**
	Wildfire	2	2	1	4	2	**2.0**
LOW	Earthquake	2	1	2	4	1	**1.8**
	Landslide	2	1	1	4	1	**1.6**
	Subsidence and Sinkhole	1	1	1	4	1	**1.3**
	Terrorism	1	1	1	4	1	**1.3**

Elk County Hazard Ranking Based on Risk Factor Assessment Methodology							
Hazard Risk	Hazard Natural (N) or Human Caused (H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		Probability	Impact	Spatial Extent	Warning Time	Duration	
	Levee Failure	1	1	2	2	1	**1.3**
	Ice Jam Flood	1	1	1	2	1	**1.1**
	Civil Disturbance	1	1	1	2	1	**1.1**

Based on these results, there are fourteen high risk hazards, four moderate risk hazards, and seven low risk hazards in Elk County. Mitigation actions were developed for all high, moderate, and low risk hazards (see section 6.4). The threat posed to life and property for moderate and high-risk hazards is considered significant enough to warrant the need for establishing hazard-specific mitigation actions. Mitigation actions related to future public outreach and emergency service activities are identified to address low risk hazard events.

A risk assessment result for the entire county does not mean that each municipality is at the same amount of risk to each hazard. *Table 74 – Countywide Risk Factor Assessment* shows the different municipalities in Elk County and what their risk factor for each hazard is compared to the county as a whole. This table was developed by the consultant based on the findings in the hazard profiles located in sections 4.3.1 through 4.3.20.

Table 74 - Countywide Risk Factor

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk									
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR									
JURISDICTION	Cyberterrorism	Utility Interruption	Emergency Services	Windstorm	Invasive Species	Winter Storm	Transportation Accidents	Environmental Hazards - Transportation	Dam Failure
	4.0	3.6	3.4	3.2	3.1	3.0	3.0	2.9	2.8
Benezette Township	2.7	3.3	2.7	3.0	2.7	3.0	2.5	2.3	1.2
Fox Township	2.9	3.1	3.4	2.8	3.1	3.1	2.9	2.4	1.9
Highland Township	Not Completed by Municipality.								
Horton Township	Not Completed by Municipality.								
Jay Township	4.0	3.6	3.4	3.2	3.2	3.0	3.0	2.9	2.8
Johnsonburg Borough	1.9	2.4	3.0	2.4	2.2	2.6	2.2	2.2	2.2
Jones Township	Not Completed by Municipality.								
Millstone Township	1.6	3.6	3.6	3.5	3.1	3.0	2.2	1.3	2.2
Ridgway Borough	Not Completed by Municipality.								
Ridgway Township	Not Completed by Municipality.								
Spring Creek Township	4.0	4.0	3.4	4.0	3.5	3.7	3.0	2.9	3.4
St Marys, City of	2.3	3.1	1.7	3.2	2.1	2.5	2.7	2.3	1.3

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk									
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR									
JURISDICTION	Flood	Flash Flood	Pandemic, Epidemic, and Infectious Disease	Environmental Hazards: Fixed Facilities	Radon Exposure	Drought	Urban Fire and Explosion	Tornado	Wildfire
	2.8	2.8	2.8	2.6	2.5	2.2	2.2	2.1	2.0
Benezette Township	2.8	2.5	2.6	2.0	1.8	2.1	1.3	2.1	3.0
Fox Township	2.2	2.7	2.8	2.2	2.1	2.2	2.1	1.8	1.9
Highland Township	Not Completed by Municipality.								
Horton Township	Not Completed by Municipality.								
Jay Township	2.8	2.8	2.8	2.6	2.5	2.2	2.2	2.1	2.0
Johnsonburg Borough	2.6	2.3	2.5	3.0	1.3	2.2	2.2	1.3	1.4
Jones Township	Not Completed by Municipality.								
Millstone Township	2.5	2.8	2.2	1.0	2.1	2.5	1.3	2.1	2.8
Ridgway Borough	Not Completed by Municipality.								
Ridgway Township	Not Completed by Municipality.								
Spring Creek Township	3.3	3.8	2.8	2.7	2.5	2.9	2.0	2.1	2.0
St Marys, City of	2.0	2.5	2.1	2.0	1.3	1.8	2.5	2.7	2.2

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk							
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR							
JURISDICTION	Earthquake	Landslide	Subsidence and Sinkhole	Terrorism	Levee Failure	Ice Jam Flood	Civil Disturbance
	1.8	1.6	1.3	1.3	1.3	1.1	1.1
Benezette Township	1.5	2.1	1.6	1.6	1.1	1.4	1.3
Fox Township	1.6	1.6	1.3	1.3	1.2	1.2	1.1
Highland Township	Not Completed by Municipality.						
Horton Township	Not Completed by Municipality.						
Jay Township	1.8	1.6	1.3	1.3	1.3	1.1	1.1
Johnsonburg Borough	1.3	1.3	1.3	1.3	1.3	1.7	1.7
Jones Township	Not Completed by Municipality.						
Millstone Township	1.3	1.6	1.6	1.3	1.3	1.2	1.1
Ridgway Borough	Not Completed by Municipality.						
Ridgway Township	Not Completed by Municipality.						
Spring Creek Township	1.8	1.6	1.6	1.3	1.3	1.1	1.1
St Marys, City of	1.3	1.3	1.3	1.3	1.1	1.1	1.9

4.4.3. Potential Loss Estimates

Based on various kinds of available data, potential loss estimates were established for flooding. Estimates provided in this section are based on HAZUS-MH, version MR4, geospatial analysis, and previous events. Estimates are considered *potential* in that they generally represent losses that could occur in a countywide hazard scenario. In events that are localized, losses may be lower, while regional events could yield higher losses.

Potential loss estimates have four basic components, including:

Replacement Value: Current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials.

Content Loss: Value of building's contents, typically measured as a percentage of the building replacement value.

Functional Loss: The value of a building's use or function that would be lost if it were damaged or closed.

Displacement Cost: The dollar amount required for relocation of the function (business or service) to another structure following a hazard event.

Flooding Loss Estimation:

Flooding is a high-risk natural hazard in Elk County. The estimation of potential loss in this assessment focuses on the monetary damage that could result from flooding. The potential property loss was determined for each municipality and for the entire county. The quantity of commercial and residential structures in each Elk County municipality is outlined in section 4.3.3 of the flooding hazard profile.

MCM Consulting Group, Inc. conducted a countywide flood study using the Hazards U.S. Multi-Hazard (HAZUS-MH) software that is provided by the Federal Emergency Management Agency. This software is a standardized loss estimation software deriving economic loss, building damage, content damage and other economic impacts that can be used in local flood mitigation planning activities.

Using HAZUS-MH, total building-related losses from a 1%-annual-chance flood in Elk County are estimated to equal $74,920,000.00 with 21.6% of that coming from residential homes. Total economic loss, including replacement value, content loss, functional loss, and displacement cost, from a countywide 1%-annual-chance flood are estimated to equal $165,970,000.00.

4.4.4. Future Development and Vulnerability

The 2020 census population for Elk County is 30,990 which is 956 fewer than the 2010 census. There was an overall decrease of 3% in population based on the data. Two municipalities have seen population increases while the remaining ten had decreases in the period between 2010 and 2020, as identified in *Table 75 – 2010 – 2020 Population Change*.

Table 75 - 2010 - 2020 Population Change

Population Change in Elk County from 2010-2020			
Municipality	**2010 Census**	**2020 Census**	**Percent of Change 2010-2020**
Benezette Township	207	216	4.4

Population Change in Elk County from 2010-2020			
Municipality	**2010 Census**	**2020 Census**	**Percent of Change 2010-2020**
Fox Township	3,630	3,576	-1.5
Highland Township	492	403	-18.1
Horton Township	1,452	1,366	-5.9
Jay Township	2,072	1,963	-5.3
Johnsonburg Borough	2,483	2,404	-3.2
Jones Township	1,624	1,573	-3.1
Millstone Township	82	95	15.9
Ridgway Borough	4,078	4,039	-1.0
Ridgway Township	2,523	2,416	-4.2
Spring Creek Township	233	201	-14.0
St. Marys, City of	13,070	12,738	-3.0
TOTAL	**31,946**	**30,990**	**-3.0**
Source: United States Census Bureau 2023, 2010 and 2020 Census Data			

The 2021 census estimates indicate that there are approximately 16,952 housing units in Elk County, Pennsylvania. Of those, 10,781 or 79.9% of the structures are occupied-housing units. The county-wide population changes indicate a potential alteration to overall hazard vulnerability. Municipalities that undergo widespread population reductions may have more difficulty meeting personnel demands than expanding jurisdictions. However, certain municipalities experienced significant resident increases and, thus, may be more vulnerable to certain hazards due to development and residential growth. Although expanding population zones may be especially vulnerable to hazards outlined in section 4.3 of this hazard mitigation plan update, natural and human caused hazards could potentially occur at any time regardless of population change. The Elk County Hazard Mitigation Local Planning Team will conduct annual reviews of this plan and the impacts all hazards have on the county and new development every year and within the time frame after a disaster or major emergency.

5. Capability Assessment

5.1. Update Process Summary

The capability assessment is an evaluation of Elk County's governmental structure, political framework, legal jurisdiction, fiscal status, policies and programs, regulations, ordinances, and resource availability. Each category is evaluated for its strengths and weaknesses in responding to, preparing for, and mitigating the effects of the profiled hazards. A capability assessment is an integral part of the hazard mitigation planning process. Here, the county and municipalities identify, review, and analyze what they are currently doing to reduce losses and identify the framework necessary to implement new mitigation actions. This information will help the county and municipalities evaluate alternative mitigation actions and address shortfalls in the mitigation plan.

A capabilities assessment survey was provided to the municipalities during the planning process at meetings held with Elk County officials. These meetings were designed to seek input from the key county and municipal stakeholders on legal, fiscal, technical, and administrative capabilities of all jurisdictions. As such, the capabilities assessment helps guide the implementation of mitigation projects and will help evaluate the effectiveness of existing mitigation measures, policies, plans, practices, and programs.

Throughout the planning process, the mitigation local planning team considered the county's twelve municipalities. Pennsylvania municipalities have their own governing bodies, pass, and enforce their own ordinances and regulations, purchase equipment and manage their own resources, including critical infrastructure. Therefore, these capability assessments consider the various characteristics and capabilities of municipalities under study.

The evaluation of the following categories – political framework, legal jurisdictions, fiscal status, policies and programs and regulations and ordinances – allows the mitigation planning team to determine the viability of certain mitigation actions. The capability assessment analyzes what Elk County, and its municipalities have the capacity to do and provides an understanding of what must be changed to mitigate loss.

Elk County has several resources it can access to implement hazard mitigation initiatives including emergency response measures, local planning and regulatory tools, administrative assistance and technical expertise, fiscal capabilities and participation in local, regional state, and federal programs. The presence of these resources enables community resiliency through actions taken before, during and after a hazardous event. While the capability assessment serves as a good instrument for identifying local capabilities, it also provides a means for recognizing gaps

and weaknesses that can be resolved through future mitigation actions. The results of this assessment lend critical information for developing an effective mitigation strategy.

5.2. Capability Assessment Findings

All of the municipalities in Elk County completed and submitted a capability assessment survey. Three other stakeholders submitted a capability assessment form as well, to increase the variety of information received. The results of the survey were collected, aggregated, and analyzed.

5.2.1. Planning and Regulatory Capability

Municipalities have the authority to govern more restrictively than state and county minimum requirements as long as they are compliant with all criteria established in the Pennsylvania Municipalities Planning Code (MPC) and their respective municipal codes. Municipalities can develop their own policies and programs and implement their own rules and regulations to protect and serve their residents. Local policies and programs are typically identified in a comprehensive plan, implemented through a local ordinance, and enforced by the governmental body or its appointee.

Municipalities regulate land use via the adoption and enforcement of zoning, subdivision, land development, building codes, building permits, floodplain management and/or stormwater management ordinances. When effectively prepared and administered, these regulations can lead to an opportunity for hazard mitigation. For example, the National Flood Insurance Program (NFIP) established minimum floodplain management criteria, and adoption of the Pennsylvania Floodplain Management Act (Act 166 of 1978) established even higher floodplain management standards. A municipality must adopt and enforce these minimum criteria to be eligible for participation in the NFIP. Municipalities have the option of adopting a single-purpose ordinance or incorporating these provisions into their zoning, subdivision, and land development, or building codes; thereby mitigating the potential impacts of local flooding. This capability assessment details the existing Elk County and municipal legal capabilities to mitigate the profiled hazards. It identifies the county and the municipal existing planning documents and their hazard mitigation potential. Hazard mitigation recommendations are, in part, based on the information contained in the assessment.

Building Codes

Building codes are important in mitigation because they are developed for a region of the country in respect to the hazards that exist in that area. Consequently, structures that are built according to applicable codes are inherently resistant to many hazards, such as intense winds, floods, and earthquakes; and can help mitigate regional hazards, such as wildfires. In 2003, Pennsylvania implemented the Uniform Construction Code (UCC) (Act 45), a comprehensive

building code that establishes minimum regulations for most new construction, including additions and renovations to existing structures.

The code applies to almost all buildings, excluding manufactured and industrialized housing (which are covered by other laws), agricultural buildings, and certain utility and miscellaneous buildings. The UCC requires builders to use materials and methods that have been professionally evaluated for quality and safety, as well as inspections to ensure compliance.

The initial election period, during which all of Pennsylvania's 2,565 municipalities were allowed to decide whether the UCC would be administered and enforced locally, officially closed on August 7, 2004. The codes adopted for use under the UCC are the 2003 International Codes issued by the International Code Council (ICC). Supplements to the 2003 codes have been adopted for use over the years since.

If a municipality has "opted in", all UCC enforcement is local, except where municipal (or third party) code officials lack the certification necessary to approve plans and inspect commercial construction for compliance with UCC accessibility requirements. If a municipality has "opted-out", the Pennsylvania Department of Labor and Industry is responsible for all commercial code enforcement in that municipality; and all residential construction is inspected by independent third-party agencies selected by the owner. The department also has sole jurisdiction for all state-owned buildings no matter where they are located. Historical buildings may be exempt from such inspections and Act 45 provides quasi-exclusion from UCC requirements.

The municipalities in Elk County adhere to the standards of the Pennsylvania Uniform Code (Act 45). All but one municipality has some type of building permit enforcement. Some of the municipalities in the county use third party building code enforcement and some use Elk County. The only municipality that does not have any regulations or oversight is Millstone Township.

Zoning Ordinance

Article VI of the Municipalities Planning Code (MPC) authorizes municipalities to prepare and enact zoning to regulate land use. Its regulations can apply to the permitted use of land, the height and bulk of structures, the percentage of a lot that may be occupied by buildings and other impervious surfaces, yard setbacks, the density of development, the height and size of signs, and the parking regulations. A zoning ordinance has two parts, including the zoning map that delineates zoning districts and the text that sets forth the regulations that apply to each district. There is no county-wide zoning enforcement in Elk County and the planning department does not provide these services.

Subdivision Ordinance

Subdivision and land development ordinances include regulations to control the layout of streets, the planning lots and the provision of utilities and other site improvements. The objectives of subdivision and land development ordinance are to coordinate street patterns, to assure adequate utilities and other improvements are provided in a manner that will not pollute streams, wells and/or soils, to reduce traffic congestions, and to provide sound design standards as a guide to developers, the elected officials, planning departments, and other municipal officials. Article V of the Municipality Planning Code authorizes municipalities to prepare and enact a subdivision and land development ordinance. Subdivision and land development ordinances provide for the division and improvement of land. Of the twelve municipalities in Elk County, five are covered under the Elk County subdivision ordinances. These municipalities are Benezette Township, Highland Township, Horton Township, Millstone Township, and Spring Creek Township. The remaining municipalities have their own subdivision ordinances (Elk County Planning Department, April 2023).

Stormwater Management Plan/Stormwater Ordinance

The proper management of storm water runoff can improve conditions and decrease the chance of flooding. Pennsylvania's Storm Water Management Act (Act 167) confers on counties the responsibility for development of watershed plans. The Act specifies that counties must complete their watershed storm water plans within two years following the promulgation of these guidelines by the Pennsylvania Department of Environmental Protection (PA DEP), which may grant an extension of time for any county for the preparation and adoption of plans. Counties must prepare the watershed plans in consultation with municipalities and residents. This is to be accomplished through the establishment of a watershed plan advisory committee. The counties must also establish a mechanism to periodically review and revise watershed plans. Plan revisions must be done every five years or sooner, if necessary.

Municipalities have an obligation to implement the criteria and standards developed in each watershed storm water management plan by amending or adopting laws and regulations for land use and development. The implementation of storm water management criteria and standards at the local level are necessary since municipalities are responsible for local land use decisions and planning. The degree of detail in the ordinance depends on the extent of existing and projected land development. The watershed storm water management plan is designed to aid the municipality in setting standards for the land uses it has proposed. Municipalities within rapidly developing watersheds will benefit from the watershed storm water management plan and will use the information for sound land use considerations. A major goal of the watershed plan and the attendant municipal regulations is to prevent future drainage problems and avoid the aggravation of existing problems. All municipalities in Elk County have adopted the county's stormwater management plan.

Comprehensive Plan

A comprehensive plan is a policy document that states objectives and guides the future growth and physical development of a municipality. The comprehensive plan is a blueprint for housing, transportation, community facilities, utilities, and land use. It examines how the past led to the present and charts the community's future path. The Pennsylvania Municipalities Code (MPC Act 247 of 1968, as reauthorized and amended) requires counties to prepare and maintain a county comprehensive plan. In addition, the MPC requires counties to update the comprehensive plan every ten years.

Regarding hazard mitigation planning, Section 301.a(2) of the Municipality Planning Code requires comprehensive plans to include a plan for land use, which, among other provisions, suggests that the plan consider floodplains and other areas of special hazards and other similar uses. The MPC also requires comprehensive plans to include a plan for community facilities and services that recommends considering storm drainage and floodplain management.

Elk County last updated its comprehensive plan in 1999. An update to the county's comprehensive plan is currently underway and is scheduled to be completed prior to the end of the 2023 calendar year.

Article III of the MPC enables municipalities to prepare a comprehensive plan: however, development of a comprehensive plan is voluntary. Two of the twelve municipalities in Elk County have adopted their own comprehensive plans. Those municipalities are the City of St Marys and Ridgway Township. The City of St Marys is updating their comprehensive plan at the time of this writing.

Capital Improvements Plan

The capital improvements plan is a multi-year policy guide that identifies needed capital projects and is used to coordinate the financing and timing of public improvements. Capital improvements relate to streets, storm water systems, water distribution, sewage treatment, and other major public facilities. A capital improvements plan should be prepared by the respective county's planning department and should include a capital budget. This budget identifies the highest priority projects recommended for funding in the next annual budget. The capital improvements plan is dynamic and can be tailored to specific circumstances.

Participation in the National Flood Insurance Program (NFIP)

Floodplain management is the operation of programs or activities that may consist of both corrective and preventative measures for reducing flood damage, including but not limited to such things as emergency preparedness plans, flood control works, and flood plain management

regulations. The Pennsylvania Floodplain Management Act (Act 166) require every municipality identified by the Federal Emergency Management Agency (FEMA) to participate in the National Flood Insurance Program and permits all municipalities to adopt floodplain management regulations. It is in the interest of all property owners in the floodplain to keep development and land usage within the scope of the floodplain regulations for their community. This helps keep insurance rates low and ensures that the risk of flood damage is not increased by property development.

The Pennsylvania Emergency Management Agency (PEMA) was appointed by legislation in September 2021 to coordinate the Commonwealth NFIP and employ the State NFIP Coordinator. For many years prior, these roles were held by the Pennsylvania Department of Community and Economic Development (DCED), which still offers support to communities through its Floodplain Mitigation Program. PEMA provides communities, based on CFR Title 44, Section 60.3 level of regulations, with a suggested ordinance document to assist municipalities in meeting the minimum requirements of the NFIP along with the Pennsylvania Flood Plain Management Act (Act 166). These suggested or model ordinances contain provisions that are more restrictive than state and federal requirements. Suggested provisions include, but are not limited to, the following:

1. Prohibiting manufactured homes in the floodway
2. Prohibiting manufactured homes within the area measured fifty feet landward from the top-of-bank of any watercourse within a special flood hazard area
3. Special requirements for recreational vehicles within the special flood hazard area
4. Special requirement for accessory structure
5. Prohibiting new construction and development within the area measured fifty feet landward from the top-of-bank of any watercourse within a special flood hazard area
6. Providing the county conservation district an opportunity to review and comment on all applications and plans for any proposed construction or development in any identified floodplain area

Act 166 mandates municipal participation in, and compliance with, the NFIP. It also establishes higher regulatory standards for new or substantially improved structures which are used for the production or storage of dangerous materials (as defined by Act 166) by prohibiting them in the floodway. Additionally, Act 166 established the requirement that a special permit be obtained prior to any construction or expansion of any manufactured home park, hospital, nursing home, jail and prison if said structure is located within a special flood hazard area.

The NFIP's Community Rating System (CRS) provides discounts on flood insurance premiums in those communities that establish floodplain management programs that go beyond NFIP

minimum requirements. Under the CRS, communities receive credit for more restrictive regulations, acquisition, relocation, or flood-proofing of flood prone buildings, preservation of open space, and other measures that reduce flood damages or protect the natural resources and functions of floodplains.

The CRS was implemented in 1990 to recognize and encourage community floodplain management activities that exceed the minimum NFIP standards. Section 541 of the 1994 Act amends Section 1315 of the 1968 Act to codify the Community Rating System in the NFIP. The section also expands the CRS goals to specifically include incentives to reduce the risk of flood-related erosion and to encourage measures that protect natural and beneficial floodplain functions. These goals have been incorporated into the CRS and communities now receive credit toward premium reductions for activities that contribute to them.

Under the Community Rating System, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet a minimum of three of the following CRS goals.

1. Reduce flood losses
2. Protect public health and safety
3. Reduce damage to property
4. Prevent increases in flood damage from new construction
5. Reduce the risk of erosion damage
6. Protect natural and beneficial floodplain functions
7. Facilitate accurate insurance rating
8. Promote the awareness of flood insurance

There are ten Community Rating System classes. Class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction. CRS premium discounts on flood insurance range from 5% for Class 9 communities up to 45% for Class 1 communities. The CRS recognizes eighteen credible activities, organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness.

FEMA Region III makes available to communities an ordinance review checklist which lists required provisions for floodplain management ordinances. This checklist helps communities develop an effective floodplain management ordinance that meets federal requirements for participation in the NFIP. PEMA provides communities, based on their 44 CFR 60.3 level of regulations, with a suggested ordinance document to assist municipalities in meeting the minimum requirements of the NFIP and the Pennsylvania Flood Plain Management Act (Act 166). Act 166 mandates municipal participation in and compliance with the NFIP. It also

established higher regulatory standards for hazardous materials and high-risk land uses. As new Digital Flood Insurance Rate Maps (DFIRMs) are published, the Pennsylvania State NFIP Coordinator at DCED works with communities to ensure the timely and successful adoption of an updated floodplain management ordinance by reviewing and providing feedback on existing and draft ordinances.

According to the State NFIP Coordinator, all but one of Elk County's twelve municipalities have floodplain regulations in place that meet requirements set forth by the NFIP. Currently, no municipalities have completed or started to complete the CRS program. Additional research will be conducted on the CRS program and mitigation actions will be developed in support of the CRS.

To spread awareness as well as capture participation levels, all municipalities were instructed to complete an NFIP survey provided by the Federal Emergency Management Agency. In total, all municipalities in Elk County submitted an NFIP survey. These surveys can be found in Appendix C of this plan.

5.2.2. Administrative and Technical Capability

There are two boroughs, nine townships, and one city within Elk County. Each of these municipalities conducts its daily operations and provides various community services according to local needs and limitations. Some of these municipalities have formed cooperative agreements and work jointly with their neighboring municipalities to provide services such as police protection, fire and emergency response, infrastructure maintenance, and water supply management. Other municipalities choose to operate independently and provide such services internally. Municipalities vary in staff size, resource availability, fiscal status, service provision, constituent population, overall size, and vulnerability to the profile hazards. Technical capability relates to an adequacy of knowledge and technical expertise of local government employees or the ability to contract resources for this expertise in order to effectively execute mitigation activities. Common examples of skill sets, and technical personnel needed for hazard mitigation include: planners with knowledge of land development and management practices, engineers or professionals trained in construction practices related to buildings and/or infrastructure (e.g. building inspectors), planners or engineers with an understanding of natural and/or human caused hazards, emergency managers, floodplain managers, land surveyors, scientists familiar with hazards in the community, staff with education of expertise to assess community vulnerability to hazards, personnel skilled in geographic information systems, resource development staff or grant writers, fiscal staff to handle complex grant application processes.

County Planning Department

In Pennsylvania, planning responsibilities traditionally have been delegated to each county and local municipality through the Municipalities Planning Code (MPC). A planning agency acts as an advisor to the governing body on matters of community growth and development. A governing body may appoint individuals to serve as legal or engineering advisors to the planning agency. In addition to the duties and responsibilities authorized by Article II of the MPC, a governing body may, by ordinance, delegate approval authority to a planning agency for subdivision and land development applications. A governing body has considerable flexibility, not only as to which powers and duties are assigned to a planning agency, but also what form an agency will possess. A governing body can create a planning department, a planning commission, or both. The Elk County Planning Department assists all municipalities in the county as needed.

Municipal Engineer

A municipal engineer performs duties as directed in the areas of construction, reconstruction, maintenance and repair of streets, roads, pavements, sanitary sewers, bridges, culverts, and other engineering work. The municipal engineer prepares plans, specifications and estimates of the work undertaken by the township. Most municipalities in Elk County have a municipal engineer under contract to perform these duties. The City of St Marys has a municipal engineer on staff, Ridgway Township has one municipal engineer appointed for stormwater, and Fox Township employs an engineer as needed. Jones Township, Johnsonburg Borough, Ridgway Borough, Jay Township, and Horton Township contract out municipal engineer duties.

Personnel Skilled in GIS or FEMA HAZUS Software

A geographic information system (GIS) is an integrated, computer-based system designed to capture, store, edit, analyze, and display geographic information. Some examples of uses for GIS technology in local government are land records management, land use planning, infrastructure management, and natural resources planning. A GIS automates existing operations such as map production and maintenance, saving a great deal of time and money. The GIS also includes information about map features such as the capacity of a municipal water supply or the acres of public land. GIS data is managed, maintained, and developed by the Elk County GIS Department, which is available to assist all the county's municipalities. GIS data is an important tool to use in hazard mitigation planning and is instrumental in assessing the risk of municipalities to various hazards.

Emergency Management Coordinator

Emergency management is a comprehensive, integrated program of mitigation, preparedness, response, and recovery for emergencies/disasters of any kind. No public or private entity is immune to disasters and no single segment of society can meet the complex needs of a major emergency or disaster on its own. Hence, the National Preparedness Goal of 2011 also defines what it means for the whole community to be prepared for all types of disasters and emergencies and lists five mission areas which support preparedness: prevention, protection, mitigation, response, and recovery – doubling the emphasis on mitigation activities in an emergency management program.

The Pennsylvania Emergency Management Services Code (PA Title 35) requires Elk County and its municipalities to have an emergency management coordinator.

The Elk County Office of Emergency Services coordinates countywide emergency management efforts. Each municipality has a designated local emergency management coordinator who possesses a unique knowledge of the impact hazardous events have on their community.

A municipal emergency management coordinator is responsible for emergency management – preparedness, response, recovery, and mitigation within his/her respective authority having jurisdiction (AHJ). The responsibilities of the emergency management coordinator are outlined in PA Title 35 §7633.

- Prepare and maintain a current disaster emergency management plan
- Establish, equip, and staff an emergency operations center
- Provide individual and organizational training programs
- Organize and coordinate all locally available manpower, materials, supplies, equipment, and services necessary for disaster emergency readiness, response, and recovery
- Adopt and implement precautionary measures to mitigate the anticipated effects of a disaster
- Cooperate and coordinate with any public and private agency or entity
- Provide prompt information regarding local disaster emergencies to appropriate commonwealth and local officials or agencies and the public
- Participate in all tests, drills, and exercises, including remedial drills and exercises, scheduled by the agency or by the federal government

PA Title 35 requires that all municipalities in the Commonwealth have a local emergency operations plan (EOP) which is updated every two years. Ten municipalities have in place their own EOP. The notification and resource section of the plan was developed individually by each municipality.

Federal Agency Assistance

There are many federal agencies that can provide technical assistance for mitigation activities, and these include, but are not limited to:

- United States Army Corps of Engineers (USACE)
- Department of Housing and Urban Development (HUD)
- Department of Agriculture (DOA)
- Economic Development Administration
- Emergency Management Institute (EMI)
- Environmental Protection Agency (EPA)
- Federal Emergency Management Agency (FEMA)
- Small Business Administration (SBA)

State Agency Assistance

There are many commonwealth agencies that can provide technical assistance for mitigation activities, and these include but are not limited to:

- Pennsylvania Emergency Management Agency (PEMA)
- Pennsylvania Department of Community and Economic Development
- Pennsylvania Department of Conservation and Natural Resources
- Pennsylvania Department of Environmental Protection

Political Capability

One of the most difficult capabilities to evaluate involves the political will of a jurisdiction to enact meaningful policies and projects designed to mitigate hazard events. The adoption of hazard mitigation measures may be seen as an impediment to growth and economic development. In many cases, mitigation may not generate interest among local officials when compared with competing priorities. Therefore, the local political climate must be considered when designing mitigation strategies, as it could be the most difficult hurdle to overcome in accomplishing the adoption or implementation of specific actions.

The capability assessment survey was used to capture information on each jurisdiction's political capability. Survey respondents were asked to identify examples of political capability, such as guiding development away from hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum state or federal requirements (i.e., building codes, floodplain management ordinances, etc.). These examples were used to guide respondents in scoring their community on a scale of "unwilling" (0) to "very willing" (5) to adopt policies and programs that reduce hazard

vulnerabilities. *Table 76 – Elk County Community Political Capability* summarizes the results of political capability.

Table 76 - Elk County Community Political Capability

Elk County Community Political Capability						
Municipality Name	**Capability Ranking**					
	0	**1**	**2**	**3**	**4**	**5**
Benezette Township	Not completed by municipality.					
Fox Township						X
Highland Township	Not completed by municipality.					
Horton Township				X		
Jay Township					X	
Johnsonburg Borough						X
Jones Township				X		
Millstone Township				X		
Ridgway Borough				X		
Ridgway Township	Not completed by municipality.					
Spring Creek Township				X		
St. Mary's, City of						X
Other Stakeholders:						
Elk County						X
DCNR Bureau of Forestry				X		
Ridgway Area School District					X	

Self-Assessment

In addition to the inventory and analysis of specific local capabilities, the capability assessment survey required each local jurisdiction to conduct its own self-assessment of its capability to effectively implement hazard mitigation activities. As part of this process, county and municipal officials were encouraged to consider the barriers to implementing proposed mitigation strategies in addition to mechanisms that could further enhance such strategies. In response to the survey questionnaire, local officials classified each of the capabilities as wither "L = Limited", "M = Moderate", or "H = High." *Table 77 – Capability Self-Assessment Matrix* summarizes the results of the self-assessment survey. Eleven municipalities returned this section of the assessment completed. Three other organizations returned this section of the assessment completed.

Table 77 - Capability Self-Assessment Matrix

Elk County Capability Self-Assessment Matrix				
Municipality Name	**Capability Category**			
	Planning and Regulatory Capability	**Administrative and Technical Capability**	**Fiscal Capability**	**Community Political Capability**
Benezette Township	L	M	M	L
Fox Township	H	H	H	M
Highland Township	L	L	L	L
Horton Township	L	L	L	L
Jay Township	M	M	M	M
Johnsonburg Borough	M	M	L	H
Jones Township	M	L	M	M
Millstone Township	L	L	L	L
Ridgway Borough	M	H	H	H
Ridgway Township	Not completed by the municipality.			
Spring Creek Township	L	L	L	L
St. Mary's, City of	H	H	H	H
Other Stakeholders:				
Elk County	*M*	*M*	*M*	*M*
DCNR Bureau of Forestry	*M*	*M*	*L*	*L*
Ridgway Area School District	*M*	*M*	*M*	*M*

In addition to the institutional capability of the municipal government structure described above, the county itself can engage in mitigation activities. The county has its own staff, resources, budget, and objectives, which may or may not be like those of its constituent municipalities. Therefore, the county has its own capabilities to mitigate the profiled hazards through planning and coordination of local mitigation efforts. The Elk County GIS Department can provide the necessary skills in the analysis of geographic data. Other local organizations that can and do act as partners include the Elk County Planning Department, the Elk County Conservation District, the Elk County Redevelopment Authority, the Elk County Area Agency on Aging, the Fire Advisory Committee and Regional Firefighters Association, business development organizations, and historical or cultural agencies.

Existing Limitations

Funding has been identified as the largest limitation for a municipality to complete mitigation activities. The acquisition of grants is the best way to augment this process for the municipalities. The county and municipality representatives will need to rely on regional, state, and federal partnerships for future financial assistance. Development of intra-county regional partnerships and intra-municipality regional partnerships will bolster this process.

5.2.3. Financial Capability

Fiscal capability is significant to the implementation of hazard mitigation activities. Every jurisdiction must operate within the constraints of limited financial resources. The decision and capacity to implement mitigation-related activities is often strongly dependent on the presence of financial resources. While some mitigation actions are less costly than others, it is important that money is available locally to implement policies and projects. Financial resources are particularly important if communities are trying to take advantage of state or federal mitigation grant funding opportunities that require local-match contributions. Based on survey results, five municipalities stated that their fiscal capability was low, three reported that their fiscal capabilities were moderate, and three municipalities reported that their capability was high. One municipality did not complete that portion of the assessment. The following information pertains to various financial assistance programs relevant to hazard mitigation.

State and Federal Grants

During the 1960s and 1970s state and federal grants-in-aid were available to finance many municipal programs, including streets, water and sewer facilities, airports, parks, and playgrounds. During the early 1980s, there was a significant change in federal policy, based on rising deficits and a political philosophy that encouraged states and local governments to raise their own revenues for capital programs. The result has been a growing interest in “creative financing”.

Grant programs that may be utilized to accomplish hazard mitigation objectives include the: Pennsylvania Department of Community and Economic Development Community Development Block Grant (CDBG); Land Use Planning and Technical Assistance (LUPTAP); Shared Municipal Services (SMS); Community Revitalization (CR) and Floodplain Land Use Assistance Programs; the PA DEP’s Growing Greener; Act 167 Stormwater Management; Source Water Protection; and Flood Protection Programs. The Flood Protection Programs include the PA DCNR’s Community Conservation Partnership Program, PEMA’s Pre-Disaster Mitigation (PDM) Grant, Flood Mitigation Assistance Grant Programs (FMA), and Hazard Mitigation Grant Program.

Below are some of the other state programs that may provide financial support for mitigation activities:

- DCED Flood Mitigation Program
- DCED H2O PA Flood Control Projects
- DCED H2O PA High Hazard Unsafe Dam Projects
- DCED H2O PA Water Supply, Sanitary Sewer and Storm Water Projects
- DCED PA Small Water and Sewer
- DCNR Community Conservation Partnerships Program
- DCNR Pennsylvania Heritage Areas Program
- DCNR Pennsylvania Recreational Trails Program
- DCNR Land and Water Conservation Fund

Below are some of the federal programs that may provide financial support for mitigation activities:

- FEMA Community Assistance Program – State Support Services Element (CAP-SSSE)
- FEMA Community Disaster Loan Program
- FEMA Community Rating System
- FEMA Emergency Management Performance Grants (EMPG)
- FEMA Environmental Planning and Historic Preservation Program (EHP)
- FEMA Flood Mitigation Assistance Program
- FEMA Hazard Mitigation Grant Program (HMGP)
- FEMA Individuals and Households Program (IHAP)
- FEMA National Dam Safety Program
- FEMA National Flood Insurance Program
- FEMA Pre-Disaster Mitigation Program
- FEMA Public Assistance Program (PA)
- FEMA Regional Catastrophic Preparedness Grant Program
- FEMA Repetitive Flood Claims Program (RFC)
- FEMA Severe Repetitive Loss Grant Program
- USACE Continuing Authorities Program
- USACE Flood Plain Management Services Program (FPMS)
- USACE Inspection of Completed Works Program (ICW)
- USACE National Levee Safety Program
- USACE Planning Assistance to States
- USACE Rehabilitation and Inspection Program (RIP)

Capital Improvement Financing

Because most of the capital investments involve the outlay of substantial funds, local governments can seldom pay for these facilities through annual appropriations in the annual operating budget. Therefore, numerous techniques have evolved to enable local government to pay for capital improvements over a time period exceeding one year. Public finance literature and state laws governing local government finance classify techniques that are used to finance capital improvements. The techniques include revenue bonds, lease-purchase, authorities and special district, current revenue (pay-as-you-go); reserve funds; and tax increment financing. Most municipalities have very limited local tax funds for capital projects. Grants and other funding are always priorities.

Indebtedness through General Obligation Bonds

Some projects may be financed with general obligation bonds. With this method, the jurisdiction's taxing power is pledged to pay interest and principal to retire debt. General obligation bonds can be sold to finance permanent types of improvements, such as schools, municipal buildings, parks, and recreational facilities. Voter approval for this may be required.

Municipal Authorities

Municipal authorities are most often used when major capital investments are required. In addition to sewage treatment, municipal authorities have been formed for water supply, airports, bus transit systems, swimming pools, and other purposes. Joint authorities have the power to receive grants, borrow money, and operate revenue generating programs. Municipal authorities are authorized to sell bonds, acquire property, sign contracts, and take similar actions. Authorities are governed by authority board members, who are appointed by the elected officials of the member municipalities.

Sewer Authorities

Sewer authorities include multi-purpose authorities with sewer projects. They sell bonds to finance acquisition of existing systems for construction, extension, or system improvement. Sewer authority operating revenues originate from user fees. The fee frequently is based on the amount of water consumed and payment is enforced by the ability to terminate service by the imposition of liens against real estate. In areas with no public water supply, flat rate charges are calculated on average use per dwelling unit.

Water Authorities

Water authorities are multi-purpose authorities with water projects, many of which operate both water and sewer systems. The financing of water systems for lease back to the municipality is

one of the principal activities of the local government facilities' financing authorities. An operating water authority issues bonds to purchase existing facilities to construct, extend, or improve a system. The primary source of revenue is user fees based on metered usage. The cost of construction or extending water supply lines can be funded by special assessments against abutting property owners. Tapping fees also help fund water system capital costs. Water utilities are also directly operated by municipal governments and by privately owned public utilities regulated by the Pennsylvania Public Utility Commission. The Pennsylvania Department of Environmental Protection has a program to assist with consolidating small water systems to make system upgrades more cost effective.

U.S. Department of Agriculture Circuit Riding Program (Engineer)

The Circuit Riding Program is an example of intergovernmental cooperation. This program offers municipalities the ability to join to accomplish a common goal. The circuit rider is a municipal engineer who serves several small municipalities simultaneously. These are municipalities that may be too small to hire a professional engineer for their own operations yet need the skills and expertise the engineer offers. Municipalities can jointly obtain what no one municipality could obtain on its own.

5.2.4. Education and Outreach

The Elk County Office of Emergency Services conducts public outreach at public events to update the citizens and visitors of the county on natural and human-caused hazards. The county planning office and county conservation district also conduct outreach on various activities and projects in the county.

Education activities that directly impact hazard mitigation in Elk County predominantly revolve around the first responders. Providing fire, medical, search and rescue training, and education enhances the response and recovery capabilities of response agencies in the county. Newly appointed emergency management coordinators are trained in both Duties and Responsibilities and damage assessment – which includes a discussion on mitigation; this training can be translated into teaching municipal employees or local emergency services to assist them during a disaster.

The county also has several websites and social media accounts that can educate residents about hazard mitigation and risk while also communicating information in the event of a disaster:

- Elk County Website: https://www.co.elk.pa.us/
- Elk County Emergency Services Website: https://www.co.elk.pa.us/index.php/government/local-government/county-offices/item/206-elk-county-office-of-emergency-services-911

The Elk County GIS Department website has an education and outreach capability, particularly with the county map viewer, which could be updated to include hazard mitigation data. The websites of the Elk County Office of Emergency Services and the Elk County Planning Department also post information to educate residents, particularly in disaster preparedness, floodplain management, and zoning requirements. The Elk County Planning Department currently provides access to planning documents and educational brochures about the benefits of planning and helpful guides. The DES also holds regular Local Emergency Planning Committee (LEPC) meetings that are open to the public, which serve as another means to conduct outreach and educate the public about hazard mitigation.

Education and outreach on the NFIP are necessary. With new regulations in flood-plain management, updated digital flood insurance rate maps and new rates for insurance policies, education, and outreach on the NFIP would assist the program. The Elk County Local Planning Team will identify actions necessary to complete this.

5.2.5. Plan Integration

Plan integration recognizes that hazard mitigation is most effective when it works in efficient coordination with other plans, regulations, and programs. Plan integration promotes safe, resilient growth, effective management, an overall reduction of risk, by ensuring that the goals and actions established in the Hazard Mitigation Plan are included in the comprehensive planning efforts so they can affect future land use and development. Some of the most important areas of planning and regulatory capabilities which hazard mitigation goals and actions should be integrated include comprehensive plans, the hazard mitigation plans from all surrounding or encompassing areas, EOPs, building codes, floodplain ordinances, subdivision, land development ordinances, stormwater management plans and ordinances, and zoning ordinances. All of these tools provide mechanisms for the implementation of adopted mitigation strategies.

Elk County Comprehensive Plan

Overview

Comprehensive plans establish the overall vision, goals, and objectives for a community's growth. The Elk County Comprehensive Plan was adopted by the Elk County Commissioners on May 26, 1999. The plan is a collaborative effort between Elk County and its municipalities that do not have their own comprehensive plan and contains actions that assist in planning for comprehensive development within Elk County. The plan establishes countywide goals and objectives, describes environmental and demographic characteristics, identifies potential capital improvement projects, and inventories existing planning initiatives and tools in the county.

As part of the update process, the goals and objectives in the 1999 comprehensive plan were reviewed, and those that are currently supportive of hazard mitigation goals and principles were identified. Specific recommendations for Elk County, Pennsylvania in the 1999 comprehensive plan are outlined in phase two of the plan. Each of these recommendations offers a range of existing actions for future development in the county from the perspective at the time of the comprehensive plan update in 1999. The recommendations in the comprehensive plan cover areas like population, economic development, housing, environmental, forest resources, public utilities and infrastructure, transportation, public service and recreation, energy conservation, and land use.

Recommendations for Continued and Future Integration

As discussed, many of the goals and objectives outlined in the Elk County Comprehensive Plan are related to the hazard mitigation risks and goals established in the HMP. Several could be revised to include updated information from this HMP. Additionally, the comprehensive plan can identify the places of higher vulnerability that are identified in this plan for all the high-risk hazards, and include objectives aimed at reducing the risk to these vulnerable areas.

Another key opportunity for further integration of hazard mitigation into planning and regulatory tools is to incorporate hazard mitigation goals and objectives into the ongoing and future Elk County Comprehensive Plan update. Elk County is due for an update to the 1999 comprehensive plan.

Elk County County-wide Subdivision Land Development Plan

Overview

Subdivision and land development plans establish land use and development for a community's growth and provide guidance on the ordinances that relate to land development. The Elk County County-wide Subdivision Land Development Plan was finalized and adopted by the county in June of 2003.

Recommendations for Continued and Future Integration

The County-wide Subdivision Land Development Plan offers land use and development guidelines and ordinances. This plan must be looked at and included in all future planning efforts including future comprehensive plan updates and hazard mitigation plan updates.

Elk County Community Wildfire Protection Plan

Overview

The Elk County Community Wildfire Protection Plan is used for area identification for areas of high risk to wildland fires and makes recommendations for the reduction of risk for Elk County to wildfire events. The Elk County Community Wildfire Protection Plan was completed on October 25th, 2017. This plan outlines a review of wildfire vulnerability in Elk County and its risk assessment and vulnerability assessments match processes used in hazard mitigation.

Recommendations for Continued and Future Integration

The Elk County Community Wildfire Protection Plan should continue to be used in collaboration with the hazard mitigation planning efforts in Elk County. A review of mitigation items from this plan should continue to be used with assessing the risk of wildfire vulnerability.

6. Mitigation Strategy

6.1. Update Process Summary

Mitigation goals are general guidelines that explain what the county wants to achieve. Goals are usually expressed as broad policy statements representing desired long-term results. Mitigation objectives describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date. There were five goals and nine objectives identified in the 2018 hazard mitigation plan. The 2023 Elk County Hazard Mitigation Plan Update has five goals and eighteen objectives. Objectives have been added and arranged in order to associate them with the most appropriate goal. These changes are noted in *Table 78 – 2018 Mitigation Goals and Objectives Review*. These reviews are based on the five-year hazard mitigation plan review worksheet, which includes a survey on existing goals and objectives completed by the local planning team. Municipal officials then provided feedback on the changes to the goals and objectives via a mitigation strategy update meeting. Copies of these meetings and all documentation associated with the meetings are located in Appendix C.

Actions provide more detailed descriptions of specific work tasks to help the county and its municipalities achieve prescribed goals and objectives. There were twenty-one actions identified in the 2018 mitigation strategy. A review of the 2018 mitigation actions was completed by the local planning team. The results of this review are identified in *Table 79 – 2018 Mitigation Actions Review*. Actions were evaluated by the local planning team with the intent of carrying over any actions that were not started or continuous for the next five years.

Table 78 - 2018 Mitigation Goals and Objectives Review

Elk County 2018 Mitigation Goals and Objectives		
GOAL Objective	**Description**	**Comment**
GOAL 1	Local Plans and Regulations	**2023 Verbiage Change** "Coordinate and collaborate with all hazard mitigation stakeholders to develop, implement, and maintain regulations, ordinances, plans, and procedures to decrease the effects of natural and human caused hazards."

Elk County 2018 Mitigation Goals and Objectives		
GOAL Objective	**Description**	**Comment**
Objective 1A	Utilize radio spots, newspaper articles, and public service announcements.	The numbering system changed to 1.1. This objective is moved to the 2023 Goal 4 and is now an action under Objective 4.2.
Objective 1B	Make available to the public an assortment of disaster preparedness brochures	The numbering system changed to 1.2. This objective is moved to an action under the 2023 Goal 4 Objective 4.2.
GOAL 2	Improve and update countywide datasets and update general municipal maps accordingly.	**2023 Verbiage Change** "Reduce impacts of flooding, flash flooding, and ice jam flooding in Elk County and all watersheds."
Objective 2A	Create a committee to improve and update maps of each municipality.	This objective was removed for 2023.
Objective 2B	Incorporate updated Flood Insurance Rate Maps (FIRMs) into county processes.	This objective is moved and reworded to 2023 Objective 2.4.
GOAL 3	Improve public and public officials' participation in the mitigation implementation process.	**2023 Change** "Reduce the potential impact of, and losses stemming from, natural and human caused hazards."
Objective 3A	Use public service announcements to inform the public and officials of the importance of hazard mitigation in order to get more people interested in the mitigation process	This objective was removed for 2023.

Elk County 2018 Mitigation Goals and Objectives		
GOAL Objective	**Description**	**Comment**
GOAL 4	Rank all the mitigation opportunity forms	**2023 Change** "Conduct education, awareness, and outreach programs and projects to prepare for, respond to, recover from, and mitigation natural and human caused hazards."
Objective 4A	Review all of the submitted Hazard Mitigation Opportunity forms submitted by the 12 municipalities of Elk County and rank them according to a viable ranking system in order	This objective was removed for 2023.
GOAL 5	Facilitate the protection life and property from natural and man-made disasters	**This goal is moved to 2023 Goal 3 and was reworded. A new Goal 5 was created for 2023 to read** "Participate in FEMA's High-Hazard Potential Dam Program (HHPD)."
Objective 5A	Reduce wildfire potential through planning and outreach.	This objective is moved and reworded to be included in Goal 2, Objective 2.1.
Objective 5B	Implement structural projects to reduce the impacts from flooding including acquisition, elevation, and relocation.	This objective is moved and reworded to the 2023 Goal 2, Objective 2.1.
Objective 5C	Improve coordination and communication disaster response organizations, emergency management entities, and local and county governments.	This objective is moved and reworded to the 2023 Goal 3, Objective 3.3.

Table 79 - 2018 Mitigation Actions Review

Elk County Mitigation Actions Review Worksheet						
Existing Mitigation Actions (2018 HMP)	**Status**					**Review Comment**
	No Progress/Unknown	**In progress/Not Yet**	**Continuous**	**Completed**	**Discontinued**	
Action 1 Continue to engage the public using various means of communication. Elk County has a new re-designed website that is more interactive and has been well received by the public. Articles and news information concerning hazard mitigation can now be posted regularly.			✓			**2023 Review Comment:** Things can be changed at any time on the website.

Elk County Mitigation Actions Review Worksheet						
Existing Mitigation Actions (2018 HMP)	**Status**					**Review Comment**
	No Progress/Unknown	**In progress/Not Yet**	**Continuous**	**Completed**	**Discontinued**	
Action 2 North Central PA Regional Planning & Development Commission has hired a new position. The new employee will actively raise awareness of the short and long term public and private impacts of the Flood Insurance Reform. North Central plans to develop and implement a self-help flood resiliency protocol for a selected pilot community. This tool will allow municipal governments to complete flood mitigation assessments, including flood proofing, structure elevation, structure relocation, and municipal boundary expansions. The self-analysis will allow for municipalities to implement mitigation measures utilizing existing available state and federal funding. Another anticipated outcome of the project will be to develop an Elevation Certificate Program for the region. North Central will develop a model RFP to solicit professional survey or engineering services to prepare and issue FEMA Elevation Certificates for interested homeowners within the 100-year floodplain (Zone AE). The intent of this program is to create savings in the community for each participating property owner.				✓		**2023 Review Comment:** Completed but funding ran out for this program.
Action 3 County and local municipal authorities will work together to share information on new funding sources and/or programs as they become available.			✓			**2023 Review Comment:** No comment.

Elk County Mitigation Actions Review Worksheet						
Existing Mitigation Actions (2018 HMP)	**Status**					**Review Comment**
	No Progress/Unknown	**In progress/Not Yet**	**Continuous**	**Completed**	**Discontinued**	
Action 4 Widespread dissemination of the new Community Wildfire Protection Plan to local municipal officials and fire departments. Mitigation programs and educational programs will be implemented according to the plan.				✓		**2023 Review Comment:** Community wildfire protection plan was completed October 2017.
Action 5 County personnel will work cooperatively with emergency services, local municipal officials and PennDOT to develop an action plan within the next five years.	✓					**2023 Review Comment:** Unknown status.
Action 6 The Elk County Planning Department will outreach to local municipalities in order to educate them about the potential use of CDBG funds for these types of projects as well as coordinate with North Central PA Regional Planning and Development Corporation's local Rural Planning Organization to offer solutions.			✓			**2023 Review Comment:** No comment.
Action 7 Elk County will partner with the local conservation district, DEP, and the Western Pennsylvania Conservancy Watershed Manager to work cooperatively together to clear local streams excess gravel annually.					✓	**2023 Review Comment:** This is something that is not done.
Action 8 Elk County will partner with the local conservation district, DEP, and the Western Pennsylvania Conservancy Watershed Manager to work cooperatively together to clear local streams of debris annually.					✓	**2023 Review Comment:** This is something that is not done.

Elk County Mitigation Actions Review Worksheet						
Existing Mitigation Actions (2018 HMP)	**Status**					**Review Comment**
	No Progress/Unknown	**In progress/Not Yet**	**Continuous**	**Completed**	**Discontinued**	
Action 9 Although Jones Township is complete, the City of St. Marys has a much larger area to oversee. The County will continue to share information and work cooperatively with the city to help them implement their stormwater projects.	✓					**2023 Review Comment:** Unknown status.
Action 10 Elk County Emergency Management will continue to update equipment as new technology becomes available.			✓			**2023 Review Comment:** No comment.
Action 11 None at this time however if new/improved technology becomes available to replace SWIFT County OES will investigate it.				✓		**2023 Review Comment:** No comment.
Action 12 Elk County OES will continue to address communication issues as they arise.			✓			**2023 Review Comment:** No comment.
Action 13 The Elk County Planning Department will contact DEP and determine whether or not a drought contingency plan is needed. If so, planning department staff will pursue the project within the next five years.	✓					**2023 Review Comment:** Droughts are low. Not sure what plan was with this.
Action 14 Encourage residents with repetitive losses to participate in the buy-out program. Assist in locating funding to pay for flood mitigation actions.	✓					**2023 Review Comment:** Never heard of this.
Action 15 Elk County and Emergency Management will work with local municipalities to educate the citizens about options to improve the structural integrity of their homes.	✓					**2023 Review Comment:** Section refers to the wildfire protection plan, so it may be complete.

Elk County Mitigation Actions Review Worksheet						
Existing Mitigation Actions (2018 HMP)	**Status**					**Review Comment**
	No Progress/Unknown	**In progress/Not Yet**	**Continuous**	**Completed**	**Discontinued**	
Action 16 Encourage manufactured and mobile home owners to prepare an emergency plan in case of these types of emergencies utilizing public education materials. They will be posted on local web sites and placed in local newspapers. This will be done annually at the start of the spring season to remind residents to take cover.			✓			**2023 Review Comment:** No comment.
Action 17 Explore the feasibility of properties eligible for funding in order to demolish and reconstruct houses in the flood zone.	✓					**2023 Review Comment:** Not aware if this was pursued.
Action 18 Elk County will continue to encourage local municipalities to utilize the stormwater management plan. Elk County would like to update the plan to include stormwater modeling if new funding becomes available.	✓					**2023 Review Comment:** Plan is from 2010. Local enforcement.
Action 19 Variations of the plan have been discussed. Elk County Planning will keep in touch with Ridgway Borough to discuss future plans.	✓					**2023 Review Comment:** No comment.
Action 20 Projects are scheduled for Elk Creek in Ridgway by the US Army Corp. St. Marys projects are in the planning phase and Kersey Run's issues have not been identified. A feasibility study has been discussed but funding is an issue.	✓					**2023 Review Comment:** No comment.

Elk County Mitigation Actions Review Worksheet						
Existing Mitigation Actions (2018 HMP)	**Status**					**Review Comment**
	No Progress/Unknown	**In progress/Not Yet**	**Continuous**	**Completed**	**Discontinued**	
Action 21 Create a database or emergency call list of residents that are elderly or disabled and have no means to evacuate on their own if necessary in order to expedite removal in case of evacuation.					✓	**2023 Review Comment:** No plans for this. Unaware of anything done with it.

6.2. Mitigation Goals and Objectives

Based on results of the goals and objectives evaluation exercise and input from the local planning team, a list of five goals and seventeen corresponding objectives were developed. *Table 80 – 2023 Goals and Objectives* details the mitigation goals and objectives established for the 2023 Elk County Hazard Mitigation Plan.

Table 80 - 2023 Goals and Objectives

Elk County 2023 Mitigation Goals and Objectives	
Goal / Objective	**Description**
Goal 1	**Coordinate and collaborate with all hazard mitigation stakeholders to develop, implement, and maintain regulations, ordinances, plans, and procedures to decrease the effects of natural and human caused hazards.**
Objective 1.1	Participate in hazard specific planning committees and organizations and build public-private partnerships to decrease the impact and increase public knowledge of these hazards.
Objective 1.2	Protect Elk County's natural resources through the implementation of natural resource, recreation, and stormwater management planning.

Elk County 2023 Mitigation Goals and Objectives	
Goal / Objective	**Description**
Objective 1.3	Develop, implement, review, and maintain ordinances and plans to decrease the impact of all hazards.
Goal 2	**Reduce impacts of flooding, flash flooding, and ice jam flooding in Elk County and all watersheds.**
Objective 2.1	Evaluate, update, and enforce existing floodplain ordinances to meet or exceed the NFIP standards.
Objective 2.2	Complete project opportunities to acquire, elevate, demolish or demolish/reconstruct properties, repetitive loss properties and severe repetitive loss properties.
Objective 2.3	Encourage municipalities to re-establish floodplain connectivity and conduct projects to increase protection from flood related events.
Objective 2.4	Maintain participation in the National Flood Insurance Program.
Goal 3	**Reduce the potential impact and losses stemming from natural and human caused hazards.**
Objective 3.1	Protect vulnerable populations, buildings, and community lifeline facilities with the implementation of actions and projects.
Objective 3.2	Identify actions and projects to decrease the impact of cyberterrorism.
Objective 3.3	Improve emergency preparedness and response countywide.
Objective 3.4	Identify actions and projects to decrease the impacts of invasive species.
Goal 4	**Conduct education, awareness, and outreach programs and projects to prepare for, respond to, recover from, and mitigate natural and human caused hazards.**
Objective 4.1	Conduct various workshops, seminars, and educational activities.
Objective 4.2	Develop, organize, and disseminate hazard mitigation information.
Objective 4.3	Target public and private property owners within identified hazard areas for additional outreach regarding mitigation and disaster preparedness.
Objective 4.4	Develop and foster outreach, education, and awareness of hazard mitigation to underserved and socially vulnerable communities to increase input into the development process.
Goal 5	**Participate in FEMA's High-Hazard Potential Dam Program (HHPD).**

Elk County 2023 Mitigation Goals and Objectives	
Goal / Objective	**Description**
Objective 5.1	Educate Elk County municipalities, property owners, and businesses about FEMA's HHPD program.
Objective 5.2	Reduce long-term vulnerabilities from eligible high-hazard potential dams that pose an unacceptable risk to the public.
Objective 5.3	Identify, by area, locations in Elk County that could potentially be impacted by FEMA's HHPD program.

Goal 5 and Objectives 5.1, 5.2, and 5.3 relate to multiple mitigation actions in *Table 82 – 2023 Mitigation Action Plan*. Action 5.1.1 relates to Objective 5.1 for HHPD, Action 5.2.1 relates to Objective 5.2 for HHPD, and Action 5.3.1 relates to Objective 5.3. All three of the mitigation actions are covered by Goal 5 of the goals and objectives for the 2023 Hazard Mitigation Plan. These mitigations reduce the vulnerability of county populations and structures by educating the public on the HHPD program, enhancing local policies and procedures for HHPD planning, and digitizing dam inundation areas for future analysis and prevention of losses.

6.3. Identification and Analysis of Mitigation Techniques

This section includes an overview of alternative mitigation actions based on the goals and objectives identified in Section 6.2. There are four general mitigation strategy techniques to reducing hazard risks.

- Planning and regulations
- Structure and infrastructure
- Natural systems protection
- Education and awareness

Planning and Regulations: These actions include government authorities, policies or codes that influence the way land and buildings are developed and built. The following are some examples.

- Comprehensive plans
- Land use ordinances
- Subdivision regulations
- Development review
- Building codes and enforcement
- National Flood Insurance Program and Community Rating System
- Capital improvement programs
- Open space preservation
- Stormwater management regulations and master plans

The planning and regulations technique will protect and reduce the impact of specific hazards on new and existing buildings by improving building code standards and regulating new and renovation construction. The improved building codes will decrease the impact of risk hazards. Subdivision and land development enhancements will also augment this process. Ensuring that municipalities participate in the National Flood Insurance Program and encourage participation in the Community Rating System will decrease the impact as well.

Structure and infrastructure implementation: These actions involve modifying existing structures and infrastructure or constructing new structures to reduce hazard vulnerability. The following are examples:

- Acquisitions and elevations of structures in flood prone areas
- Utility undergrounding
- Structural retrofits
- Floodwalls and retaining walls
- Detention and retention structures
- Culverts
- Safe rooms

Structure and infrastructure implementation is a technique that removes or diverts the hazard from structure or protects the structure from a specific hazard. The new or renovated structures are therefore protected or have a reduced impact of hazards.

Natural Systems Protection: These are actions that minimize damage and losses and also preserve or restore the functions of natural systems. They include the following:

- Erosion and sediment control
- Stream corridor restoration
- Forest management
- Conservation easements
- Wetland restoration and preservation

Natural resource protection techniques allow for the natural resource to be used to protect or lessen the impact on new or renovated structures through the management of these resources. Utilization and implementation of the examples above will protect new and existing buildings and infrastructure.

Education and Awareness: These are actions to inform and educate citizens, elected officials and property owners about hazards and potential ways to mitigate them and may also include participation in national programs. Examples of these techniques include the following.

- Radio and television spots
- Websites with maps and information
- Real estate disclosure

- Provide information and training
- NFIP outreach
- StormReady
- Firewise communities

The education and awareness technique will protect and reduce the impact of specific hazards on new and existing buildings through education of citizens and property owners on the impacts that specific hazards could have on new or renovated structures. This information will allow the owner to make appropriate changes or enhancements that will lessen or eliminate the impacts of hazards.

Table 81 – Mitigation Strategy Technique Matrix provides a matrix identifying the mitigation techniques used for all low, moderate, and high-risk hazards in the county. The specific actions associated with these techniques are included in *Table 82 – 2023 Mitigation Action Plan*.

Table 81 - Mitigation Strategy Technique Matrix

Elk County Mitigation Strategy Technique Matrix				
Hazard	**MITIGATION TECHNIQUE**			
	Planning and Regulations	**Structure and Infrastructure**	**Natural Systems Protection**	**Education and Awareness**
Civil Disturbance	X	X		X
Cyberterrorism	X	X		X
Dam Failure	X	X		X
Drought	X	X		X
Earthquake	X	X		X
Emergency Services	X	X		X
Environmental Hazards: Fixed Facility	X	X		X
Environmental Hazards: Transportation	X	X		X
Flood	X	X		X
Flash Flood	X	X		X
Ice Jam Flood	X	X		X
Invasive Species	X	X	X	X
Landslide	X	X		X
Levee Failure	X	X		X
Opioid Epidemic	X	X		X
Pandemic, Epidemic, and Infectious Disease	X	X		X
Radon Exposure	X	X		X
Subsidence and Sinkhole	X	X		X
Terrorism	X	X		X
Tornado	X	X		X

Elk County Mitigation Strategy Technique Matrix				
Hazard	MITIGATION TECHNIQUE			
	Planning and Regulations	Structure and Infrastructure	Natural Systems Protection	Education and Awareness
Transportation Accidents	X	X		X
Urban Fire and Explosion	X	X		X
Utility Interruption	X	X		X
Wildfire	X	X		X
Windstorm	X	X		X
Winter Storm	X	X		X

6.4. Mitigation Action Plan

The Elk County Hazard Mitigation Local Planning Team (LPT) immediately began work on the mitigation strategy section of the 2023 hazard mitigation plan (HMP) update after the risk assessment section was completed. The LPT started this section by reviewing the 2018 HMP mitigation strategy section. A review of the previous goals, objectives, actions, and project opportunities documented in the 2018 HMP was conducted. The next step the LPT completed was the brainstorming of possible new actions based on new identified risks. The LPT compiled all this information for presentations to the municipalities.

MCM Consulting Group, Inc. completed municipality meetings at various time periods via virtual platforms or in-person meetings. During all these meetings, an overview of mitigation strategy was presented, and the municipalities were informed that they needed to have at least one hazard-related mitigation action for their municipality. All municipalities were invited to attend these meetings. Municipalities that were not able to join conference calls were contacted individually.

The municipalities were notified of draft mitigation actions and encouraged to provide new mitigation actions that could be incorporated into the plan. Municipalities were provided copies of their previously submitted mitigation opportunity forms and asked to determine if the projects were still valid. Municipalities were solicited for new project opportunities as well. All agendas, sign in sheets, and other support information from these meetings is included in Appendix C.

Mitigation measures for the 2023 Elk County HMP are listed in the mitigation action plan. *Table 82 – 2023 Mitigation Action Plan* is the 2023 Elk County Mitigation Action Plan. This plan outlines mitigation actions and projects that comprise a strategy for Elk County. The action plan includes actions, a benefit and cost prioritization, a schedule for implementation, any funding sources to complete the action, a responsible agency or department and an estimated cost. All benefit and cost analysis were completed using the Pennsylvania Emergency Management Agency recommended analysis tool. The completed analysis is located in Appendix H. *Table 82 – 2023 Mitigation Action Plan* is a matrix that identifies the county and/or municipalities responsible for mitigation actions in the new mitigation action plan. *Table 83 – Municipal Hazard Mitigation Actions Checklist* shows which actions tie to specific municipalities for

responsibilities. *Table 84 – Objective to Action Checklist* shows that each mitigation objective has a mitigation action item related to it. *Table 85 – Actions Tied to Hazards* illustrates the specific actions that are tied to each hazard outlined in the hazard mitigation plan.

Funding acronym definitions:

FMA:	Flood Mitigation Assistance Grant Program, administered by the Federal Emergency Management Agency
HMGP:	Hazard Mitigation Grant Program, administered by the Federal Emergency Management Agency
BRIC:	Building Resilient Infrastructure and Communities (BRIC) Program, administered by the Federal Emergency Management Agency
EMPG:	Emergency Management Performance Grant, administered by the Federal Emergency Management Agency
HSGP:	Homeland Security Grant Program, administered by the Federal Emergency Management Agency
HMEP:	Hazardous Material Emergency Planning Grant, administered by the Pennsylvania Emergency Management Agency
HMRF:	Hazardous Material Response Fund, administered by the Pennsylvania Emergency Management Agency
HMERP:	Hazard Mitigation Emergency Response Program administered by the Pennsylvania Emergency Management Agency
HHPD:	Rehabilitation of High-Hazard Potential Dams Grant Program, administered by the Federal Emergency Management Agency

Evaluate and Prioritize Mitigation Actions

Mitigation Action Evaluation:

Evaluating mitigation actions involves judging each action against certain criteria to determine whether or not it can be executed. The feasibility of each mitigation action is evaluated using the ten evaluation criteria set forth in the Mitigation Action Evaluation methodology as outlined in the Commonwealth of Pennsylvania's All-Hazard Mitigation Planning, Standard Operating Guide. The methodology solicits input on whether each action is highly effective or feasible and ineffective or not feasible for the criteria. These criteria are listed below and aid in determining the feasibility of implementing one action over another.

- Life Safety: Will the action be effective in promoting public safety?
- Property Protection: Will the action be effective in protecting public or private property?
- Technical: How effective will the action be in avoiding or reducing future losses?
- Political: Does the action have public and political support?
- Legal: Does the community have the authority to implement the proposed measure?
- Environmental: Will the action provide environmental benefits, and will it comply with local, state, and federal environmental regulations?
- Social: Will the action be acceptable by the community, or will it cause any one segment of the population to be treated unfairly?
- Administrative: Is there adequate staffing and funding available to implement the action in a timely manner?
- Local Champion: Is there local support for the action to help ensure its completion?
- Other Community Objectives: Does the action address any current or future community objectives either through municipal planning or community goals?

To evaluate the mitigation actions, each action is identified as highly effective or feasible, ineffective, or not favorable and no cost or benefit. For each criterion, the prioritization methodology assigns a "+" if the action is highly effective or feasible, a "-" if the action was ineffective or not feasible, and a "N" if no cost of benefit could be associated with the suggested action or the action was no applicable to the criteria.

Mitigation Action Prioritization:

Actions should be compared with one another to determine a ranking or priority by applying the multi-objective mitigation action prioritization criteria. Scores are assigned to each criterion using the following weighted, multi-objective mitigation action prioritization criteria:

- Effectiveness (weight: 20% of score): The extent to which an action reduces the vulnerability of people and property.
- Efficiency (weight: 30% of score): The extent to which time, effort, and cost is well used as a means of reducing vulnerability.
- Multi-Hazard Mitigation (weight: 20% of score): The action reduces vulnerability for more than one hazard.
- Address High Risk Hazard (weight: 15% of score): The action reduces vulnerability for people and property from a hazard identified as high risk.

- Address Critical Communications/Critical Infrastructure (weight: 15% of score): The action pertains to the maintenance of critical functions and structures such as transportation, supply chain management, and data circuits, etc.

Scores of 1, 2, or 3 are assigned for each multi-objective mitigation action prioritization criterion where 1 is a low score and 3 is a high score. Actions are prioritized using the cumulative score assigned to each. Each mitigation action is given a priority ranking (Low, Medium, and High) based on the following:

- Low Priority: 1.0 – 1.8
- Medium Priority: 1.9 – 2.4
- High Priority: 2.5 – 3.0

The cumulative results of the prioritization of mitigation actions is identified in the mitigation action evaluation and prioritization tool. The results for the mitigation action evaluation and prioritization are located in Appendix H of this plan.

Table 82 - 2023 Mitigation Action Plan

Elk County 2023 Mitigation Action Plan									
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization			Implementation		
	Category	Description/ Action Items		High	Medium	Low	Schedule	Funding	Local Champion
1.1.1	Planning and Regulations	County and municipal personnel will work cooperatively with emergency services and PennDOT to develop an action plan to address means to manage stranded travelers during winter storms.	Winter Storms/Transportation			**X**	2023 – 2028	Local	Office of Emergency Services & Municipalities

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
1.1.2	Education and Awareness	The Elk County Planning Department will educate local municipalities about the use of CDBG funds for potential projects. The planning department will also coordinate with North Central PA Regional Planning and Development Corporation's local Rural Planning Organization on solutions.	Transportation		**X**		2023 - 2028	Local	County Planning Dept.
1.1.3	Education and Awareness	Elk County utilizes Rave to communicate with residents and those traveling through the county of hazardous conditions.	All Hazards		**X**		2023 - 2028	Local	Office of Emergency Services
1.1.4	Education and Awareness	Swift Reach/Rave is used by Ridgway Borough, Johnsonburg Borough, and municipal water authorities to communicate with residents/customers.	Utility Interruption		**X**		2023 - 2028	Local	Municipalities
1.1.5	Planning and Regulations	Encourage schools to get together for school safety plans and "Safe School Plans" through the Criminal Justice Board.	Terrorism/ School Safety	**X**			2023 - 2028	Local	Judge's Office
1.1.6	Planning and Regulations	Create a networking climate for industry officials to provide education and outreach on safety protocols.	Environmental Hazards		**X**		2023 - 2028	Local	LEPC
1.1.7	Planning and Regulations	Ensure collaboration with both private and public dam owners, to ensure that their input is included in the local planning team, and the planning process in general.	Dam Failure		**X**		2023 - 2028	Local	Elk County Local Planning Team
1.2.1	Planning and Regulations	Update Stormwater Management Plan (Act 167)	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 - 2028	Local	County Planning Dept.

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
1.2.2	Planning and Regulations	Review, maintain, and integrate the North Central Greenways and Active Transportation Plan.	All Hazards		**X**		2023 - 2028	Local	North Central
1.2.3	Planning and Regulations	Review and maintain the Community Wildfire Protection Plan. Implement the mitigation programs and educational programs outlined in that plan.	Wildfire			**X**	2023 – 2028	Local	County Planning Dept.
1.3.1	Planning and Regulations	Work with local municipalities to ensure that infrastructure improvements are not directed towards hazardous areas without adhering to all appliable local, state, and federal regulations.	All Hazards		**X**		2023 - 2028	Local	County Planning Dept.
1.3.2	Planning and Regulations	Review and maintain the county's Comprehensive Plan.	All Hazards		**X**		2023- 2024	Local	County Planning Dept.
1.3.3	Planning and Regulations	Review annually the Commodity Flow Study, and update on a five-year basis to identify hazardous materials that are transported in and through the county.	Environmental Hazards/Transportation			**X**	2023 - 2028	Local	Office of Emergency Services
1.3.4	Planning and Regulations	Review, maintain, and exercise the county COOP.	All Hazards		**X**		2023 – 2028	Local	County Commissioners
2.1.1	Planning and Regulations	Elk County Planning will coordinate with Ridgway Borough and PA DEP to discuss a flood protection plan for the riverfront project.	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 – 2028	Local	County Planning Dept.
2.1.2	Planning and Regulations	Encourage municipalities to enforce existing floodplain ordinances.	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 - 2028	Local	Conservation

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
2.1.3	Planning and Regulations	Review existing regulations to ensure adequacy in reducing the amount of future development in the special flood hazard area (SFHA) and any vulnerable flood, flash flood, and ice jam flood areas.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 – 2028	Local	Municipalities
2.1.4	Planning and Regulations	Provide regulatory requirement awareness to municipalities	All Hazards			**X**	2023 – 2028	Local	County Planning Dept.
2.1.5	Planning and Regulations	Review and implement items from community floodplain ordinances related to substantial damage/substantial improvement for all local jurisdictions in the next hazard mitigation plan update.	Flooding, Flash Flooding, & Ice Jam Flooding	**X**			2023 - 2028	Local	Elk County Local Planning Team & County Planning Dept.
2.2.1	Structure and Infrastructure	Educate residents with repetitive losses on the opportunity to participate in the property buy-out program. Assist in locating funding to pay for flood mitigation actions.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 – 2028	Local	County Planning Dept. & Municipalities
2.2.2	Structure and Infrastructure	Evaluate the feasibility of demolishing or demolishing and reconstructing structures in the special flood hazard area.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 – 2028	Local	County Planning Dept. & Municipalities
2.3.1	Structure and Infrastructure	The county will assist municipalities where available with identifying, prioritizing, and implementing stormwater projects.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 - 2028	Local	County Planning Dept.
2.3.2	Planning and Regulations	Elk County will continue to encourage local municipalities to utilize the stormwater management plan.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 – 2028	Local	County Planning Dept.

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
2.3.3	Planning and Regulations	Update the Elk County stormwater management plan to include stormwater modeling if new funding becomes available.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 – 2028	Local	County Planning Dept.
2.3.4	Planning and Regulations	Assist with the implementation of flooding and floodplain related projects in Elk County including Elk Creek project in Ridgway by the USACE, St. Marys flooding projects, and a feasibility study of Kersey Run if funding is available.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 - 2028	Local	Municipalities
2.3.5	Education and Awareness	Provide stormwater information when a building permit application is requested.	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 - 2028	Local	Municipalities
2.3.6	Structure and Infrastructure	Seek funding to upgrade stormwater infrastructure project opportunities.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 - 2028	Local	Elk County
2.3.7	Planning and Regulations	Encourage municipalities to create a stormwater tax for capital improvement projects.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 - 2028	Local	County Planning Dept. & Conservation
2.3.8	Planning and Regulations	Conduct a flood study of the West Branch of the Clarion River to reduce flooding in Johnsonburg and Ridgway.	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 - 2028	Local	North Central
2.3.9	Planning and Regulations	Seek funding to implement the recommendations from the flood study conducted on Elk Creek in St. Marys.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 - 2028	Local	City of St. Marys

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
2.3.10	Structure and Infrastructure	Encourage municipalities to upsize and upgrade stormwater structures, especially when they are being replaced.	Flooding, Flash Flooding, & Ice Jam Flooding			**X**	2023 - 2028	Local (DGLVR program)	Municipalities
2.3.11	Education and Awareness	Create and regularly provide a stream maintenance class for road crew staff. This class could cover bank stabilization, gravel bar removal, municipality requirements.	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 - 2028	Local	Conservation
2.4.1	Education and Awareness	Provide education on NFIP.	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 - 2028	Local	County Planning Dept. & Office of Emergency Services
2.4.2	Education and Awareness	Provide education on the Community Rating System.	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 - 2028	Local	County Planning Dept. & Office of Emergency Services
3.1.1	Structure and Infrastructure	Continue to work with the American Red Cross for long-term shelter needs. Continue to work with and communication with local agencies for short-term shelters for extreme temperature events.	Extreme Temperatures	**X**			2023 - 2028	Local	Office of Emergency Services
3.1.2	Structure and Infrastructure	Work with known shelter locations to ensure adequate accommodations (e.g., generator, potable water, meals, etc.)	All Natural Hazards		**X**		2023 - 2028	Local	Office of Emergency Services
3.1.3	Planning and Regulations	Develop drought plans to address water usage and recommendations in time of low precipitation and drought declarations.	Drought			**X**	2023 - 2028	Local	Municipalities

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
3.1.4	Structure and Infrastructure	Review the maintenance needs for all municipal buildings to ensure that they are earthquake resilient. If deficiencies are found, evaluate ways to resolve infrastructure needs.	Earthquake			**X**	2023 - 2028	Local	Municipalities
3.1.5	Structure and Infrastructure	Monitor slope movement in municipalities that are at a high-risk of landslide including those municipalities with structures within slope areas greater than 23°.	Landslide		**X**		2023 - 2028	Local	Municipalities
3.1.6	Planning and Regulations	Work with Elk County and the regional department of health to review the current infectious disease statistics, including but not limited to positive Lyme Disease and West Nile Virus cases.	Pandemic, Epidemic, and Infectious Disease		**X**		2023 - 2028	Local	Municipalities
3.1.7	Planning and Regulations	Review areas of social vulnerability in each municipality and determine where those areas of vulnerability directly overlap with high-risk radon areas.	Radon Exposure		**X**		2023 - 2028	Local	Municipalities
3.1.8	Structure and Infrastructure	Review areas of past mining and extraction activities within each municipality for soil movement that could result in damage to emergency shelters, community lifelines, and areas of social vulnerability.	Subsidence and Sinkholes			**X**	2023 - 2028	Local	Municipalities
3.1.9	Structure and Infrastructure	Examine areas of dense vegetation interface with community lifelines and reduce those areas to prevent wildfire events close to those locations.	Wildfire		**X**		2023 - 2028	Local	Municipalities

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
3.2.1	Planning and Regulations	Examine and research cybersecurity directives, best practices, and resources from the United States Department of Homeland Security's (US DHS) Cybersecurity & Infrastructure Security Agency (CISA) to lessen the impact of a potential cyber-security incident at the county.	Cybersecurity		**X**		2023 - 2028	Local	County IT
3.3.1	Structure and Infrastructure	Elk County Emergency Management will continue to update radio communications equipment as new technology becomes available.	All Hazards		**X**		2023 - 2028	Local	Office of Emergency Services
3.3.2	Structure and Infrastructure	Elk County OES will continue to address communication issues between 911 Dispatch and municipal governments as they arise.	Emergency Services	**X**			2023 - 2028	Local	Office of Emergency Services
3.4.1	Education and Awareness	Educate the public on invasive species.	Invasive Species			**X**	2023 - 2028	Local	County Conservation
3.4.2	Natural Systems Protection	Place educational signage or warnings in high traffic areas (Examples: Benezette, East Branch Lake, campgrounds, etc.) in reference to invasive species.	Invasive Species			**X**	2023-2028	Local	County Conservation
3.4.3	Structure and Infrastructure	Seek funding for treatment, removal, remediation, or assistance with managing invasive species.	Invasive Species			**X**	2023-2028	Local/NRCS	County Conservation/NRCS & Municipalities
3.4.4	Education and Awareness	Seek funding for a steward program to have a paid person assigned to a boat launch or other high traffic area and educate people on what they need to do to combat invasive species prior to leaving the area(s).	Invasive Species			**X**	2023-2028	Local	County Conservation

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
3.4.5	Education and Awareness	Create a committee or work with established agencies to identify high-risk invasive species for Elk County. (This list should include all species not just plants.)	Invasive Species			**X**	2023-2028	Local	County Conservation
4.1.1	Education and Awareness	Continue to engage the public using various means of communication with articles and news information concerning hazard mitigation.	All Hazards		**X**		2023 – 2028	Local	Office of Emergency Services
4.1.2	Education and Awareness	Conduct education and outreach to maintain participation in the National Flood Insurance Program.	Flooding, Flash Flooding, & Ice Jam Flooding		**X**		2023 - 2028	Local	Office of Emergency Services
4.1.3	Education and Awareness	Increase awareness about the Rave system. Create a location where residents only need to sign up once for inclusion in their municipality Rave system and the county's system.	All Hazards		**X**		2023 - 2028	Local	Elk County & Office of Emergency Services
4.2.1	Education and Awareness	Distribute hazard mitigation pamphlets and handouts on hazards in the county at county events including county fairs, festivals, etc. and have those pamphlets in county offices, local municipal offices, and county chamber of commerce for distribution.	All Hazards		**X**		2023 – 2028	Local	Elk County
4.2.2	Education and Awareness	Coordinate review of this hazard mitigation plan for any annual updates and future HMP development with the counties immediately adjacent to Elk County.	All Hazard	**X**			2023 - 2028	Local	Elk County Local Planning Team

Elk County 2023 Mitigation Action Plan									
Action Number	**Mitigation Actions**		**Hazard Vulnerability**	**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**		**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Local Champion**
4.3.1	Education and Awareness	Elk County municipalities will work to educate the citizens about structural integrity improvement options for their manufactured and mobile homes.	Tornado/ Windstorm		**X**		2023 - 2028	Local	Municipalities
4.3.2	Education and Awareness	Encourage manufactured and mobile homeowners to prepare an emergency plan in case of tornado and windstorm emergencies by utilizing public education materials.	Tornado/ Windstorm			**X**	2023 – 2028	Local	Municipalities
4.3.3	Structure and Infrastructure	Maintain a database of residents that are special needs.	All Hazards		**X**		2023 – 2028	Local	Office of Emergency Services
4.4.1	Planning and Regulations	The Elk County local planning team will work with human services in Elk County and the Elk County Area Agency on Aging to identify socially vulnerable populations and present those communities with planning items.	All Hazards		**X**		2023 - 2028	Local	Elk County Local Planning Team
4.4.2	Planning and Regulations	Update the Elk County local planning team with stakeholders involved in outreach to socially vulnerable populations, including those identified in the action 4.4.1.	All Hazards		**X**		2023 - 2028	Local	Elk County Local Planning Team
4.4.3	Planning and Regulations	Provide hard copies of hazard mitigation plan documents during annual reviews and future HMP development to government facilities and media locations, to facilitate access for socially vulnerable populations.	All Hazards		**X**		2023 - 2028	Local	Elk County Local Planning Team

Elk County 2023 Mitigation Action Plan									
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization			Implementation		
	Category	Description/ Action Items		High	Medium	Low	Schedule	Funding	Local Champion
4.4.4	Planning and Regulations	Develop multilingual hazard mitigation plan public notices in languages including Spanish to enhance accessibility for those whose primary language is not English.	All Hazards	**X**			2023 - 2028	Local	Elk County Local Planning Team
5.1.1	Education and Awareness	Distribute educational pamphlets about the HHPD program to municipalities and county residents.	Dam failure		**X**		2023 - 2028	Local	Office of Emergency Services
5.2.1	Education and Awareness	Provide education on local mitigation policies and programs that address high-hazard potential dams to municipalities and county residents.	Dam failure		**X**		2023 - 2028	Local	Office of Emergency Services
5.3.1	Structure and Infrastructure	Acquire or maintain digitized dam inundation GIS polygons to determine at risk populations for dams designated High-Hazard Potential Dams by FEMA.	Dam failure			**X**	2023 - 2028	Local	Office of Emergency Services

Table 83 - Municipal Hazard Mitigation Actions Checklist

Municipal Hazard Mitigation Actions Checklist							
Municipality	**1.1.1**	**1.1.2**	**1.1.3**	**1.1.4**	**1.1.5**	**1.1.6**	**1.1.7**
Benezette Township				X			
Fox Township				X			
Highland Township				X			
Horton Township				X			
Jay Township				X			
Johnsonburg Borough				X			
Jones Township				X			
Millstone Township				X			
Ridgway Borough				X			
Ridgway Township				X			

Municipal Hazard Mitigation Actions Checklist							
Municipality	**1.1.1**	**1.1.2**	**1.1.3**	**1.1.4**	**1.1.5**	**1.1.6**	**1.1.7**
Spring Creek Township				X			
St Marys, City of				X			
Elk County	X	X	X		X	X	X

Municipal Hazard Mitigation Actions Checklist							
Municipality	**1.2.1**	**1.2.2**	**1.2.3**	**1.3.1**	**1.3.2**	**1.3.3**	**1.3.4**
Benezette Township							
Fox Township							
Highland Township							
Horton Township							
Jay Township							
Johnsonburg Borough							
Jones Township							
Millstone Township							
Ridgway Borough							
Ridgway Township							
Spring Creek Township							
St Marys, City of							
Elk County	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist								
Municipality	**2.1.1**	**2.1.2**	**2.1.3**	**2.1.4**	**2.1.5**	**2.2.1**	**2.2.2**	**2.3.1**
Benezette Township			X			X	X	
Fox Township			X			X	X	
Highland Township			X			X	X	
Horton Township			X			X	X	
Jay Township			X			X	X	
Johnsonburg Borough			X			X	X	
Jones Township			X			X	X	
Millstone Township			X			X	X	
Ridgway Borough			X			X	X	
Ridgway Township			X			X	X	
Spring Creek Township			X			X	X	
St Marys, City of			X			X	X	
Elk County	X	X		X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist							
Municipality	**2.3.2**	**2.3.3**	**2.3.4**	**2.3.5**	**2.3.6**	**2.3.7**	**2.3.8**
Benezette Township			X	X			
Fox Township			X	X			
Highland Township			X	X			
Horton Township			X	X			
Jay Township			X	X			
Johnsonburg Borough			X	X			
Jones Township			X	X			
Millstone Township			X	X			
Ridgway Borough			X	X			
Ridgway Township			X	X			
Spring Creek Township			X	X			
St Marys, City of			X	X			
Elk County	X	X			X	X	XX

Municipal Hazard Mitigation Actions Checklist							
Municipality	**2.3.9**	**2.3.10**	**2.3.11**	**2.4.1**	**2.4.2**	**3.1.1**	**3.1.2**
Benezette Township		X					
Fox Township		X					
Highland Township		X					
Horton Township		X					
Jay Township		X					
Johnsonburg Borough		X					
Jones Township		X					
Millstone Township		X					
Ridgway Borough		X					
Ridgway Township		X					
Spring Creek Township		X					
St Marys, City of	X	X					
Elk County			X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist							
Municipality	**3.1.3**	**3.1.4**	**3.1.5**	**3.1.6**	**3.1.7**	**3.1.8**	**3.1.9**
Benezette Township	X	X	X	X	X	X	X
Fox Township	X	X	X	X	X	X	X
Highland Township	X	X	X	X	X	X	X
Horton Township	X	X	X	X	X	X	X
Jay Township	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist							
Municipality	**3.1.3**	**3.1.4**	**3.1.5**	**3.1.6**	**3.1.7**	**3.1.8**	**3.1.9**
Johnsonburg Borough	X	X	X	X	X	X	X
Jones Township	X	X	X	X	X	X	X
Millstone Township	X	X	X	X	X	X	X
Ridgway Borough	X	X	X	X	X	X	X
Ridgway Township	X	X	X	X	X	X	X
Spring Creek Township	X	X	X	X	X	X	X
St Marys, City of	X	X	X	X	X	X	X
Elk County							

Municipal Hazard Mitigation Actions Checklist							
Municipality	**3.2.1**	**3.3.1**	**3.3.2**	**3.4.1**	**3.4.2**	**3.4.3**	**3.4.4**
Benezette Township						X	
Fox Township						X	
Highland Township						X	
Horton Township						X	
Jay Township						X	
Johnsonburg Borough						X	
Jones Township						X	
Millstone Township						X	
Ridgway Borough						X	
Ridgway Township						X	
Spring Creek Township						X	
St Marys, City of						X	
Elk County	X	X	X	X	X	X	X

	Municipal Hazard Mitigation Actions Checklist							
Municipality	**3.4.5**	**4.1.1**	**4.1.2**	**4.1.3**	**4.2.1**	**4.2.2**	**4.3.1**	**4.3.2**
Benezette Township							X	X
Fox Township							X	X
Highland Township							X	X
Horton Township							X	X
Jay Township							X	X
Johnsonburg Borough							X	X
Jones Township							X	X
Millstone Township							X	X
Ridgway Borough							X	X
Ridgway Township							X	X

Municipal Hazard Mitigation Actions Checklist								
Municipality	**3.4.5**	**4.1.1**	**4.1.2**	**4.1.3**	**4.2.1**	**4.2.2**	**4.3.1**	**4.3.2**
Spring Creek Township							X	X
St Marys, City of							X	X
Elk County	X	X	X	X	X	X		

Municipal Hazard Mitigation Actions Checklist								
Municipality	**4.3.3**	**4.4.1**	**4.4.2**	**4.4.3**	**4.4.4**	**5.1.1**	**5.2.1**	**5.3.1**
Benezette Township								
Fox Township								
Highland Township								
Horton Township								
Jay Township								
Johnsonburg Borough								
Jones Township								
Millstone Township								
Ridgway Borough								
Ridgway Township								
Spring Creek Township								
St Marys, City of								
Elk County	X	X	X	X	X	X	X	X

Table 84 - Objective to Action Checklist

Objective	Number of Actions
Objective 1.1	7
Objective 1.2	3
Objective 1.3	4
Objective 2.1	5
Objective 2.2	2
Objective 2.3	11
Objective 2.4	2
Objective 3.1	9
Objective 3.2	1
Objective 3.3	2
Objective 3.4	5
Objective 4.1	3
Objective 4.2	2
Objective 4.3	3
Objective 4.4	4
Objective 5.1	1

Objective	Number of Actions
Objective 5.2	1
Objective 5.3	1

Table 85 - Action Tied to Hazard

Actions Tied to Hazard	
Hazard	**Actions Related**
Civil Disturbance	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Cyberterrorism	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.2.1, 3.3.1, 4.1.1, 4.1.3, 4.2.1, , 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Dam Failure	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.3.1, 4.1.1, 4.1.3, 4.2.1, , 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4 5.1.1, 5.2.1, 5.3.1
Drought	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.1.3, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Earthquake	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Emergency Services	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 3.3.2, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Environmental Hazards: Fixed Facility	1.1.3, 1.1.6, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Environmental Hazards: Transportation	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Flood	1.1.3, 1.2.1, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.5, 2.3.6, 2.3.7, 2.3.8, 2.3.9, 2.3.10, 2.3.11, 2.4.1, 2.4.2, 3.1.2, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Flash Flood	1.1.3, 1.2.1, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.5, 2.3.6, 2.3.7, 2.3.8, 2.3.9, 2.3.10, 2.3.11, 2.4.1, 2.4.2, 3.1.2, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Ice Jam Flood	1.1.3, 1.2.1, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3,

Actions Tied to Hazard	
Hazard	**Actions Related**
	2.3.4, 2.3.5, 2.3.6, 2.3.7, 2.3.8, 2.3.9, 2.3.10, 2.3.11, 2.4.1, 2.4.2, 3.1.2, 3.3.1, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Invasive Species	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.3.1, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Landslide	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.1.5, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Levee Failure	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Opioid Epidemic	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Pandemic, Epidemic, and Infectious Disease	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.1.6, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Radon Exposure	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.1.7, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Subsidence and Sinkhole	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.1.8, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Terrorism	1.1.3, 1.1.5, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Tornado	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Transportation Accidents	1.1.1, 1.1.2, 1.1.3, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Urban Fire and Explosion	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Utility Interruption	1.1.3, 1.1.4, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Wildfire	1.1.3, 1.2.2, 1.2.3, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.1.9, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4

Actions Tied to Hazard	
Hazard	**Actions Related**
Windstorm	1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4
Winter Storm	1.1.1, 1.1.3, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 2.1.4, 3.1.2, 3.3.1, 4.1.1, 4.1.3, 4.2.1, 4.2.2, 4.3.3, 4.4.1, 4.4.2, 4.4.3, 4.4.4

7. Plan Maintenance

7.1. Update Process Summary

Monitoring, evaluating, and updating this plan is critical to maintaining its value and success in Elk County's hazard mitigation efforts. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule of maintenance activities including a description of how the public will be involved on a continued basis. This HMP update also defines the municipalities' role in updating and evaluating the plan. Finally, the 2023 HMP update encourages continued public involvement and how this plan may be integrated into other planning mechanisms in the county.

7.2. Monitoring, Evaluating and Updating the Plan

Hazard mitigation planning in Elk County is a responsibility of all levels of government (i.e., county, and local), as well as the citizens of the county. The Elk County Local Planning Team will be responsible for maintaining this multi-jurisdictional HMP. The local planning team will meet annually and following each emergency declaration to review the plan. Every municipality that has adopted this plan will also be afforded the opportunity to provide updated information or information specific to hazards encountered during an emergency or disaster. Each review process will ensure that the hazard vulnerability and risk analysis reflect the current conditions of the county, that the capabilities assessment accurately reflects local circumstances and that the hazard mitigation strategies are updated based on the county's damage assessment reports and local mitigation project priorities. The HMP must be updated on a five-year cycle. An updated HMP must be completed and approved by the end of the five-year period. The monitoring, evaluating, and updating of the plan every five years will rely heavily on the outcomes of the annual HMP planning team meetings.

The Elk County Local Planning Team will complete a hazard mitigation progress report to evaluate the status and accuracy of the multi-jurisdictional HMP and record the local planning team's review process. The annual plan review will be distributed to appropriate representatives at both PEMA and FEMA. The following items will be completed during the annual review and reporting process:

- Review the risk assessment section and identify occurrences of hazards within the last year. Identify date, time, damage, fatalities, and other specific information of the events. Also identify any new hazards that have occurred or increased risk with the county.

- Complete a review and update of the capability assessment section. Identify any capability weaknesses since the last review.
- Complete a review of the mitigation strategy section. Review the goals and objectives identified in the 2023 HMP and determine if any updates are needed. Provide all mitigation actions and opportunities to the county and municipalities that are applicable. Have all entities complete an action review matrix and document all results in the report. Also, add any new actions that are identified. Complete a review of each mitigation opportunity and identify the status of each opportunity on the opportunity review spreadsheet. All information will be included in the annual review report.

The Elk County Planning Department will maintain a copy of these records and place them in Appendix I of this plan. Elk County will continue to work with all municipalities regarding hazard mitigation projects, especially those municipalities that did not submit projects for inclusion in this plan.

7.3. Continued Public Involvement

The Elk County Planning Department will ensure that the 2023 Elk County Hazard Mitigation Plan is posted and maintained on the Elk County website and will continue to encourage public review and comment on the plan. The Elk County website that the plan will be located at is as follows: https://www.co.elk.pa.us/index.php/planning-department-top-menu/item/330-elk-county-hazard-mitigation-plan-update

The public will have access to the 2023 Elk County HMP through their local municipal office, the Elk County Planning Department, or the Elk County Office of Emergency Services. Information on upcoming events related to the HMP or solicitation for comments will be announced via newsletters, newspapers, mailings, and the county website.

The citizens of Elk County are encouraged to submit their comments to elected officials and/or members of the Elk County HMP Local Planning Team. To promote public participation, the Elk County Local Planning Team will post a public comment form as wells as the Hazard Mitigation Project Opportunity Form on the county's website. These forms will offer the public various opportunities to supply their comments and observations. All comments received will be maintained and considered by the Elk County Hazard Mitigation Planning Team.

8. Plan Adoption

8.1. Resolutions

In accordance with federal and state requirements, the governing bodies of each participating jurisdiction must review and adopt by resolution, the 2023 Elk County Hazard Mitigation Plan. Copies of the adopting resolutions are included in this plan in Appendix J. FEMA Region III in Philadelphia, Pennsylvania is the final approval authority for the Hazard Mitigation Plan. PEMA also reviews the plan before submission to FEMA.

9. Appendices

APPENDIX A: **References**

APPENDIX B: **FEMA Local Mitigation Review Tool**

APPENDIX C: **Meetings and Support Documents**

APPENDIX D: **Municipal Flood Maps**

APPENDIX E: **Critical and Community Lifeline Facilities**

APPENDIX F: **2023 HAZUS Reports**

APPENDIX G: **2023 Mitigation Project Opportunities**

APPENDIX H: **2023 Mitigation Action Evaluation & Prioritization**

APPENDIX I: **Annual Review Documentation**

APPENDIX J: **Elk County & Municipal Adoption Resolutions**