



Beaver County 2021 Hazard Mitigation Plan



Prepared for:

Beaver County Emergency
Services

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**Beaver County, Pennsylvania
2021 Hazard Mitigation Plan**

Certification of Annual Review Meetings

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED? *	SIGNATURE
2021			
2022			
2023			
2024			
2025			

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

**Beaver County, Pennsylvania
2021 Hazard Mitigation Plan**

Record of Changes

DATE	DESCRIPTION OF CHANGE MADE, MITIGATION ACTION COMPLETED, OR PUBLIC OUTREACH PERFORMED	CHANGE MADE BY (PRINT NAME)	CHANGE MADE BY (SIGNATURE)
REMINDER: <i>Please attach all associated meeting agendas, sign-in sheets, handouts and minutes.</i>			

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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 2021, Beaver County Emergency Services contracted the services of a consulting agency to revise and update the 2021 County Hazard Mitigation Plan. The plan was successfully updated in accordance with the requirements set forth by the Pennsylvania Emergency Management Agency (PEMA) and the Federal Emergency Management Agency (FEMA). The updated 2021 County Hazard Mitigation Plan was adopted by the Beaver County Commissioners in 2021.

The Beaver County Commissioners secured a grant to complete the 2021 update to the Beaver County Hazard Mitigation Plan. MCM Consulting Group, Inc. was hired to assist the county with the update of the plan. The planning kick-off meeting was conducted January 20, 2021.

The planning process for the 2021 Beaver 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 conducted via an online media to provide residents an opportunity to provide input on the HMP. Several meetings were held virtually, 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:

- Pandemic
- Opioid Epidemic
- Nuclear Incident

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- Winter Storm
- Emergency Services
- Utility Interruptions
- Flooding
- Transportation Accident
- Dam/Levee Failure
- Terrorism and Cyber Terrorism
- Radon Exposure
- Invasive Species
- Environmental Hazards
- Civil Disturbance and Criminal Activity
- Tornado and Windstorm
- Earthquake
- Landslide
- Urban Fire and Explosion
- Drought

A total of nineteen hazards are identified in the 2021 Beaver County Hazard Mitigation Plan. A total of sixteen identified hazards were listed in the previous 2016 plan update. Dam failure and levee failure hazards were combined for this update. Terrorism, criminal activity, or civil disturbance were all one profile in the 2016 plan update; these were split into two categories. New hazards identified in this plan include opioid epidemic, emergency services, and invasive species.

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

1. Protect lives, property, environmental quality, and natural resources.
2. Enhance consistent coordination, collaboration, and communications among stakeholders.
3. Provide a framework for active hazard mitigation planning, implementation, and recovery efforts.
4. Build political support and secure funding for mitigation efforts.
5. Increase awareness, understanding, and preparedness.
6. Participate in FEMA's High-Hazard Potential Dam Program (HHPD).

Mitigation actions are specific projects and activities that help achieve goals. A total of fifty-two actions were developed for this plan update as they pertain to hazards identified by the local planning team. The 2016 Beaver County Hazard Mitigation Plan consisted of thirty-six 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. A total of forty-seven project opportunity forms were submitted during the 2016 HMP update. Municipalities were asked to indicate the status of these projects submitted in 2016, of which two

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indicated completed projects. A total of forty project opportunities were submitted for this plan update.

The 2021 Beaver County Hazard Mitigation Plan is the cornerstone to reducing Beaver 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 2021 Beaver 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.

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1. Introduction

1.1. Background

The Beaver 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 Beaver County and all of its fifty-three municipalities. Beaver County Emergency Services and Beaver County Office of Planning and Redevelopment was charged by the County Board of Commissioners to prepare the 2021 plan. The 2016 HMP has been utilized and maintained during the five-year life cycle.

The Beaver 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 Beaver County as a sub-grantee. The Beaver County Commissioners assigned Beaver County Emergency Services 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 Beaver County. This updated HMP will provide another solid foundation for the Beaver 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 cycle 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 and 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.

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- Comply with both state and federal legislative requirements for local hazard mitigation plans.

1.3. Scope

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

A multi-jurisdictional planning approach was utilized for the Beaver County HMP update, thereby eliminating the need for each municipality to develop its own approach to hazard mitigation and its own planning document. Further, this type of planning effort results in a common understanding of the hazard vulnerabilities throughout the county, a comprehensive list of 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 Reference

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 Storm Water 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

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- 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

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2. Community Profile

2.1. Geography and Environment

Beaver County, located in western Pennsylvania, is bordered to the following: Ohio and West Virginia to the west, Lawrence County in the north, Butler County in the east, Allegheny County in the southeast, and Washington County in the south. The county consists of a hilly region on the Allegheny Plateau with Ohio and Beaver rivers that run through. Beaver County covers approximately 444 square miles. Of the 444 square miles, 435 square miles is land, and 9.3 square miles is water.

The major bodies of water located within Beaver County include the Ohio River and Beaver River. Other bodies of water include Homewood Falls, Darlington Lake, Mistika Lake, Hughes Lake, Hereford Manor Lake, Brady's Run Lake, Big Beaver Pond, and various streams. The major protected land features in Beaver County are the Ohio River Islands National Wildlife Refuge, Brady's Run Park, Brush Creek Park, Old Economy Park, and Raccoon Creek State Park. Beaver County presents a wide range of topographic features. Elevations in the county range from a high of 1,506 feet (459 meters) to a low of 669 feet (204 meters). Beaver County is 46th in terms of lowest elevations when compared to a total of sixty-seven counties in Pennsylvania.

The county's public parks provide a wide range of active and passive recreational opportunities. Additionally, with the City of Pittsburgh being a short driving distance, county residents have the ability to enjoy amenities of big city cultural, recreational, and educational amenities yet avoid the crowded congested lifestyle.

Within the county, there are various public transportation and roadways that cross through Beaver County. A total of fifteen major roadways/highways cross through Beaver County. Interstates I-76 and I-376 are the two interstates that pass through the county. US-30 is the only US Route that passes through the county. A variety of PA State Routes pass through the county which include PA 18, PA 65, PA 68, PA 151, PA 168, PA 251, PA 288, PA 351, PA 551, PA 588, and PA 989. There are two airports that are present in Beaver County. The two major airports in the county are Beaver County Airport and Zelienople Municipal Airports. Other various methods of public transportation are provided by the Beaver County Transit Authority.

The climate averages for Beaver County include 38.1 inches of rainfall, 21.6 inches of snowfall, 145.7 days with precipitation, average high temperatures during the month of July is 82.8°F, and the average low in the month of January is 20.7°F. Beaver County consists of about five comfortable months with temperatures ranging of 70°F to 85°F. There are 6.9 days annually when the high temperature over 90°F. However, there are 116.7 days annually when the low temperature falls below freezing and 2.7 days annually when low temperature falls below 0°F. Although the average low temperature for Beaver County is 20.7°F, this is warmer than most locations in Pennsylvania with a low of 18.8°F. January is the rainiest month for Beaver with fifteen days of rain and August

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being the driest month with only 9.3 days of rain. On average, there are 145.7 days of rain annually in Beaver. February is the snowiest month in Beaver County with an average of 6.6 inches of snow.

2.2. Community Facts

Beaver County was formed in March of 1880 from portions of Allegheny and Washington counties. The townships and boroughs in Beaver County have changed frequently in the county's early years. Beaver County originally had six townships, split by the Ohio River. These townships were Sewickley, South Beaver, and North Beaver Townships in the north half of the county. Hanover, First Moon, and Second Moon Townships were south of the Ohio River. In 1814, the southern townships were recognized as four equal quarters and given the names Hopewell, Moon, Greene, and Hanover Townships. The northern townships had a much more complicated history of division. Sewickley Township divided in 1801 into North Sewickley and New Sewickley Townships. South Beaver Township experienced several divisions to satisfy residents' complaints that the township was too large. South Beaver Township was first divided in 1802 into three townships: Little Beaver, Big Beaver, and South Beaver Townships. In 1804, the small area in the southeast corner of South Beaver Township, known as Beaver Borough, broke off and became a borough. It retained this name until 1970, when it was renamed Vanport Township. In 1805, what was left of South Beaver Township split into Ohio and South Beaver Townships. In 1816, the townships of Ohio and South Beaver were reorganized into four equivalent quarters: Ohio and Brighton Townships just north of the Ohio River and South Beaver and Chippewa Townships further north. The economy within the county during the early years had a steady increase. Despite a steady increase in commercial industry, the county's population was slow to grow for its first fifty years. The sluggish growth rate stemmed from the large number of lawsuits over land titles between settlers claiming title under purchase from the State and those claiming title under the 1792 clause of settlement and improvement.

Today, Beaver County has two cities, twenty-nine boroughs, and twenty-two townships. Beaver Borough is designated at the county seat for Beaver. The following include all the cities, boroughs, and townships within Beaver County:

Cities:

Aliquippa and Beaver Falls

Boroughs:

Ambridge, Baden, Beaver, Big Beaver, Bridgewater, Conway, Darlington, East Rochester, Eastvale, Economy, Fallston, Frankfort Springs, Freedom, Georgetown, Glasgow, Homewood, Hookstown, Industry, Koppel, Midland, Monaca, New Brighton, New Galilee, Ohioville, Patterson Heights, Rochester, Shippingport, South Heights, and West Mayfield.

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Townships:

Brighton, Center, Chippewa, Darlington, Daughtry, Franklin, Greene, Hanover, Harmony, Hopewell, Independence, Marion, New Sewickley, North Sewickley, Patterson, Potter, Pulaski, Raccoon, Rochester, South Beaver, Vanport, and White.

North American Industry Classification System (NAICS) developed top employers and industries in Beaver County for the year 2020. Beaver County’s top leading industry includes elementary and secondary schoolings. Additionally, Beaver County’s top employer is Great Arrow Builders LLC. *Table 1 – Beaver County Top Ten Employers and Industries from 2020* shows the top ten tanked employers and industries in Beaver County.

Table 1 - Beaver County Top Ten Employers and Industries from 2020

Beaver County Top Ten Employers and Industries from 2020 (PA Department of L&I, 2020)		
Top Ten Employers	Top Ten Industries (NAICS Industry Description)	NAICS
Great Arrow Builders LLC	Elementary and Secondary Schools	6111
Valley Medical Facilities Inc	Restaurants and Other Eating Places	7225
Wal-Mart Associates Inc	Residential Mental Health Facilities	6232
Passavant Memorial Homes	Utility System Construction	2371
Beaver Valley Nuclear Plant	Individual and Family Services	6241
Lindy Paving Inc	Executive, Legislative, and General Government	9211
Giant Eagle Inc	General Merchandise Stores	4523
Bechtel Oil Gas & Chemicals Inc	Nursing Care Facilities	6231
Veka Inc	General Medical and Surgical Hospitals	4451
McGuire Memorial	Grocery Stores	2211

As mentioned, education is a major industry within Beaver County. Within the county, there are various colleges/universities, community/technical colleges, public school districts, charter schools, and private schools. A total of three college/universities, one community college, fourteen public school districts, three charter schools, and fourteen private schools. Below are the lists of the various school types within the county:

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Colleges/Universities:

Geneva College, Penn State Beaver Campus, and Trinity Episcopal School for Ministry

Community/Technical Colleges:

Community College of Beaver County

Public School Districts: Aliquippa, Abridge Area, Beaver Area, Big Beaver Falls Area, Blackhawk, Central Valley, Freedom Area, Hopewell Area, Midland Borough, New Brighton Area, Riverside Beaver County, Rochester Area, South Side Area, and Western Beaver County

Charter Schools: Baden Academy Charter School, Lincoln Park Performing Arts Charter School, and Pennsylvania Cyber Charter School

Private Schools: Agapeland Children Garden, Beaver County Christian School, Beaver County Christian, Bethel Christian School, Deliverance Temple Ministries ROOTS Inc Christian Academy, Divine Mercy Academy, Hope Christian Academy, Our Lady of Fatima School, Pleasant Hill Wesleyan Academy, St Peter & Paul School, and Sylvania Hills Christian

2.3. Population and Demographics

Beaver County is the twenty-first ranked county in terms of population within the Commonwealth of Pennsylvania. Beaver County has a recorded population of 163,929 based on the year 2019 from the U.S. Census. From 2010 to the year 2019, the population within Beaver County has declined about 3.9%. The total census in 2019 for Beaver County was a population number of 170, 271. The average age of Beaver County residents is middle aged to older individuals. About 5% of the population is five years or younger, 19.2% of the population is 18 years or younger, and 22% of the population is sixty-five years or older. The overall sex of the population in Beaver County is equal across. Approximately 51.4% of Beaver County residents are female, while the remaining 48.6% are male. The population per municipality are identified in *Table 2 – Beaver County Municipal Population* below. The municipality with the highest population in both the 2010 and 2019 US Census was Hopewell Township, indicated in red. Hopewell Township is a municipality located along the southeast boundary of Beaver County and is a suburb of Pittsburgh. In contrast, the municipality with the lowest population in 2010 US Census was Glasgow Borough, indicated in green. Glasgow Borough is located along the Ohio River in Beaver County. However, in 2019, the municipality with the lowest population was Homewood borough, indicated in blue. Homewood Borough is located on the northern side of Beaver County.

Table 2 - Beaver County Municipal Population

Beaver County Municipal Population (U.S. Census, 2019)					
Municipality	2010 Population	2019 Population	Municipality	2010 Population	2019 Population
Aliquippa City	9,637	9,004	Hookstown Borough	178	144
Ambridge Borough	7,075	6,707	Hopewell Township	12,610	12,616

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Municipality	2010 Population	2019 Population	Municipality	2010 Population	2019 Population
Baden Borough	4,154	3,948	Independence Township	2,460	2,355
Beaver Borough	4,542	4,33234	Industry Borough	1,894	1,698
Big Beaver Borough	1,941	1,784	Koppel Borough	695	707
Beaver Falls City	9,123	8,464	Marion Township	916	877
Bridgewater Borough	654	884	Midland Borough	2,682	2,918
Brighton Township	8,227	8,267	Monaca Borough	5,757	5,521
Center Township	11,790	11,365	New Brighton Borough	6,071	5,780
Chippewa Township	7,632	7,594	New Galilee Borough	404	324
Conway Borough	2,122	2,114	New Sewickley Township	7,379	7,197
Darlington Borough	335	199	North Sewickley Township	5,488	5,402
Darlington Township	1,970	1,878	Ohioville Borough	3,547	3,338
Daugherty Township	3,185	3,038	Patterson Township	3,023	2,874
East Rochester Borough	628	472	Paterson Heights Borough	636	724
Eastvale Borough	180	215	Potter Township	550	568
Economy Borough	8,969	9,182	Pulaski Township	1,505	1,415
Fallston Borough	265	227	Raccoon Township	3,074	2,923
Frankfort Springs Borough	167	178	Rochester Borough	3,676	3,502
Franklin Township	4,055	3,879	Rochester Township	2,803	2,656
Freedom Borough	1,582	1,532	Shippingport Borough	170	174
Georgetown Borough	177	174	South Beaver Township	2,780	2,662
Glasgow Borough	46	112	South Heights Borough	417	344
Greene Township	2,355	2,369	Vanport Township	1,321	1,349
Hanover Township	3,747	3,630	West Mayfield Borough	1,226	1,081
Harmony Township	3,200	3,021	White Township	1,391	1,314
Homewood Borough	99	93			

In Beaver County, various ethnic groups and races are present throughout. The leading race is white alone with 90.5% present in Beaver County. The next most predominant race in Beaver is Black/African American alone with 6.5%. Other races that are present in Beaver County are American Indian with 0.4%, Asian alone with 0.8%, and Hispanics/Latinos with 1.8%. *Table 3 – Beaver County Race Origins* shows the overall percentages and actual numbers of each race group within Beaver County based of the 2019 population total.

Table 3 - Beaver County Race Origins

Beaver County Race Origins (U.S. Census 2019)		
Race	Percentage of 2019 Population	Actual Numbers of 2019 Population
White alone	90.5%	148,356
Black/African American alone	6.5%	10,655
American Indian alone	0.4%	655
Asian alone	0.8%	1,311

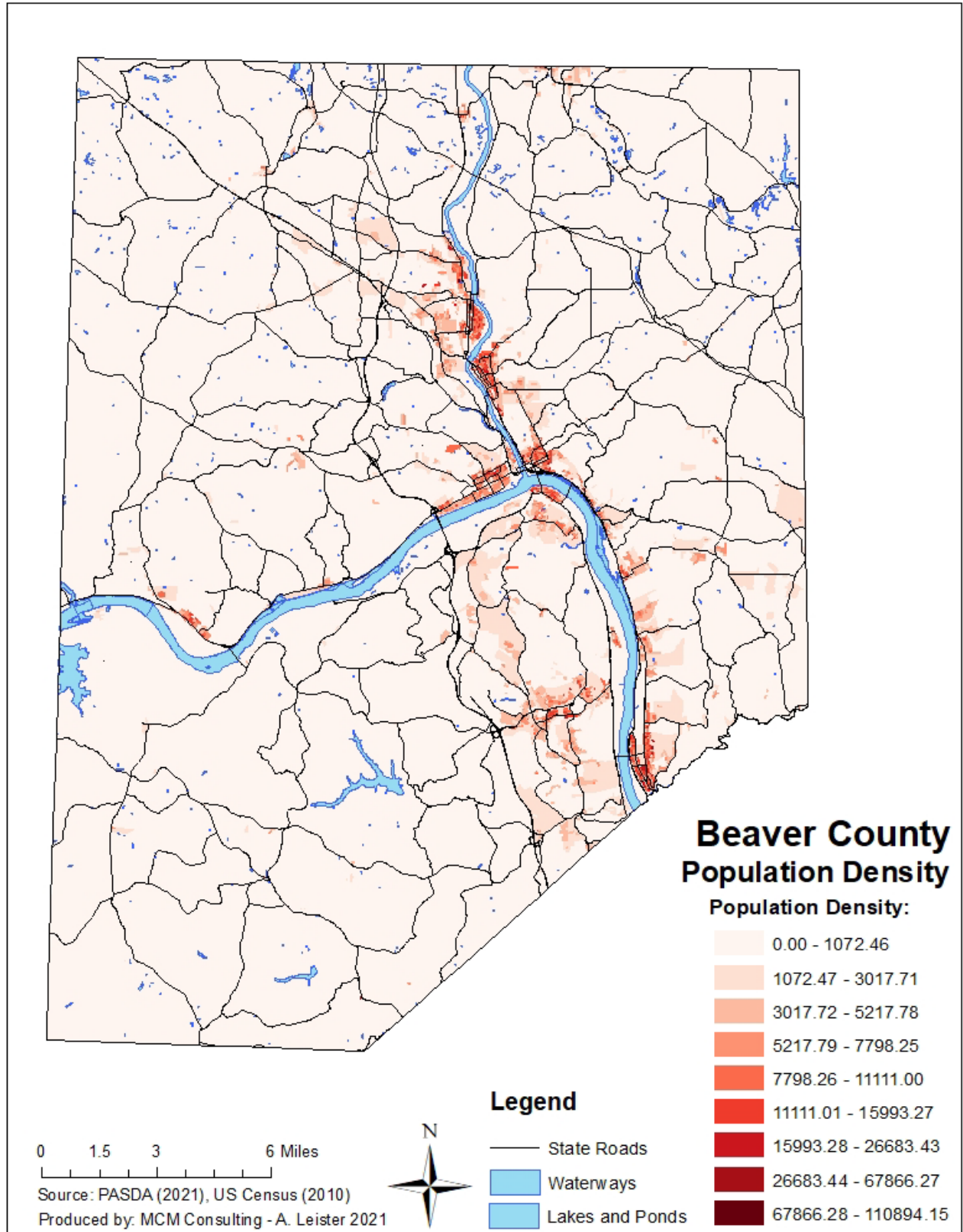
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Race	Percentage of 2019 Population	Actual Numbers of 2019 Population
Hispanics/Latinos alone	1.8%	2,952

As of 2019, there were a total of 77,765 housing units at an average density of 179 per square mile. In total, 29% had children under the age of eighteen, 55% had married couples living together, 11% had a female with no husband present, and 30% were non-families. The average household size in Beaver County was 2.29. The median value of own-occupied housing units from 2019 was approximately \$141,100.00.

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Figure 1 - Population Density Map



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2.4. Land Use and Development

Farming and agriculture are major industries in Beaver County. As of 2017, there are 613 farms present in Beaver County. There is 53,832 acres of farmland within the county with eighty-eight acres being the average size per farm. Therefore, approximately 19% of the acreage in Beaver County is used for farmland and agriculture purposes. The five most grown crops include: Forage/Hay (13,443 acres), corn for grain (3,809 acres), soybeans (2,039 acres), corn for silage (954 acres), and cultivated Christmas trees (836 acres). Many of these crops are grown throughout the Commonwealth of Pennsylvania, however, these are the top five crops in Beaver County. Along with the crops, there is a great number of livestock. The top five livestock inventory in Beaver County include: cattle/calves, hogs/pigs, horses/ponies, sheep/lambs, and broilers or other meat-type chickens. The value of sales related to farmland and agriculture use are high in the county. The total market value of products sold in Beaver county comes to about \$23,653,000.00. This value has increased about 13% over the last couple of years. The market value per farm on products sold is \$38,586.00 which has also increased over the past couple years by 19%. Therefore, a great number of land use in the county is related to farmland and agriculture use.

Another great use of the land in Beaver County is the well-known Raccoon Creek State Park, which has been operating since the 1930s. The park encompasses 7,572 acres with 101 acres being the Raccoon Lake. This portion of the land in Beaver County is used for a various of recreational activities. The two major land uses of Beaver County include the Raccoon Park and agriculture purposes.

2.5. Data Sources

The county relied heavily on existing data sources developed by other Beaver County departments, including:

- Beaver County Hazard Vulnerability Analysis.
- Beaver County Comprehensive Plan.
- Beaver County Assessment Department data.
- Beaver County Subdivision and Land Development Ordinance.
- Beaver County Open Space Management Plan.
- Beaver County Greenways Plan.
- Beaver County Digital Tax Assessment Data.
- Beaver County Commodity Flow Study.

The following are additional data sources used during the update process:

- U.S. Census Bureau.
- National Climatic Data Center (NCDC).
- National Oceanic and Atmospheric Administration (NOAA).
- Pennsylvania Department of Conservation and Natural Resources.
- Pennsylvania Groundwater Information System.
- Pennsylvania Emergency Incident Reporting System.
- Pennsylvania Emergency Management Agency.

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- Pennsylvania Department of Labor and Industry.

The countywide digital flood insurance rate maps (DFIRM), were used for all flood risk analysis and estimation of loss. The Beaver DFIRMs were approved and effective on May 16, 2008. The DFIRM database provides flood frequency and elevation information used in the flood hazard risk assessment. Other Beaver County GIS datasets including road centerlines, parcels and structures were utilized in conjunction with the DFIRM. In addition to the county's existing spatial datasets, the Beaver County Office of Planning and Redevelopment developed a database and maps of the county's critical facilities, special needs populations, transportation systems and hazardous materials facilities. Potential losses were then analyzed by using existing county tax assessment data and DFIRM data.

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 core foundation of data was available from Beaver County Emergency Services and Beaver County Office of Planning and Redevelopment. Some data was downloaded from the Pennsylvania Spatial Data Access (PASDA) and utilized. The following is a list of existing GIS data that was utilized in the plan update process and a list of new GIS data that was developed to complete the 2021 mitigation plan update.

Existing Beaver County GIS Data Used:

- Structures
- Road Centerlines
- Tax Parcels
- Municipality Boundaries
- Digital Flood Insurance Rate Maps
- Watershed and Sub-Sheds
- Lakes and Streams

New GIS Data Developed and Used:

- Critical Facilities
- Functional Needs Facilities
- Bedrock Geology
- Land Slope Features
- Land Use Features
- Mobile Homes
- Utility Locations
- Shared Relief Digital Elevation Model
- Tornado Paths
- Recreational Opportunities
- Zip Codes
- Wildlife Urban Interface Values

The Beaver County parcel dataset includes a value for the land in each parcel, as well as a combined value for all buildings on each parcel. Some parcels that contain multiple buildings with one or more buildings in the flood plain and one or more buildings out of the flood plain. The individual value by

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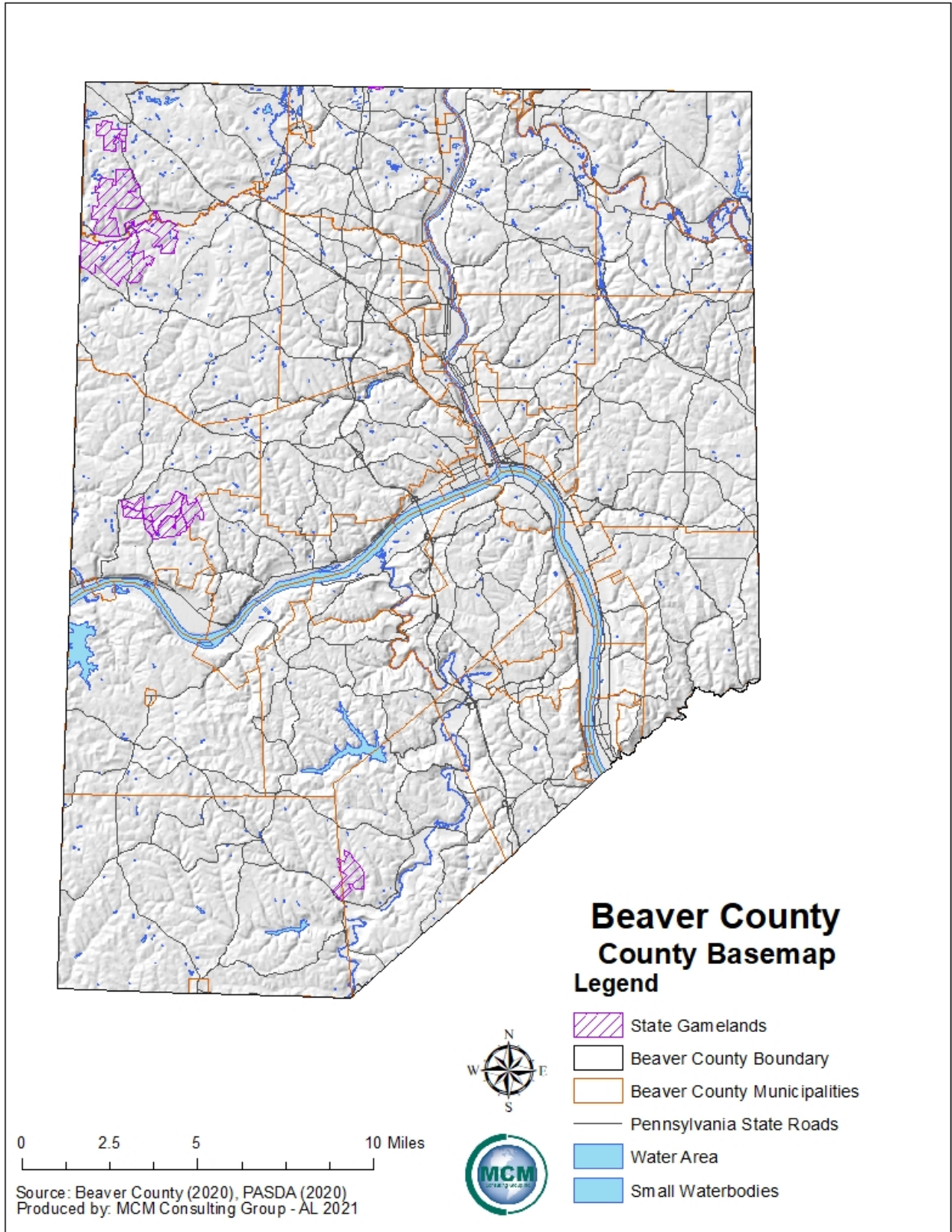
specific building within any given parcel was indeterminate from the data provided by Beaver County. Therefore, the combined value of all buildings in that parcel has been used – not simply the value of only the structures in the floodplain.

HAZUS calculations and statistics were based on a total of twelve reaches. There were zero failed reaches. The loss estimations were completed as part of the HAZUS scenario processing and represent FEMA depths grids and general building information from FEMA's general building stock.

The following maps provide a base map of Beaver County and other specific features of the county.

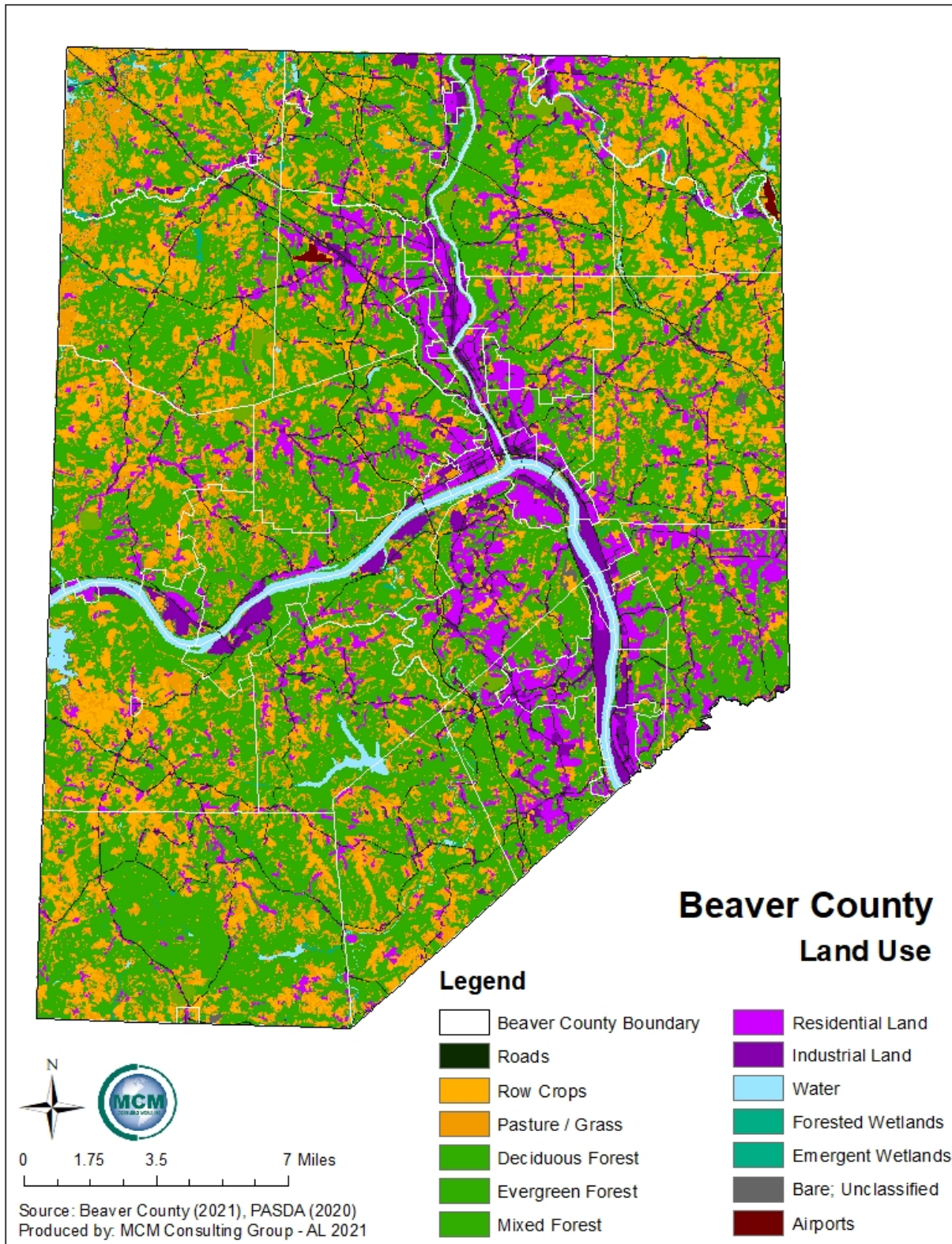
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Figure 2 - Base Map of Beaver County



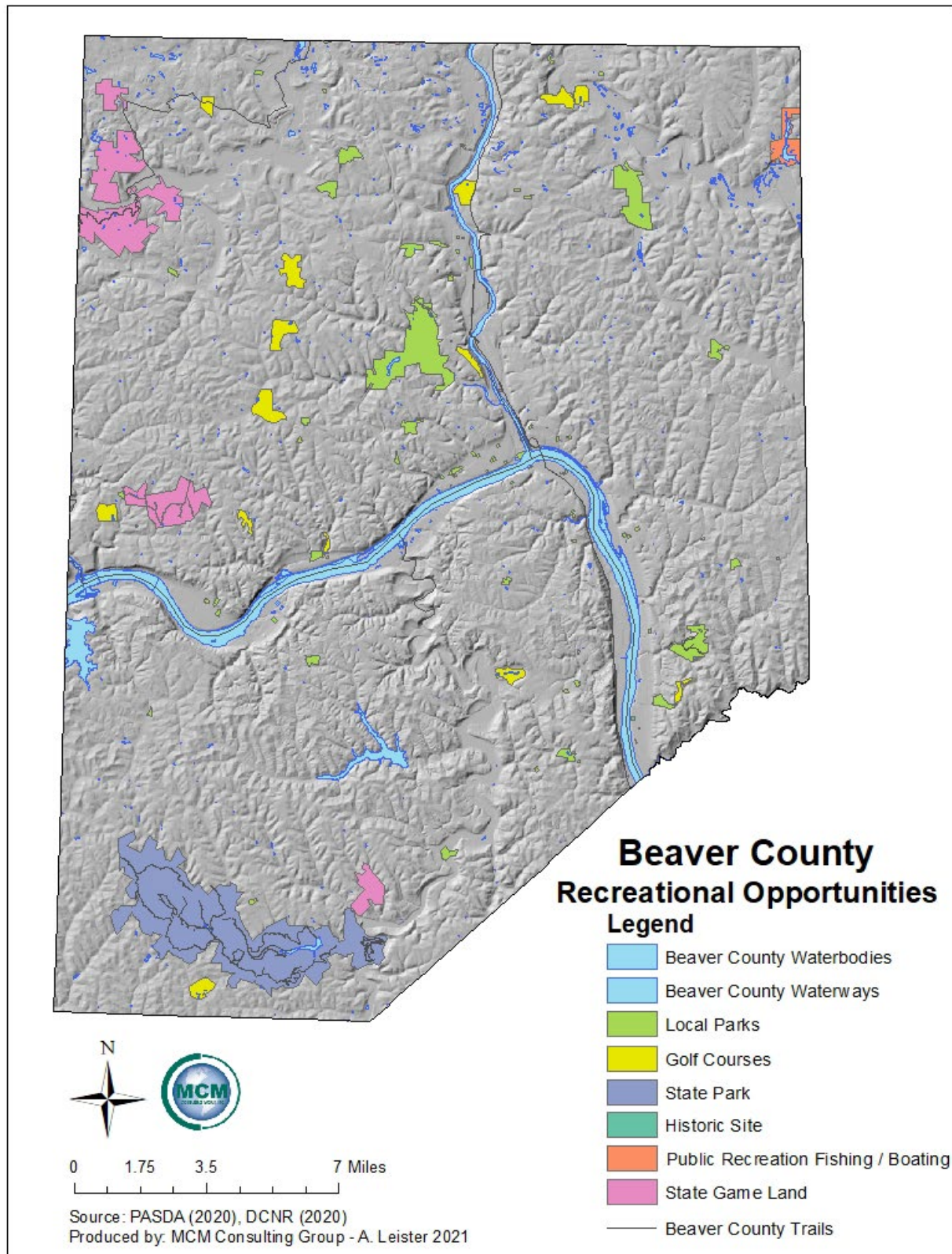
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Figure 3 - Beaver County Land Use Map



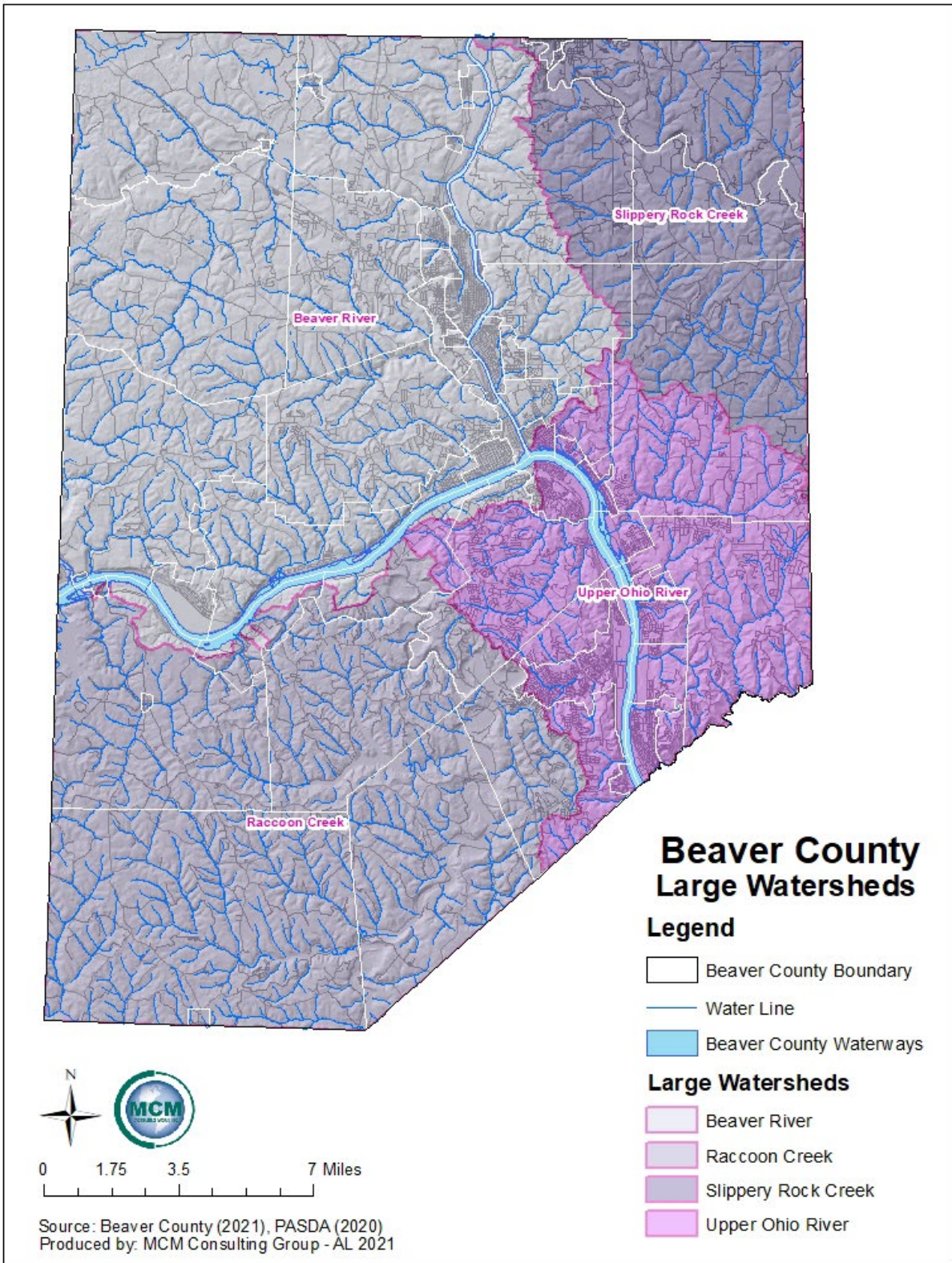
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Figure 4 - Recreational Opportunities Map



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Figure 5 - Beaver County Watershed Map



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3. Planning Process

3.1. Update Process and Participation Summary

The Beaver County Hazard Mitigation Plan update began January 20, 2021. The Beaver County Commissioners were able to secure a hazard mitigation grant to start the process. Beaver County Emergency Services was identified as the lead agency for the Beaver County Hazard Mitigation Plan update. The planning process involved a variety of key decision makers and stakeholders within Beaver County. Beaver 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 Beaver County Emergency Services, Beaver County Office of Planning and Redevelopment, 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 Beaver County Office of Planning and Redevelopment, and Beaver County Assessment Department, as well as Beaver County Emergency Services in coordinating and leading public involvement meetings, local planning team meetings, analysis, and the writing of the updated HMP. The Beaver 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, most meetings were held virtually. Meeting agendas, and meeting minutes 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 Beaver County Local Planning Team and staff. Due to COVID-19, all meetings were held virtually. 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. Beaver County will continue to work with all local municipalities to collect local hazard mitigation project opportunities.

The HMP planning process consisted of:

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- 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 Beaver County Board of Commissioners.
- Plan submission to FEMA and PEMA.

The 2021 Beaver County HMP was completed June 24, 2021. The 2021 plan follows an outline developed by PEMA which provides a standardized format for all local HMPs in the Commonwealth of Pennsylvania. The 2021 HMP format is consistent with the PEMA recommended format. The 2021 Beaver County HMP has additional hazard profiles that were added to the HMP and these additional profiles increased the subsections in section 4.3 of the HMP.

3.2. The Planning Team

The 2021 Beaver County Hazard Mitigation Plan update was led by the Beaver County Steering Committee. The Beaver 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 4 – Steering Committee* outlines the individuals that comprised this team.

Table 4 - Steering Committee

Beaver County Hazard Mitigation Plan Update Steering Committee		
Name	Organization	Position
Eric Brewer	Beaver County Emergency Services	Director
Frank Parris	Beaver County Emergency Services	Deputy Director
Kelly Staschak	Beaver County Emergency Services	Emergency Management Specialist
Lance Grabel	Beaver County Office of Planning and Redevelopment	Director
Joseph West	Beaver County Office of Planning and Redevelopment	Assistant Director

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Name	Organization	Position
Dan Distler	Beaver County Office of Planning and Redevelopment	Environmental Planner
Thomas Albanese	New Brighton Borough	Appointed Official
Bryan Dehart	Brighton Township	Appointed Official
Jack Manning	Beaver County	County Commissioner
Michael Rearick	MCM Consulting Group, Inc.	Senior Consultant
Valerie Zents	MCM Consulting Group, Inc.	Consultant
Corbin Snyder	MCM Consulting Group, Inc.	Consultant

In order to represent the county, the Beaver County Steering Committee developed a diversified list of potential local planning team (LPT) members. Members that participated in the 2016 hazard mitigation plan were highly encouraged to join the 2021 team. The steering committee then provided invitations to the prospective members and provided a description of duties to serve on the LPT. The following agencies, departments and organizations were invited to participate in the LPT: Beaver County Commissioners, Beaver County Office of Planning and Redevelopment, Beaver County Conservation District, Beaver County Chamber of Commerce, Heritage Valley Health System, Beaver Valley Intermediate Unit, Lawrence County Department of Public Safety, Butler County Department of Emergency Services, Allegheny County Department of Emergency Services, New Brighton Borough, Ambridge Borough, and Brighton Township. The invitations for membership of the LPT were disseminated by Beaver County Emergency Services 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 5 – Local Planning Team* served on the 2021 Beaver County Hazard Mitigation Local Planning Team, actively participated in the planning process by attending meetings, completing assessments, surveys, and worksheets and/or submitting comments.

Table 5 - Local Planning Team

Beaver County Hazard Mitigation Plan Update Local Planning Team		
Name	Organization	Position
Eric Brewer	Beaver County Emergency Services	Director
Frank Parris	Beaver County Emergency Services	Deputy Director
Kelly Staschak	Beaver County Emergency Services	Emergency Management Specialist
Jack Manning	Beaver County Commissioners	County Commissioner
Dan Distler	Beaver County Office of Planning & Redevelopment	Environmental Planner/Redevelopment Spec
Bryan K. Dehart	Brighton Township	Township Manager

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Name	Organization	Position
Joseph C. West	Beaver County Office of Planning & Redevelopment	Assistant Director
Helen Kissick	Beaver County Chamber of Commerce	President and Executive Director
Joseph Campbell	Heritage Valley Beaver	Prehospital and Disaster Coordinator
Thomas Albanese	New Brighton Borough	Borough Manager
Mario Leone, Jr.	Ambridge Borough	Borough Manager
Matthew Brown	Allegheny County Department of Emergency Services	Chief
Steve Wilharm	Allegheny County Department of Emergency Services	Emergency Management Division Manager
Valerie Zents	MCM Consulting Group, Inc.	Consultant
Corbin Snyder	MCM Consulting Group, Inc.	Consultant
Michael Rearick	MCM Consulting Group, Inc.	Senior Consultant

3.3. Meetings and Documentation

Meetings with local elected officials and the local planning team were held as needed. Meetings were mostly held via conference call and virtual meeting rooms due to COVID-19. 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 6 – 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, any other documentation is located in Appendix C. It should be noted that as a result of the COVID-19 pandemic, most meetings were held virtually. As a result, the number of sign-in sheets decreased when compared to the 2016 HMP update. Participants are identified on the Local Planning Team meeting minutes found in Appendix C.

The draft plan was made available for public review on June 29, 2021. The draft was advertised on Beaver County’s social media page and was made available digitally on the Beaver County website at: <http://www.beavercountypa.gov/Depts/EMS/Pages/HazardMitigation.aspx>

The public comment period remained open until July 29, 2021. All public comments were submitted via an online survey or in writing to Frank Parris or Kelly Staschak at Beaver County Emergency Services. All public comments have been included in this plan in Appendix C.

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Table 6 - HMP Process Timeline

Beaver County HMP Process - Timeline		
Date	Meeting	Description
01/20/2021	Local Planning Team Kick-Off meeting	Identified challenges and opportunities as they relate to fulfilling the DMA 2000 requirements. Identified existing studies and information sources relevant to the hazard mitigation plan. Identified stakeholders, including the need to involve local officials. Presentation on hazard identification, capability assessment and NFIP worksheets. Defined hazard mitigation planning and identified roles and responsibilities. Discussed the 2016 hazard mitigation plan and defined a timeline to complete the update.
01/20/2021 – 01/21/2021	Municipality Kick-off meetings	Presentation on hazard identification, capability assessment and NFIP worksheets.
01/20/2021	Local Planning Team meeting	Complete the hazard identification worksheet and the capabilities assessment survey.
02/10/2021	Local Planning Team Meeting – Selection of Hazards	Beaver County LPT met via Zoom to discuss hazards profiled in the previous plan and identify any new hazards to be included in the plan update.
03/17/2021	Local Planning Team Meeting – Risk Factor Assessment and Mitigation Strategy	Beaver County LPT met via Zoom to determine a risk factor score for each of the selected hazards in the 2021 update. A municipal comparison document was then sent to all municipalities in Beaver County for their input.
03/17/2021	Meetings with Municipal Officials	Virtual meetings. Educated county and local elected officials on the hazard mitigation planning process. Presented the findings of the hazard vulnerability analysis and risk assessment. Sought input for mitigation projects throughout the county. Distributed hazard mitigation project opportunity forms. Distributed review worksheets from the 2016 HMP.
04/14/2021	Local Planning Team Meeting – Mitigation Strategy	Beaver County LPT met via Zoom to begin mitigation strategy development by discussing the goals and objectives to be included in this plan update.

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Date	Meeting	Description
04/28/2021	Local Planning Team Meeting – Mitigation Strategy	Beaver County LPT met via Zoom to finalize the 2021 goals, objectives, and actions for mitigation strategy development. The LPT also reviewed all mitigation actions from the 2016 plan and finalized new actions for the plan update.
06/29/2021	Beaver County Hazard Mitigation Plan – Draft Plan Public Review	The draft HMP was made available for all members of the public to review. All were invited to submit any comments via an online survey or provide comments to Beaver County Emergency Services.

3.4. Public and Stakeholder Participation

Beaver 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 Beaver County website. Copies of those advertisements are located 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 to complete and return to Beaver County Emergency Services 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 Emergency Management Agency.

1. **Risk Assessment Hazard Identification and Risk Evaluation Worksheet:** Capitalizes on local knowledge to evaluate the change in the frequency of occurrence, magnitude of 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:** Copies of the 2016 mitigation opportunity forms that were included in the current HMP were provided to the municipalities for review and amendment. These opportunities are located in Appendix G. The previous mitigation actions were provided and reviewed at update meetings. New 2021 municipal project opportunity forms are included as well, located in Appendix G.

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4. **National Flood Insurance Program Survey:** Collects data from county residents and measures their level of participation in the National Flood Insurance Program (NFIP) provided by FEMA.

Members of the public were encouraged to contact Beaver County Emergency Services 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.

Beaver County invited all contiguous counties to review the 2021 draft hazard mitigation plan. A letter was sent to the emergency management coordinator in Allegheny, Butler, Lawrence, and Washington counties in Pennsylvania, on January 7, 2021. Copies of these letters are included in Appendix C.

3.5. Multi-Jurisdictional Planning

Beaver 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 risks 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 7 – Municipality Participation in Worksheets, Surveys, and Forms* reflects the municipality participation by completing worksheets, surveys, and forms.

Table 7 - Municipality Participation in Worksheets, Surveys, and Forms

Municipality Participation in Worksheets, Surveys and Forms			
Municipality	Capability Assessment Survey	Risk Assessment Hazard Identification and Risk Evaluation Worksheet	Hazard Mitigation Opportunity Form Review and Updates
Ambridge Borough	X	X	
Baden Borough	X	X	
Beaver Borough	X	X	
Big Beaver Borough	X	X	X
Bridgewater Borough	X	X	X
Brighton Township	X	X	X
Center Township	X	X	
Chippewa Township	X	X	X
City of Aliquippa	X	X	X

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Municipality	Capability Assessment Survey	Risk Assessment Hazard Identification and Risk Evaluation Worksheet	Hazard Mitigation Opportunity Form Review and Updates
City of Beaver Falls	X	X	
Conway Borough	X	X	X
Darlington Borough	X	X	
Darlington Township	X	X	X
Daugherty Township	X	X	X
East Rochester Borough	X	X	X
Eastvale Borough			
Economy Borough	X	X	
Fallston Borough	X	X	X
Frankfort Springs Borough	X	X	
Franklin Township	X	X	X
Freedom Borough	X	X	X
Georgetown Borough	X	X	
Glasgow Borough	X	X	
Greene Township	X	X	
Hanover Township	X	X	X
Harmony Township	X	X	
Homewood Borough		X	X
Hookstown Borough	X	X	
Hopewell Township	X	X	X
Independence Township	X	X	
Industry Borough	X	X	X
Koppel Borough	X	X	
Marion Township	X	X	
Midland Borough	X	X	X
Monaca Borough	X	X	X
New Brighton Borough	X	X	X
New Galilee Borough	X	X	
New Sewickley Township	X	X	X
North Sewickley Township			
Ohioville Borough	X	X	X
Patterson Township	X	X	X

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Municipality	Capability Assessment Survey	Risk Assessment Hazard Identification and Risk Evaluation Worksheet	Hazard Mitigation Opportunity Form Review and Updates
Patterson Heights Borough			
Potter Township	X	X	
Pulaski Township	X	X	
Raccoon Township			
Rochester Borough	X	X	X
Rochester Township	X	X	X
Shippingport Borough	X	X	X
South Beaver Township	X	X	
South Heights Borough	X	X	
Vanport Township	X	X	X
West Mayfield Borough			
White Township	X	X	X

In March of 2020, Pennsylvania and the rest of the world experienced a pandemic event entitled COVID-19. Unfortunately, because of the pandemic, public meetings were unable to be held as normal during the hazard mitigation planning process. Members of the public were encouraged to submit any questions or comments about the project to Beaver County Emergency Services or MCM Consulting Group, Inc. Additionally, all Beaver County residents were encouraged to complete an online community preparedness survey to both engage community members and to measure preparedness levels.

A total of thirty-one municipalities within Beaver County adopted the 2016 Beaver County Hazard Mitigation Plan as the municipal hazard mitigation plan. The goal of the Beaver County Local Planning Team is to 100% participation by municipalities in adopting the 2021 Beaver County Hazard Mitigation Plan.

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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 Beaver County risk assessment provides in-depth knowledge of the hazards and vulnerabilities that affect Beaver 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 Beaver County Emergency Operations Plan (EOP), local EOPs and other public and private emergency management plans.

The Beaver 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 Beaver County Local Planning Team reviewed and assessed the change in risk for all natural and human-caused hazards identified in the 2016 hazard mitigation plan. The mitigation planning team then identified hazards that were outlined within the Pennsylvania Hazard Mitigation Plan but not included in the 2016 Beaver County Hazard Mitigation Plan that could impact Beaver County. The team utilized the hazard identification and risk evaluation worksheet that was provided by the Pennsylvania Emergency Management Agency.

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The Beaver County Steering Committee met with municipalities and provided guidance on how to complete the municipal hazard identification and risk evaluation worksheet. Forty-seven municipalities in Beaver 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 Beaver County assessment data to estimate loss to particular hazards. Risk factor was then assessed to each of the nineteen 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 8 – Presidential & Gubernatorial Disaster Declaration contains a list of all Presidential and Gubernatorial disaster declarations that have affected Beaver County and its municipalities from 1955 through 2021, according to the Pennsylvania Emergency Management Agency.

Table 8 - Presidential & Gubernatorial Disaster Declarations

Presidential Disaster Declarations and Gubernatorial Declarations and Proclamations		
Date	Hazard Event	Action
September, 1955	Drought	Gubernatorial Declaration
January, 1966	Heavy snow	Gubernatorial Declaration
February, 1972	Heavy snow	Gubernatorial Declaration
June, 1972	Flood (Agnes)	Presidential Disaster Declaration
February, 1974	Truckers' strike	Gubernatorial Declaration
September, 1975	Severe storms, heavy rains, flooding	Presidential Disaster Declaration
January, 1978	Heavy snow	Gubernatorial Declaration
February, 1978	Blizzard	Gubernatorial Declaration
March, 1993	Blizzard	Presidential Emergency Declaration
January, 1994	Severe winter storms	Presidential Disaster Declaration
September, 1995	Drought	Gubernatorial Declaration
January, 1996	Severe winter storms	Presidential Disaster Declaration
January, 1996	Flooding	Presidential Disaster Declaration
July, 1999	Drought	Gubernatorial Declaration
September, 1999	Hurricane Floyd	Presidential Disaster Declaration
December, 1999	Drought	Gubernatorial Declaration

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Date	Hazard Event	Action
September, 2003	Hurricane Isabel/Henri	Presidential Disaster Declaration
September, 2004	Tropical Depression Ivan	Presidential Disaster Declaration
September, 2005	Hurricane Katrina	Gubernatorial Proclamation of Emergency
September, 2006	Tropical depression Ernesto	Gubernatorial Proclamation of Emergency
February, 2007	Severe winter storm	Gubernatorial Proclamation of Emergency
February, 2007	Waive the regulations regarding hours-of-service limitations for drivers of commercial vehicles	Gubernatorial Proclamation of Emergency
April, 2007	Severe storm	Gubernatorial Declaration
April, 2007	Severe winter storm	Gubernatorial Proclamation of Emergency
February, 2010	severe winter storm	Gubernatorial Proclamation of Emergency
October, 2010	Hurricane Sandy	Presidential Emergency Declaration
January, 2011	Severe winter storm	Gubernatorial Proclamation of Emergency
September, 2011	Severe storms and flooding (Lee/Irene)	Gubernatorial Proclamation of Emergency
April, 2012	Spring, winter storms	Gubernatorial Proclamation of Emergency
October, 2012	Hurricane Sandy	Gubernatorial Proclamation of Emergency
June, 2013	High winds, thunderstorms, heavy rain, tornado, flooding	Gubernatorial Proclamation of Emergency
January, 2014	Extended prolonged cold	Gubernatorial Proclamation of Emergency
January, 2014	Driver hours waived due to prolonged and continued severe winter weather	Gubernatorial Proclamation of Emergency
February, 2014	Severe winter weather	Gubernatorial Proclamation of Emergency
February, 2014	Severe winter storm	Presidential Proclamation of Emergency

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Date	Hazard Event	Action
March, 2017	Severe winter storm	County and Municipal Declarations
July, 2017	Flash flooding	County and Municipal Declarations
January, 2018	Opioid crisis	Gubernatorial Proclamation of Emergency
March, 2020	COVID-19	Presidential Disaster Declaration
<i>Source: Pennsylvania Emergency Management Agency and Federal Emergency Management Agency</i>		

4.2.2. Summary of Hazards

The Beaver County Local Planning Team (LPT) was provided the Pennsylvania Standard List of Hazards to be considered for evaluation in the 2021 HMP Update. Following a review of the hazards considered in the 2016 HMP and the standard list of hazards, the local planning team decided that the 2021 plan should identify, profile, and analyze nineteen profiled hazards. These nineteen hazards include all of the hazards profiled in the 2016 plan. The list below contains the nineteen hazards that have the potential to impact Beaver County as identified through previous risk assessments, the Beaver County Hazard Vulnerability Analysis and input from those who participated in the 2021 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 10 to 20 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 people 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. (FEMA, 1997).

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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 Diseases

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.

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,

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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.

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

Dam/Levee Failures

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. 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, 2015). 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.

Civil Disturbance/Criminal Activity

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. Criminal activity is an act committed in violation of law that can lead to imprisonment.

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

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:

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- 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).

Nuclear Incidents

Nuclear explosions can cause significant damage and casualties from blast, heat, and radiation. The primary concern following a nuclear accident or nuclear attack is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g., death, burns, severe impairment), chronic health effects (e.g., cancer), and psychological effects.

Terrorism/Cyberterrorism

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; cyber-attacks (computer-based); and the use of chemical, biological, nuclear, and radiological weapons. Cyber-attacks 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.

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Urban Fire and Explosion

Urban fire and explosion hazards include vehicle and building/structure fires as well as overpressure rupture, overheat, or other explosions that do not ignite. This hazard occurs in denser, more urbanized areas statewide and most often occur in residential structures. Nationally, fires cause over 3,000 deaths and approximately 16,000 injuries each year.

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, for example.
- 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

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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 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 Beaver 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). As previously mentioned, 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 rainfalls, increasing the risk of flooding and dam and levee failures. Similarly, winter storms are expected to become more intense, if possibly less frequent (Section 4.3.9). 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 4.3.4). 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 the favor of non-native species, contributing to species loss and the risk of extinction.

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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 to reduce emissions and 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 be subject to drought conditions. 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 Beaver 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 drought:

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.

Leaving areas with little moisture, droughts are often one of the leading contributing factors to wildfires.

Droughts can have adverse effects on farms and other water-dependent industries. This can result in a local economic loss. Areas with extensive agriculture uses are particularly vulnerable to drought; roughly 53,832 acres of Beaver County, or 19% of the 284,000 total land acreage, are held in farms (United States Department of Agriculture [USDA], 2017 Census). This agricultural land is spread throughout Beaver County, although it is slightly smaller (4%) than reported in the 2012 census.

Public safety is an issue in terms of consumable water not being available, as well as water for fire protection and emergency services.

4.3.1.2 Range of Magnitude

Nearly 50% of the annual precipitation of 38 inches is during the spring/summer. Fall is usually the driest. Average snowfall for the county is 22 inches. Rural farming areas of Beaver County are most at risk when a drought occurs. A drought can be a significant financial burden as approximately 61%

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of the county farmland use is devoted to crop cultivation and 39% to livestock and poultry. (U.S. Census of Agriculture, 2017). Wildfires are often the most severe secondary effect associated with drought. Wildfires can devastate wooded and agriculture areas, threatening natural resources, structures near high wildfire loads, and farm production facilities. 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.

Table 9 - Drought Preparation Phases shows the FEMA-defined levels of drought severity along with suggested actions, requests, and goals. Drought can cause municipalities to enforce water rationing and distribution.

Table 9 - Drought Preparation Phases

Drought Preparation Phases (PA DEP, 2017)				
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	Reduce water use by 15%

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Local Water Rationing: Although not a drought phase, local municipalities may, with the approval of the Pennsylvania Emergency Management Council, implement local water rationing to share a rapidly dwindling or severely depleted water supply in designated water supply service areas. 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 both mandatory restrictions imposed by the commonwealth and local water rationing, procedures are provided for granting of variances to consider individual hardships and economic dislocations.

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. Beaver County also has a growing agritourism business that would be threatened by long-term drought.

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;
- Groundwater elevations in a number of counties (comparing to past month, past year, and historic record); and
- Soil moisture via the Palmer Drought Index (See *Table 10- Palmer Drought Severity Index*) – a soil moisture algorithm calibrated for relatively homogeneous regions which measures dryness based on recent precipitation and temperature.

Table 10 - Palmer Drought Severity Index

Palmer Drought Severity Index	
Severity Category	PDSI
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 wet 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

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Severity Category	PDSI
Moderate drought	-2.0 to -2.99
Severe drought	-3.0 to -3.99
Extreme drought	-4.0 or less

Hydrologic drought events result in a reduction of stream flows, reduction of lake/reservoir storage, and a lowering of groundwater levels. These events have adverse impacts on public water supplies for human consumption, rural water supplies for livestock consumption and agricultural operations, water quality, natural soil water or irrigation water for agriculture, soil moisture, conditions conducive to wildfire events, and water for navigation and recreation.

The effects of a drought can be far-reaching in both the economic and environmental realms. Economic impacts include the 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:

- Hydrologic effects – Lower water levels in reservoirs, lakes, and ponds; reduced stream flow; loss of wetlands; estuarine impacts; groundwater depletion and land subsidence; and effects on water quality, such as increases in salt concentration and water temperature;
- Damage to animal species – Lack of feed and drinking water; disease; loss of biodiversity, migration, or concentration; and reduction and degradation of fish and wildlife habitat;
- Damage to plant communities – Loss of biodiversity and loss of trees from urban landscapes and wooded conservation areas;
- Increased number and severity of fires;
- Reduced soil quality;
- Air quality effects – Dust and pollutants; and
- 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 *11, Past Drought Events in Beaver County*.

Based on the county’s disaster history and other drought occurrence data, the worst drought event in Beaver County occurred in the summer of 1999. Extended dry weather spurred Governor Ridge to declare a drought emergency in fifty-five counties, including Beaver. During this event, precipitation deficits for that summer averaged five to seven inches; the rivers hit record low flows, streams were

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empty, and wells dried up. Crop damages indicated losses of over \$500 million statewide, and crop losses totaled 70% - 100%. There were also additional losses from the decline of milk production due to the drought (National Climatic Data Center [NCDC], 2011). Additionally, during this event, the state asked municipal and private water suppliers to cut local water use.

Table 11 - Past Drought Event in Beaver County

Past Drought Events in Beaver County			
Dates	Drought Status	Dates	Drought Status
03/03/1989 – 5/15/1989	Watch	09/5/2002 – 06/18/2003	Watch
06/18/1991 – 8/16/1991	Watch	04/11/2006 – 06/30/2006	Watch
08/16/1991 – 9/11/1992	Warning	08/06/2007 – 09/05/2007	Watch
09/01/1995 –	Watch	11/07/2008 – 01/26/2009	Watch
12/03/1998 – 6/18/1999	Watch	09/16/2010 – 11/10.2010	Watch
6/18/1999 – 7/20/1999	Warning	11/10/2010 – 12/17/2010	Warning
07/20/1999 – 9/30/1999	Emergency	08/05/2011 – 09/02/2011	Watch
09/30/1999 – 2/25/2000	Warning	07/19/2012 – 08/31/2012	Watch
02/25/2000 – 5/5/2000	Watch		

SOURCE: PA DEP, 2021

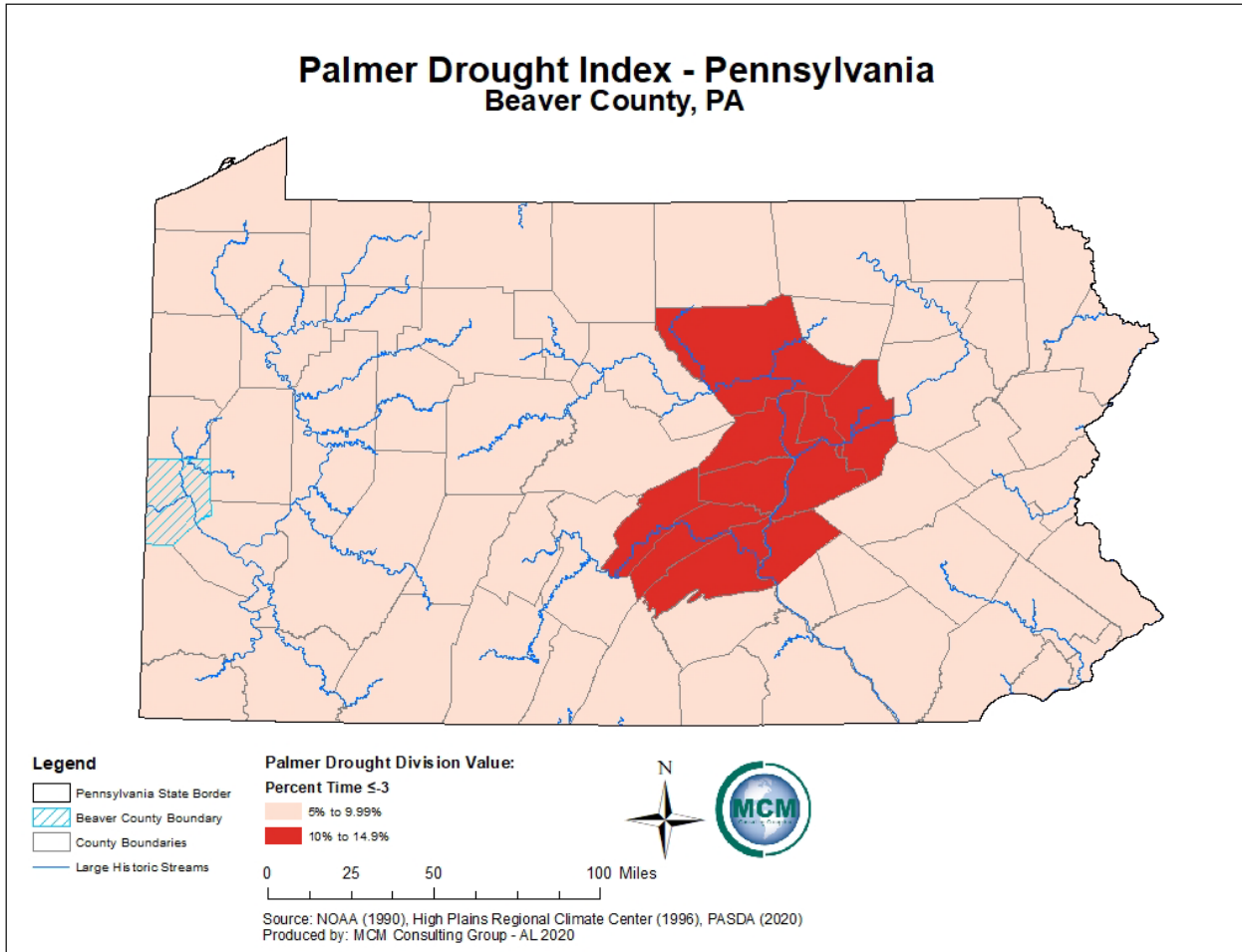
SHELDUS also notes crop indemnity payments in 2016 for \$165,000.00. The National Centers for Environmental Information (NCEI) report that year’s precipitation was below normal but did not reach drought status. Pennsylvania had its warmest July on record in 2020, and twenty-nine counties entered Drought Watch status on September 30, 2020; however, Beaver County was not among them. At the writing of this plan, drought watches had been lifted in all but three counties – Centre, Clearfield, and Clinton.

4.3.1.4 Future Occurrence

It is difficult to forecast the exact severity and frequency of future drought events and the future of climate change will lead to increased uncertainty and extremity of climate events, suggesting that it is best to be prepared for potentially adverse conditions. As depicted in *Figure 6 – Palmer Drought Severity Index for Pennsylvania*, Beaver County has experienced severe drought between 5% – 10% of the time between in a 100-year period. This report can be used to make a rough estimate of the future probability of drought in Beaver 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 (Sheffield & Wood, 2008; EPA, 2016).

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Figure 6 - Palmer Drought Severity Index for Pennsylvania



The potential for a drought to occur in Beaver County is, nevertheless, high. Given the frequency of drought watches issued for Beaver County and its municipalities, the county can reasonably expect to be under a drought watch at least once per year. While some form of drought condition frequently exists in Beaver County, the impact depends on the duration of the event, severity of conditions, and area affected.

4.3.1.5 Vulnerability Assessment

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.

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Wildfire is the most severe secondary effect associated with drought. Wildfires can devastate wooded and agricultural areas, threatening natural resources and farm production facilities.

Prolonged drought conditions can cause major ecological changes, such as increases in scrub growth, flash flooding, and soil erosion.

Droughts can have adverse effects on farms and other water-dependent industries. This can result in a local economic loss. The 2017 U.S. Census of Agriculture lists 53,832 acres of prime agricultural land in Beaver County. Beaver County also boasts many outdoor recreation areas dependent upon rainfall and water for their enjoyment: over 878 miles of rivers and streams, with major floodplains adjacent to the Ohio and Beaver Rivers, as well as Brush, Connoquenessing, Raccoon, and North Fork Little Beaver creeks and over 8,000 acres of wetlands. Beaver County has one state park complex, the 1,400-acre Raccoon Creek State Park, run by the Department of Conservation and Natural Resources. The county also includes four county parks, four state game lands, and the Beaver County Conservation District Environmental Center (Independence Township). Other protected lands include several privately held game lands and conservation easements.

From a societal perspective, public safety is an issue in terms of consumable water not being available, as well as water for fire protection and emergency services.

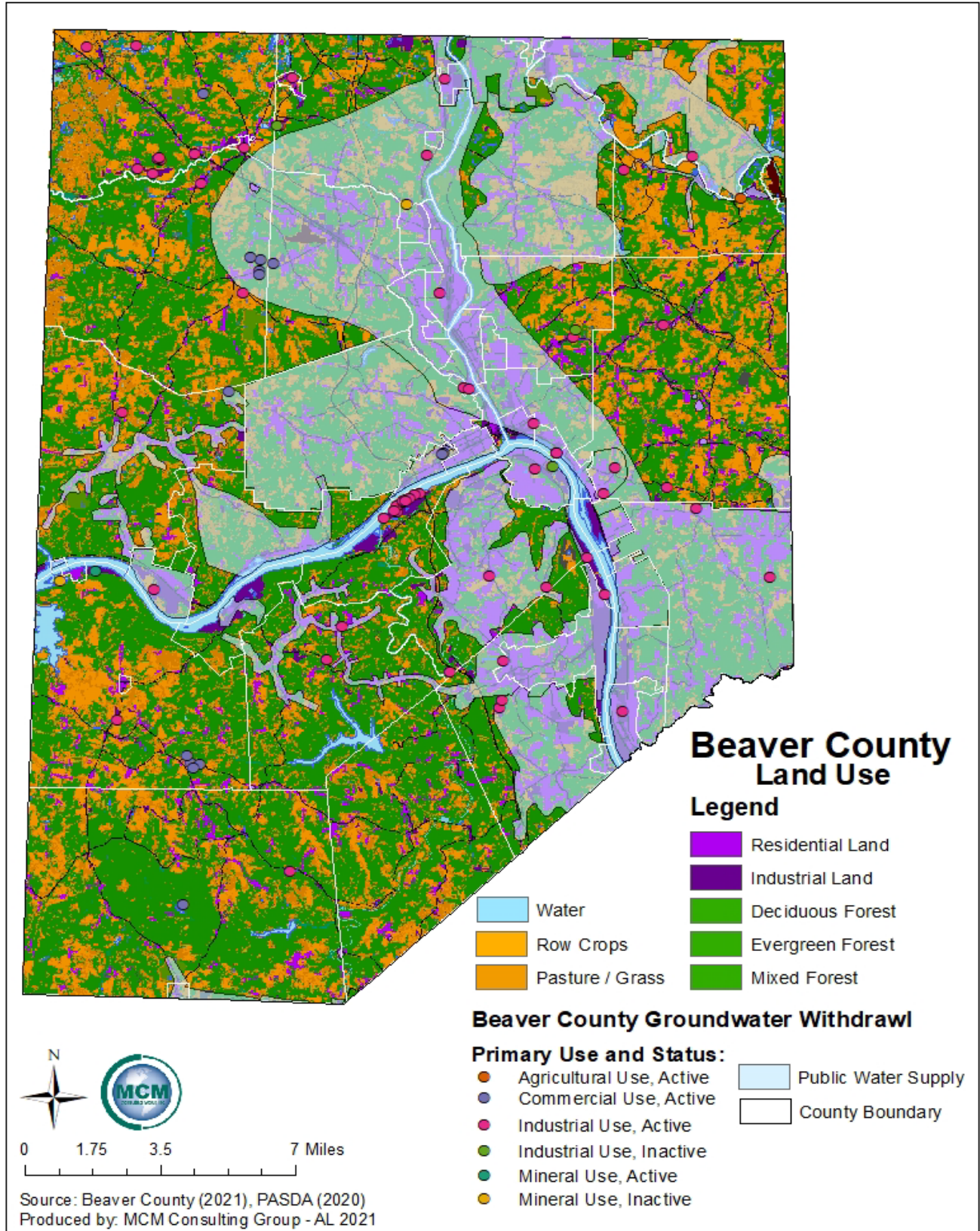
The most significant losses resulting from drought events are typically found in the agriculture sector. The 1999 Gubernatorial Proclamation was issued in large part due to significant crop damage. Preliminary estimates by the Pennsylvania Department of Agriculture indicated possible crop losses across the commonwealth in excess of \$500 million. This estimate did not include a 20% decrease in dairy milk production which also resulted in million-dollar losses (NCDC, 2009).

While these were statewide impacts, they illustrate the potential for droughts to severely impair the local economy in more agricultural communities. The 2017 Census of Agriculture reports there were 613 farms in Beaver County, at an average size of 88 acres. Beaver County ranks forty-third of sixty-seven counties in the commonwealth for agricultural production, totaling over \$23 million annually (USDA, 2017). Agricultural production from crops, including nursery and greenhouse crops, accounts for \$14,486,000.00 in commerce annually. Production from livestock, poultry, and their products accounts for \$9,167,000.00 annually.

A map of properties with tillable agricultural land use, forestry, and other land in the county vulnerable to drought is shown below at *Figure 7, Land Use and Cover Vulnerable to Drought*.

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Figure 7 - Land Use and Cover Vulnerable to Drought

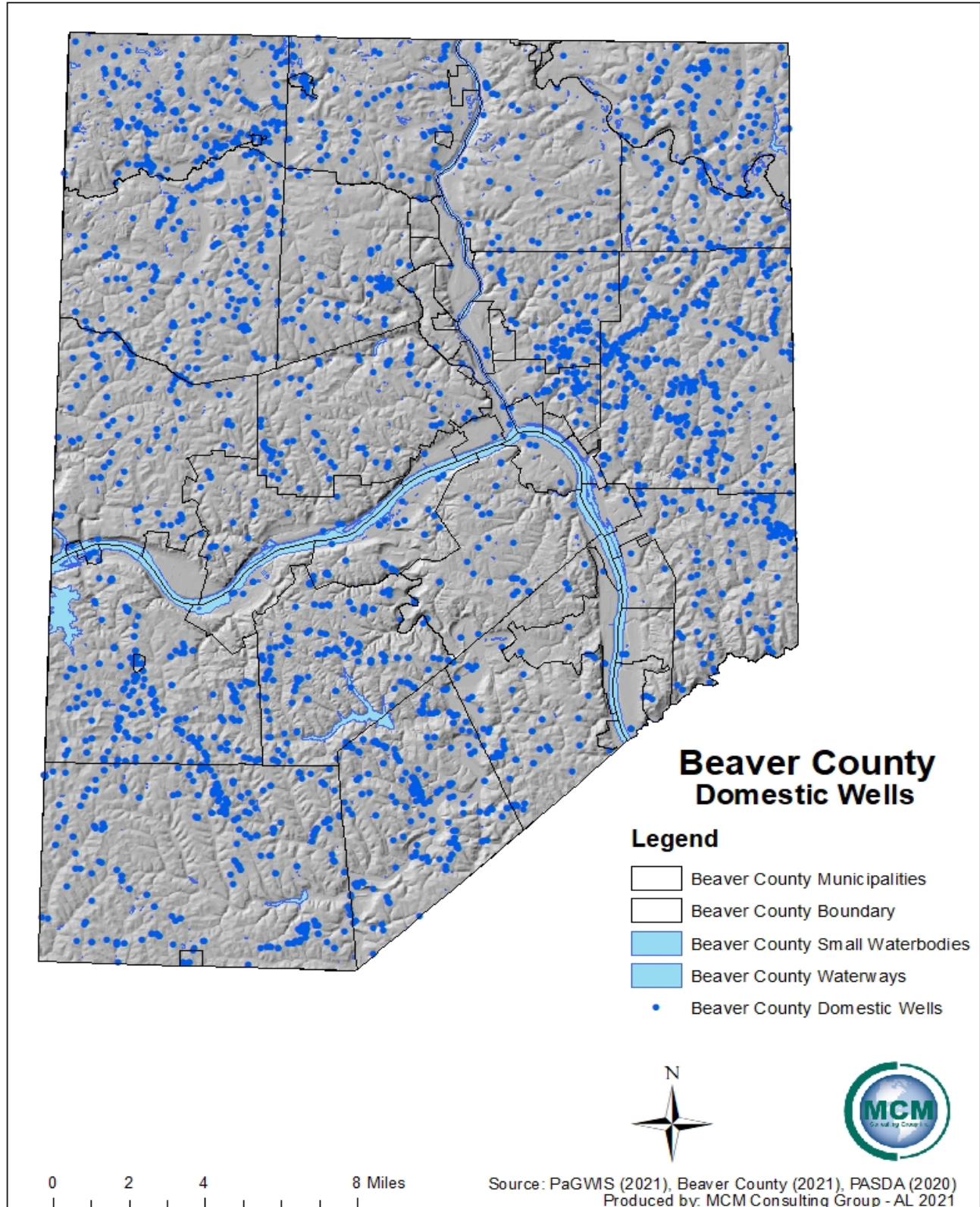


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Public or municipal water supplies are also vulnerable to the effects of drought because supply sources include rivers, reservoirs, and groundwater. Public water service areas cover only some of the land area in the county, as depicted in *Figure 8 – Domestic Wells Per Municipality in Beaver County*. The majority of the county relies on domestic wells for their fresh drinking water. Residents or water authorities that use private domestic wells are more vulnerable to droughts because their drinking water can literally dry up. There is a total of 4,441 domestic wells in the county. It is important to note that the well data was obtained from the Pennsylvania Groundwater Information System (PaGWIS). PaGWIS relies on *voluntary submissions* of well record data by well drillers; as a result, it is not a complete database of all domestic wells in the county. This is the most complete dataset of domestic wells available.

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Figure 8 - Beaver County Domestic Wells



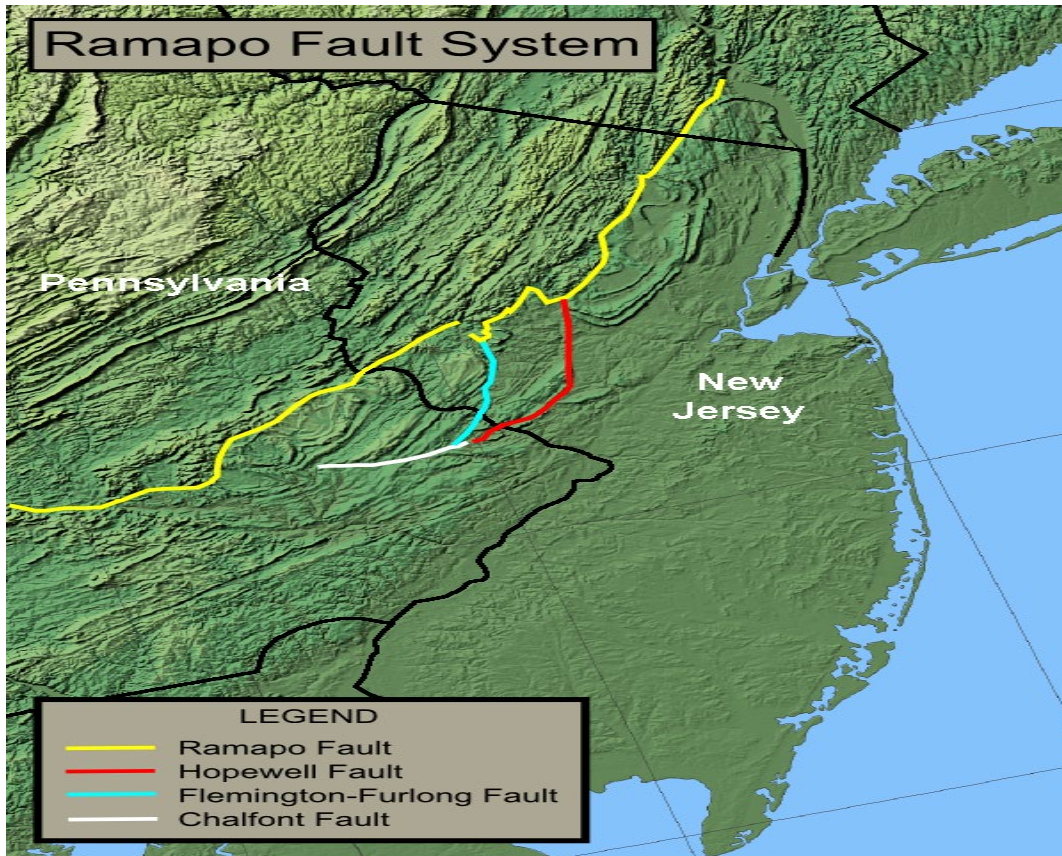
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4.3.2. Earthquake

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 of the earth's tectonic plates, a volcanic eruption, or by a human induced explosion (DCNR, 2007). Earthquake events in Pennsylvania, including Beaver 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 Beaver 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. The Ramapo Fault System runs through New York, New Jersey, and eastern Pennsylvania (See *Figure 9 – Ramapo Fault System*). This fault system is associated with some small earthquakes, and it is thought unlikely to produce large earthquakes.

Figure 9 - Ramapo Fault System

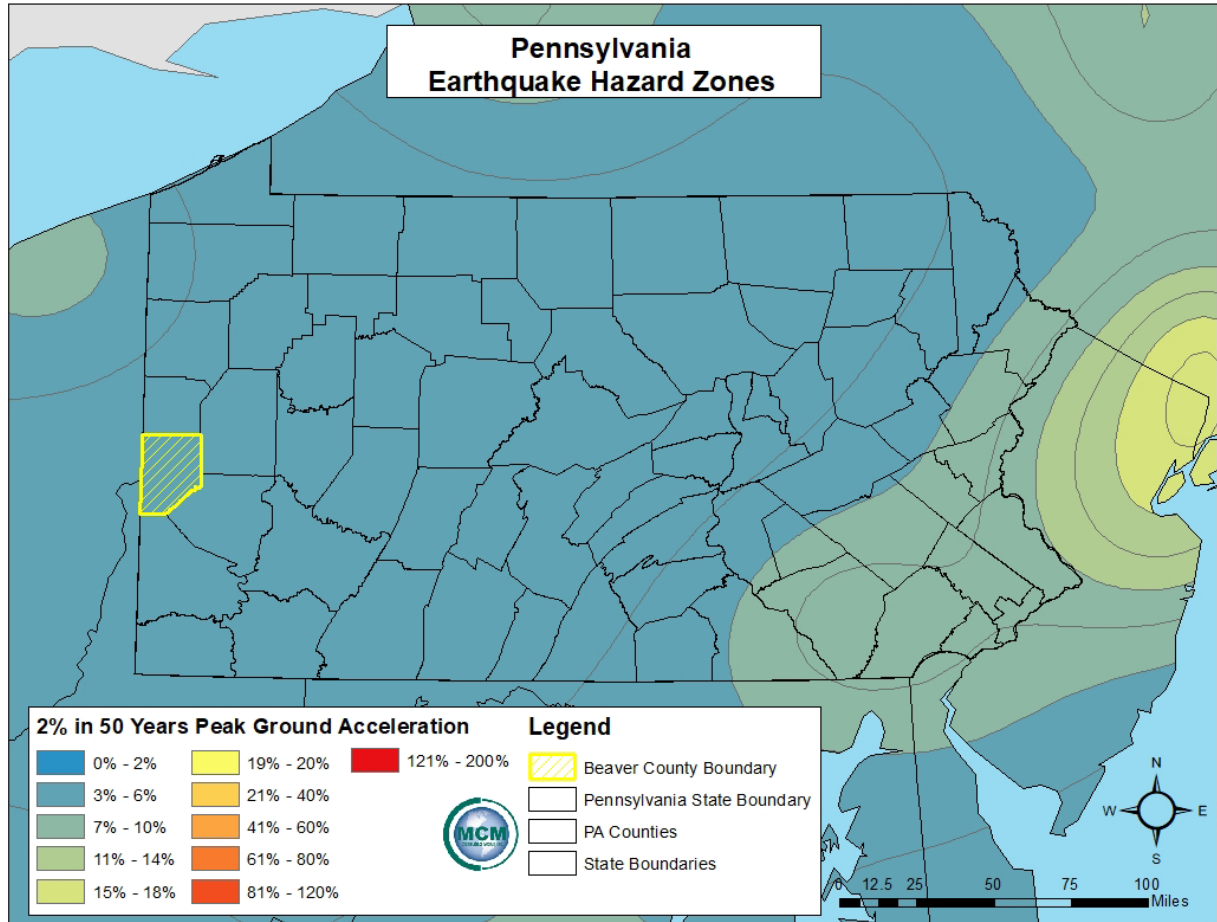


When the supercontinent of Pangaea broke apart about 200 million years ago, the Atlantic Ocean began to form. Since then, many faults have developed. Locating all of the faults would be an idealistic approach to identifying the region's earthquake hazard; however, many of the fault lines in this region have no seismicity associated with them. The best way to determine earthquake history

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for Beaver County is to conduct a probabilistic earthquake-hazard analysis with the earthquakes that have already happened in and around the county. (See *Figure 10 – Earthquake Hazard Zones*).

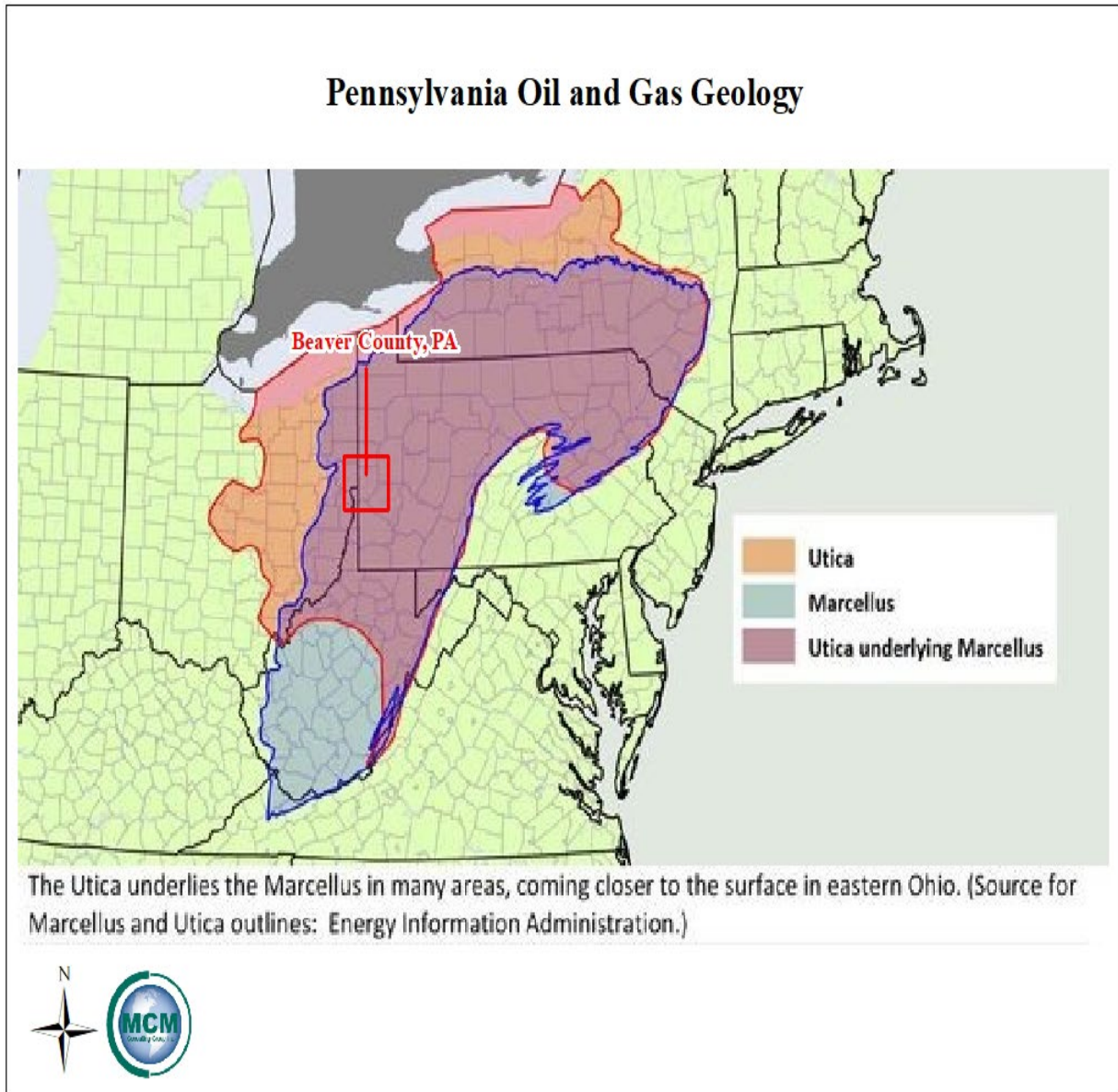
Figure 10 - Earthquake Hazard Zones



Natural gas extraction of the Marcellus/Utica Shale formation (see *Figure 11, Pennsylvania Oil and Gas Geology*) has occurred in Beaver County. 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).

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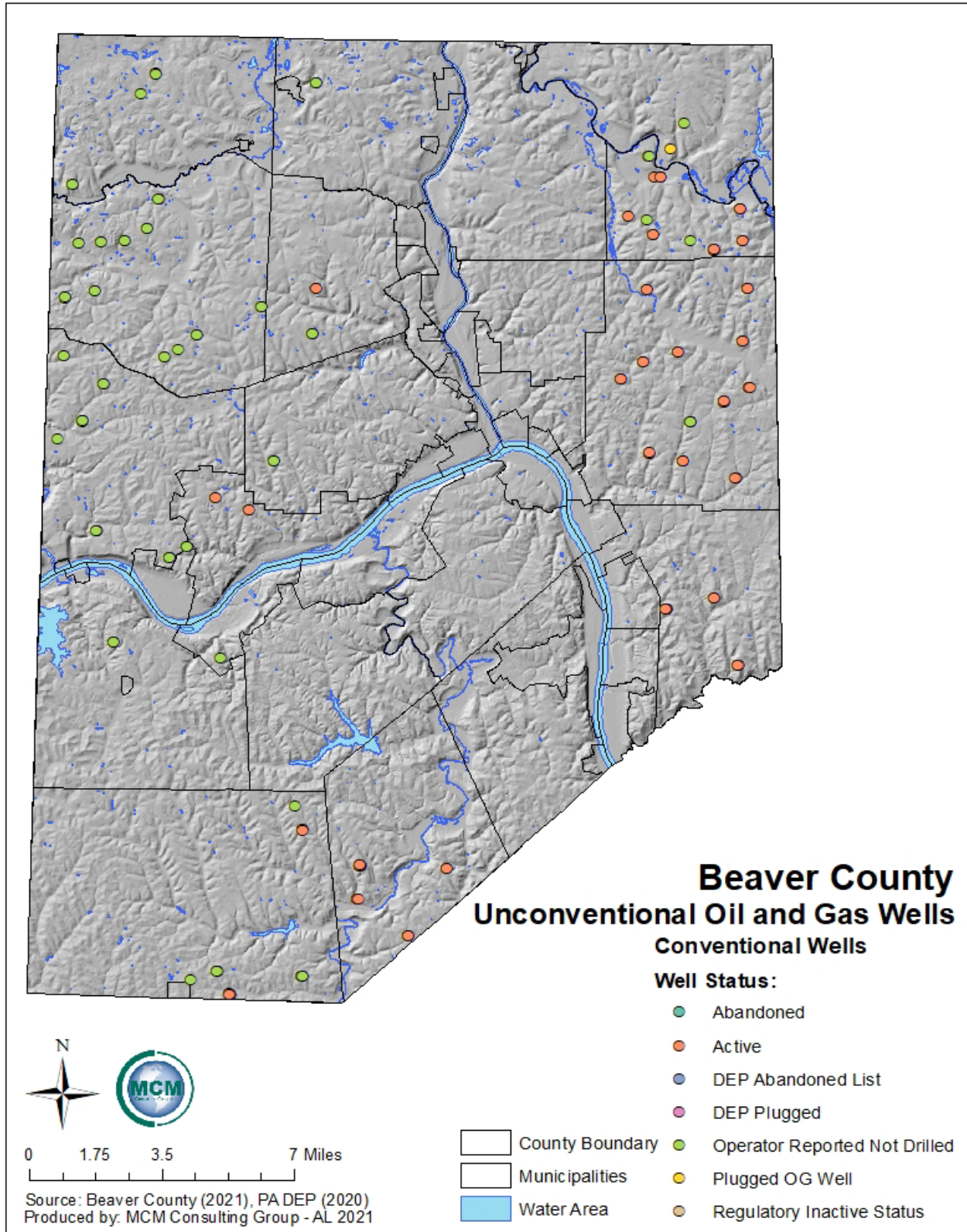
Figure 11 - Pennsylvania Oil and Gas Geology



A series of low-level quakes in 2016 in Lawrence County, just to the north of Beaver County, were linked to hydraulic fracturing. 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 Beaver County have been issued by the Pennsylvania Department of Environmental Protection, and are shown in *Figure 12, Beaver County Unconventional Oil and Gas Wells*.

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Figure 12 - Beaver County Unconventional Oil and Gas Wells



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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 12 - Richter Scale* summarizes Richter Scale magnitudes as they relate to the spatial extent of impacted areas. The Modified Mercalli Intensity Scale (*Table 13 - 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 12 - Richter Scale

Richter Scale	
Richter Magnitude	Earthquake Effects
Less than 3.5	Generally not felt but recorded.
3.5-5.4	Often felt, but rarely causes damage.
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 13 - 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

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Scale	Intensity	Earthquake Effects	Richter Scale Magnitude
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.	<6.9
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

The strongest recorded earthquake in Pennsylvania was a magnitude 5.1 on the Richter Scale, so it could be expected that effects of such an event could be felt in Beaver County from earthquake events that happen around the Commonwealth.

4.3.2.3 Past Occurrence

According to *Figure 13 - Earthquake Epicenters Within 200 Miles of Beaver County* no earthquakes have ever occurred in Beaver County. However, both *Figure 13* and the one at the following hyper-link show earthquake epicenters within close enough proximity to the county to produce some effects in the county:

http://elibrary.dcnr.pa.gov/GetDocument?docId=1751247&DocName=Map69_EQCatalog-Epicenter_Pa

On December 31, 2011, a 4.0 earthquake occurred around Youngstown, Ohio; on August 23, 2011, a 5.9 earthquake occurred in Virginia and in January 2007, a 2.5 earthquake occurred just north of Meadville. Parts of the county experienced some of the shock waves from these minor earthquakes that have occurred around the region. Tremors were also felt from earthquakes in Ontario, Canada on June 23, 2011, and McDonald, Ohio on December 31, 2011. 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 Beaver County 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

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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.

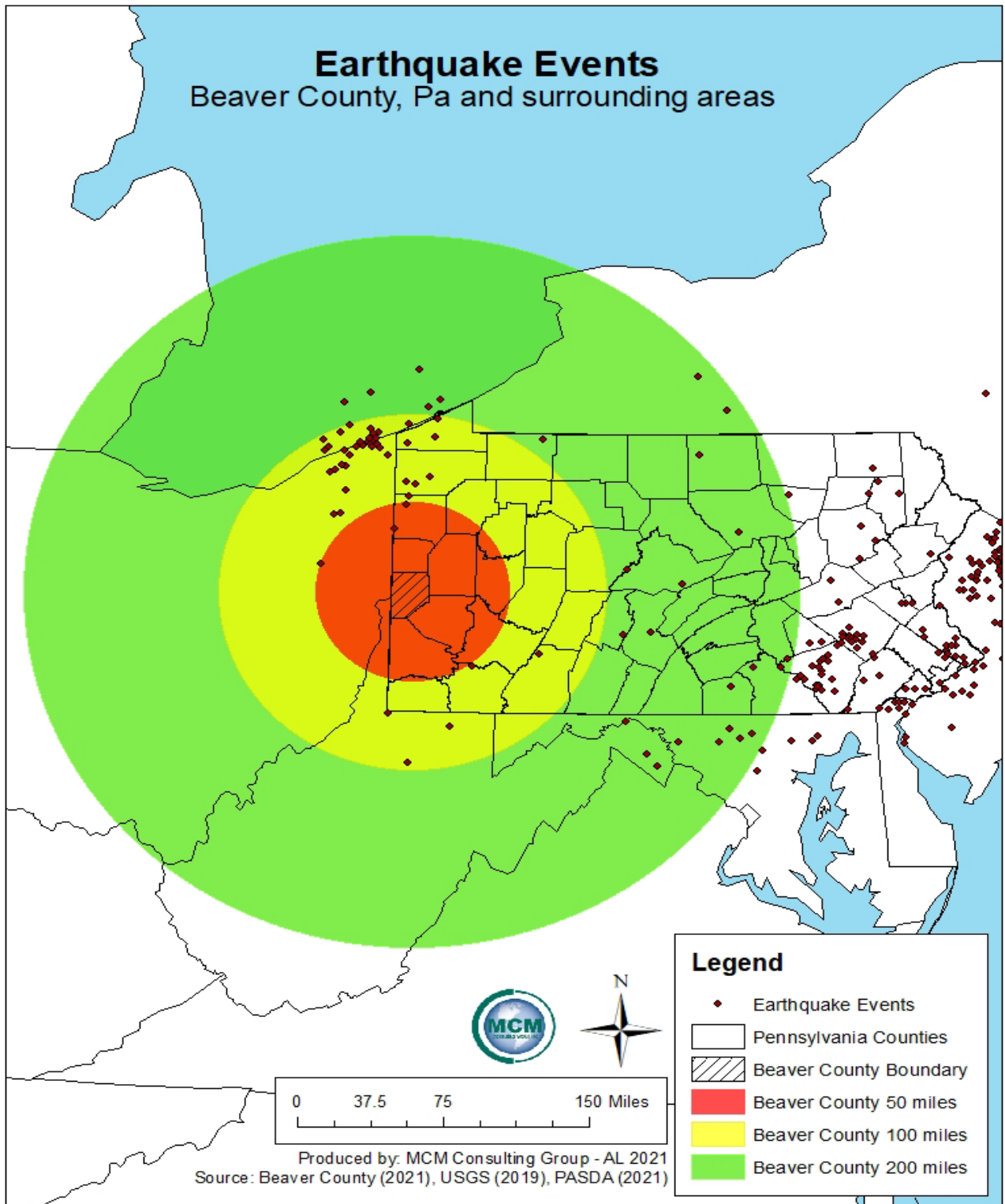
The most likely cause of the wells drying was because of the increase in hydraulic conductivity or "fracking" of shale rock under this area caused by the earthquake. The quake affected the existing faults and created new faults in the shale.

https://en.wikipedia.org/wiki/1998_Pymatuning_earthquake - cite note-:0-3 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 *within* hundreds of miles of Beaver County are shown below at *Figure 13 - Earthquake Epicenters Within 200 Miles of Beaver County*.

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Figure 13 - Earthquake Epicenters Within 200 Miles of Beaver County



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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. *Figure 10 – Earthquake Hazard Zones* shows that Beaver County is in the lowest non-zero hazard zone for earthquake activity according to the USGS (2014), 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 14 - Recent Earthquake Trends in Northeastern United States*). This uptick in seismicity is considered to be 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 kicked around for a lot of years, according to Charles Scharnberger, a retired professor of geology at Millersville University, who monitors the seismic station there. Scharnberger said Pennsylvania earthquakes are more of a mystery but 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 14 - Recent Earthquake Trends in Northeastern United States

Earthquake Trends in Northeastern U.S. (USGS, 2020)	
Year	Number of Magnitude 3+ Earthquakes
2015	0
2016	3
2017	4
2018	0

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Year	Number of Magnitude 3+ Earthquakes
2019	5
2020	3 (as of January 27, 2020)

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 Beaver 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).

The Nuclear Regulatory Commission's estimate of the risk each year of an earthquake intense enough to cause core damage to the reactor at Beaver Valley Power Station was: Reactor 1: 1 in 20,833; Reactor 2: 1 in 45,455.

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 Beaver 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 Beaver 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.

While historically the risk of earthquakes in southwestern Pennsylvania is low (See *Figure 10 – Earthquake Hazard Zones*), the uptick in seismicity due to hydraulic fracturing increases the likelihood of Beaver County experiencing a damaging earthquake. Marcellus shale exploration for natural gas is widespread throughout southwestern Pennsylvania, meaning there has been moderate hydraulic fracturing. Considering the current knowledge of increased seismicity due to hydraulic fracturing, and the recent trends in Pennsylvania, Beaver County could expect to experience magnitude two and larger earthquakes. Increased seismic activity is expected to last even after hydraulic fracturing stops, so the increased seismic risk should be expected to last well into the future. This induced seismicity is dependent on local conditions, and the impacts of hydraulic fracturing on earthquakes is variable geographically (Van der Baan & Calixto, 2017). While seismicity is likely to increase, it is thought that regions that before were relatively inactive seismically will not experience uncharacteristically catastrophic earthquakes due to hydraulic fracturing (Zhao et al., 2018).

4.3.3 Flood, Flash Flood, and Ice Jams

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

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of excessive precipitation. General flooding is typically experienced when precipitation occurs over a given river basin for an extended period. Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often in mountain streams and mountainous regions, and in urban areas where much of the ground is covered by impervious surfaces. Flash floods are the most common type of flooding in Beaver County. The severity of a flood event 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 then 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. 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 the floodplain associated with a flood that has a 0.2% annual 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. Special flood hazard area (SFHA) and base flood elevations (BFE) are developed from the 1% annual chance flood event, as seen in *Figure 14 – Flooding and Floodplain Diagram*. Structures 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 Beaver County local governments. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply to the following high-risk special flood hazard areas in *Table 15 – Flood Hazard High Risk Zones*. Appendix D of this hazard mitigation plan includes a flooding vulnerability map for each municipality in Beaver County with vulnerable structures and functional needs facilities identified using the most current DFIRM data for Beaver County dated 2020.

Most of Beaver County's municipalities are flood prone. Flood problems exist mostly in Franklin, Hopewell, Independence, New Sewickley, and North Sewickley Townships. Flooding has also occurred in multiple boroughs, including Ambridge, Baden, Industry, Koppel, and Monaca boroughs. The City of Aliquippa and the City of Beaver Falls also are prone to flooding because they are located next to flood prone waterways. Flooding has occurred along the Ohio River and its tributaries that run through Beaver County.

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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 functional needs 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, and/or store hazardous materials. A flood could potentially release and transport hazardous materials out of these areas. As the water recedes it would spread the hazardous materials throughout the area. Most flood damage to property and structures located in the floodplain is caused by water exposure to the interior, high velocity water and debris flow.

Figure 14 - Flooding and Floodplain Diagram

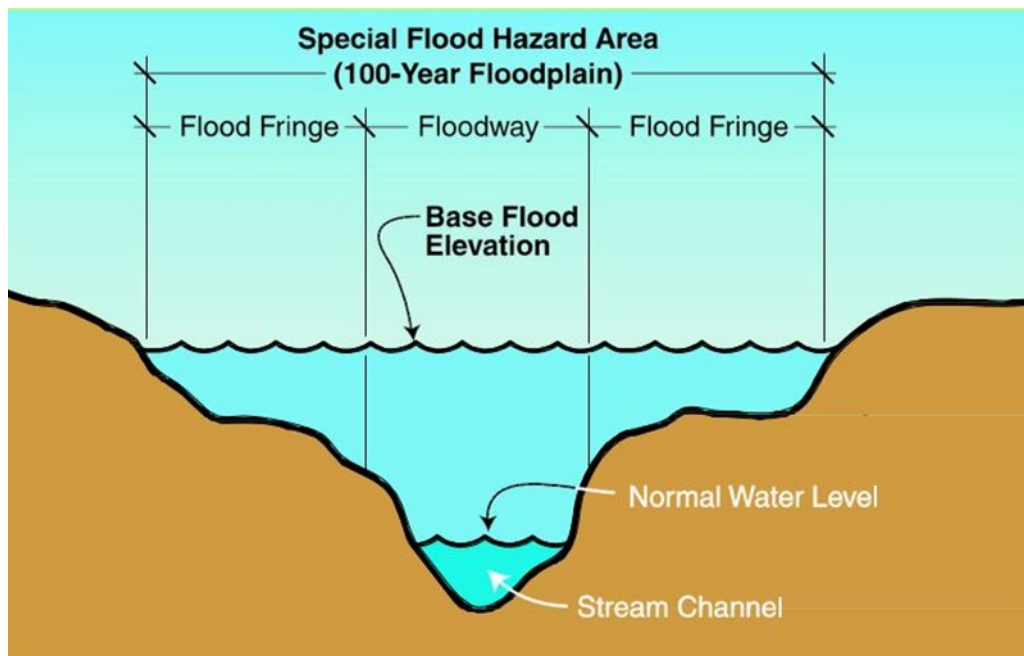


Table 15 - Flood Hazard High Risk Zones

Flood Hazard High Risk Zones (FEMA, 2017)	
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.

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Zone	Description
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.

4.3.3.2 Range of Magnitude

The Ohio River Basin has caused significant flooding in Beaver County, specifically on the following rivers and their tributaries:

- Ohio River:
 - Beaver River
 - Raccoon Creek

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

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

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Flash floods can occur very quickly and with little warning. Flash floods can also be deadly because of the rapid rises in water levels and devastating flow velocities. The more developed areas in the county can be especially susceptible to flash floods because of the significant presence of impervious surfaces, such as streets, sidewalks, parking lots, and driveways.

Severe flooding also comes with many secondary effects that could have long lasting impacts on the population, economy and infrastructure of Beaver 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. Critical infrastructure, such as sewage and water treatment facilities, can cause sewage systems to fail and overflow, contaminating 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 Beaver County is estimated by looking at the potential loss data and repetitive loss data, both analyzed in the risk assessment portion 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 losses is typically done with FEMA’s HAZUS software. A level two HAZUS scenario was performed for the entirety of Beaver County and there were no failed reaches within the scenario. Beaver County has a large portion of streams and rivers that can lead to flood inundation. The FEMA 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 16 – 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 17 – HAZUS Business Interruption Economic Loss Figures*. *Figure 15 – Loss by Occupancy Type* illustrates the breakdown of economic loss by either residential, commercial, industrial, or other. The information displayed in *Table 16 – HAZUS Building Economic Loss Figures* and in *Table 17 – HAZUS Business Interruption Economic Loss Figures* indicates a significant impact to Beaver County in terms of flood risk. This is also reflected on *Table 65 – Risk Factor Assessment* found on page 222 which also indicates that flooding is a high risk to Beaver County residents.

Table 16 - HAZUS Building Economic Loss Figures

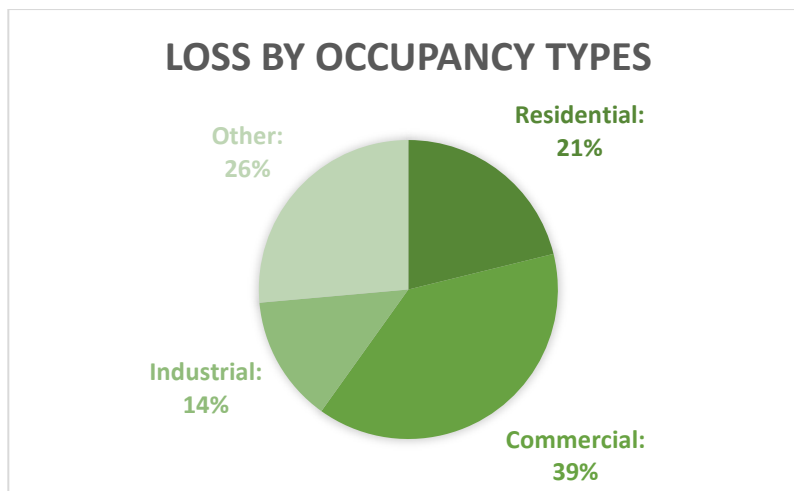
HAZUS Building Economic Loss Figures (HAZUS 2021)					
	Residential	Commercial	Industrial	Other	Total:
Building:	\$55,980,000	\$24,310,000	\$16,530,000	\$5,490,000	\$102,310,000
Content:	\$26,970,000	\$62,130,000	\$40,050,000	\$24,480,000	\$153,630,000
Inventory:	\$0	\$1,680,000	\$6,620,000	\$30,000	\$8,330,000
Subtotal:	\$82,950,000	\$88,120,000	\$63,200,000	\$ 30,000,000	\$264,270,000

Table 17 - HAZUS Business Interruption Economic Loss Figures

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HAZUS Business Interruption Economic Loss Figures (HAZUS 2021)					
	Residential	Commercial	Industrial	Other	Total:
Income:	\$400,000	\$40,560,000	\$1,400,000	\$8,540,000	\$50,900,000
	Residential	Commercial	Industrial	Other	Total:
Relocation:	\$14,960,000	\$9,710,000	\$1,110,000	\$4,410,000	\$30,190,000
Rental Income:	\$5,570,000	\$7,100,000	\$290,000	\$460,000	\$13,420,000
Wage:	\$960,000	\$46,320,000	\$1,560,000	\$87,710,000	\$136,550,000
Subtotal:	\$21,890,000	\$103,690,000	\$4,360,000	\$101,120,000	\$231,060,000

Figure 15 - Loss by Occupancy Type



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 sediment which improves 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 can contaminate habitats after flood events.

4.3.3.3 Past Occurrence

Beaver County has experienced numerous flooding, flash flooding and ice jam flooding events in the past. The flooding and flash flooding were caused by a variety of heavy storms, tropical storms, and other issues. A summary of flood event history for Beaver County from January 1996 to March 2020 is found in *Table 18 – Past Flood and Flash Flood Events*. Details of each event can be found in NOAA’s National Center for Environmental Information (NCEI) database.

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Table 18 - Past Flood and Flash Flood Events

Past Flood and Flash Flood Events (NCEI NOAA)			
Event Location	Event Date	Event Type	Property Damage Estimates
Beaver County (entire county)	01/19/1996	Flood	\$9,600,000*
Beaver Falls Borough	01/19/1996	Flash Flood	\$0*
New Sewickley Township	03/19/1996	Flash Flood	\$0*
Beaver County (entire county)	03/20/1996	Flood	\$6,000*
Beaver Borough	03/20/1996	Flash Flood	\$0*
City of Aliquippa	05/17/1996	Flash Flood	\$8,000*
Freedom Borough	06/19/1996	Flash Flood	\$7,500,000*
Monaca Borough	06/24/1996	Flash Flood	\$0*
Beaver County (entire county)	01/08/1998	Flash Flood	\$0*
Beaver County (entire county)	01/09/1998	Flash Flood	\$0*
City of Aliquippa	06/02/1998	Flash Flood	\$0*
City of Aliquippa	06/02/1998	Flash Flood	\$0*
Beaver County (entire county)	04/09/1999	Flash Flood	\$50,000*
Ambridge Borough	07/28/2000	Flash Flood	\$5,000*
Monaca Borough	08/12/2002	Flash Flood	\$15,000*
North Sewickley Township	08/12/2002	Flash Flood	\$5,000*
Beaver County (entire county)	01/01/2003	Flood	\$0*
Monaca Borough	05/10/2003	Flash Flood	\$0*
Hanover Township	07/08/2003	Flash Flood	\$1,000*
Monaca Borough	08/09/2003	Flash Flood	\$40,000*
Franklin Township	09/09/2003	Flash Flood	\$5,000*
Rochester Borough	11/19/2003	Flash Flood	\$0*
Ambridge Borough	11/19/2003	Flash Flood	\$0*

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Event Location	Event Date	Event Type	Property Damage Estimates
Beaver County (entire county)	01/04/2004	Flood	\$0*
Beaver County (entire county)	01/04/2004	Flood	\$0*
Beaver County (entire county)	02/03/2004	Flood	\$0*
Beaver County (entire county)	02/06/2004	Flood	\$10,000*
Beaver County (entire county)	05/22/2004	Flood	\$3,000,000*
City of Beaver Falls	06/15/2004	Flash Flood	\$0*
Beaver County (entire county)	08/21/2004	Flood	\$0*
Beaver County (entire county)	09/08/2004	Flood	\$4,000,000*
Beaver County (entire county)	09/17/2004	Flood	\$4,000,000*
Beaver County (entire county)	01/05/2005	Flood	\$300,000*
Rochester Borough	09/14/2006	Flood	\$10,000*
North Sewickley Township	03/02/2007	Flood	\$0*
Beaver Borough	03/15/2007	Flood	\$0*
City of Aliquippa	07/05/2007	Flood	\$10,000,000*
Industry Borough	07/05/2007	Flash Flood	\$5,000*
City of Aliquippa	08/09/2007	Flash Flood	\$25,000*
Franklin Township	08/20/2007	Flash Flood	\$75,000*
Koppel Borough	08/20/2007	Flash Flood	\$75,000*
Franklin Township	02/05/2008	Flood	\$10,000*
City of Aliquippa	06/17/2009	Flash Flood	\$100,000*
Independence Township	06/17/2009	Flash Flood	\$50,000*
South Heights Borough	06/17/2009	Flash Flood	\$50,000*
Economy Borough	05/31/2010	Flood	\$75,000*
Economy Borough	06/01/2010	Flood	\$35,000*

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Event Location	Event Date	Event Type	Property Damage Estimates
Hookstown Borough	06/02/2010	Flood	\$25,000*
New Sewickley Township	07/09/2010	Flash Flood	\$5,000*
Hopewell Township	08/19/2011	Flash Flood	\$100,000*
Bridgewater Borough	08/19/2011	Flash Flood	\$100,000*
North Sewickley Township	12/01/2010	Flood	\$100,000*
Franklin Township	12/01/2010	Flood	\$50,000*
Franklin Township	02/28/2011	Flood	\$25,000*
Rochester Borough	02/28/2011	Flood	\$25,000*
Darlington Borough	03/10/2011	Flood	\$8,000*
South Heights Borough	07/18/2011	Flood	\$30,000
Conway Borough	08/19/2011	Flood	\$50,000*
City of Aliquippa	08/19/2011	Flood	\$75,000*
Beaver Borough	08/19/2011	Flood	\$20,000*
Ambridge Borough	08/19/2011	Flood	\$25,000*
City of Aliquippa	08/19/2011	Flood	\$25,000*
City of Beaver Falls	08/19/2011	Flood	\$75,000*
Davidson Heights	08/19/2011	Flood	\$75,000*
West Mayfield Borough	09/26/2011	Flood	\$25,000*
Potter Township	09/26/2011	Flood	\$5,000*
Hopewell Township	05/07/2012	Flood	\$25,000*
City of Aliquippa	09/01/2012	Flash Flood	\$25,000*
Hopewell Township	09/01/2012	Flash Flood	\$50,000*
Ambridge Borough	09/01/2012	Flash Flood	\$15,000*
Baden Borough	06/25/2013	Flood	\$1,000*
City of Aliquippa	06/25/2013	Flood	\$2,000*
Hanover Township	07/10/2013	Flash Flood	\$25,000*
Independence Township	07/10/2013	Flash Flood	\$25,000*
City of Aliquippa	07/10/2013	Flash Flood	\$50,000*
Independence Township	02/21/2014	Flood	\$0*

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Event Location	Event Date	Event Type	Property Damage Estimates
West Mayfield Borough	03/14/2015	Flood	\$0*
Fallston Borough	05/31/2015	Flood	\$0*
Darlington Borough	06/15/2015	Flash Flood	\$50,000*
City of Beaver Falls	06/15/2015	Flash Flood	\$25,000*
New Galilee Borough	06/15/2015	Flash Flood	\$15,000*
City of Aliquippa	09/09/2015	Flash Flood	\$0*
City of Aliquippa	06/03/2016	Flash Flood	\$5,000*
Ambridge Borough	06/03/2016	Flash Flood	\$5,000*
South Heights Borough	06/16/2016	Flash Flood	\$2,000*
Hopewell Township	07/06/2017	Flash Flood	\$0*
Hopewell Township	07/28/2017	Flash Flood	\$10,000*
City of Aliquippa	07/28/2017	Flash Flood	\$0*
West Mayfield Borough	11/06/2017	Flood	\$0*
Franklin Township	01/12/2018	Flood	\$0*
Industry Borough	02/15/2018	Flood	\$0*
Bridgewater Borough	09/09/2018	Flood	\$5,000*
City of Beaver Falls	09/09/2018	Flood	\$1,000*
Darlington Township	09/09/2018	Flood	\$1,000*
New Sewickley Township	09/09/2018	Flood	\$15,000*
Beaver Borough	09/09/2018	Flood	\$5,000*
Independence Township	09/09/2018	Flood	\$5,000*
North Sewickley Township	09/09/2018	Flood	\$5,000*
North Sewickley Township	09/10/2018	Flood	\$5,000*
New Brighton Borough	09/10/2018	Flood	\$1,000*
New Galilee Borough	09/10/2018	Flood	\$1,000*

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Event Location	Event Date	Event Type	Property Damage Estimates
Franklin Township	09/10/2018	Flood	\$1,000*
Bridgewater Borough	05/28/2019	Flash Flood	\$1,000*
New Sewickley Township	05/28/2019	Flash Flood	\$0*
City of Aliquippa	05/29/2019	Flash Flood	\$1,000*
City of Aliquippa	05/29/2019	Flash Flood	\$1,000*
North Sewickley Township	05/29/2019	Flood	\$1,000,000*
Independence Township	07/11/2019	Flash Flood	\$5,000*
South Heights Borough	07/11/2019	Flash Flood	\$5,000*
Hanover Township	07/11/2019	Flash Flood	\$5,000*
South Heights Borough	09/01/2019	Flash Flood	\$500*
Darlington Borough	03/20/2020	Flood	\$50,000*
Hopewell Township	03/28/2020	Flash Flood	\$25,000*
City of Aliquippa	03/28/2020	Flash Flood	\$10,000*
* All damages are estimates and not based on in field estimations		<u>Total:</u>	\$41,376,500*

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 the 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 19 – Repetitive Loss Properties* illustrates the communities that have repetitive loss properties, the total building payments, the contents payments, and the number of losses and properties.

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. There are 287 repetitive loss properties in Beaver County. *Table 21 - Severe Repetitive Loss Properties* illustrates the communities within Beaver County that have severe

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repetitive loss properties, the total building payments, the contents payments and the number of losses and properties. The data used in the table is based on data from PEMA from 2017.

Most municipalities in Beaver County participate in the NFIP. Information on each participating municipality can be found in *Table 22 – Municipal NFIP Policies & Vulnerability*.

Table 19 - Repetitive Loss Properties

Repetitive Loss Properties (PEMA 2018)						
Community Name	Number	Payments	Payments	Payments	Losses	NFIP Policies as of February 10, 2021
City of Aliquippa	420101	548,345.35	31,600.66	579946.01	23	9
Bridgewater Borough	420106	658,886.55	325,174.42	984,060.97	23	6
Brighton Township	422309	3,237.57	0	3,237.57	2	1
Darlington Township	422312	63,048.78	4,652.43	67,701.21	6	4
Economy Borough	420109	37,887.09	8,994.70	46,881.79	2	2
Ellwood City Borough	420567	525,213.62	12,007.56	537,221.18	28	4
Fallston Borough	420110	10,255.66	77,117.32	87,372.98	2	1
Franklin Township	421065	1,494,217.72	389,270.41	1,883,488.13	90	32
Hopewell Township	421321	76,647.51	21,392.98	98,040.49	4	2
Independence Township	421323	70,963.63	0	70,963.63	2	1
Industry Borough	420113	8,414.59	0	8,414.59	2	1
Marion Township	422249	219,428.88	96,945.89	316,374.77	22	7
Midland Borough	422321	24,011.03	493.99	24,505.02	2	1
Monaca Borough	420114	15,353.19	4,744.89	20,098.08	2	1

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Community Name	Number	Payments	Payments	Payments	Losses	NFIP Policies as of February 10, 2021
New Brighton Borough	420115	126,239.65	13,686.25	139,925.90	9	3
New Galilee Borough	422322	14,639.61	0	14,639.61	2	1
North Sewickley Township	421161	580,451.80	166,782.45	747,234.25	30	21
Rochester Township	421322	17,900.00	3,224.61	21,124.61	3	1
South Beaver Township	422329	46,143.68	0	46,143.68	3	1

Table 20 - Summary 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
City of Aliquippa	2	0	4	0	3
Bridgewater Borough	2	0	3	1	0
Brighton Township	0	0	1	0	0
Darlington Township	0	0	4	0	0
Economy Borough	0	0	2	0	0
Ellwood City Borough	0	0	4	0	0
Fallston Borough	1	0	0	0	0
Franklin Township	1	0	31	0	0
Hopewell Township	2	0	0	0	0
Independence Borough	0	0	1	0	0
Industry Borough	1	0	0	0	0
Marion Township	0	0	7	0	0
Midland Borough	1	0	0	0	0
Monaca Borough	0	0	0	0	1
New Brighton Borough	1	0	2	0	0
New Galilee Borough	0	1	0	0	0
North Sewickley Township	0	0	21	0	0

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Municipality	Type				
	Non-Residential	2-4 Family	Single Family	Condo	Other Residential
Rochester Township	0	0	1	0	0
South Beaver Township	0	0	1	0	0

Table 21 - Severe Repetitive Loss Properties

Severe Repetitive Loss Properties (PEMA 2018)						
Community Name	Number	Payments	Payments	Payments	Payment	Losses
Franklin Township	421065	78,748.35	23,497.12	102,245.47	20,449.09	5
Marion Township	422249	40,809.04	27,673.73	68,482.77	13,696.55	5

Table 22 - Municipal NFIP Policies & Vulnerability

Municipal NFIP Policies and Vulnerability (PEMA, 2018)					
Community Name	Comm. Num.	Contract Count	Policy Count	Total Coverage	Premium and Policy Fee
Ambridge Borough	420102	3	3	\$2,369,000.00	\$62,787.00
Baden Borough	420103	3	3	\$648,000.00	\$2,695.00
Beaver Borough	420104	5	5	\$981,000.00	\$4,711.00
Beaver Falls, City of	420105	35	35	\$5,203,300.00	\$57,808.00
Big Beaver Borough	422307	8	8	\$985,600.00	\$7,313.00
Bridgewater Borough	420106	52	82	\$14,354,100.00	\$89,623.00
Brighton Township	422309	5	5	\$910,500.00	\$5,323.00
Center Township	422310	12	12	\$2,777,200.00	\$7,250.00
Chippewa Township	422311	8	8	\$1,379,200.00	\$4,721.00
Conway Borough	420107	1	1	\$210,000	\$378
Darlington Township	422312	25	25	\$3,392,400.00	\$15,688.00
Daugherty Township	422313	2	2	\$228,300.00	\$3,822.00
East Rochester Borough	420108	1	1	\$26,600.00	\$381.00

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Municipal NFIP Policies and Vulnerability (PEMA, 2018)					
Community Name	Comm. Num.	Contract Count	Policy Count	Total Coverage	Premium and Policy Fee
Economy Borough	420109	13	13	\$2,831,900.00	\$15,783.00
Ellwood City Borough (Shared with Lawrence County)	420567	6	6	\$828,000.00	\$2,346.00
Fallston Borough	420110	2	2	\$1,234,600.00	\$15,818.00
Freedom Borough	420111	2	2	\$505,000.00	\$1,376.00
Greene Township	422317	2	2	\$392,000.00	\$622.00
Industry Borough	420113	2	2	\$392,000.00	\$1,344.00
Midland Borough	422321	1	1	\$70,000.00	\$275.00
Monaca Borough	420114	1	1	\$350,000.00	\$446.00
New Brighton Borough	420115	6	6	\$1,045,500.00	\$23,914.00
New Galilee Borough	422322	1	1	\$84,000.00	\$1,188.00
New Sewickley Township	422323	6	6	\$758,200.00	\$3,850.00
North Sewickley Township	421161	32	32	\$4,675,200.00	\$37,602.00
Ohioville Borough	422324	1	1	\$350,000.00	\$446.00
Potter Township	421467	4	4	\$991,000.00	\$3,625.00
Pulaski Township	421798	4	4	\$430,000.00	\$4,826.00
Raccoon Township	421220	1	1	\$210,000.00	\$499.00
Rochester Borough	420116	1	1	\$93,700.00	\$355.00
Rochester Township	421322	5	5	\$1,574,800.00	\$13,379.00
South Beaver Township	422329	1	1	\$234,900.00	\$4,933.00

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Municipal NFIP Policies and Vulnerability (PEMA, 2018)					
Community Name	Comm. Num.	Contract Count	Policy Count	Total Coverage	Premium and Policy Fee
Vanport Township	421320	4	4	\$1,609,600.00	\$43,936.00
West Mayfield Borough	422331	2	2	\$411,700.00	\$2,784.00
Totals:		257	287	\$52,308,700.00	\$429,601.00

4.3.3.4 Future Occurrence

Flooding is a frequent problem throughout the Commonwealth of Pennsylvania. Beaver County will certainly be impacted by flooding events in the future, as Beaver 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 or 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 rate maps (DFIRMs) are used to identify areas subject to the 1% annual chance 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 is the area that 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. It simply designates the probability of a flood of this magnitude every year. Further away from this area is the fifty-year flood plan. 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 23 – Flood Probability Summary*.

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Table 23 - Flood Probability Summary

Flood Probability Summary (FEMA)	
Flood Recurrence Intervals	Annual Chance of Occurrence
10-year	10.00%
50-year	2.00%
100-year	1.00%
500-year	0.20%

4.3.3.5 Vulnerability Assessment

River and Stream Flooding:

Beaver County is vulnerable to flooding events. Flooding puts the entire population at some level of risk, whether through flooding of homes, businesses, places of employment, or the road, sewer and water infrastructure. Flooding can cause significant power outages and poor road conditions that can lead to heightened transportation accident risk.

Table 22 – Municipal NFIP Policies and Vulnerability identifies how many structures are located in the special flood hazard area by municipality using local GIS data. Functional needs 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 leaks or equipment failure. Appendix D of this hazard mitigation plan includes a flooding vulnerability map for each municipality in Beaver County with vulnerable structures, functional needs facilities that are located within the special flood hazard area. There is one critical infrastructure facility that is located within the Special Flood Hazard Area and that is located in Bridgewater Borough.

While the regulatory one-hundred-year floodplain as defined by the NFIP and FEMA is a useful tool to estimate flooding vulnerability, it is important to note that it is not always completely accurate.

Flash Flooding:

Flash flooding is a common occurrence in Beaver 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 with Beaver 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 18 - Past Flood and Flash Flood Events* above.

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

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- City of Aliquippa
- Ambridge Borough
- Bridgewater Borough
- Industry Borough
- North Sewickley Township

Although the above locations were identified as vulnerable areas within Beaver County, they are not the only locations that are vulnerable to flash flooding. The Beaver County Hazard Mitigation Team will continue to work with municipalities to identify vulnerable flash flooding locations and identify vulnerable functional needs population and critical facilities.

Ice Jam Flooding:

Ice jam flooding has affected Beaver County in the past. Areas along the Ohio River, Beaver River, and Raccoon Creek are the most vulnerable. The affected areas would see an increase in erosion to riverbanks and loss of vulnerable land.

The Beaver County Hazard Mitigation Team will continue to work with municipalities to identify vulnerable ice jam flooding locations and identify vulnerable functional needs population and facilities.

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. The environment, the economy, and even human health can be impacted by an invasive species. Often, an invasive species spreads and reproduces quickly. They are not limited to organisms that come from a foreign country; invasive species can come from a different region in the United States. However, the main occurrence of invasive species is due to 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

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- 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.

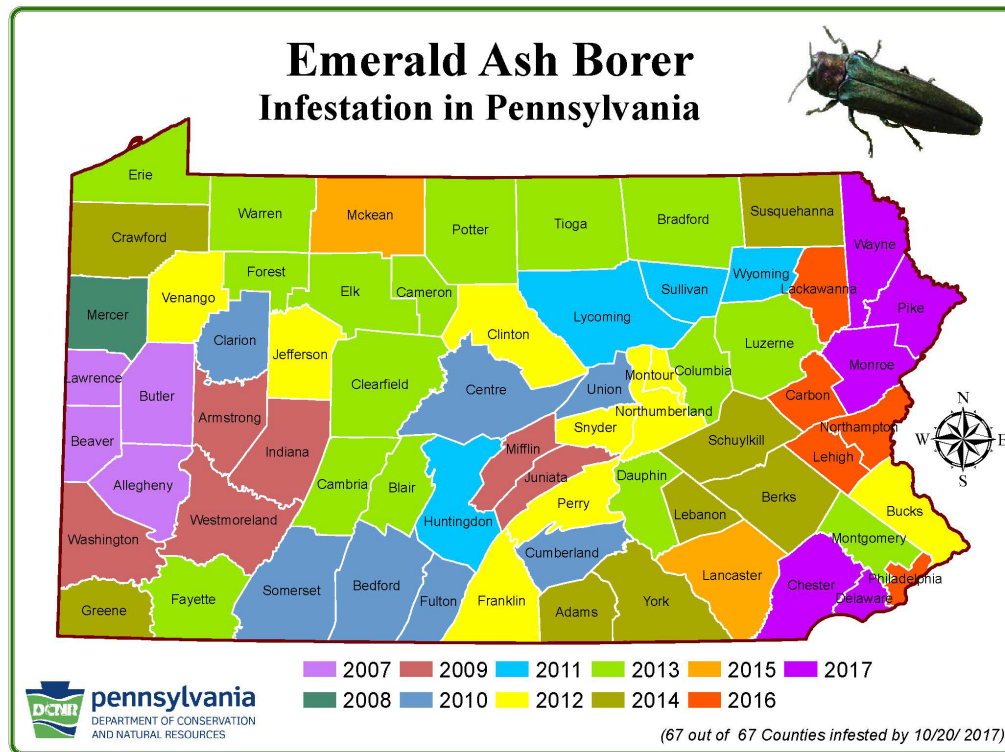
The location and extent of invasive threats is dependent on the preferred habitat of the species, as well as the species' ease of movement and establishment. For example, kudzu vine is an aggressive vascular plant. With wide ecological parameters and ease of spread, the vine is a more widespread invasive species threat. Other species' spread has been limited by state agency activity, like the spotted lanternfly. First discovered in Berks County in 2014, this Asian plant hopper was placed under a quarantine by the Pennsylvania Department of Agriculture in thirteen counties, which later had an effect on Beaver County. *Table 24 - Prevalent Invasive Species* lists invasive species that have been found in Beaver 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 for 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 is the success of the Emerald Ash Borer in Beaver County and the surrounding region. The Emerald Ash Borer has already become established in Beaver County (see *Figure 16 - Emerald Ash Borer Infestation in Pennsylvania*) and the surrounding region, and there is a high mortality rate for trees associated with this pest.

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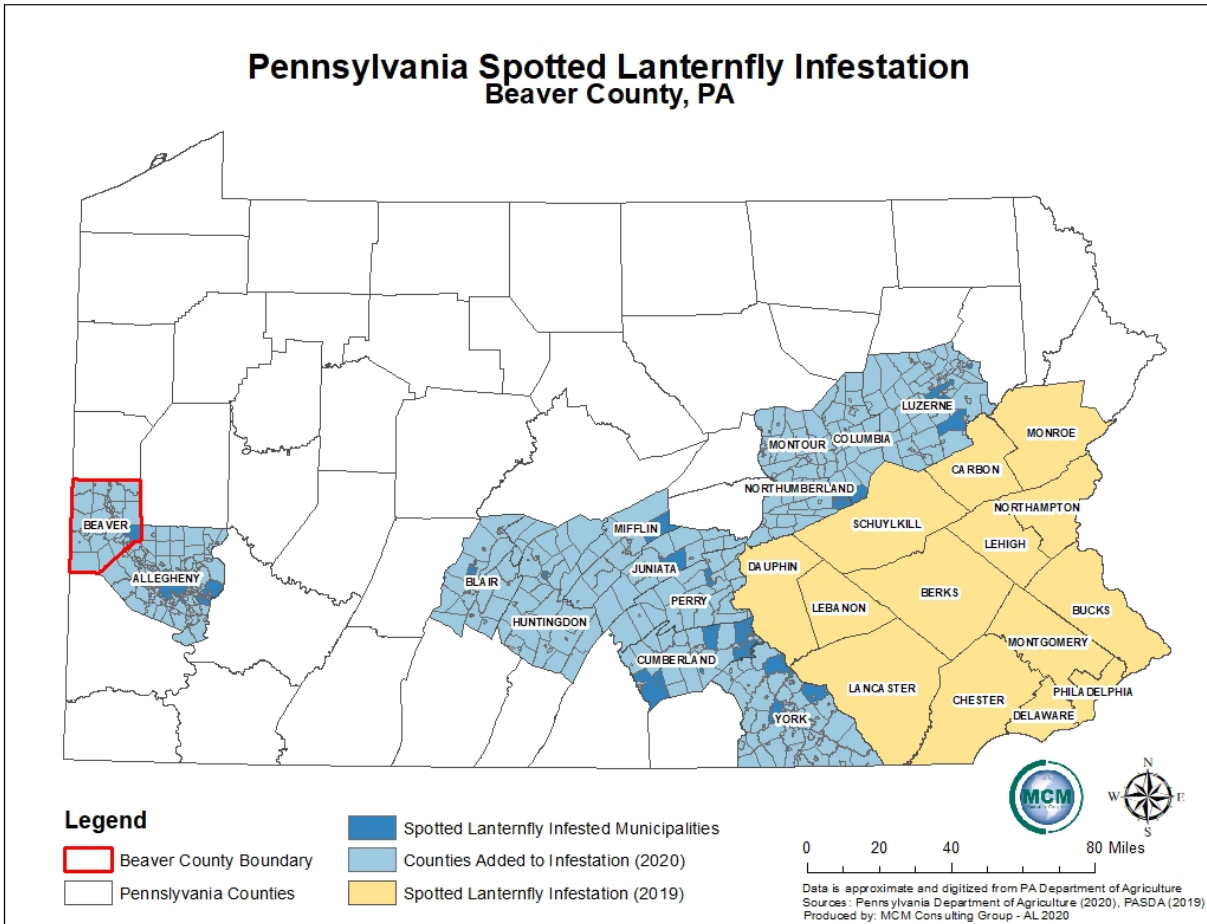
Figure 16 - Emerald Ash Borer Infestation in Pennsylvania



Another example of a negative 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 was probably introduced into the northeastern United States in the 1950s and it was first discovered in Pennsylvania in 1967. This insect has been damaging hemlock ever since and it is spreading. To date, sixty-four counties in Pennsylvania, including Beaver County, have been infested with this insect. See *Figure 17 - Hemlock Woolly Adelgid Infestation in Pennsylvania*. 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).

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Figure 18 - 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. Beaver County has a total of twenty-nine different natural heritage areas in which invasive species thrive. Within the twenty-nine natural heritage areas, one is ranked of global significance, six with regional significance, and twenty-two with state significance. Within Beaver County, the greatest number of invasive species found are more aquatic related due to the great number of wetlands and waterways that are in the county. The main waterway where the greatest number of invasive species have been found in past events is the Ohio River in Beaver County, which is considered to be a global significance. There are many invasive aquatic species that

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have been widespread in Beaver County that are common problems throughout the Commonwealth, some of the most problematic include:

- Common Carp
- Asiatic Clam
- Goldfish
- Zebra Mussel

Along with invasive aquatic species, a great number of other invasive species are common problems within Beaver County. The additional problematic invasive species include plants and insects. The main forest area where the greatest number of invasive species have been found in past events is Raccoon Creek State Park in Beaver County, which is considered to be a regional significance. Other common problematic invasive species in Beaver County include:

- Spotted Lanternfly
- Emerald Ash Borer
- Hemlock Woolly Adelgid
- Tree-of-Heaven

Since the past, many of the extreme problematic species have been around for many years. However, the most recent problematic species are the Emerald Ash Borer, Hemlock Woolly Adelgid, and the Spotted Lanternfly. In 2007, both the Emerald Ash Borer and Hemlock Woolly Adelgid were both newly spotted species that caused extreme damage. Even more recently than 2007, the Spotted Lanternfly appeared in Beaver County. In 2014, this invasive species welcomed itself to Pennsylvania, however, it was not until 2020 that Beaver County had entered the quarantine zone for the Spotted Lanternfly, making the overall total twenty-six counties in this zone.

Table 24 - Prevalent Invasive Species lists problematic non-native species that are established in Beaver County. While all species listed here are not native to Beaver County, those species highlighted in red are considered to pose a severe ecological threat than some of the others (Rank 1), species highlighted in orange are considered to pose a significant ecological threat but not considered to spread as easily and aggressively (Rank 2), and species highlighted in green are considered to pose a lesser ecological threat (Rank 3).

Table 24 - Prevalent Invasive Species

Prevalent Invasive Species (EDDMaps, 2020; iMapInvasives, 2020; PA DCNR, 2019)		
Scientific Name	Common Name	Type
Corbicula fluminea	Asiatic Clam	Animal
Lonicera spp	Bush Honeysuckle	Plant
Cirsium vulgare	Bull Thistle	Plant
Cirsium arvense	Canada Thistle	Plant
Cyprinus carpio	Common Carp	Animal

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Scientific Name	Common Name	Type
<i>Phragmites australis</i> ssp. <i>australis</i>	Common Reed	Plant
<i>Tanacetum vulgare</i>	Common Tansy	Plant
<i>Agrilus planipennis</i>	Emerald Ash Borer	Insect
<i>Alliaria petiolata</i>	Garlic Mustard	Plant
<i>Lymantria dispar</i>	Gypsy Moth	Insect
<i>Adelges tsugae</i>	Hemlock Woolly Adelgid	Insect
<i>Berberis thunbergii</i>	Japanese Barberry	Plant
<i>Lonicera japonica</i>	Japanese Honeysuckle	Plant
<i>Polygonum cuspidatum</i>	Japanese Knotweed	Plant
<i>Microstegium vimineum</i>	Japanese Stiltgrass	Plant
<i>Lonicera morrowii</i>	Morrow's Honeysuckle	Plant
<i>Rosa multiflora</i>	Multiflora Rose	Plant
<i>Celastrus orbiculata</i>	Oriental Bittersweet	Plant
<i>Lythrum salicaria</i>	Purple Loosestrife	Plant
<i>Lycroma delicatula</i>	Spotted Lanternfly (<i>Lycorma</i>)	Insect
<i>Lonicera tatarica</i>	Tatarian Honeysuckle	Plant
<i>Ailanthus altissima</i>	Tree-of-Heaven	Plant
<i>Elaeagnus umbellata</i>	Autumn Olive	Plant
<i>Cryptococcus fagisuga</i>	Beech Bark Disease	Disease
<i>Tussilago farfara</i>	Colt's-foot	Plant
<i>Potamogeton crispus</i> L.	Curly-leaved Pondweed	Plant
<i>Plantago lanceolata</i>	English Plantain	Plant
<i>Popillia japonica</i>	Japanese Beetle	Insect
<i>Poa pratensis</i>	Kentucky Bluegrass	Plant
<i>Choristoneura conflictana</i>	Large Aspen Tortrix	Insect
<i>Ceratocystis fagacearum</i>	Oak Wilt	Disease
<i>Polygonum caespitosum</i>	Oriental Lady's-thumb	Plant
<i>Phalaris arundinacea</i>	Reed Canary Grass	Plant
Emaravirus RRD	Rose Rosette Disease (RRD)	Disease
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass	Plant
<i>Myosotis scorpioides</i>	True Forget-me-not	Plant
<i>Cronartium ribicola</i>	White Pine Blister Rust	Disease
<i>Dreissena polymorpha</i>	Zebra Mussel	Animal
<i>Lithobates catesbeianus</i>	American Bullfrog	Animal
<i>Brassica nigra</i>	Black Mustard	Plant
<i>Halyomorpha halys</i>	Brown Marmorated Stink Bug	Insect

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Scientific Name	Common Name	Type
Ophiognomonium clavignenti-juglandacearum	Butternut Canker	Disease
Cryphonectria parasitica	Chestnut Blight or Canker	Disease
Solanum dulcamara	Climbing Nightshade	Plant
Veronica officinalis	Common Speedwell	Plant
Hypericum perforatum	Common St. John's-wort	Plant
Holcus lanatus	Common Velvetgrass	Plant
Achillea millefolium	Common Yarrow	Plant
Discula destructiva	Dogwood Anthracnose	Disease
Convallaria majalis	European Lily-of-the-valley	Plant
Reynoutria sachalinensis F. Schmidt ex Maxim	Giant Knotweed	Plant
Sorghum halepense	Johnsongrass	Plant
Arctium minus	Lesser Burdock	Plant
Vinca minor	Lesser Periwinkle	Plant
Artemisia vulgaris	Mugwort	Plant
Hieracium aurantiacum	Orange Hawkweed	Plant
Celastrus orbiculatus	Oriental Bittersweet	Plant
Mentha x piperita	Peppermint	Plant
Rumex acetosella	Sheep Sorrel	Plant
Cardamine impatiens	Touch-me-not Bittercress	Plant
Rorippa nasturtium-aquaticum	Watercress	Plant

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 unknown 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

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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 Beaver County but have not yet been detected inside the county (see *Table 25 - 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 much more difficult to eradicate it from an ecosystem meaning prevention is very important. The species that are labeled in red are listed as a Rank 1 species, which indicates a severe ecological threat to the environment. Therefore, Asian Long-Horned Beetle, Eurasian Watermilfoil, European Water Chestnut, Glossy Buckhorn, Goatsrue, Japanese Hops, Kudzu, and Mile-A-Minute Vine are all widespread and highly problematic in nearby counties but have not been reported in Beaver County (as shown highlighted in red in *Table 25 – Vulnerable Species*). The development of appropriate plans will assist the county in reducing the possibility of a future encounter with any of these species. It would be beneficial to the forests of Beaver County to work toward keeping these species out of the area.

Table 25 - Vulnerable Species

Vulnerable Species (EDDMaps, 2020; PA DCNR, 2019; iMapInvasives, 2020)		
Scientific Name	Common Name	Type
Dryocosmus kuriphilus	Asian Chestnut Gall Wasp	Insect
Anoplophora glabripennis	Asian Long Horned Beetle	Insect
Scolytus schevyrewi	Banded Elm Bark Beetle	Insect
Otiorhynchus sulcatus	Black Vine Weevil	Insect
Bromus tectorum L.	Cheatgrass	Plant
Cipangopaludina chinensis	Chinese Mysterysnail	Animal
Linaria dalmatica	Dalmatian Toadflax	Plant
Myriophyllum spicatum	Eurasian Watermilfoil	Plant
Hylastes opacus	European Bark Beetle	Insect
Sturnus vulgaris Linnaeus	European Starling	Bird
Trapa natans	European Water Chestnut	Plant
Convolvulus arvensis	Field Bindweed	Plant
Butomus umbellatus L.	Flowering Rush	Plant
Frangula alnus	Glossy Buckthorn	Plant
Galega officinalis	Goatsrue	Plant
Passer domesticus	House Sparrow	Bird
Humulus japonicus	Japanese Hops	Plant
Pueraria montana var. lobata	Kudzu	Plant
Pristiphora erichsonii	Larch Sawfly	Insect
Euphorbia esula	Leafy Spurge	Plant

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Scientific Name	Common Name	Type
Persicaria perfoliata	Mile-A-Minute Vine	Plant
Carduus nutans	Musk Thistle	Plant
Ligustrum spp.	Privet	Plant
Trachemys scripta elegans	Red-eared Slider	Amphibian
Cytisus scoparius L.	Scotch Broom	Plant
Centaurea stoebe ssp. micranthos	Spotted Knapweed	Plant
Bipalium pennsylvanicum Ogren	Three-Lined Land Planarian	Animal
Salix alba	White Willow	Plant

4.3.4.5 Vulnerability Assessment

Beaver 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 Beaver 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 Beaver County, there is a risk of future damage from invasive species that are present in the area. With about 284,000 acres of total land in Beaver County, there is vulnerability to various land sites and waterways. There is a total of twenty-nine possible areas in Beaver County that species can invade, one being globally ranked, six being regionally ranked, and twenty-two being state ranked. As mentioned, Beaver County has many waterways and wetlands available for invasive species to invade. Possible major (either regional or globally ranked) wetlands and waterways of Beaver County include: Beaver River at Rock Point (regional ranked), North Fork Little Beaver Creek – State Line (regional ranked), and Ohio River in Beaver County (globally ranked). Possible major (either regional or globally ranked) forest areas in Beaver include: Ambridge Reservoir Valleys (regional ranked), Monaca Bluffs (regional ranked), Raccoon Creek State Park (regional ranked), and Raccoon Creek Valley and Wildflower Reserve (regional ranked).

Therefore, a great amount of land and native wildlife within Beaver 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 Beaver County has a significant impact on the vulnerability of an ecosystem to invasive species, where overpopulation of deer favors invasive species.

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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, Tree-of-Heaven which all been identified red in *Table 24 - Prevalent Invasive Species* for priority species in Beaver County.

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 Beaver County but not yet present in the county (priority species in *Table 25 - Vulnerable Species*). Public outreach and education are important for 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.

4.3.5. Landslides

4.3.5.1 Location and Extent

The large regions of Pennsylvania have a variety of different topography, with each area having a different susceptibility to landslides. The Greater Pittsburgh area has the greatest potential for landslides in the Commonwealth. Beaver County can be considered part of the Greater Pittsburgh

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area. Landslides are described as downward and outward movement of slope-forming soils, rock and vegetation reactive to the force of gravity. Rockfalls, rockslides, rock topples, block glides, debris flows, mud flows and mudslides are all forms of landslides. Natural causes of landslides include heavy rain, rapid snow melt, erosion, earthquakes and changes in groundwater levels. Landslides occur most frequently in areas with moderate to steep slopes and high precipitation, and most often slope failures happen during or after periods of sustained or above average precipitation or snowmelt events. Human activity can increase the likelihood of landslides by reducing vegetation cover, altering the natural slope gradient or increasing the soil water content. Areas where this type of human activity is common are areas that were excavated along highways and other roadways.

Most landslides are slow moving and more often cause property damage rather than causing human injury. These landslides are due to geologic properties of the area that make it easily prone to erosion.

4.3.5.2 Range of Magnitude

Landslides can cause damage to utilities as well as transportation routes, resulting in road closure or travel delays. Fortunately, deaths and injuries due to landslides are rare in Pennsylvania and Beaver County. Most reported deaths due to landslides have occurred when rockfalls or other slides along highways have involved vehicles. Storm-induced debris flows can also sometimes cause death and injury. As residential and recreational development increases 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 property rather than people.

The Pennsylvania Department of Transportation (PennDOT) and large municipalities incur substantial costs due to landslide damage and to extra construction costs for new roads in landslide-prone areas. A 1991 estimate showed an average of \$10 million per year is spent on landslide repair contracts across the Commonwealth and a similar amount is spent on mitigation costs for grading projects. A number of highway sites in Pennsylvania are in need of permanent repair at estimated costs of \$300,000.00 to \$2 million each (DCNR, 2010). The USGS identifies Beaver County as being split between areas of high landslide incidence and high susceptibility with low incidence. Areas that are susceptible to landslides are geologically prone to giving way after significant precipitation events.

4.3.5.3 Past Occurrence

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

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4.3.5.4 Future Occurrence

A portion of Beaver County is at high risk for landslides and mismanaged development in steeply sloped areas would increase the frequency of occurrence of landslides. Road cuts are the most common development that puts an area at an increased probability of a slide. The PA Department of Environmental Protection has an Erosion and Sediment (E & S) program that sets requirements for which development projects of a certain scale that are intended to mitigate erosion, which are similar practices to prevent causing landslides.

4.3.5.5 Vulnerability Assessment

Landslides are often precipitated by other natural hazards such as earthquakes or floods, and a serious landslide can cause millions of dollars in damages. Continued enforcement of floodplain management and proper road and building construction helps to mitigate the threat of 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 fractures could lead to unexpected flood events.

A comprehensive database of land highly prone to erosion and landslides is difficult to come by. Construction projects in Beaver County should be wary of erosion and the potential for landslides. There are several general factors that can be indicators of a landslide prone area. These include:

- 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 lines, tilted trees, cracks in the ground and irregularly surfaced ground.

Beaver County has approximately 179 structures that are at risk to landslide vulnerability. These structures are within an area that has a high percentage of slope, which given specific sets of weather patterns, could result in a landslide. There are no critical infrastructure or functional needs facilities that fall within the high percentage slope areas for Beaver County. *Figure 19 – Landslide Vulnerable Structures* shows the structures within Beaver County that are within a high slope area where the slope percentage is severe. *Table 26 – Structure Vulnerability Data* illustrates the number of site structures per municipality, the number of structures in high slope areas, and the number of critical infrastructure sites in the high slope area.

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Table 26 - Structure Vulnerability Data

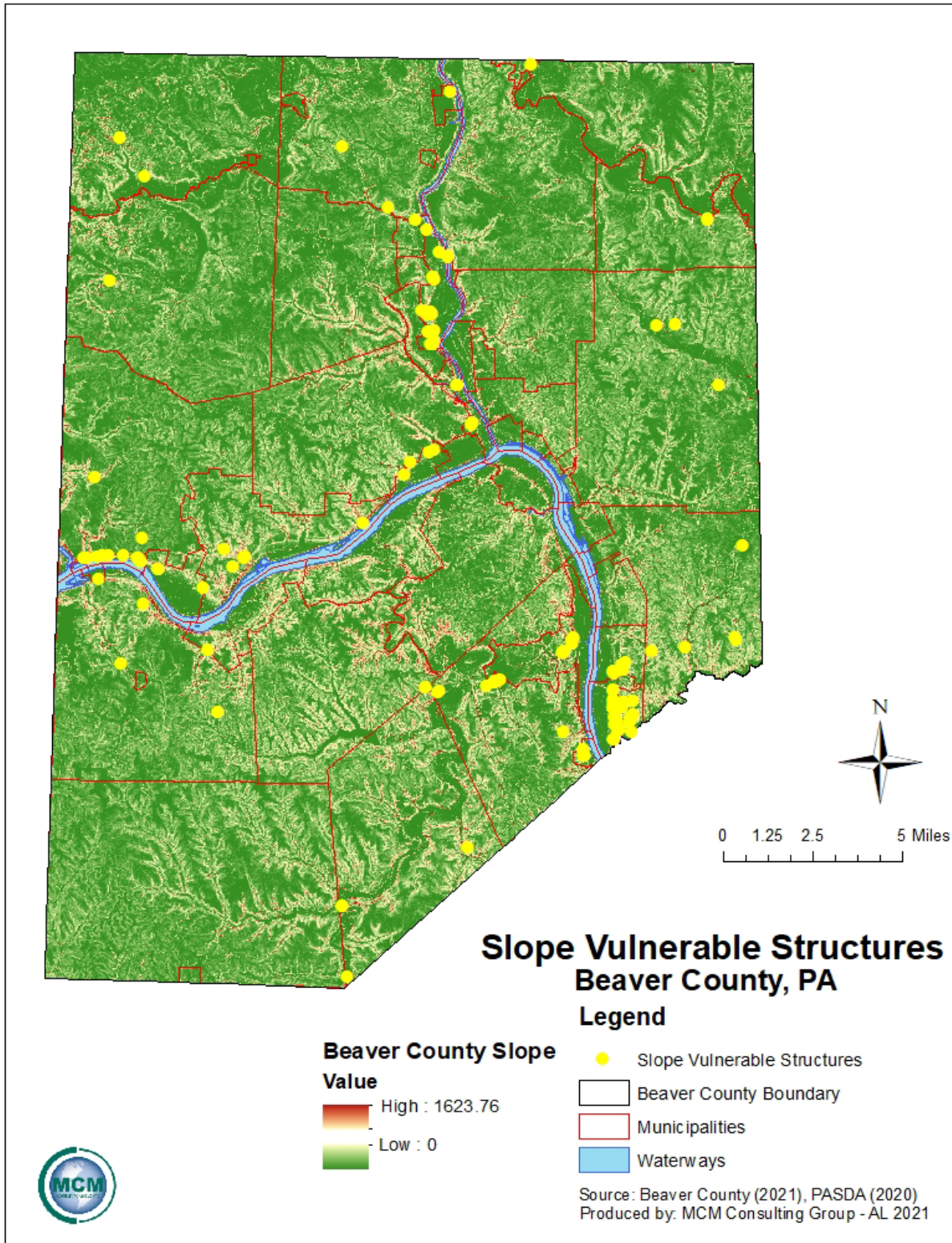
Structure Vulnerability Data			
Municipality	Number of Addressable Structures Per Municipality	Number of Structures in Slope Area	Number of Critical Infrastructure in Slope Area
Ambridge Borough	3242	23	0
Baden Borough	1838	0	0
Beaver Borough	1940	0	0
Big Beaver Borough	1205	2	0
Bridgewater Borough	475	3	0
Brighton Township	3443	2	0
Center Township	5587	0	0
Chippewa Township	3689	0	0
City of Aliquippa	5672	10	0
City of Beaver Falls	4179	17	0
Conway Borough	979	0	0
Darlington Borough	141	0	0
Darlington Township	912	2	0
Daugherty Township	1360	0	0
East Rochester Borough	333	0	0
Eastvale Borough	146	0	0
Economy Borough	4304	5	0
Ellwood City Borough	1	0	0
Fallston Borough	159	2	0
Frankfort Springs Borough	51	0	0
Franklin Township	1946	1	0
Freedom Borough	740	0	0
Georgetown Borough	80	1	0
Glasgow Borough	36	0	0
Greene Township	1045	3	0
Hanover Township	1526	0	0
Harmony Township	1622	44	0
Homewood Borough	80	0	0
Hookstown Borough	78	0	0
Hopewell Township	6134	12	0
Independence Township	1043	4	0
Industry Borough	862	5	0
Koppel Borough	434	1	0

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Municipality	Number of Addressable Structures Per Municipality	Number of Structures in Slope Area	Number of Critical Infrastructure in Slope Area
Marion Township	402	2	0
Midland Borough	1562	4	0
Monaca Borough	2668	0	0
New Brighton Borough	2434	0	0
New Galilee Borough	187	0	0
New Sewickley Township	3728	3	0
North Sewickley Township	2590	2	0
Ohioville Borough	1864	12	0
Patterson Heights Borough	272	6	0
Patterson Township	1262	3	0
Potter Township	385	0	0
Pulaski Township	733	0	0
Potter Township	385	0	0
Pulaski Township	733	0	0
Raccoon Township	1371	1	0
Rochester Borough	1556	0	0
Rochester Township	1341	0	0
Shippingport Borough	113	1	0
South Beaver Township	1241	1	0
Southheights Borough	262	5	0
Vanport Township	869	2	0
West Mayfield Borough	582	0	0
White Township	646	0	0
Totals:	81,350	179	0

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Figure 19 - Landslide Vulnerable Structures



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4.3.6. Pandemic and Infectious Disease

4.3.6.1 Location and Extent

Pandemic & Epidemic

An epidemic is when an infectious disease spreads more quickly than experts expected. It is characterized by very widespread growth or extent that spreads quickly and affects many individuals at the same time. When an epidemic occurs, it typically affects a larger area than an outbreak would.

A pandemic is a disease outbreak that spreads across countries or continents which affects the population of an extensive area. When a pandemic is present, the event typically affects more people and takes more lives than an epidemic typically would. Pandemics are continuous events in third-world countries but do not affect the United States as frequently. A pandemic is measured and defined by the spreading of a disease and not by the fatalities associated with it. There are various characteristics of a pandemic outbreak, such as large, 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. Pandemics travel more effectively than epidemics.

Each year, different strains of influenza are labeled as potential pandemic threats. Pandemics happen when novel (new) viruses emerge and can infect people easily and spread efficiently and are sustained from person to person. The spread of a disease depends on the mode of transmission of the disease, how contagious it is, and the amount of contact between infected and non-infected persons. In the event of a pandemic occurring in the eastern United States, the entirety of Beaver County would likely be affected. Strains of influenza, or the flu, are highly contagious, have caused epidemics and pandemics, and 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.

The 2009 H1N1 flu virus resulted in seventy-eight deaths in Pennsylvania by the time the pandemic ended. Studies after the 2009 H1N1 influenza pandemic showed that the strain disproportionately impacted people younger than twenty-four years old. Schools have potential to become outbreak centers due to their large young adult populations, high levels of close social contact, and permeable boundaries. During a pandemic or disease outbreak, the population affected may exceed the seasonal norm of one-third of the student population. Because universities and schools can be sites of transmission, they may cause a virus to spread among the surrounding community as well.

On March 11, 2020, the World Health Organization (WHO) characterized the outbreak of a coronavirus disease as a pandemic. The virus was named “SARS-CoV-2” and the disease it causes is named “coronavirus disease 2019” (COVID-19). Coronaviruses are common in people and many different species of animals to include camels, cattle, cats, and bats. The disease is believed to have started in Wuhan Province, China in late 2019 and spread around the globe. At the epicenter in

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China, the virus was linked to a large seafood and live animal market; however, community spread of the virus rapidly ensued.

Infectious Disease

Infectious diseases are disorders caused by pathogenic organisms such as bacteria, viruses, fungi, or parasites. There are various types of organisms that live on and within the human system but are considered harmless. Organisms become harmful and cause disease when under certain conditions. The causes of infectious diseases vary. The sources of infectious disease occur from contaminated food or waterways, infected animals/livestock, infection from biological vectors such as mosquitoes, etc. Infectious diseases include influenza, pneumonia, tuberculosis, rabies, Middle East Respiratory Syndrome (MERS), Lyme Disease, Zika, Ebola, and HIV/AIDS.

West Nile virus is contracted through a mosquito bite and is aided by warm temperatures and wet climates conducive to mosquito breeding, with most cases occurring between April and October. West Nile virus is a vector-borne disease. This means an animal, usually an insect or a tick, transmits parasitic microorganisms to people and animals, and therefore, the diseases they cause. The disease causes headaches, high fever, neck stiffness, disorientation, tremors, convulsions, muscle weakness, paralysis, and death in its most serious form.

Lyme Disease, spread by the bite of infected blacklegged ticks, is a bacterial disease with symptoms including fever, headaches, and characteristic skin rash. Untreated, Lyme Disease can spread to joints, the heart, and the nervous system (CDC, 2016). To prevent the disease, it is recommended to use insect repellent, remove ticks promptly, apply pesticides, and reduce tick habitat.

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.

4.3.6.2 Range of Magnitude

Pandemic & Epidemic

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 has less than 80% of cases that are clinically asymptomatic. Therefore, approximately 20% of the cases

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result in mild infection, as known as West Nile fever. However, there is a small percentage of cases that will 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 disease. However, advances in medical technologies have greatly reduced the number of deaths caused by the influenza over time. In the early 1900s, flu pandemics could cause tens of millions of deaths, while the 2009 swine flu caused fewer than 20,000 deaths world-wide, and many people infected with swine flu in 2009 recovered without needing medical treatment. However, the modern flu viruses are still quite dangerous. About 70% of those who were hospitalized with the 2009 H1N1 flu virus in the United States belonged to a high-risk group. High risk populations for influenza include children, the elderly, pregnant women, and patients with reduced immune system capability. Currently, we are seeing the advancements of medical technology help with the current COVID-19 pandemic. Therefore, the global effects of various influenza outbreaks have drastically declined over the past century. While there are limited secondary hazards related to public health emergencies, an outbreak could cause a variety of general secondary effects. Civil disorder is the most likely hazard to result from a public health emergency. Further potential secondary effects could include: a shortage of medical supplies and personnel; hoarding of household paper and cleaning supplies; school, business, and government closings; government restrictions on travel; low attendance at places of employment; and, slowed productivity.

During the writing of this plan, the United States is experiencing a pandemic. However, the seasonal flu is still present throughout the country as well. A pandemic flu is not the same as a seasonal flu, as explained in *Table 27 – Pandemic and Seasonal Flu Differences*. The seasonal flu is less of a concern than what the pandemic flu potentially is. Predictability and regularity are factors into the reasoning behind less of a concern when dealing with seasonal flu. However, the pandemic flu is considered to be more severe than seasonal flu due to lack of these factors.

Table 27 - Pandemic and Seasonal Flu Differences

Pandemic and Seasonal Flu Differences		
	Seasonal Flu	Pandemic Flu
What is it?	Influenza (flu) is a contagious respiratory illness caused by flu A and B viruses that infect the human respiratory tract.	A flu pandemic is a global outbreak of a new flu A virus in people that is very different from current and recently circulating seasonal flu A viruses.
Occurrence?	Epidemics of seasonal flu happen every year. Fall and winter is the most common time for flu in the United States.	Flu pandemics happen rarely. Five have happened within the last 100 years.

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	Seasonal Flu	Pandemic Flu
Transmission ?	Flu viruses are thought to spread mainly from person to person through droplets made when someone with flu coughs, sneezes, or talks near a person (within 6 feet).	Pandemic flu viruses spread in the same way as seasonal flu, but a pandemic virus is likely to infect more people because fewer people have immunity to the pandemic flu virus.
Vaccination?	Seasonal flu vaccines are made each year to vaccinate people against the seasonal flu. Typically, only one dose is needed.	Although the U.S. government maintains a limited stockpile of pre-pandemic flu vaccines, this inventory may not be widely available in the early stages of a pandemic. Two doses of vaccine are likely required.
High Risk Group?	Young children, people sixty-five years and older, pregnant women, and the immunocompromised are more likely to have serious flu complications.	In some past pandemics, healthy and young adults, along with the immunocompromised and elderly were at high risk for developing severe flu complications.

Source: (CDC, 2009)

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. The time after the first pandemic wave has been elaborated into post peak and post pandemic periods. These phases are listed below in *Table 28 - Pandemic Influenza Phases*.

Table 28 - 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.

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Phase	Characteristics
Phase 3	An animal or human-animal influenza 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.
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.
<i>Source: (WHO, 2009)</i>	

4.3.6.3 Past Occurrence

Pandemic & Epidemic

Several pandemic influenza outbreaks have occurred over the past 100 years that not only affected Beaver County but the United States as a whole. *Table 29 - Past Pandemic Events in the United States* illustrates the various past pandemic events that have occurred since the late 1800's. 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 Beaver County and the United States are the swine flu/Novel H1N1 and COVID-19 pandemics.

Spanish Flu

Prior to the COVID-19 world-wide pandemic, the 1918 influenza (Spanish Flu) pandemic was classified as the "Mother of all Pandemics". An estimated $\frac{1}{3}$ of the world's population was infected and had clinically apparent illnesses during the 1918 to 1919 influenza pandemic. Pennsylvania was

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one of the most affected states in the country because influenza tends to strike cities very hard. The Spanish Flu claimed 500,000 lives in the United States, which included Pennsylvania and Beaver County. Therefore, Beaver County was drastically affected by the Spanish Flu Pandemic.

Swine Flu/H1N1

Beaver County was impacted by the H1N1 virus during 2009. The Pennsylvania Department of Health set up clinics throughout the county to administer vaccines. The Pennsylvania Department of Health confirmed sixty-one cases and two deaths related to the swine flu in Beaver County.

Table 29 - 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

COVID-19

This is an on-going pandemic at the time of the writing of this plan, so websites are used to provide the most up-to-date statistics. As of January 2021, Pennsylvania has 824,400 total cases and 21,350 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 Beaver County was on March 16th, 2020. As of January 2021, Beaver County alone has recorded 10,833 cases with 316 deaths related to the COVID-19 pandemic. The cases and deaths in Beaver County are increasing. Therefore, exact numbers of deaths and cases are constantly changing. To see more updated information, follow here:

<https://www.health.pa.gov/topics/disease/coronavirus/Pages/Cases.aspx>.

Infectious Disease

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

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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. 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. 2018 had the most positive cases in Beaver County since 2015. *Table 30 - West Nile Virus Control Program in Beaver County Since 2015* outlines the West Nile Virus within Beaver County since 2015, according to Pennsylvania Department of Environmental Protection.

Table 30 - West Nile Virus Control Program in Beaver County Since 2015

West Nile Virus Control Program in Beaver County Since 2015				
Year	Total Positives	Human Positives	Mosquito Positives	Bird Positives
2020	6	0	6	0
2019	12	0	12	0
2018	155	2	153	0
2017	62	0	62	0
2016	11	0	11	0
2015	11	1	10	0

Lyme Disease

Lyme Disease has been present in the United States and Beaver County for many years. More wooded areas, such as Beaver County, have higher cases due to ticks being the main biological vector. Lyme disease is found in all sixty-seven counties within Pennsylvania with a total of nearly 9,500 cases. Beaver County has approximately 984 confirmed cases of Lyme disease according to the CDC. Beaver County experienced the highest number of positive cases in 2018 at 254 cases, compared to the lowest number of cases in 2014 at sixty-seven cases. However, it is possible that numbers have risen dramatically due to lack of testing in previous years. Lyme disease case counts are alarming and consistently rising over the past several years. Although, it should be noted that information represented for each county “may vary with respect to the resources they have to devote to investigation of Lyme cases”. It should also be noted that these figures represent a rough estimate of the Lyme disease burden in Beaver County. *Table 31 - Lyme Disease Data for Beaver County* outlines the Lyme Disease within Beaver County since 2013, according to Pennsylvania Department of Environmental Protection.

Table 31 - Lyme Disease Data for Beaver County

Lyme Disease Data for Beaver County	
Year	Total Positives
2018	254
2017	211

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Year	Total Positives
2016	188
2015	106
2014	67
2013	73

4.3.6.4 Future Occurrence

Pandemic & Epidemic

The probability of a widespread pandemic public health emergency is every ten years or less with varying degrees of severity. Minor outbreaks of less serious communicable disease, such as influenza, occur much more frequently. Beaver County is more prone to these diseases and infections since people commute to the larger urban areas outside the county for employment and from the larger urban areas to the county for recreation and sport related activities. Beaver County is expected to undergo pandemic influenza outbreaks every 11 to 41 years according to historical data. Exact timing of pandemic influenza outbreaks is unpredictable, and complete avoidance of the events is nearly impossible. Therefore, future occurrences of pandemics and infectious disease are unclear. Future pandemics may also emerge from other diseases, especially invasive pathogens for which Beaver County and Pennsylvania as a whole lack natural immunity which adds to the uncertainty of future occurrences.

Infectious Disease

Pandemic future occurrences have several unknown circumstances; however, future infectious disease occurrences are likely to occur in the future. Infectious diseases such as West Nile Virus, Influenza, and Lyme Disease have been present in Beaver County for many years and are expected to continue in the future of Beaver County.

West Nile Virus

The best defense against West Nile virus is to remove mosquito breeding locations – stagnant water sources. Another defensive measure is to prevent insect bites by wearing shoes, socks, long pants, and a long-sleeved shirt when outdoors for long periods of time, or when mosquitoes are most active. Also, mosquito repellent can be used whenever people are outside.

Influenza

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

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Lyme Disease

Lyme disease is best combated using insect repellent, removing ticks promptly, applying pesticides, and reducing tick habitat. Once a person realizes they have been bitten by a tick, they should seek medical attention, as undetected Lyme Disease can seriously damage a body's musculoskeletal and nervous systems or result in death.

4.3.6.5 Vulnerability Assessment

It is extremely difficult to predict a pandemic or an epidemic. The severity of the next pandemic cannot be predicted, but modeling studies suggest the impact of a pandemic on the United States could be substantial. In the absence of any control measures (vaccination or drugs), it is estimated that a "medium-level" pandemic could cause 89,000 to 207,000 deaths, 314,000 to 734,000 hospitalizations, 18 to 42 million outpatient visits, and another 20 to 47 million sick people in the United States. Between 15% to 35% of the U.S. population could be affected by a pandemic, and the economic impact could range between \$71.3 to \$166.5 billion. The data for the current COVID-19 pandemic has fluctuated widely but, at the time of the writing of this plan, was on pace for greater than a "medium level" pandemic. The COVID-19 pandemic has severely affected populations over the age of sixty-five, especially those in nursing homes – disproportionately; it has also severely affected different races disproportionately, e.g., non-Hispanic American Indian and Black people. The CDC reports that long-standing systemic health and social inequities have put some members of racial and ethnic minority groups at increased risk of getting COVID-19 or experiencing severe illness, regardless of age. As of January 2021, according to the Johns Hopkins Coronavirus Resource Center, there were nearly 103,043,330 confirmed cases of COVID-19 resulting in nearly 2,229,600 deaths world-wide. The United States is the leading country of confirmed cases with 26,000,000 cases. The World Health Organization also reports all countries, areas, and territories have been affected by the COVID-19 pandemic. The most up-to-date United States information, including data by county, may be found here: <https://coronavirus.jhu.edu/us-map>

Elderly individuals, children and immune deficient individuals are most vulnerable to disease. Nursing facilities, personal care facilities, daycares, schools, and hospitals are considered more vulnerable since there are normally groups of these functional-needs population present at the facilities. Spread of disease is at an increased risk due to the vulnerability and density of these populations. 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 suffered staggering 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 situations (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 that work outdoors for extended periods of time in warm months may be more vulnerable to West Nile, Lyme Disease or the Zika virus.

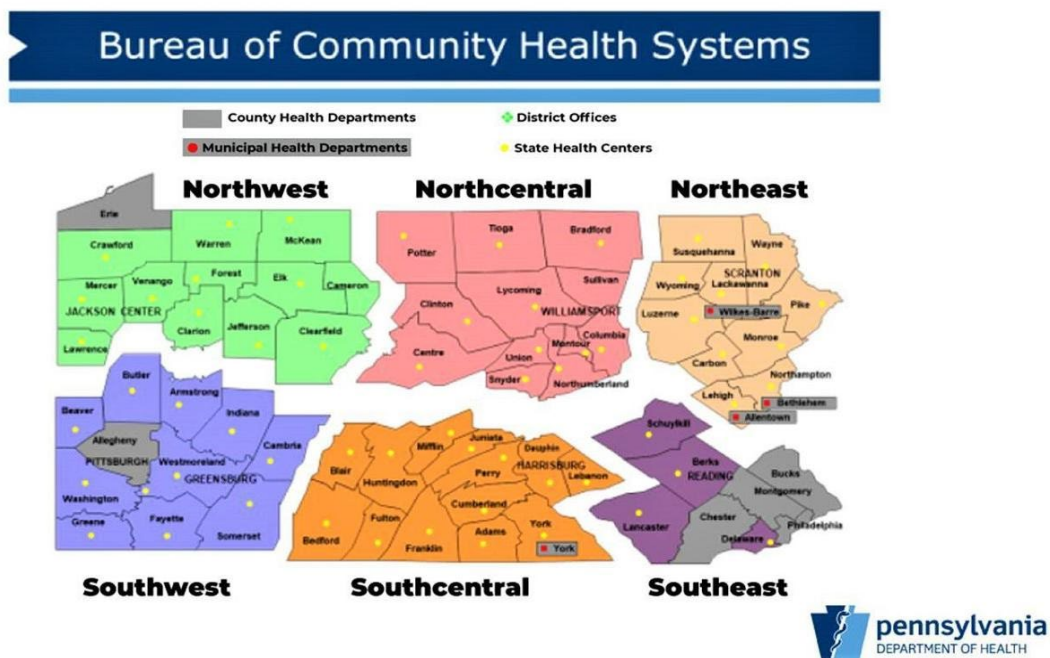
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The number of hospitals and beds present in a county can affect the vulnerability impact on the county as well. The number of hospitals within the county and number of beds within the hospital determines the amount of care vulnerable and sick patients will receive in times of need. The vulnerable individuals will need access to hospitals and medical procedures as well. If sick and vulnerable patients are higher in number than beds available, the vulnerability rates within the county will rise. Heritage Valley Health System is the one major hospital within the county with a total of 361 beds. It is important to plan preparedness activities that will permit a prompt and 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 through the six regional healthcare districts (see *Figure 20 - Pennsylvania Department of Health Districts*). Beaver County is in the southwest district. At the time of the writing of this plan, POD planning for mass vaccinations against COVID-19 is occurring and hundreds of locations are offering the vaccinations. This is just one source of reference:

<https://www.health.pa.gov/topics/disease/coronavirus/Pages/Vaccine.aspx#map>.

Figure 20 - Pennsylvania Department of Health Districts



Source: (PA DOH, 2019)

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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 gases, radon gas is very stable, so it does not easily combine with other chemicals. Two isotopes of radon are commonly found: ^{222}Rn and ^{220}Rn . The ^{220}Rn 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 ^{222}Rn 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 ^{222}Rn , it only exists in relative proximity to its radioactive parent, usually within tens of feet away. Radon is a carcinogen and when inhaled, it causes humans to develop 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. 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.

Radon gas is considered ubiquitous and can be found in indoor and outdoor environments, however 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 content of air in the surrounding soils. Because of the flow dynamics of air inside of most homes, 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 the most at risk. Such deposits are rare in the Commonwealth of Pennsylvania.
- Some more common rocks have higher than average uranium content (5 to 50 ppm), and proximity to such rocks also increase the risk or 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.

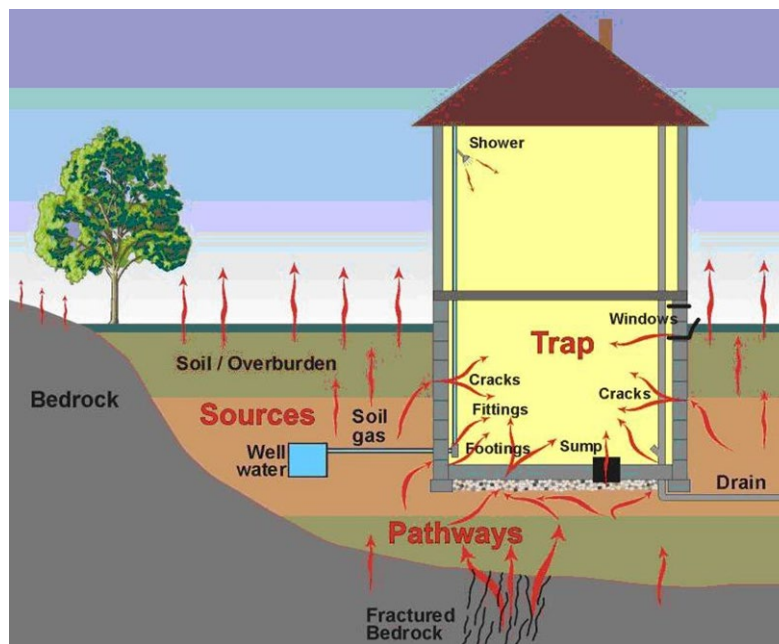
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- Other soil and bedrock properties that facilitate radon mobility. The amount of pore space in the soil and its permeability – more porous soils will allow radon to travel more easily. Limestone-dolomite soils can also be predisposed to collect radon 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 homes are now recognized (see *Figure 21 – 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.

Figure 21 - Sketch of Radon Entry Points into A House



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

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contains from 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.

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 Beaver County. The majority of Beaver County has high 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 (^{218}Po , ^{214}Pb , ^{214}Bi) which may become attached to lung tissue and induce lung cancer due to their 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 4 pCi/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 32 – 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 the *Table 32 – Radon Risk for Smokers and Nonsmokers* below, a smoker exposed to radon has a much higher risk of lung cancer.

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Table 32 - 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	Fix Structure
8	About 120 people could get lung cancer	30 times the risk of dying in a fall	Fix Structure
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)	
20	About 36 people could get lung cancer	35 times the risk of drowning	Fix Structure
10	About 18 people could get lung cancer	20 times the risk of dying in a home fire	Fix Structure
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	Fix Structure
Non-smokers			
2	About 4 people could get lung cancer	The risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L

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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
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 of 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 986 zip codes. The missing zip codes that report in the database are returned as “N/A” for insufficient data and had fewer than thirty test results or no test results at all. *Table 32 – Radon Level Test Results in Beaver County* shows that there is a total of thirty-three zip codes in Beaver County where tests were reported for the PA DEP to report their findings, one of which have insufficient data. The highest average radon level was from zip code 15050 with an average rating of 16.1 pCi/L within the location of one basement. Most reporting zip codes in Beaver County have an average basement radon level significantly above the suggested EPA action level of 4 pCi/L. The average basement reading for reporting zip codes in the county is 8.20 pCi/L, and the average first floor reading is 4.78 pCi/L.

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Table 33 - Radon Level Test Results in Beaver County

Radon Level Test Results in Beaver County (PA DEP 2021)				
Zip Code	Location	Number of Tests	Max Result (pCi/L)	Average Result (pCi/L)
15001	Basement	3,512	224.5	7.9
	First Floor	144	282.7	7.9
15003	Basement	863	227.0	8.3
	First Floor	38	14.4	3.1
15005	Basement	1252	169.0	7.0
	First Floor	65	14.4	3.8
15009	Basement	2,578	253.3	8.3
	First Floor	126	55.6	5.4
15010	Basement	2,472	125.0	7.1
	First Floor	124	45.5	3.8
15019	Basement	45	25.1	5.8
	First Floor	N/A	N/A	N/A
15021	Basement	329	110.1	7.3
	First Floor	N/A	N/A	N/A
15026	Basement	355	170.9	10.9
	First Floor	N/A	N/A	N/A
15027	Basement	156	53.2	4.2
	First Floor	N/A	N/A	N/A
15042	Basement	650	194.2	8.1
	First Floor	42	76.3	5.2
15043	Basement	119	87.1	11.3
	First Floor	N/A	N/A	N/A
15050	Basement	229	123.1	16.1
	First Floor	N/A	N/A	N/A
15052	Basement	263	120.0	13.2
	First Floor	N/A	N/A	N/A
15056	Basement	126	33.8	4.4
	First Floor	N/A	N/A	N/A
15059	Basement	167	92.7	10.8
	First Floor	N/A	N/A	N/A
15061	Basement	1,115	88.6	6.8
	First Floor	57	36.3	4.2
15066	Basement	690	210.5	8.6

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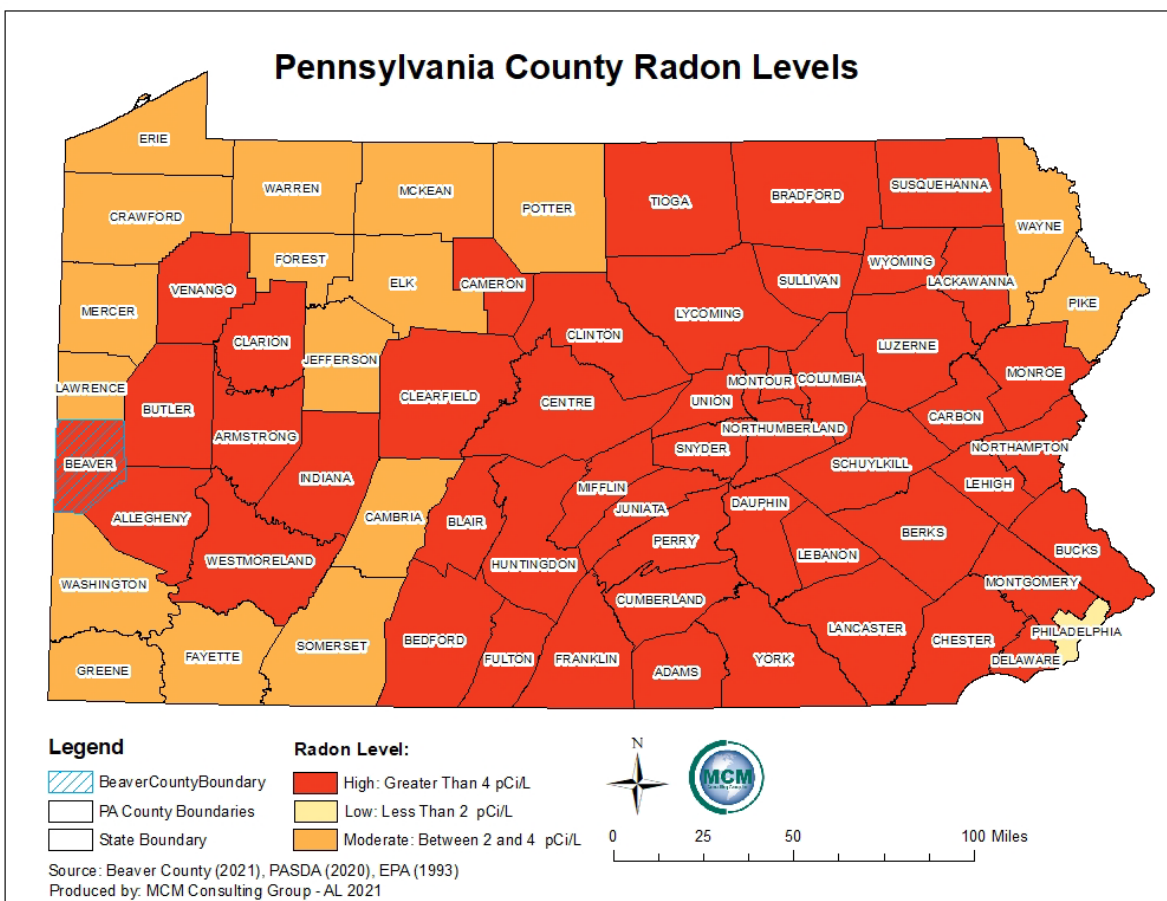
Zip Code	Location	Number of Tests	Max Result (pCi/L)	Average Result (pCi/L)
15066	First Floor	41	43.8	4.7
15074	Basement	403	135.2	6.3
	First Floor	N/A	N/A	N/A
15081	Basement	88	68.1	11.7
	First Floor	N/A	N/A	N/A
15108	Basement	4,332	162.9	6.2
	First Floor	513	54.6	4.5
15126	Basement	986	151.0	4.6
	First Floor	74	34.8	3.3
15143	Basement	6,450	268.9	7.2
	First Floor	567	60.7	3.9
16037	Basement	581	126.0	9.5
	First Floor	35	36.7	4.5
16046	Basement	3,129	149.2	6.5
	First Floor	306	71.1	3.8
16063	Basement	842	115.0	6.6
	First Floor	84	29.7	3.3
16066	Basement	7,040	180.0	5.3
	First Floor	232	41.9	4.1
16115	Basement	144	116.4	10.9
	First Floor	N/A	N/A	N/A
16117	Basement	1,033	128.2	5.7
	First Floor	40	11.2	2.6
16120	Basement	67	158.5	10.4
	First Floor	N/A	N/A	N/A
16123	Basement	111	110.9	10.4
	First Floor	N/A	N/A	N/A
16136	Basement	N/A	N/A	N/A
	First Floor	N/A	N/A	N/A
16141	Basement	37	35.8	6.3
	First Floor	N/A	N/A	N/A
16157	Basement	114	152.9	8.8
	First Floor	N/A	N/A	N/A

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4.3.7.4 Future Occurrence

Radon exposure is inevitable given the geologic and geomorphic conditions in Beaver 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 22 – Beaver County Radon Hazard Zone*. Each zone reflects the average short-term measurement of radon that can be expected in a building without radon controls. Beaver County is located within Zone 1 with counties of high potential for radon which indicate great likelihood of occurrence in the future.

Figure 22 - Beaver County Radon Hazard Zone



- Zone 1 has the highest potential and readings can be expected to exceed the 4 pCi/L recommended limit.
- Zone 2 has a moderate potential for radon with levels expected to be between 2 and 4 pCi/L.
- Zone 3 has a low potential with levels expected to be less than 2 pCi/L.

Due to the great 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 means as radon gas. *Table 33 – Suggested*

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Actions and Time Frame for Exposure to Radon Daughters provides suggested actions and time frames for varying levels of exposure to radon daughters.

Table 34 - *Suggested Actions and Time Frame for Exposure to Radon Daughters (2020)*

Suggested Actions and Time Frame for Exposure to Radon Daughters (2020)		
Exposure Level*	Suggested Action**	Time Frame 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 to 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
<p>*Assumes continuous 24-hour exposure in living area.</p> <p>**Home testing should be conducted at the end of the indicated time frame to determine if remedial action has reduced the exposure levels of the radon daughters below the indicated value. If remedial action has not been successful, residents should be aware of the risks associated with continuous exposure at the indicated levels.</p> <p>***Work levels of exposure to radon daughters.</p>		

4.3.7.5 Vulnerability Assessment

Proper testing for radon levels should be completed across Beaver 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.

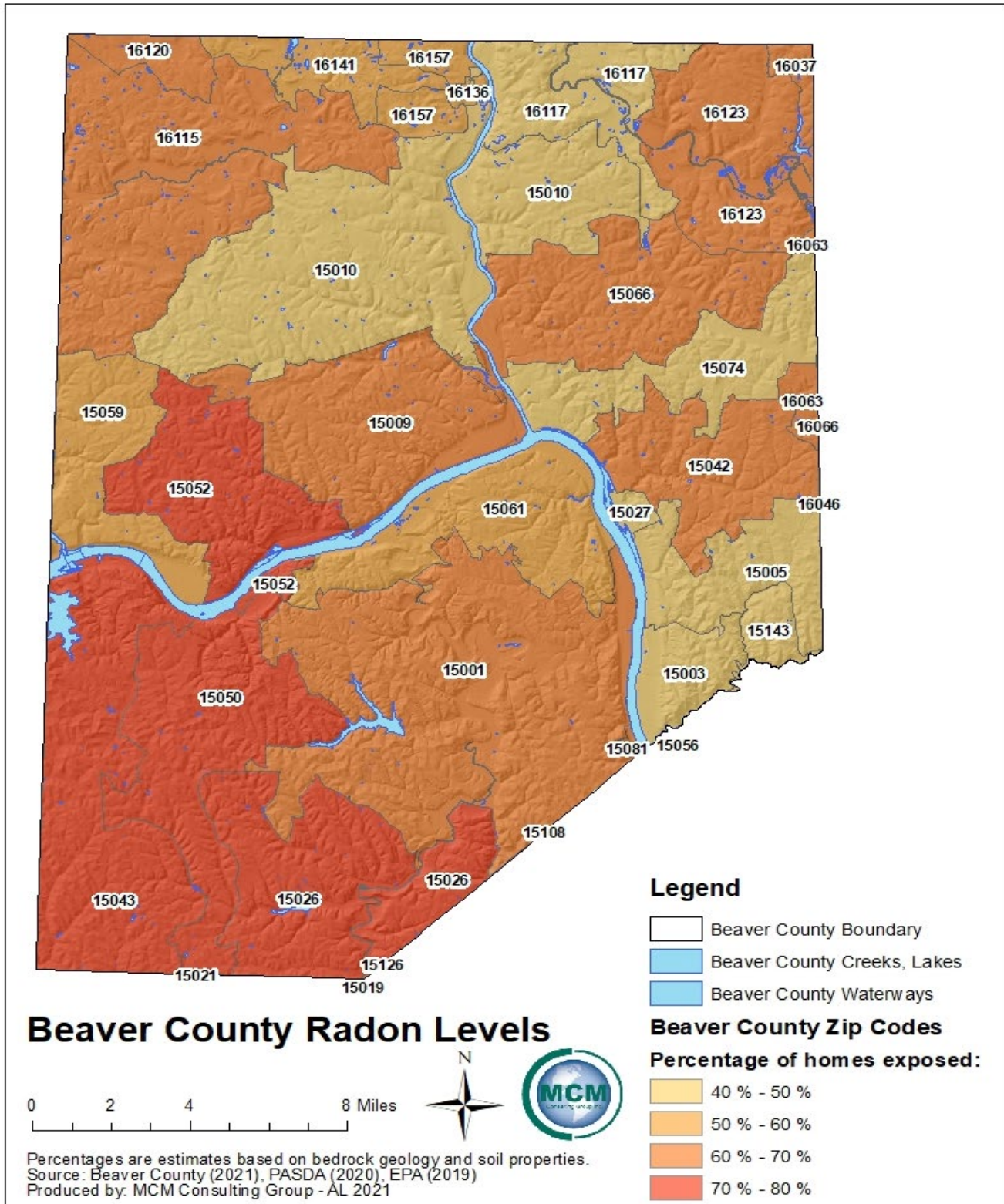
Beaver County is in the EPA Region Hazard Zone 1, meaning that there is a high risk of radon exposure. Smokers can be up to ten times more vulnerable to lung cancer from high levels of radon

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depending on the level of radon they are exposed to (see *Table 32 – Radon Risk for Smokers and Nonsmokers*). 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 pCi/L. *Figure 23 – Radon Vulnerability for Beaver County* 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 provide short- and long- term tests to determine radon levels, as well as information on how to mitigate high levels of radon in a building.

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Figure 23 - Radon Vulnerability for Beaver County



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4.3.8. Tornado/Windstorm

4.3.8.1 Location and Extent

Tornadoes and windstorms can occur throughout Beaver County, though incidents are usually localized. Severe thunderstorms may result in conditions favorable for the formation of numerous or long-lived tornadoes. Tornadoes are nature's most violent storm and can cause fatalities and devastation to neighborhoods within the county. Tornadoes can occur at any time during the day or night but are most frequent during late afternoon into early evening, the warmest hours of the day, and most likely to occur during the spring and early summer months of March through June. Tornado movement is characterized in two ways: direction/speed of spinning winds and forward movement of the tornado, also known as the storm track. The rotational wind speeds can range from 100 to more than 250 mph. The speed of forward motion can be 0 - 50 mph. On estimate, the maximum velocity of tornados is about 300 mph. Forward motion of the tornado path can be a few to several hundred miles in length. Widths of tornados vary from less than 100 feet to more than a mile wide. 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 distances", which explains why one house may be completely demolished by a tornado and a neighboring house could be untouched. Some tornadoes never touch the ground and are short lived, while others may touch the ground several times. 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 a key to the development of a supercell and eventually a tornado to occur. Once the updraft is rotating and being fed by warm air flowing in, the tornado is formed. The other type of tornado is categorized as non-supercell, which is not as commonly found. 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. These types of tornadoes are weaker and more short-lived compared to super cell thunderstorms. However, the QLCS are more difficult to detect effectively. Another type of non-supercell tornado is a landspout. These tornadoes are narrow and rope-like funnels that form when the thunderstorm cloud is still growing with no rotating updraft which causes the spinning motion to appear near the ground more. Waterspouts are similar non-supercell tornadoes to the landspout but not likely to be found within Beaver County due to lack of bodies of water present.

Windstorms may be caused by thunderstorms, hurricanes, and tornadoes, but the most frequent cause of windstorms in western Pennsylvania is thunderstorms. Windstorms are generally defined with 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 a county: Straight-line wind, downdraft, macroburst, microburst, downburst, gust front, derecho, and haboob. Straight-line winds are the most common wind event due to being defined with any thunderstorm wind that is not associated with rotation. These types of winds are different than tornadic winds. A downdraft is a small-scale column of air that rapidly sinks toward the ground. A macroburst is the outward burst of strong winds that are near or at the surface with horizontal dimensions greater than 2 1/2 miles. These types of winds may begin over a smaller area and then

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spread out to an even 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. The microbursts are less than 2 1/2 miles in horizontal dimension. These are typically short-lived winds that last at maximum of ten minutes, with windspeeds reaching up to 100 mph. The microbursts can be wet or dry. Wet microbursts are typically associated with heavy precipitation at the surface. Dry microbursts do not have precipitation associated with them, which is more commonly found in the western portion of the United States. Beaver County is more likely to experience a wet microburst instead of a dry microburst event. A downburst is typically used to describe the macro and microbursts. A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. The gust fronts are 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. Lastly, haboob is a wall of dust that is moved along the ground from thunderstorms at very high speeds and would not typically be found in Beaver County.

4.3.8.2 Range of Magnitude

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, the worst being 1936. The number of tornado reports has increased by 14% 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.

Damages and deaths can be especially significant when tornadoes move through populated, developed areas. The destruction caused by tornadoes ranges from minor to severe depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light weight construction such as mobile homes. Further discussion about the vulnerability of mobile homes can be found in section 4.3.8.5. 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 (*Table 36 - Enhanced Fujita Scale*). Although F Scale has been used for many years, this scale has limitations associated with it. Limitations of the F-Scale include lack of damage indicators (DI), no account of construction quality and variability, and no definitive correlation between damage and wind speeds. The limitation is what led to a more accurate scaling method of the EF- Scale. The EF-Scale became effective on February 1st, 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.

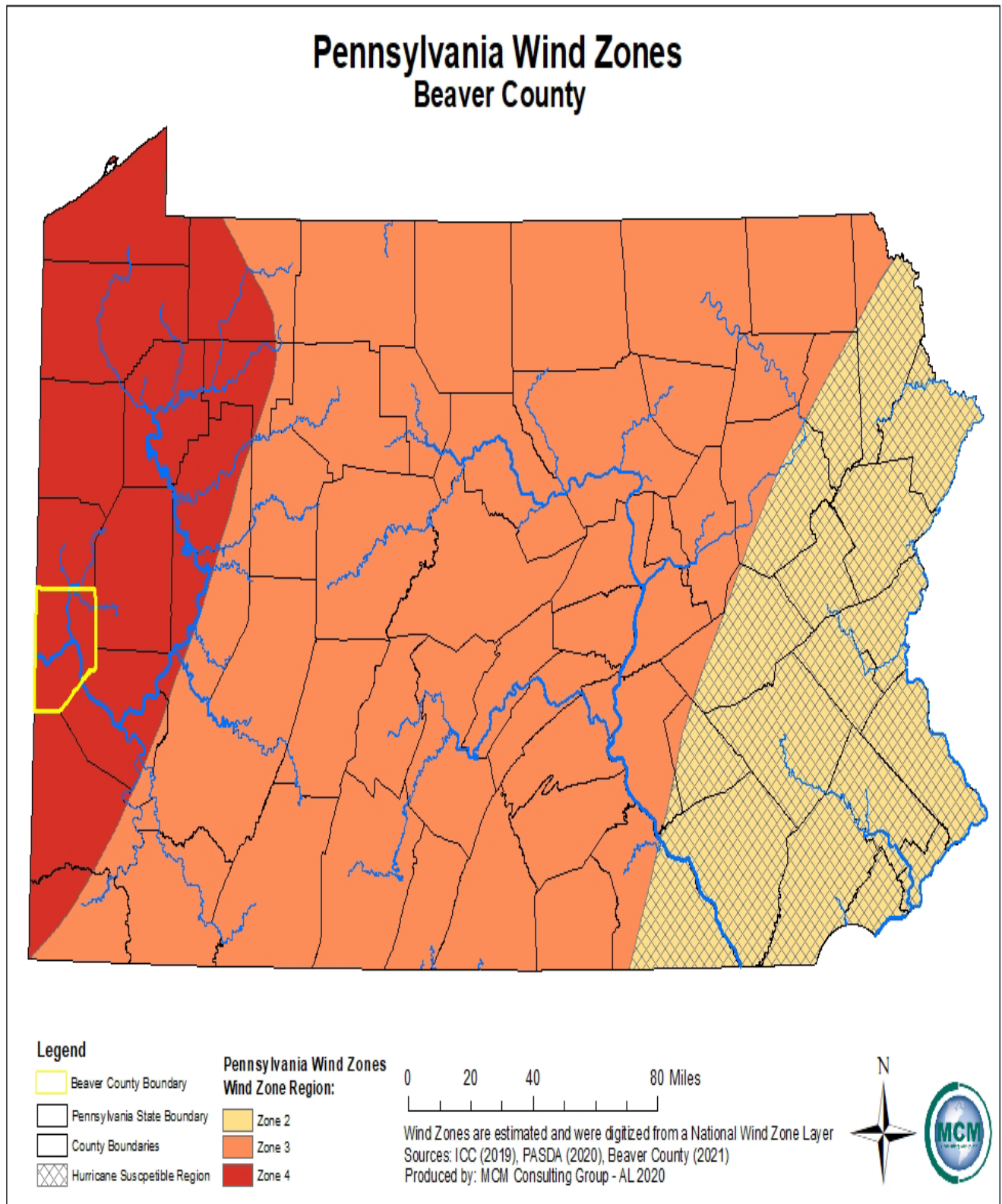
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Previously recorded tornadoes are reported with the older F-Scale values, but *Table 36 - Enhanced Fujita Scale* shows F-Scale categories with corresponding EF-Scale wind speeds.

Figure 24 - Pennsylvania Wind Zones identifies wind speed zones across the state. The figure identifies wind speeds that could occur across the state to 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 design wind speeds for shelters and critical facilities should be able to withstand a three-second gust of up to 200 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm incident. The western portion of the state falls within the Zone IV which indicates shelters can withstand up to 250 mph winds, while the eastern side falls within the Zone II where shelters can withstand up to only 160 mph. *Table 35 - Wind Zones and Counties Affected in Pennsylvania* identifies which county is located in specific wind zones throughout Pennsylvania. As shown on *Figure 24* and *Table 35*, Beaver County is identified to be in Wind Zone IV.

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Figure 24 - Pennsylvania Wind Zones



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Table 35 - Wind Zones and Counties Affected in Pennsylvania

Wind Zones and Counties Affected in Pennsylvania (NOAA, 2019)	
Wind Zones with Speed	Counties Affected
Zone I (130 mph)	N/A
Zone II (160 mph)	Berks, Bucks, Carbon, Chester, Delaware, Lackawanna, Lancaster, Lebanon, Lehigh, Luzerne, Monroe, Montgomery, Northampton, Philadelphia, Pike, Schuylkill, Wayne, York
Zone III (200 mph)	Adams, Armstrong, Bedford, Blair, Bradford, Cambria, Cameron, Centre, Clearfield, Clinton, Columbia, Cumberland, Dauphin, Elk, Fayette, Franklin, Fulton, Greene, Huntingdon, Indiana, Juniata, Jefferson, Lycoming, McKean, Mifflin, Montour, Northumberland, Perry, Potter, Snyder, Somerset, Sullivan, Susquehanna, Tioga, Union, Westmoreland,
Zone IV (250 mph)	Allegheny, Beaver , Butler, Clarion, Crawford, Erie, Forest, Lawrence, Mercer, Venango, Warren, Washington

Beaver County falls within Zone IV, meaning shelters and critical facilities should be designed to withstand up to 250 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 can have varying secondary effects. The most common is power failure. The severe wind can dismantle power sources and cause significant structural damage. Hazardous material spills can occur if a tornado comes near a holding tank, or the spill stems from a traffic accident caused by high winds. Since tornado incidents are typically localized, environmental impacts are rarely widespread. However, where these incidents occur, severe damage to plant species is likely. This includes loss of trees and an increased threat of wildfire in areas where dead trees are not removed.

Tornadoes/windstorms of all types have caused the following problems within Beaver 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.

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Table 36 - Enhanced Fujita Scale

Enhanced Fujita Scale (NWS, 2007)			
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.
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.

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4.3.8.3 Past Occurrence

Beaver County has experienced numerous tornadoes since 1954 and wind incidents since 1996 that have been reported for the county (see *Table 37 – Beaver County Tornado History* and *Table 38 – Beaver County High Wind History*). Numerous sources provide information in regard to past occurrences and losses associated with tornadoes/windstorms in Beaver County and the Commonwealth as a whole. Due to the number of sources available with information, number of events and losses could vary slightly in number. Based on NOAA 2020 information, there have been twenty-five high-wind incidents recorded in Beaver County since 1996. Most often these are the result of intense thunderstorms, which often fell trees and damage power lines, causing power outages in some areas. Historically, the county has experienced both severe windstorms and tornadoes. Based on NOAA 2020 information, there have been eighteen tornado incidents recorded in Beaver County since 1954. The most recent tornado impacts in Beaver County occurred very recently on June 10th, 2020 when an EF1 was reported within the county. The most damaging tornado to affect Beaver County was an F3 on May 31st, 1985 which reported to have caused \$25 million in damages. From a relatively high magnitude tornado event, the damages were high in number as well. Approximately, three fatalities were recorded in Beaver County due to tornadoes. The three fatalities were all associated with the same major F3 tornado that appeared in the county. Along with the three recorded fatalities for Beaver County, forty-seven injuries, forty of them occurring during the F3 tornado event, have been reported over the years. The F3 tornado event in 1985 led to a Presidential Declaration of Major Disaster. The variety of past tornado events in Beaver County range from are F0/EF0 through F3/EF3 levels. Since tornado incidents are typically localized, environmental impacts are rarely widespread. However, where these incidents occur, severe damage to plant species is likely. This includes loss of trees and an increased threat of wildfire in areas where dead trees are not removed. The most recent wind incident in Beaver County occurred on February 24th, 2019 when a 50-magnitude wind event was reported. The most damaging wind incident to affect Beaver County was on September 14th, 2008 with a 70- magnitude wind event which reported to have caused \$5 million in damages. See *Tables 37 – Beaver County Tornado History*, *Table 38 - Beaver County High Wind History*, and *Figure 25 - Past Tornado Occurrences in Beaver County* below for reference to the past tornado occurrence events and data within the county.

Table 37 - Beaver County Tornado History

Beaver County Tornado History (NOAA NCEI, 2020)					
Location	Date	Magnitude (F/EF Scale)	Deaths	Injuries	Property Damage
Beaver County	6/10/1954	F2	0	1	\$25,000.00
Beaver County	5/12/1956	F2	0	0	\$250,000.00
Beaver County	4/23/1966	F1	0	0	\$25,000.00
Beaver County	9/3/1970	F1	0	5	\$2,500,000.00
Beaver County	3/24/1975	F1	0	0	\$25,000.00

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Location	Date	Magnitude (F/EF Scale)	Deaths	Injuries	Property Damage
Beaver County	6/4/1975	F2	0	0	\$250.00
Beaver County	7/11/1976	-	0	0	\$2,500.00
Beaver County	6/21/1981	F1	0	0	\$25,000.00
Beaver County	7/4/1983	F1	0	1	\$250,000.00
Beaver County	7/19/1983	F1	0	0	\$25,000.00
Beaver County	5/31/1985	F3	3	40	\$25,000,000.00
Beaver County	7/22/1990	F1	0	0	\$25,000.00
Beaver County	4/9/1998	F1	0	0	\$10,000.00
Beaver County	6/2/1998	F1	0	0	\$400,000.00
Beaver County	6/2/1998	F0	0	0	\$10,000.00
Beaver County	7/10/2017	EF0	0	0	\$15,000.00
Beaver County	4/7/2020	EF0	0	0	\$0.00
Beaver County	6/10/2020	EF2	0	0	\$0.00
Totals	18 events	-	3	47	\$28,588,000.00

Table 38 - Beaver County High Wind History

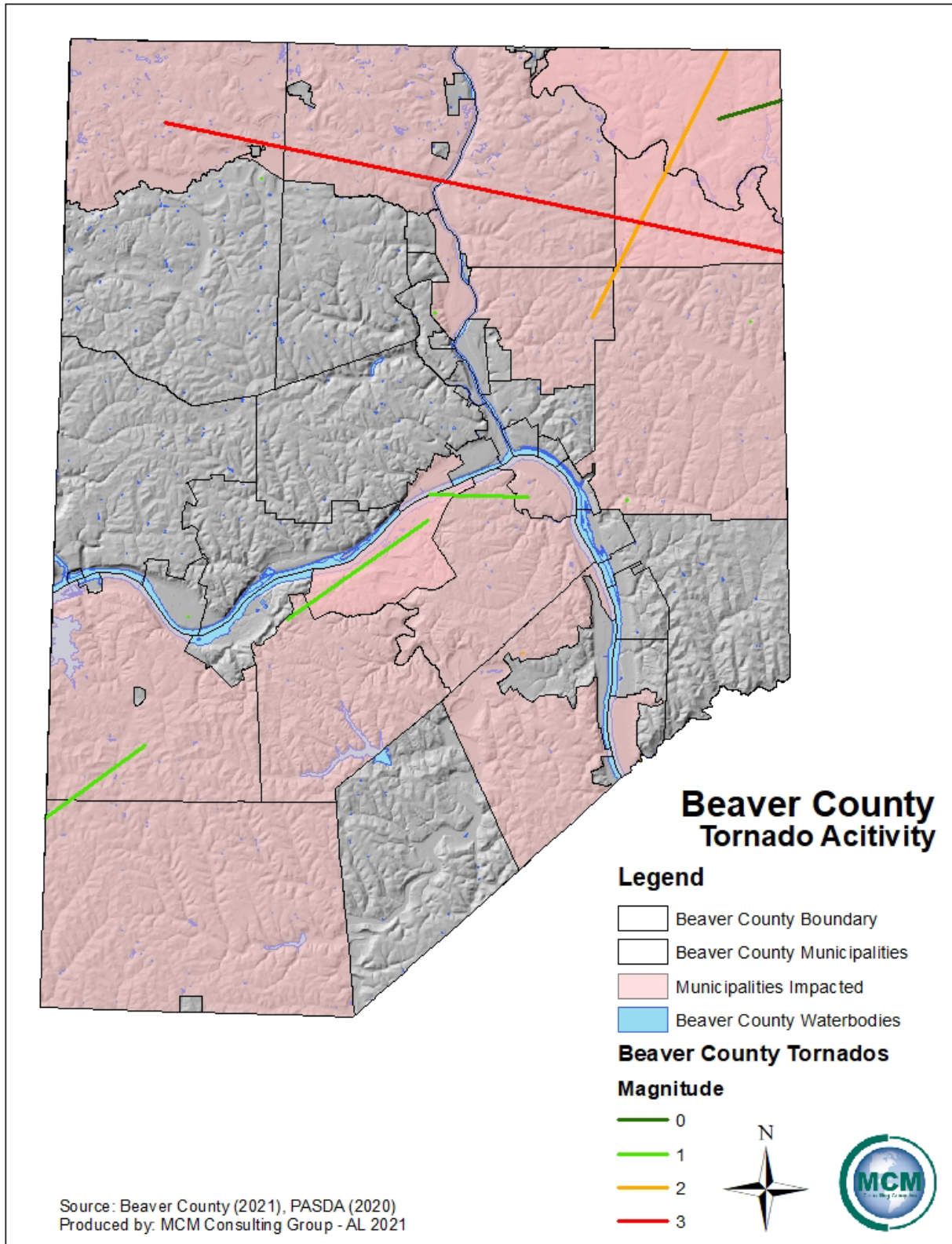
Beaver County High Wind History (NOAA NCEI, 2020)				
Location	Date	Mag. (knots)	Injuries	Property Damage
Beaver County	3/25/1996	55 kts.	0	\$0.00
Beaver County	4/30/1996	51 kts.	0	\$0.00
Beaver County	10/30/1996	55 kts.	0	\$5,000.00
Beaver County	2/22/1997	-	0	\$2,000.00
Beaver County	5/1/1997	-	1	\$10,000.00
Beaver County	9/29/1997	-	0	\$4,000.00
Beaver County	4/16/1999	50 kts.	0	\$0.00
Beaver County	1/10/2000	50 kts.	0	\$4,000.00
Beaver County	12/12/2000	-	0	\$100,000.00
Beaver County	2/25/2001	52 kts.	0	\$5,000.00
Beaver County	12/14/2001	50 kts.	0	\$5,000.00

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Location	Date	Mag. (knots)	Injuries	Property Damage
Beaver County	2/1/2002	-	0	\$10,000.00
Beaver County	3/9/2002	-	0	\$10,000.00
Beaver County	2/23/2003	55 kts.	0	\$5,000.00
Beaver County	3/8/2003	55 kts.	0	\$0.00
Beaver County	7/21/2003	52 kts.	0	\$5,000.00
Beaver County	3/5/2004	50 kts.	1	\$10,000.00
Beaver County	12/1/2006	55 kts.	0	\$25,000.00
Beaver County	1/30/2008	50 kts.	0	\$50,000.00
Beaver County	9/14/2008	70 kts.	0	\$5,000,000.00
Beaver County	2/12/2009	50 kts.	0	\$100,000.00
Beaver County	12/9/2009	50 kts.	0	\$0.00
Beaver County	12/9/2009	50 kts.	0	\$750,000.00
Beaver County	2/24/2012	50 kts.	0	\$10,000.00
Beaver County	2/24/2019	50 kts.	0	\$0.00
Total	25 events	-	2	\$6,110,000.00

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Figure 25 - Past Tornado Occurrences in Beaver County



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4.3.8.4 Future Occurrence

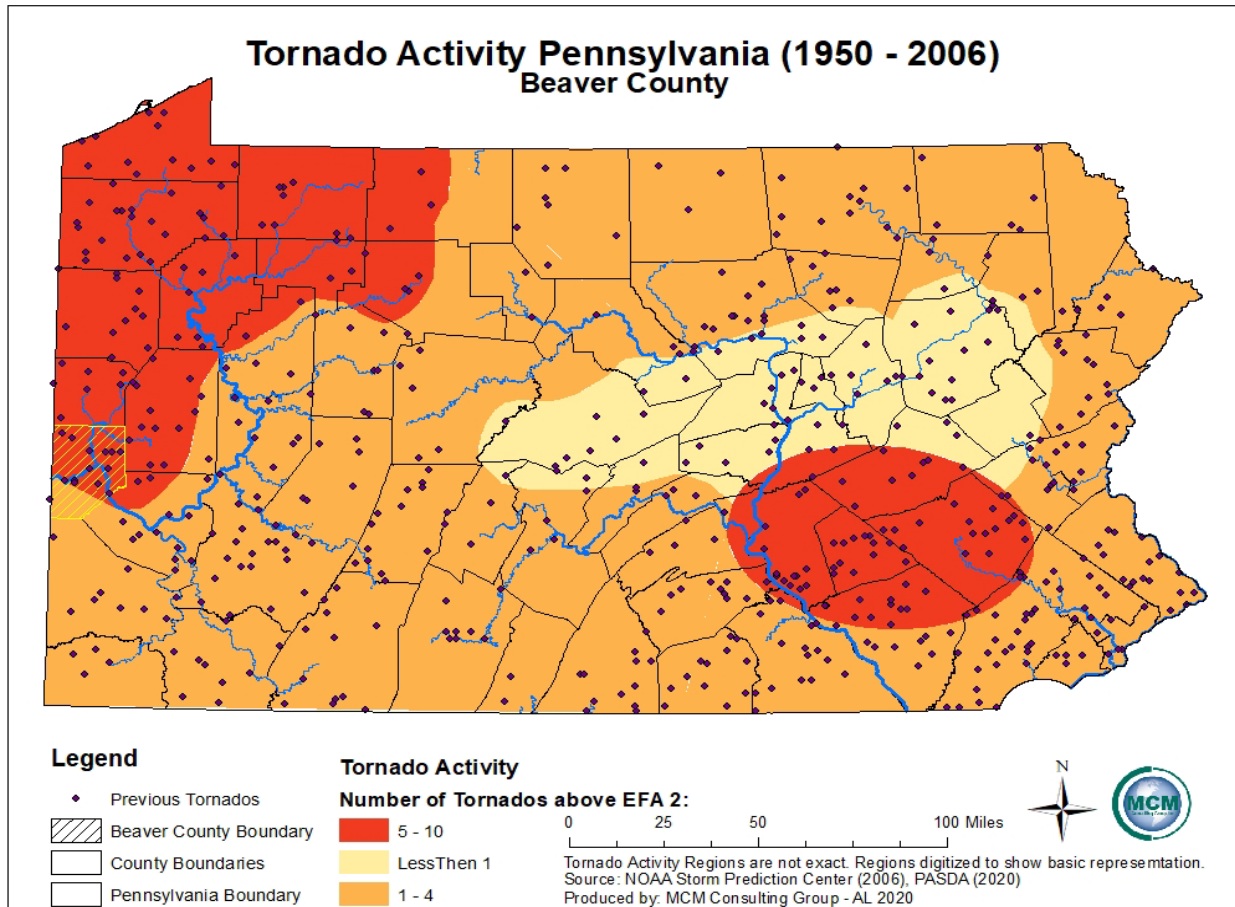
According to the National Weather Service, the Commonwealth of Pennsylvania has an annual average of ten tornadoes with two related deaths. While the chance of being hit by a devastating tornado in Beaver County is average, the damage that results when the tornado arrives can be catastrophic. An EF-5 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. The number of windstorms and tornadoes occurring in the county is expected to remain constant. As the county’s population continues to 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 county with hilly terrain. 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 higher. The number of days when tornadoes occur in the United States has decreased; however, there has been an increase in tornado activity on those days. The tornado season has also been lengthening, with the season starting earlier than it has historically. Pennsylvania had, for example, a record number of tornados in April and May 2019 compared to any other April or May on record. Climate change is causing temperatures and air moisture to increase, and it is thought that these changes could result in an increase in frequency and intensity of tornadoes and severe windstorms; however, there is somewhat low confidence in these conclusions and there is still much uncertainty. Therefore, the number of future tornado/windstorm events could potentially increase due to many factors.

Based on historical incidents, there are three zones in Pennsylvania that can either experience less than one, one to four, and five to ten of EF2 or above tornadoes per 3,700 square miles. Communities in Beaver County, as shown in the *Figure 26 - Tornado Activity in Beaver County* below, are expected to have five to ten tornadoes annually. The approximation of five to ten tornadoes annually assists with determining the rate of future tornado occurrences within Beaver County. Future tornadoes will be similar to those that affected the county in past events.

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Figure 26 - Tornado Activity in Beaver County



4.3.8.5 Vulnerability Assessment

Tornadoes can occur at any time of the year, though they are more likely during peak months, which are during the summer for the northern part of the United States, such as Pennsylvania. While 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 are 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 secondary impacts of tornadoes and windstorms, including 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.

Dangers that accompany thunderstorms associated with tornadoes which increase the vulnerability of Beaver County:

- Flash floods – with 146 deaths annually nationwide
- Lightning – 75 to 100 deaths annually nationwide

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- Damaging straight-line winds – reaching 140 mph wind speed
- Large hail – can reach the size of a grapefruit and causes several \$100 million in damages annually to property and crops.

Since high-wind incidents may affect the entire county, it is important to identify specific critical facilities and assets that are most vulnerable to the hazard. Critical facilities are highly vulnerable to high windstorms. While many severe storms can cause exterior damage to structures, tornadoes can also completely destroy structures, along with their surrounding infrastructure, abruptly halting operations. Tornadoes are often accompanied by severe storms which can be threatening to critical facilities within the county. Many critical facilities are particularly vulnerable to power outages which can leave facilities functionless, potentially crippling infrastructure supporting the population of the county. A storm potentially has the ability to destroy structures, citizens, and their possessions that are often left at the will of the storm. The elderly and disabled, and non-English speaking residents are at risk when faced with tornadoes. Without assistance to evacuate or difficulty understanding public information, they may be unable to prepare themselves or their homes and other possessions to safely weather the storm. Due to their lightweight and often unanchored design, commercial trailers and mobile homes are also extremely vulnerable to high winds/tornadoes and will generally sustain the most damage. These structures represent a reasonable percentage of the occupied structures within the county. A majority of the mobile homes are found in New Sewickley Township, Independence Township, and South Beaver Township, which makes these three municipalities more vulnerable to tornado events than others. Locations of mobile home parks in Beaver County can be found in *Table 39 – Vulnerable Mobile Homes in Beaver County*.

Table 39 - Vulnerable Mobile Homes in Beaver County

Vulnerable Mobile Homes in Beaver County	
Municipality	Number of Mobile Homes
Greene Township	19
Hanover Township	5
Independence Township	112
New Sewickley Township	390
Raccoon Township	30
South Beaver Township	120
Total	676

The local economy is also vulnerable due to possibility of being crippled by tornadoes and windstorms and their secondary effects when buildings and supporting infrastructure are destroyed in the storm. Power outages can create work stoppages while transportation accidents and road closures

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can limit the transportation of goods and services. Additionally, flooding cannot be discounted as it can destroy the physical structures, merchandise, and equipment essential for business operation. In the case of hazardous material spills caused by windstorms, the local environment can also be negatively impacted, requiring extensive clean-up, and mitigation efforts.

4.3.9. Winter Storm

4.3.9.1 Location and Extent

There is an average of thirty-five winter weather events that impact Pennsylvania each year. Such winter storms are regional events, so each county in Pennsylvania share these hazards; however, the northern tier, western counties and mountainous regions generally experience storms more frequently and with a greater severity due to lake effects and geographic influence. The extent of a severe winter storm can be classified by meteorological measurements and by evaluating the societal impacts.

On occasion, Beaver County can be affected by a Nor'easter, depending on its track. A Nor'easter is a storm characterized by a central low-pressure area that deepens dramatically as it moves northward along the U.S. East Coast. The name came from the strong northeast winds that precede and accompany the storm as it passes over New England. Nor'easters are notorious for producing heavy snow in the Central and Northeastern Mountains, but typically make lighter snow (or even no snow) for counties in the west. Nor'easters will ordinarily produce a heavy, wet snow. There is usually a fairly consistent distinction between rain, mixed precipitation, and snow which moves along with the storm and generally parallel to the track of the surface low. The boundary typically pivots with the storm as the track changes direction. The mixed precipitation and rainfall are generated when warmer marine air is pulled into the storm. The heaviest snow in a Nor'easter falls to the north and west of the track of the surface low (NWS).

4.3.9.2 Range of Magnitude

Winter storms consist of cold temperatures, heavy snow or ice, and sometimes strong winds. Descriptions of types of winter storms can be found in *Table 40 - Winter Weather Events*. Beaver County generally experiences one or more significant winter storms each year. The storms come in the form of snow, freezing rain, and sub-zero temperatures lasting for several days. Winter storms have caused power failures, loss of communications networks, road closings, disruption of EMS and fire response capabilities and losses of water supplies throughout the county. Power outages, sometimes caused by large amounts of snow or ice weighing on and breaking power lines, can result in a loss of heat for residential customers, potentially posing a threat to human life.

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Table 40 - Winter Weather Events

Winter Weather Events (NWS, 2009)	
Weather Event	Classification/Description
Heavy Snowstorm	Accumulations of 4 inches or more in a six-hour period, or 6 inches or more in a twelve-hour period.
Sleet Storm	Significant accumulations of solid pellets which form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces posing hazards to pedestrians and motorists.
Sleet Storm	Significant accumulations of solid pellets which form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces posing hazards to pedestrians and motorists.
Ice Storm	Significant accumulations of rain or drizzle freezing on objects (trees, power lines, roadways, etc.) as it strikes them, causing slippery surfaces and damage from the sheer weight of ice accumulation.
Blizzard	Wind velocity of 35 miles per hour or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period of time.
Severe Blizzard	Wind velocity of 45 miles per hour, temperatures of 10°F or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period time.

NOAA’s National Centers for Environmental Information (NCEI) has produced the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the United States. The RSI ranks snowstorm impacts on a scale from one to five, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. However, RSI differs from these others because population is included. The RSI is based on spatial extent of the storm, the amount of snowfall, and the combination of these elements with population. Including population information ties the index to societal impacts. The RSI is an evolution of the Northeast Snowfall Impact Scale (NESIS), which NCEI, then NCDC, produced. *Table 41 – NOAA’s RSI Scale* show the RSI categories one through five with their related description. The United States, as a whole, is divided up into six easternmost climate regions which include, Northern Rockies, Upper Midwest, Northeast, Ohio Valley, South, and Southeast. Beaver County, along with the Commonwealth, are located within the Northeast portion of the six.

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Table 41 - NOAA's RSI Scale

NOAA's RSI Scale (NOAA & NCDC, 2011)		
Category	RSI Value	Description
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18.0+	Extreme

Long cold spells can cause rivers and lakes to freeze over. A subsequent thaw and rise in the water level break the ice into large chunks and can result in ice jams when the ice begins to flow. The ice jams can act as dams and result in flooding. Environmental impacts often include damage to shrubbery and trees due to heavy snow loading, ice build-up, and high winds which can break limbs or even bring down large trees. While gradual melting of snow and ice provides excellent groundwater recharge, high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding. *Table 42 – Monthly Snowfall Average* illustrates the snowfall average for each month experienced in Beaver County.

Table 42 - Monthly Snowfall Average

Monthly Snowfall Average (NOAA, 2020)	
Month	Beaver County
January	6.3"
February	6.6"
March	3.5"
April	0.6"
May	0.0"
June	0.0"
July	0.0"
August	0.0"
September	0.0"
October	0.1"
November	0.7"
December	3.9"
Annual	21.6"

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4.3.9.3 Past Occurrence

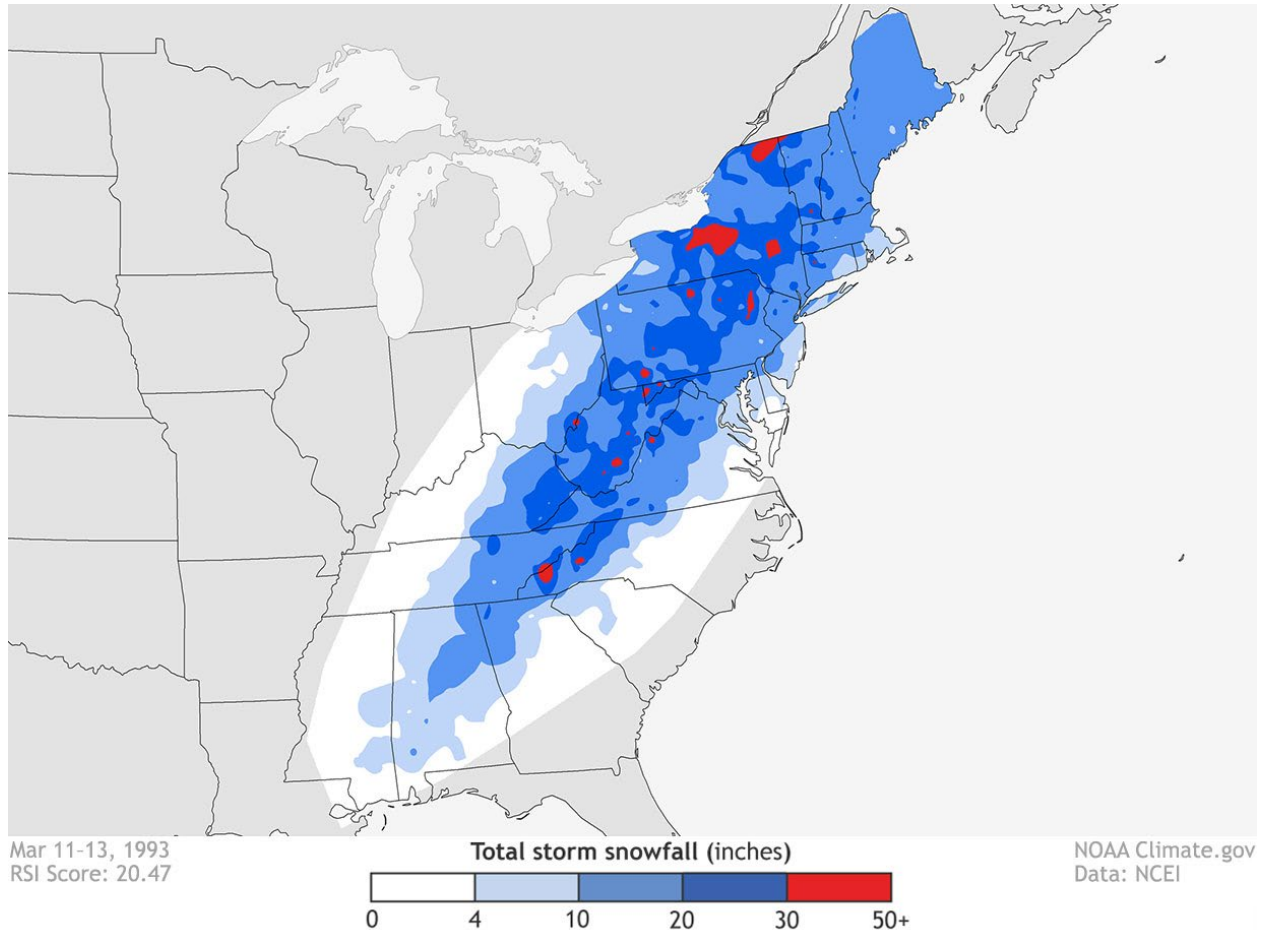
Due to a great number of various sources in regard to winter events in Beaver County, loss and impact of information for these events may vary depending on the source. Winter storms occur on average anywhere from one to three times a year in Beaver County. According to NOAA-NCEI, Beaver County underwent eleven winter storm events (1993 – 2018), ten winter weather events (2009 – 2020), eleven heavy snow events (1996 – 2018), and eleven ice storm events (1996 – 2016). Data was only available between certain years for each hazard type. This information can be found in *Table 43 – Beaver County Winter Storm History*, *Table 44 – Beaver County Winter Weather History*, *Table 45 – Beaver County Heavy Snow History*, and *Table 46 – Beaver County Ice Storm History* below. There was no available data for sleet events in Beaver County. No direct deaths or injuries were reported for the following winter weather events in Beaver County, but detailed reports of each event can be found on NOAA’s Storm Events Database at www.ncdc.noaa.gov/stormevents. Beaver County has been susceptible to an array of winter weather events. This weather has had the ability to close businesses, close schools, and block/damage roadways throughout the county. The main transportation routes in the county (Interstates 76 and 376, U.S. Route 30/Lincoln Highway, State Routes 18, 51, 65, 68, 151, 168, 251, 288, 351, 551, 588, 989) are normally opened immediately for emergency traffic, but secondary roads can remain impassable for days. Most residents and travelers in Beaver County are aware of winter weather announcements and avoid travel when under a winter storm watch. The history of major winter storms and other related events in Beaver County since 1950 is outlined in the tables at the end of this section.

A severe winter event in the county’s history and the Commonwealth as a whole was in the winter of 1994 when the state was hit by a series of protracted winter storms. The severity and nature of these storms combined with accompanying record-breaking frigid temperatures posed a major threat to the lives, safety and well-being of Commonwealth residents and caused major disruptions to the activities of schools, businesses, hospitals, and nursing homes. One of these devastating winter storms occurred in early January 1994 with record snowfall depths in many areas of the commonwealth, strong winds and freezing rains. Numerous storm-related power outages were reported and as many as 600,000 residents were without electricity, in some cases for several days at a time. A ravaging ice storm followed which closed major arterial roads and downed many trees and power lines. Utility crews from a five-state area were called to assist in power restoration repairs. Serious and sporadic power supply outages continued through mid-January in many locations due to record cold temperatures. The entire Pennsylvania-New Jersey-Maryland grid and its partners in the District of Columbia, New York and Virginia experienced fifteen to thirty minute rolling blackouts, threatening the lives of people and the safety of the facilities in which they resided. Power and fuel shortages affecting Pennsylvania and the East Coast power grid system required the Governor to recommend power conservation measures be taken by all commercial, residential, and industrial power consumers. The record cold conditions (with temperatures as low as -31°F) resulted in numerous water-main breaks and interruptions of service to thousands of municipal and city water customers throughout the Commonwealth. The extreme cold in conjunction with accumulations of

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frozen precipitation resulted in acute shortages of road salt. Trucks were dispatched to haul salt from New York to expedite deliveries to Pennsylvania Department of Transportation storage sites. For Beaver County specifically, specific snowfall totals during that storm were not available, but the county noted this was one of the worst storms ever experienced. The year prior to the 1994 event, the country’s so-called “Storm of the Century” clobbered the east coast. See *Figure 28 - Storm of the Century Total Storm Snowfall*.

Figure 27 - Storm of the Century Total Storm Snowfall



Source: (NOAA, 1993)

On March 12–14, 1993, a massive storm system bore down on nearly half of the U.S. population. Causing approximately \$5.5 billion in damages (\$9.9 billion in year 2020 dollars), America’s “Storm of the Century”, as it would become known, swept from the Deep South all the way up the East Coast. With a central pressure usually found in Category three hurricanes, the storm spawned tornadoes and left coastal flooding, crippling snow, and bone-chilling cold in its wake. Of the more than 250 weather and climate events with damages exceeding \$1 billion since 1980, this storm remains the country’s most costly winter storm to date. Beaver County specifically experienced anywhere around 10 to 30 inches of snow from the snowstorm events and damages throughout the entire county.

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Table 43 - Beaver County Winter Storm History

Beaver County Winter Storm History (NOAA NCEI, 2020)		
Location	Date	Event
Beaver County	03/13/1993	Winter Storm
Beaver County	01/07/1994	Winter Storm
Beaver County	01/02/1999	Winter Storm
Beaver County	01/02/1999	Winter Storm
Beaver County	01/08/1999	Winter Storm
Beaver County	01/13/1999	Winter Storm
Beaver County	12/13/2000	Winter Storm
Beaver County	02/12/2008	Winter Storm
Beaver County	03/07/2008	Winter Storm
Beaver County	02/09/2010	Winter Storm
Beaver County	02/04/2014	Winter Storm
Beaver County	01/12/2018	Winter Storm

Table 44 - Beaver County Winter Weather History (NOAA NCEI, 2020)

Beaver County Winter Weather History (NOAA NCEI, 2020)		
Location	Date	Event
Beaver County	12/13/2009	Winter Weather
Beaver County	02/16/2010	Winter Weather
Beaver County	11/22/2014	Winter Weather
Beaver County	12/02/2014	Winter Weather
Beaver County	03/20/2014	Winter Weather
Beaver County	04/01/2018	Winter Weather
Beaver County	11/14/2018	Winter Weather
Beaver County	02/20/2019	Winter Weather
Beaver County	12/17/2019	Winter Weather
Beaver County	02/07/2020	Winter Weather

Table 45 - Beaver County Heavy Snow History

Beaver County Heavy Snow History (NOAA NCEI, 2020)		
Location	Date	Event
Beaver County	01/06/1996	Heavy Snow

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Location	Date	Event
Beaver County	03/09/1999	Heavy Snow
Beaver County	02/16/2003	Heavy Snow
Beaver County	12/05/2003	Heavy Snow
Beaver County	03/01/2005	Heavy Snow
Beaver County	02/13/2007	Heavy Snow
Beaver County	01/09/2009	Heavy Snow
Beaver County	02/05/2010	Heavy Snow
Beaver County	02/21/2011	Heavy Snow
Beaver County	12/26/2012	Heavy Snow
Beaver County	02/07/2018	Heavy Snow

Table 46 - Beaver County Ice Storm History (NOAA NCEI, 2020)

Beaver County Ice Storm History (NOAA NCEI, 2020)		
Location	Date	Event
Beaver County	01/02/1996	Ice Storm
Beaver County	11/13/1997	Ice Storm
Beaver County	12/11/2002	Ice Storm
Beaver County	02/05/2004	Ice Storm
Beaver County	03/16/2004	Ice Storm
Beaver County	01/22/2005	Ice Storm
Beaver County	12/15/2005	Ice Storm
Beaver County	01/27/2009	Ice Storm
Beaver County	01/31/2011	Ice Storm
Beaver County	02/01/2011	Ice Storm
Beaver County	12/17/2016	Ice Storm

4.3.9.4 Future Occurrence

There is a high probability of winter weather and winter storms occurring in Beaver County, with expected annual events across most of the commonwealth. An analysis of the past occurrences indicates that this trend will continue annually in the future. Meanwhile, climate change is expected to bring changes to the future of winter storms impacting Pennsylvania. Climate scientists believe that extreme winter storms are expected to occur more frequently. There have been about twice as many extreme snow events in the United States in the latter half of the 20th century as occurred in the first half. This uptick is caused in part by higher-than-normal ocean surface temperatures that result in an increased source of moisture for storms that develop over the Atlantic Ocean. Conditions

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for severe winter storms are particularly heightened in the eastern United States due to changes in atmospheric circulation patterns caused by higher temperatures and melting Arctic sea ice. Winters in 2000 and 2001 were mild in Pennsylvania and led to spring-like thunderstorms during the winter months rather than snowstorms. Such thunderstorms can be followed by cold fronts and winter storms resulting in temperature drops of 50°F in a few short hours. Even though average temperatures are expected to be higher overall and there are expected to be fewer extreme cold days, those that do occur are expected to reach record-setting low temperatures more frequently. Winter storms are a regular, annual occurrence in Beaver County and should be considered highly likely.

4.3.9.5 Vulnerability Assessment

Winter storms are a concern based on frequency of winter storm effects on Beaver County. Based on the information available, all communities in Beaver County are essentially equally vulnerable to the direct impacts of winter storms. Residents of the more rural areas of the county may be more susceptible to the vulnerability of delayed emergency medical assistance.

Because of the frequency of winter storms, strategies have been developed to respond these events. Snow removal and utility repair equipment is present to respond to typical events. The use of auxiliary heat and electricity supplies such as wood burning stoves, kerosene heaters and gasoline power generators reduces the vulnerability of humans to extreme cold temperatures commonly associated with winter storms but can increase their vulnerability to other hazards. People residing in structures lacking adequate equipment to protect against cold temperatures or significant snow and ice are more vulnerable to winter storm events. Even for communities that are prepared to respond to winter storms, severe events involving snow accumulations that exceed six or more inches in a twelve-hour period can cause a large number of traffic accidents, interrupt power supply and communications, and cause the failure of inadequately designed and/or maintained roof systems.

Icy and snow-covered roads often result in increases in traffic incidents. Residents of the mountainous and more rural areas of the county may be more susceptible during severe storms, especially when emergency medical assistance is required due to the location's potential for isolation. The economic impacts from snow removal, road and infrastructure repair and other secondary effects impart a great strain on the budgets and material resources of local municipalities.

Even for communities that are prepared to respond to winter storms, severe events involving snow accumulations that exceed six or more inches in a twelve-hour period can cause a large number of traffic accidents, strand motorists due to snow drifts, interrupt power supply and communications, and cause the failure of inadequately designed and/or maintained roof systems. Similar to the vulnerability assessment discussion for tornados and severe wind, vulnerability to the effects of winter storms on buildings is dependent on the age of the building, construction material used and condition of the structure.

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4.3.10. Dam and Levee Failure

4.3.10.1 Location and Extent

Dams

A dam restricts the flow of water or underground streams and often create 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. Levees are a type of dam feature and are used to prevent water from entering an area that would otherwise be submerged. This allows for reclaiming land for human use in development, or agriculture.

Dam failures most often occur during or after a massive rainfall, flooding, or spring thaws, sometimes with little to no warning. Depending on the size of the water body where the dam is constructed, water contributions may come from distant upstream locations. Water contributions may also come from dam failures in adjoining counties, along the same riverine or water features.

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 that 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). As listed in the below table, there are (insert number of dams in county) dams in Beaver County registered with the U.S. Army Corp of Engineers (USACE) in the NID. According to the NID there are dams that have emergency action plans and dams that do not require them. *Table 47 – Beaver County Dam Inventory* illustrates the dams located within Beaver County, PA and subsequent information including year completed, drainage area, and EAP inclusion.

Table 47 - Beaver County Dam Inventory

Beaver County Dams (NID 2021)						
Dam Name	River	Owner Name	Year Completed	Drainage Area	Hazard	EAP
Montgomery Locks and Dam	Ohio River	CELRP	1936	22969	S	Y
Bradys Run	South Branch Brady Run	Beaver County Commissioners	1949	13.8	H	Y
Homewood	TR Clarks Run	Alfred E. Desanzo	1852	0.3	S	N
Group Camp	Traverse Creek	DCNR	1938	6.85	H	Y

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Dam Name	River	Owner Name	Year Completed	Drainage Area	Hazard	EAP
J C Bacon	Service Creek	Ambridge Water Authority	1956	15.45	H	Y
Raccoon Creek	Traverse Creek	DCNR	1948	19.1	H	Y
Little Blue Run	Little Blue Run	Thomas McLaughlin	1977	2.9	H	Y
Lakewood Development	Moon Run	Ted and Cathy Vana	1982	0.8	S	N
Industrial Wastes, Inc South Pond	East Fork Stateline Creek	Thomas McLaughlin	1990	0.1	L	NR
Industrial Wastes Settlement Pond	East Fork Stateline Creek	Thomas McLaughlin	1990	0.24	S	N
North Low Dissolved Solids IMP	Watershed Ohio River	FirstEnergy Generation LLC	1974	0.18	S	Y
South Low Dissolved Solids IMP	Watershed Ohio River	FirstEnergy Generation LLC	1974	0.18	S	Y
West Surge Pond	Watershed Ohio River	FirstEnergy Generation LLC	1974	0.08	S	Y
Patterson	Beaver River	Beaver Valley Power Company, LLC	1825	1981	L	NR
Upper Southside Sport	Traverse Creek	Southside Sportsmen's Club	1979	0.31	S	N
Little Blue Saddle	Mill Creek	FirstEnergy Generation LLC	1977	2.9	S	Y
Townsend	Beaver River	Beaver Falls Municipal Authority	1913	3112	L	NR

The Pennsylvania Department of Environmental Protection (PA DEP) defines a high-hazard dam as “any dam so located to endanger populated areas downstream by its failure” (PA DEP, 1985). 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 (PA DEP 2008).

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Levees

Levee failures have the potential to place large numbers of people and properties 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 flooding events. Levees do not serve a purpose beyond flood protection, unlike dams, which can serve to store water or generate energy in addition to protect areas from flooding. The National Levee Database (NLD), like its counterpart of the NID, is maintained by the U.S. Army Corps of Engineers (USACE) and tracks levees across the United States. Beaver County is home to two levees, which are detailed in *Table 48 – Beaver County Levee Inventory*. *Figure 30 – Beaver County Levee Locations* offers a map view of the levees in the county.

Both levees within Beaver County are located within Darlington Township. Darlington Township has a high level of flood protection posed by local waterways.

Table 48 - Beaver County Levee Inventory

Beaver County Levee Inventory (National Levee Database, 2021)					
Name	Levee Type	Levee Length	Levee Area	Sponsor	FEMA Accreditation Rating
Darlington- Left Bank North Fork Little Beaver	Mainline	0.295163	0.016109	Beaver County	NALS
Darlington- Right Bank North Fork Little Beaver	Mainline	0.119477	0.002502	Beaver County	NALS

4.3.10.2 Range and Magnitude

Dams

Dam failure 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 dams 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 damned impoundment or water body. *Figure 29 – Beaver County Dams* shows the location of dams with Beaver County.

Dam failures may or may not leave enough time for evacuation of people and property, depending on their abruptness. Seepages in earth dams usually develop gradually, and, if the embankment damage is detected early, downhill residents have at least a few hours or days to evacuate. Failures of concrete or masonry dams tend to occur suddenly, sending a wall of water and debris down the valley quickly. Dam failures due to the overtopping of a dam normally give sufficient time for evacuation.

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Levees

Levee failures 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 decay or deteriorate. Regular maintenance of levees is critical to successful function and protection. *Figure 30 – Beaver County Levee Locations* illustrates areas protected by Beaver County Levees, and also displays the locations of those levees with Beaver County.

A levee failure or 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 the 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.

4.3.10.3 Past Occurrence

Dams

The National Performance of Dams (NPD) Program lists no occurrences of dam failure or major incidents occurring at any of the dams in Beaver County. However, one municipality indicated there was a dam failure in Eastvale in April 2017 impacting drinking water supply.

Levees

The National Levee Database (NLD) lists no occurrence of levee failure or major incidents occurring at any of the levees in Beaver County.

4.3.10.4 Future Occurrence

Although dam and levee failures can occur at any time, given the right circumstances, the future occurrence of dam or levee failures in Beaver County can be considered 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 dams that meet or exceed the following criteria:

- Impound water from a drainage area or 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, modification, and abandonment of dams is reviewed and monitored by the PA DEP Division of Dam Safety. Dams are evaluated based on categories such as

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slope stability, undermining seepage, and spillway adequacy. Levees should also be inspected on a routine or periodic basis to ensure continued maintenance.

Additionally, 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 of flooding, other levees may be designed to protect against smaller or larger floods.

4.3.10.5 Vulnerability Assessment

Property and populations located downstream from any dam or levee are vulnerable to dam and levee failures. The Pennsylvania Code (§105.91 Classification of dams and reservoirs) classifies both dams by size and the amount of loss of life and economic loss expected in a failure event. *Table 49 – Dam Classification* displays the dam classification parameters. Although the size of a dam may result in varying impacts, the hazard potential classification of category one dams is a more important reference indicator, since that will indicate the level of potential substantial loss of life and excessive economic loss.

Table 49 - Dam Classification

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

Dams

Dam and levee 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. The economic and financial impact from damage and recovery can range from minimal to severe, depending on the magnitude of damage and scale of failure.

Of the five dams that are considered high hazard dams, the dam with the largest drainage area is the J. C. Bacon Dam which has a drainage area of 15.45 acres. The J. C. Bacon Dam was constructed in 1956 and was last inspected on November 17, 2017. The oldest dams in the county were constructed in the 1800's with the Patterson Dam being constructed in 1825 and the Homewood Dam constructed in 1852. The dams that were constructed most recently include the Industrial Wastes, Inc South Pond Dam, and the Industrial Wastes Settlement Pond Dam. These dams were constructed in 1990 and represent the only dams located in Darlington Township. The dam in Beaver County with the highest

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height is the Little Blue Run Dam which is 400 feet high. This dam is also classified as a high hazard dam based on National Inventory of Dams classification.

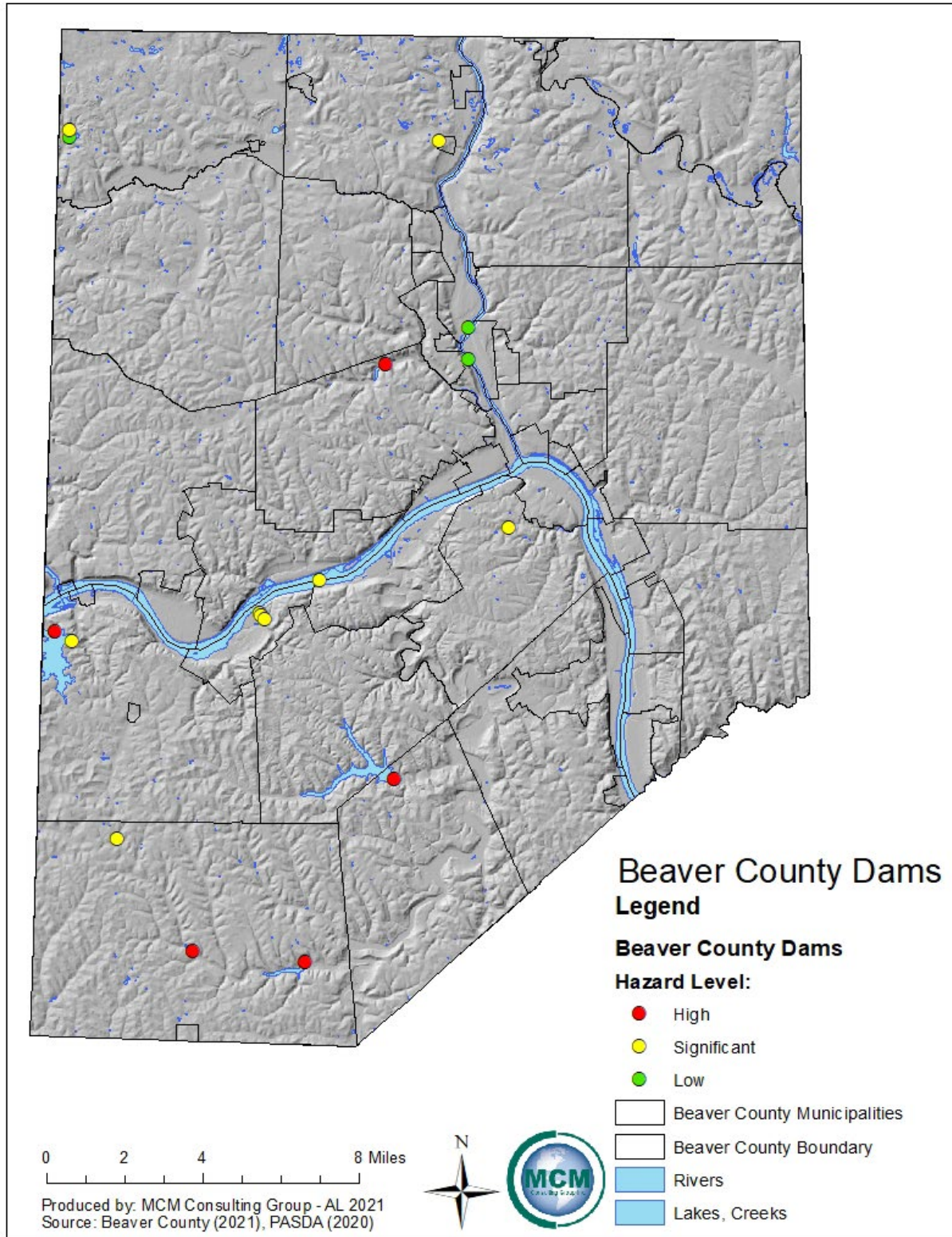
Of the dams in Beaver County, four are owned by FirstEnergy Generation, LLC. These dams are the North Low Dissolved Solids IMP Dam, South Low Dissolved Solids IMP Dam, West Surge Pond Dam, and Little Blue Run Dam. The Raccoon Creek Dam is a high hazard dam in the county that is owned by the Pennsylvania Department of Conservation of Natural Resources (DCNR). The Raccoon Creek Dam is considered high-hazard and has a drainage area of 19.1 acres. This dam was constructed in 1948 and was last inspected on June 8, 2018. The PA DCNR also owns the Group Camp Dam which is located in Hanover Township. Two dams are owned by local municipal water authorities. These dams are the J.C. Bacon Dam and the Townsend Dam and are owned by the Ambridge Water Authority and the Beaver Falls Municipal Authority, respectively.

Levees

There is a total of forty-four structures that are located within leveed areas in Beaver County. Of these structures six are located within Big Beaver Borough and thirty-eight are located within Darlington Township. There are no critical infrastructure or functional needs facilities located within the leveed areas for Beaver County. There are also no SARA facilities that are located within the leveed areas.

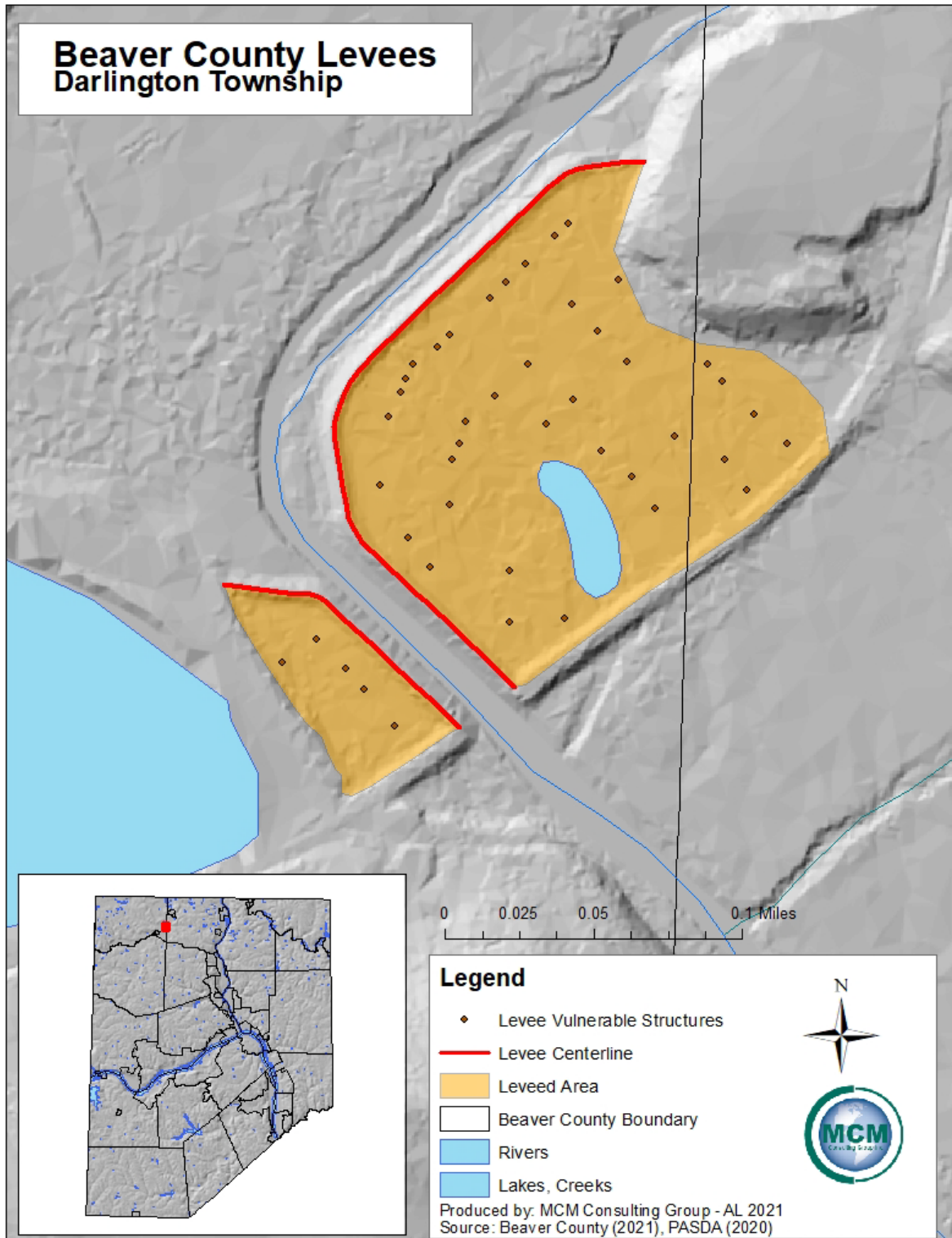
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Figure 28 - Beaver County Dams



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Figure 29 - Beaver County Levee Locations



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4.3.11. Civil Disturbance and Criminal Activity

4.3.11.1 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, disinformation, 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.

4.3.11.2 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 to 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.

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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 is attempting 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.

Beaver County's greatest threat to civil disturbance is in the town of Beaver, located in Beaver 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. Beaver County is home to three colleges/universities within its borders: Penn State Beaver, Geneva College, and Community College of Beaver County. Additionally, other major universities such as University of Pittsburgh, Duquesne University, Carnegie Mellon, Robert Morris University and Carlow College are all located within an hour of Beaver County.

4.3.11.3 Past Occurrence

The county has not experienced any significant civil disturbance events. In 2013, nearly forty employees at the Friendship Ridge Nursing Home led a peaceful protest in front of the county courthouse to protest the sale of the home to a private company. Additionally, in 2013, a well site protest was held in neighboring Lawrence County, North Beaver Township.

The only event to take place since 2013 was the Black Lives Matter (BLM) march which took place

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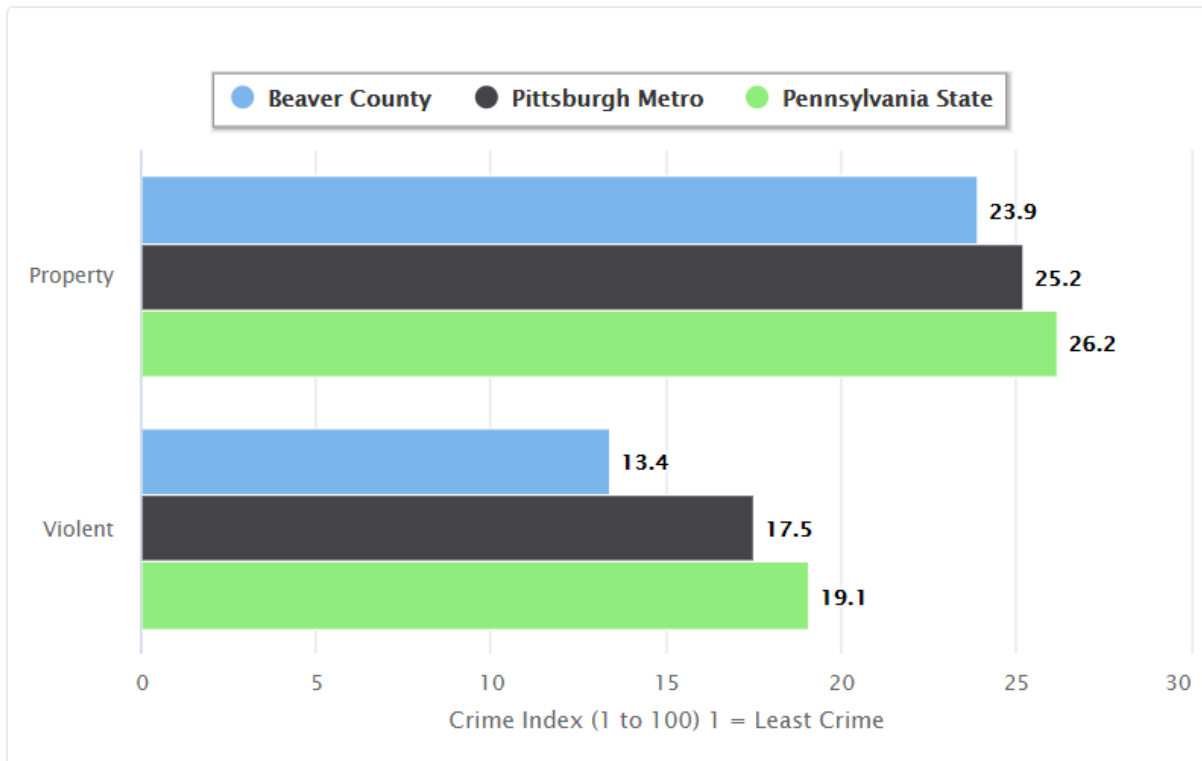
in August 2020 and ended peacefully. This walk consisted of approximately thirty marchers that crossed the state border into Beaver County from Ohio and ended in Bridgewater Borough via Route 51. It is important to note this event in this profile as it could have resulted in destruction of property and injuries to bystanders.

4.3.11.4 Future Occurrence

While unlikely, civil disturbances may occur in Beaver County, and it is difficult to accurately predict the probability of future occurrence for civil disturbance events over the long-term. It is estimated that a civil disturbance event could occur every thirty years or less in Beaver County. Overall, it is ranked as a high-risk hazard, accordingly the risk factor score developed by the local planning team. Although civil disturbance is a rare occurrence, the LPT decided this should be a high-risk hazard due to current political trends.

Similar to civil disturbance, it is extremely difficult to predict when criminal activity may take place in Beaver County and throughout the Commonwealth of Pennsylvania. According to information gathered by bestplace.net and illustrated in *Figure 31 – Crime Index in Beaver County*, Beaver County has a violent crime index of 13.4, which is 5.7 less than the Pennsylvania state average of 19.1.

Figure 30 - Crime Index in Beaver County



Overall, the local planning team has designated criminal activity as a low-risk hazard, according to

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the risk factor score found on page 192.

4.3.11.5 Vulnerability Assessment

All municipalities in Beaver 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. Some functional needs facilities are important to be aware of as both potential locations for civil disturbance events, and important locations during civil disturbance response. Maps showing functional needs facilities by municipality can be found in *Appendix D (Municipal Flood Maps)*.

4.3.12. Emergency Services

4.3.12.1 Location and Extent

Beaver County subdivisions, e.g., townships, boroughs, and cities, have assignment of services for their municipalities. Fire, emergency medical services (EMS), local emergency management coordinators (LEMC), and law enforcement service agencies are defined per municipality. In addition to the local services, the county hosts numerous special teams. These county-wide special response teams provide specialty services to include hazardous materials incidents, SWAT, technical rescue, swift water rescue and dive team, animal rescue, and ATV search teams. Regional and state-wide services are also available.

Most areas are served by volunteers instead of career personnel, which adds to the response time due to volunteer availability. Volunteers provide emergency services above and beyond their regular means of financial support and time constraints. Agencies struggle with the availability of personnel depending on the time of day and skills/resources needed. The number of responders in general has decreased due to funding and retention of personnel issues.

Another issue that has decreased the number of responders is the time and expense of training emergency service personnel (volunteers and paid) to a standard level. The initial training time for fire, EMS, and police can take several to many months to complete. For those in the emergency medical service, there is a regular schedule of continued education to maintain certification. In the fire service, after the initial training, there are specialty courses offered, of which are not required but recommended. For law enforcement, skills such as firearms proficiency must be maintained, and updates to new laws and regulations continue throughout the officer's career.

4.3.12.2 Range of Magnitude

Finances, changing political climates, leadership, or a significant high-profile event can all trigger a system to be declared as "success" or a "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 have many root causes. Labor rates, benefits, poor productivity, operational

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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. Just to replace a vehicle to the fleet and properly equip that vehicle can cost anywhere up to and over a million dollars.

4.3.12.3 Past Occurrences

Most agencies are private organizations that lack local funding and exist based on tax dollars, fund raising, and donations received from their community. The time demand for fund raising adds to the demands on the struggling availability of volunteers. Past practices are not sustaining the needed funds or manpower.

Without financial support from the communities, services may not be able to remain in operation to serve the same communities they have served for decades. Recruitment and personnel retention are a key to success.

4.3.12.4 Future Occurrence

Volunteerism has been a significant component of the fire service. Most, if not all, members of our community fire departments are volunteers. Commonly a problem is recruitment and retention of volunteers to staff both fire and emergency medical services. There has been a decline in volunteerism due to the required training requirements (time and cost) for firefighters and emergency medical technicians (EMTs) in the region. Historically, it has been difficult for small communities to have a paid service, therefore requiring volunteers. With fewer volunteers to perform the tasks associated with fire and rescue operations, it is imperative for services to facilitate fundraising. 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 by imposing a fire tax on its citizens.

The individual volunteer also faces many challenges. Most volunteers must address their own needs by providing for their family and, in many cases, are part of a two-income family. In some cases, they may have to have multiple jobs to sustain their needs. Becoming certified as a volunteer firefighter requires hundreds of hours. With the limitation of time, most members of our society find it personally challenging to dedicate time to a volunteer position. Volunteers are becoming less reliable, with many current volunteers aging and unable to perform at the same levels they once were.

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Fire departments were started to initially handle fires. However, over time, when other emergencies occurred, communities called upon the volunteer fire departments to handle various hazards such as vehicle accidents, commercial accidents, flooded basements, wire/trees down, trench rescue, hazardous material spills, traffic control, and sometimes event standbys to support other agencies or events. It would perhaps be more appropriate to call fire departments “All-Hazards Departments”.

4.3.12.5 Vulnerability Assessment

The likelihood that EMS agencies and fire services will fail is a real threat to all Beaver County communities. Many civilians within communities have the misconception that their local fire department is a paid service, and therefore view any fundraising activities as a frivolous act.

Law enforcement agencies also have been experiencing personnel shortages. Past society changes reflect how the general public supports and respects law enforcement officers, thereby, causing many individuals not wanting to pursue a law enforcement career. Becoming a law enforcement officer requires a commitment of time and finances 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.

Local emergency management coordinators are required for each municipality, however, due to most communities not having the resources to fund this requirement, volunteers are sometimes hard to find or to keep. Often, municipalities share a local emergency management coordinator. The following communities in Beaver County utilize a shared resource:

- Daugherty Township, New Brighton Borough, and Pulaski Township
- Patterson Township, Patterson Heights Borough, and White Township
- Beaver Falls City, Fallston Borough, and New Brighton Area EMA.
- Georgetown Borough, Greene Township, and Hookstown Borough
- Eastvale Borough and West Mayfield Borough

Many communities in Pennsylvania have already experienced the unfortunate failure of services. It is recommended that each municipality assess their own vulnerabilities by maintaining and building relationships with their local providers to make the determination and begin to plan accordingly if a local service were to shut down its operation. The statistics, response times, and all times associated with all units dispatched are easily obtainable from the county 911 center. Consolidation of services is not a new thought for addressing the failure of services. Municipalities must weigh all the pros and cons for consolidation of emergency services with one or more communities.

The emergency services departments in Beaver County must 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.

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It is recommended that the entire community be educated on the perpetual needs associated with providing these services. In addition, continued support, and efforts to inform legislatures could all prove to be paramount in assuring these services remain in operation into the future. At the time of the writing of this plan, a number of bills had been introduced in both the House of Representatives and the Senate as a result of a two-year study initiated by Senate Resolution 6 (SR 6) 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 Beaver County are identified in the following tables, *Table 50 – Beaver County Fire Departments*, *Table 51 – Beaver County EMS Agencies*, and *Table 52 – Beaver County Law Enforcement Agencies*. The tables identify the municipalities served, and if the agency is volunteer, paid, or a combination. This information was provided by Beaver County Emergency Services. *Figure 32 – Beaver County Emergency Services* map shows the locations of these services.

Table 50 - Beaver County Fire Departments

Beaver County Fire Departments		
Municipalities Covered	Station Name	Status
Aliquippa City	Aliquippa Bureau of Fire	Paid
Ambridge Borough	Ambridge Borough Fire Department	Combination
Baden Borough	Baden Borough Volunteer Fire Department	Volunteer
Beaver Borough	Beaver Borough Volunteer Fire Department	Volunteer
Beaver Falls City Eastvale Borough	Beaver Falls Fire Department	Combination
Big Beaver Borough New Galilee Borough	Big Beaver Borough Volunteer Fire Company	Volunteer
Bridgewater Borough	Bridgewater Borough Volunteer Fire Department	Volunteer
Brighton Township	Brighton Township Volunteer Fire Department	Combination
Center Township	Center Township Volunteer Fire Department	Volunteer
Chippewa Township	Chippewa Township Volunteer Fire Department	Volunteer
Conway Borough	Conway Borough Volunteer Fire Department	Volunteer
Darlington Borough Darlington Township	Darlington Township Volunteer Fire Department	Volunteer
Daugherty Township	Daugherty Township Volunteer Fire Department	Volunteer
Economy Borough	Economy Borough Volunteer Fire Department	Volunteer
Franklin Township	Franklin Township Volunteer Fire Department	Volunteer
Freedom Borough	Freedom Borough Volunteer Fire Department	Volunteer

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Municipalities Covered	Station Name	Status
Hanover Township	Hanover Township Volunteer Fire Department	Volunteer
Harmony Township	Harmony Township Volunteer Fire Department	Volunteer
Homewood Borough	Homewood Borough Volunteer Fire Department	Volunteer
Georgetown Brough Greene Township Hookstown Borough	Hookstown Borough Volunteer Fire Department	Volunteer
Hopewell Township South Heights Borough	Hopewell Township Volunteer Fire Department	Volunteer
Independence Township	Independence Township Volunteer Fire Department	Volunteer
Industry Borough	Industry Borough Volunteer Fire Department	Volunteer
Koppel Borough	Koppel Borough Volunteer Fire Department	Volunteer
Midland Borough	Midland Borough Volunteer Fire Department	Volunteer
Monaca Borough	Monaca Borough Volunteer Fire Department	Volunteer
Fallston Borough New Brighton Borough	New Brighton Borough Volunteer Fire Department	Volunteer
Marion Township New Sewickley Township	Big Knob Volunteer Fire Department and Pine Run Volunteer Fire Department	Volunteer
North Sewickley Township	North Sewickley Township Volunteer Fire Department	Volunteer
Glasgow Borough Ohioville Borough	Ohioville Borough Volunteer Fire Department	Volunteer
Patterson Township Patterson Heights Borough	Patterson Heights Borough Volunteer Fire Department	Volunteer
Patterson Township Patterson Heights Borough	Patterson Township Volunteer Fire Company	Volunteer
Potter Township	Potter Township Volunteer Fire Department	Volunteer
Pulaski Township	Pulaski Township Volunteer Fire Department	Volunteer
Raccoon Township	Raccoon Township Independent Volunteer Fire Department	Volunteer
East Rochester Borough Rochester Borough Rochester Township	Rochester Area Volunteer Fire Department	Volunteer

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Municipalities Covered	Station Name	Status
Shippingport Borough	Shippingport Borough Volunteer Fire Department	Volunteer
South Beaver Township	South Beaver Township Volunteer Fire Department	Volunteer
Vanport Township	Vanport Township Volunteer Fire Department	Volunteer
West Mayfield Borough	West Mayfield Borough Volunteer Fire Department	Volunteer
White Township	White Township Volunteer Fire Department	Volunteer

It should be noted that currently Patterson Heights Borough Volunteer Fire Department and Patterson Township Volunteer Fire Company respond to all calls together and are in the process of merging.

Table 51 - Beaver County EMS Agencies

Beaver County EMS Agencies	
Municipalities Covered	Station Name
Portion of New Sewickley Township	Cranberry Township EMS (Butler County)
Baden Borough Economy Borough Harmony Township Portion of New Sewickley Township	Economy Ambulance Service
Eastern portion of Franklin Township	Harmony EMS (Butler County)
Darlington Borough Darlington Township New Galilee Borough	Northwestern Ambulance Service
Majority of the county	Medic-Rescue
Portion of Franklin Township	Noga Ambulance and Medevac Ambulance (both in Lawrence County)
<p>Outside EMS services that provide mutual aid services within Beaver County are:</p> <ul style="list-style-type: none"> Allegheeny County: <ul style="list-style-type: none"> ○ Valley EMS ○ McCandless ○ Franklin Park ○ Northwest EMS • Washington County: <ul style="list-style-type: none"> ○ Ambulance and Chair • Ohio <ul style="list-style-type: none"> ○ LifeTeam ○ North Star ○ East Palestine 	

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Table 52 - Beaver County Law Enforcement Agencies

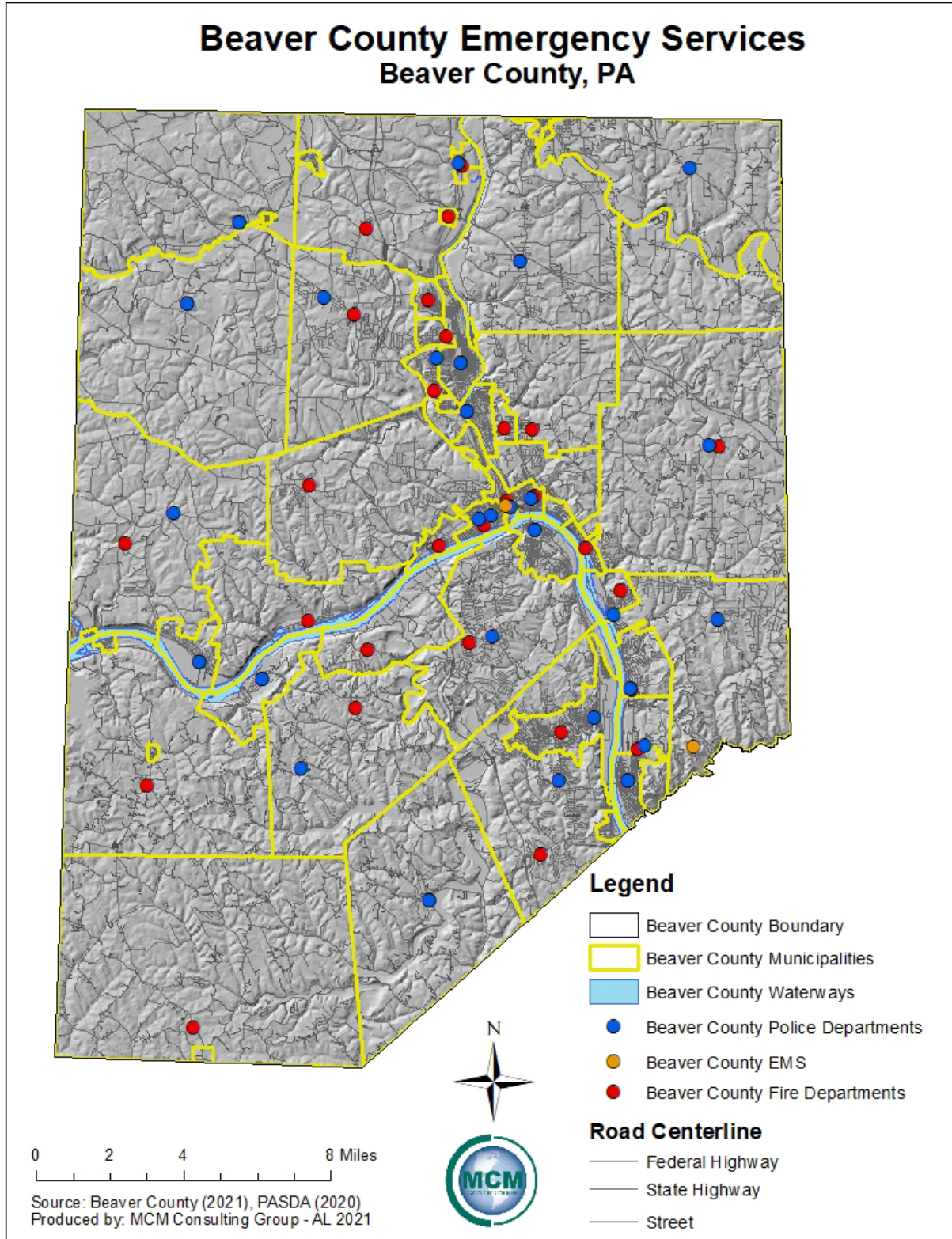
Beaver County Police Departments	
Municipalities Covered	Station Name
Aliquippa City	Aliquippa Police Department
Ambridge Borough	Ambridge Police Department
Baden Borough	Baden Police Department
Beaver Falls City Big Beaver Borough Eastvale Borough West Mayfield Borough	Beaver Falls Police Department
Bridgewater Borough	Bridgewater Police Department
Brighton Township	Brighton Township Police Department
Center Township Potter Township	Center Township Police Department
Chippewa Township	Chippewa Police Department
Conway Borough Freedom Borough	Conway Police Department
Darlington Borough Darlington Township New Galilee Borough	Darlington Township Police Department
Economy Borough	Economy Police Department
Franklin Township	Franklin Police Department
Harmony Township	Harmony Police Department
Hopewell Township	Hopewell Police Department
Independence Township	Independence Police Department
Koppel Borough	Koppel Police Department
Marion Township	Marion Township Police Department (part time) supplemented by New Sewickley Police Department
Midland Borough	Midland Police Department
Monaca Borough	Monaca Police Department
Daugherty Township Fallston Borough New Brighton Borough Pulaski Township	New Brighton Police Department
Daugherty Township Fallston Borough New Brighton Borough Pulaski Township	New Brighton Police Department

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Municipalities Covered	Station Name
Marion Township New Sewickley Township	New Sewickley Police Department
North Sewickley Township	North Sewickley Police Department
Ohioville Borough	Ohioville Police Department
Patterson Heights Borough Patterson Township White Township	Patterson Township Police Department
Raccoon Township	Raccoon Police Department
East Rochester Borough Rochester Borough	Rochester Area Police Department
Shippingport Borough	Shippingport Police Department
South Beaver Township	South Beaver Police Department
South Heights Borough	South Heights Police Department (part-time)
Countywide	Beaver County Detectives
Frankfort Springs Borough Georgetown Borough Glasgow Borough Greene Township Hanover Township	Pennsylvania State Police (full-time coverage)
Homewood Borough Hookstown Borough	Pennsylvania State Police (full-time coverage)
Darlington Borough Darlington Township Independence Township Raccoon Township Shippingport Borough South Heights Borough	Pennsylvania State Police (part-time coverage)

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Figure 31 - Beaver County Emergency Services



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4.3.13. Environmental Hazards

4.3.13.1 Location and Extent

Environmental hazards in Beaver County focus mainly on hazardous material releases at fixed facilities or due to transportation accidents, and pollution or fire from oil and gas well drilling. Hazardous material releases can occur at facilities or along transportation routes. These releases can result in injury or death, and can contaminate air, water, and soils. Activities associated with oil and gas well drilling can cause fire and pollute streams and drinking water.

Fixed facility

Facilities that use, manufacture, or store hazardous materials in Pennsylvania must comply with both Title III of the federal Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-to-know Act (EPCRA), and Pennsylvania's reporting requirements under the Hazardous Materials Emergency Planning and Response Act (1990-165), as amended. The community right-to-know reporting requirements keep communities abreast of the presence and release of chemicals at individual facilities. There are 191 SARA Title III facilities in Beaver County (Appendix E). Note that the list of SARA Title III facilities is not an exhaustive, fully comprehensive inventory of all hazardous material locations within the county and therefore, should not be used as such.

Transportation

The major highways most frequently used by facilities in Beaver County to transport hazardous materials are Interstate 76, Interstate 376, U.S. Route 30, and Pennsylvania routes 65, 68, 18, and 51. Potential also exists for a release to occur involving rail lines belonging to CSX Transportation, Norfolk Southern Corporation, Buffalo and Pittsburgh Railroad, and Genesee Wyoming Railroad; or along the county's pipeline system (spanning thirteen companies).

Oil and Gas Wells

Oil and gas wells exist in thirty municipalities in Beaver County, to include: Aliquippa City, Beaver Falls City, Ambridge, Baden, Beaver, Big Beaver, Bridgewater, Darlington, Economy, Industry, Ohioville, Rochester, Shippingport, and South Heights boroughs, and Brighton, Chippewa, Darlington, Daugherty, Franklin, Greene, Hanover, Harmony, Hopewell, Independence, Marion, New Sewickley, Potter, Raccoon, South Beaver, and White townships. There are 709 active wells, and there are thirty-one orphan and abandoned oil and gas wells throughout the county. Marcellus Shale-related activities consist of the extraction of natural gas from the Marcellus Shale formation via horizontal drilling and a process known as "hydraulic fracturing" that pumps water, mixed with sand and potentially hazardous chemicals, into the shale formation under high pressure to fracture the shale around the well, allowing natural gas to flow freely. Upon completion of the hydraulic fracturing process, the used water, often referred to as "frac fluid", must be treated to remove chemicals and minerals (Pennsylvania Department of Environmental Protection [PADEP] 2021).

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4.3.13.2 Range of Magnitude

Hazardous material releases can contaminate air, water, and soil, with a possibility of resulting in injuries and/or death. Dispersion can take place rapidly when transported by water and wind. However, responders should not approach any problem with an “it’s just water” mindset. Some chemicals have violent reactions to water, change their state of matter (physical or chemical), or float on or sink in water.

Fixed Facility and 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.

With a hazardous material release, whether accidental or intentional, there are several potentially exacerbating or mitigation circumstances that will affect its severity or impact. Mitigation conditions are precautionary measures taken in advance to reduce the impact of a release on the surrounding environment. Primary and secondary containment or shielding by sheltering-in-place protects people and property from the harmful effects of a hazardous material release. Exacerbating conditions, characteristics that can enhance or magnify the effects of a hazardous material release include:

- Weather conditions affecting how the hazard occurs and develops.
- Micro-meteorological effects of buildings and terrain alters dispersion of hazardous materials.
- Non-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 severity of the incident is dependent not only on the circumstances described above, but also with the type of material released and the distance and related response time for emergency response teams. The areas within closest proximity to the releases are generally at greatest risk, yet depending on the agent, a release can travel great distances or remain present in the environment for a long period of time (e.g., centuries to millennia for radioactive materials), resulting in extensive impacts on people and the environment.

Oil and Gas Wells

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. This can spoil public drinking water supplies and be particularly detrimental to vegetation and aquatic animals.

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Natural gas well 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.

In 2006, a fire broke out at a natural gas well in Grindstone, Fayette County, Pennsylvania injuring six people. This is an extreme case and though rare, is an example of the risk involved with oil and gas well drilling.

4.3.13.3 Past Occurrence

Fixed Facility

Since the passage of SARA, Title III, facilities which produce, use, or store hazardous chemicals must notify the public through the county emergency dispatch center and PEMA if an accidental release of a hazardous substance meets or exceeds a designated reportable quantity, and affects or has the potential to affect persons and/or the environment outside the plant. SARA, Title III and Pennsylvania Act 165 also require a written follow-up report to PEMA and the county. These written follow-up reports include any known or anticipated health risks associated with the release and actions to be taken to mitigate potential future incidents. In addition, Section 204(a)(10) of Act 165 requires PEMA to staff and operate a 24-hour State Emergency Operations Center (SEOC) to provide effective emergency response coordination.

Transportation

Hazardous materials can be transported by air, sea, and land (over the road or through pipelines). Transportation accidents along roadways is a regular occurrence.

Oil and Gas Wells

Environmental incidents including water contamination and fire spurring from oil and gas well drilling have occurred numerous times in Pennsylvania over the past century.

Table 53 – Hazardous Material Incidents for Beaver County lists all reported incidents to include fixed facilities, transportation as well as oil and gas wells, as reported on Corvena (formerly Knowledge Center™).

Table 53 - Hazardous Material Incidents for Beaver County

Hazardous Material Incidents for Beaver County		
Date	Incident	Municipality
01/04/2013	Truck rollover with hazardous materials	Hookstown Borough
01/13/2013	Bomb squad call, hazardous materials	Economy Borough
02/06/2013	Natural gas leak	Baden Borough
02/09/2013	Unknown sheen on the Ohio River	Shippingport Borough
02/27/2013	Hydraulic oil spill	Ambridge Borough

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Date	Incident	Municipality
05/03/2013	Tanker rollover with hazardous materials	Hopewell Township
05/08/2013	Possible explosive device	Monaca Borough
06/25/2013	Diesel fuel spill	Conway Borough
07/26/2013	Gas line struck	Franklin Township
08/21/2013	Oil spill	Conway Borough
10/11/2013	Natural gas leak	South Beaver Township
10/15/2013	Asphalt tanker accident	New Sewickley Township
10/29/2013	Lube oil spill	Beaver Falls City
11/26/2013	Sheriff's vehicle accident with hazardous materials	Aliquippa City
12/22/2013	Hazardous materials incident	Rochester Township
01/12/2014	Combustion by-produce spill	Shippingport Borough
02/12/2014	Fuel spill	Vanport Borough
02/20/2014	Fuel spill	Aliquippa City
04/02/2014	Contaminated diesel fuel	New Sewickley Township
04/03/2014	Fuel spill	Baden Borough
04/03/2014	Natural gas leak	Baden Borough
04/16/2014	Pipe bomb removal	Monaca Borough
04/27/2014	Crude oil spill	Conway Borough
04/30/2014	Oil spill	Georgetown Borough
05/01/2014	Crude oil spill	Conway Borough
05/05/2014	Oil spill	Conway Borough
05/09/2014	Gas leak	Rochester Township
05/28/2014	Diesel fuel spill	Conway Borough
06/05/2014	Hazardous materials incident	Conway Borough
06/20/2014	Hazardous materials incident	Conway Borough
08/27/2014	Ammonia odor	Aliquippa City
09/06/2014	Oil spill	Shippingport Borough
10/04/2014	Fuel Leak	Center Township
10/14/2014	Diesel fuel spill	Conway Borough
10/15/2014	Unknown substance	Freedom Borough
10/16/2014	Hazardous materials incident	Conway Borough
10/20/2014	Vehicle accident with a spill	Vanport Township
10/28/2014	Gas well flaring	New Sewickley Township
11/01/2014	Fuel spill	Marion Township
11/15/2014	Evacuation at Oak Hill Manor due hazardous materials	New Brighton Borough
12/15/2014	Fracking sand incident	Darlington Township
01/21/2015	Coal slurry	Shippingport Borough
01/25/2015	Unknown sheen	Ambridge Borough

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Date	Incident	Municipality
02/23/2015	Diesel fuel spill	Georgetown Borough
03/19/2015	Diesel fuel spill	Conway Borough
04/03/2015	Sheen on the Ohio River	Monaca Borough
04/28/2015	Chemical release	East Rochester Borough
06/02/2015	Hazardous materials incident	Conway Borough
07/26/2015	Chemical odor	Brighton Township
07/26/2015	Hazardous materials incident	Monaca Borough
07/28/2015	Diesel fuel spill	Conway Borough
08/01/2015	Hazardous materials incident	Ohioville Borough
08/17/2015	Hazardous materials spill	Shippingport Borough
09/15/2015	Oil spill	East Rochester Borough
10/13/2015	Natural gas release	Independence Township
10/20/2015	Vehicle accident with hazardous materials	Potter Township
12/03/2015	Unknown sheen	Conway Borough
12/18/2015	Possible oil spill	Greene Township
01/08/2016	Chlorine leak	Industry Borough
01/11/2016	Lube oil spill	Conway Borough
01/20/2016	Oil sheen	Georgetown Borough
03/01/2016	Hydraulic fluid leak	Raccoon Township
03/03/2016	Unknown sheen	Conway Borough
03/24/2016	Gas leak with evacuation of apartments	Beaver Falls City
04/21/2016	Lube oil spill	Conway Borough
05/04/2016	Oil drops in the river	Shippingport Borough
05/04/2016	Transformer oil spill	Monaca Borough
05/12/2016	Lube oil spill	Conway Borough
06/13/2016	Sheen on the Ohio River	Monaca Borough
06/22/2016	Oil spill	Conway Borough
07/13/2016	Diesel spill	New Sewickley Township
07/23/2016	Oil spill	Conway Borough
08/23/2016	Unknown sheen	Georgetown Borough
08/24/2016	Coal vessel sinking	Monaca Borough
08/26/2016	Oil sheen	Georgetown Borough
09/08/2016	Lube oil spill	Conway Borough
09/18/2016	Limestone pilings spill	Conway Borough
09/26/2016	Unknown sheen	Baden Borough
10/14/2016	Battery acid spill	Baden Borough
10/21/2016	Home heating oil spill	Hookstown Borough
10/26/2016	Hazardous materials incident	Conway Borough

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Date	Incident	Municipality
12/23/2016	Hazardous materials incident	Conway Borough
12/27/2016	Lime slurry release	Shippingport Borough
01/18/2017	Military ordinance found	Unknown
01/22/2017	Mobile meth lab	Hopewell Township
02/12/2017	Meth lab	Franklin Township
04/12/2017	Hazardous materials incident	Conway Borough
04/25/2017	Vehicle accident with chemical spill	Darlington Township
05/22/2017	High pressure gas line ruptured	Conway Borough
05/27/2017	Oil sheen on the river	Ambridge Borough
06/21/2017	Hazardous materials incident	Conway Borough
07/05/2017	Coal spill	Conway Borough
07/27/2017	Natural gas odor	Rochester Borough
08/05/2017	Frac water contamination	New Sewickley Township
08/27/2017	Hazardous materials incident	Conway Borough
08/28/2017	Hazardous materials incident	Conway Borough
08/30/2017	Mini meth lab	Ambridge Borough
08/30/2017	Hazmat – Bruce Mansfield	Shippingport Borough
08/31/2017	Hazardous materials incident	Conway Borough
09/02/2017	Hazardous materials incident	New Brighton Borough
10/01/2017	Hazardous materials leak	Conway Borough
10/07/2017	Hazardous materials rail incident	Conway Borough
11/19/2017	Evacuation due to a gas leak	South Beaver Township
12/18/2017	Unknown oil sheen	Conway Borough
02/20/2018	Bomb threat at a chemical plant	Potter Township
03/14/2018	Chemical suicide	Chippewa Township
04/04/2018	Transformer oil spill	Beaver Falls City
04/09/2018	Hazardous materials spill	Harmony Township
05/22/2018	Hazardous materials incident	Conway Borough
07/16/2018	Hazardous materials incident	North Sewickley Township
07/27/2018	Sheen on creek	Ohioville Borough
08/13/2018	Oily water release	Midland Borough
09/19/2018	Hazardous materials incident	Conway Borough
10/31/2018	Hazardous materials incident	Conway Borough
11/09/2018	Hazardous materials spill	Center Township
12/02/2018	Hazardous materials incident	Conway Borough
12/13/2018	Bomb threat	Beaver Borough
12/14/2018	Oil sheen	Georgetown Borough

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Date	Incident	Municipality
01/18/2019	Lube oil spill	Conway Borough
01/24/2019	Hazardous materials incident	Conway Borough
02/25/2019	Fuel spill	Ambridge Borough
03/04/2019	Liquid petroleum gas spill	Conway Borough
03/05/2019	Hazardous materials incident	Baden Borough
03/08/2019	Odor complaint	Aliquippa City
04/10/2019	Diesel fuel release	Conway Borough
05/05/2019	Chemical release	Monaca Borough
05/10/2019	Sulfuric acid spill	Beaver Falls City
05/10/2019	Chemical spill	Beaver Falls City
05/11/2019	Diesel fuel release	Raccoon Township
05/19/2019	Lube oil spill	Ambridge Borough
06/02/2019	Liquid spill	Independence Township
06/03/2019	Diesel spill	Conway Borough
06/14/2019	Hazardous materials incident	Conway Borough
07/07/2019	Transformer oil spill	Monaca Borough
07/12/2019	Hazardous materials incident	Rochester Borough
07/13/2019	Hazardous materials incident, rekindle	Rochester Borough
07/16/2018	Hazmat (chemical suicide)	North Sewickley Township
07/18/2019	Lube oil spill	Industry Borough
08/16/2019	Unknown sheen	Monaca Borough
08/16/2019	Unknown sheen	Monaca Borough
08/18/2019	Hazardous materials incident	Monaca Borough
08/29/2019	Acid spill	Conway Borough
09/08/2019	Oil sheen on the Ohio River	Rochester Borough
09/16/2019	Hazardous materials incident	Midland Borough
10/25/2019	Fuel spill on the Ohio River	Ohioville Borough
10/28/2019	Tractor-trailer accident with fuel spill	New Sewickley Township
11/08/2019	Gas leak	Midland Borough
12/02/2019	Natural gas leak inside a residence	Ambridge Borough
12/07/2019	Hydraulic oil spill	Monaca Borough
12/20/2019	Hazardous materials incident	Monaca Borough
12/23/2019	Styrene release	Monaca Borough
12/23/2019	Styrene release	Potter Township
12/30/2019	Unknown sheen	Shippingport Borough
01/03/2020	Hydraulic oil spill	Industry Borough
01/09/2020	Gypsum spill	Greene Township

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Date	Incident	Municipality
01/17/2020	Gas leak, odor investigation	Midland Borough
01/20/2020	Semi-truck leaking fuel	Darlington Township
06/21/2020	Hazardous materials incident	Brighton Township
07/28/2020	Hazardous materials incident	New Sewickley Township
07/30/2020	Potential hazardous materials release	Independence Township
08/12/2020	Hazardous materials incident	Conway Borough
08/28/2020	Gas release	New Brighton Borough
10/01/2020	Hazardous materials incident	Rochester Borough
10/19/2020	Chlorine leak	Center Township
10/21/2020	Hazardous materials incident	Industry Borough
10/29/2020	Gas leak at a day care center	Chippewa Township
11/25/2020	Chemical release	Monaca Borough

It should be noted that there was a trend for committing suicide called “chemical suicide”. This is where individuals sealed themselves in places like a vehicle and used chemicals to commit suicide. This process is very dangerous to first responders or an unknowing public. In March 2018 there was an instance of “chemical suicide” in Beaver County.

4.3.13.4 Future Occurrence

Even though hazardous material release incidents are difficult to predict, following past occurrences, it can be surmised that approximately twenty hazardous materials incidents will occur annually in Beaver County.

Fixed facility and Transportation

While many incidents involving hazardous material releases have occurred in Beaver County in the past, they are generally considered difficult to predict. An occurrence is largely dependent upon the accidental or intentional actions of a person or group.

Oil and Gas Wells

It is difficult to predict when and where environmental hazards will arise. Stringent monitoring through the Pennsylvania Department of Environmental Protection will reduce the likelihood of potential impacts to the community and the environment. Incidents involving oil and gas well drilling are expected to remain relatively low.

4.3.13.5 Vulnerability Assessment

Fixed facility

Every municipality in Beaver County has addressable structures within a ¼ mile radius of SARA Title III facilities, with a total of 12,567 addressable structures in the county within that buffer. Of these addressable structures, there are thirty-eight critical facilities and functional needs facilities

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within the ¼ mile of the SARA Title III facilities. Municipalities with critical infrastructures within that buffer are Aliquippa, Ambridge, Baden, Beaver, Beaver Falls, Brighton, Center, Chippewa, East Rochester, Hopewell, Marion, Midland, Monaca, New Brighton, Patterson, Pulaski, Raccoon, Rochester Borough, and Rochester Township. *Figure 33 – SARA Facility Vulnerability Map* identifies the quarter mile buffers for each facility. Populations in and around these communities are more vulnerable to facility releases, particularly those within ¼ mile of the facility. *Figure 34 – SARA Critical Infrastructure Vulnerability Map* identifies critical infrastructure within the quarter mile SARA site buffer.

Transportation

Quick response to transportation accidents involving hazardous materials minimizes the volume and concentration dispersed through air, water, and soil. Every municipality within Beaver County is vulnerable to a hazardous materials incident caused along a transportation route. These incidents can occur along highways, railways, and pipelines. *Figure 35 – Environmental Hazard Transportation Vulnerability Map* identifies the 2,000-foot hazard corridor for all highways and *Figure 36 – Environmental Hazard Airport Vulnerability Map* identifies a 2-mile radius for airports. *Figure 37 – Annual Truck Traffic* identifies the annual truck traffic percentages for all the roadways within Beaver County.

Oil and Gas Wells

Thirty of the fifty-three municipalities in Beaver County are vulnerable on some level, directly or indirectly, to environmental hazards resulting from oil and gas well activity. Surface waters closest to well sites are most vulnerable to damage and oil and gas industry workers are most likely to be affected by gas well fires. *Figure 38 – Oil and Gas Well Locations – Conventional* and *Figure 39 – Oil and Gas Well Locations - Unconventional* show the location of all active, inactive, and abandoned gas wells in the county and their proximity to surface waters.

Private water supplies 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 distance of drinking water well to known oil and gas well locations, but this data is not available at this time. Private drinking water is largely unregulated and information on these wells is submitted to the Pennsylvania Topographic and Geologic Survey by water well drillers. Therefore, the existing data is largely incomplete and/or inaccurate (PaGWIS).

Table 54 – Oil and Gas Wells per Municipality lists all the active, abandoned and orphan, plugged or inactive, and proposed wells for Beaver County.

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Table 54 - Oil and Gas Wells per Municipality

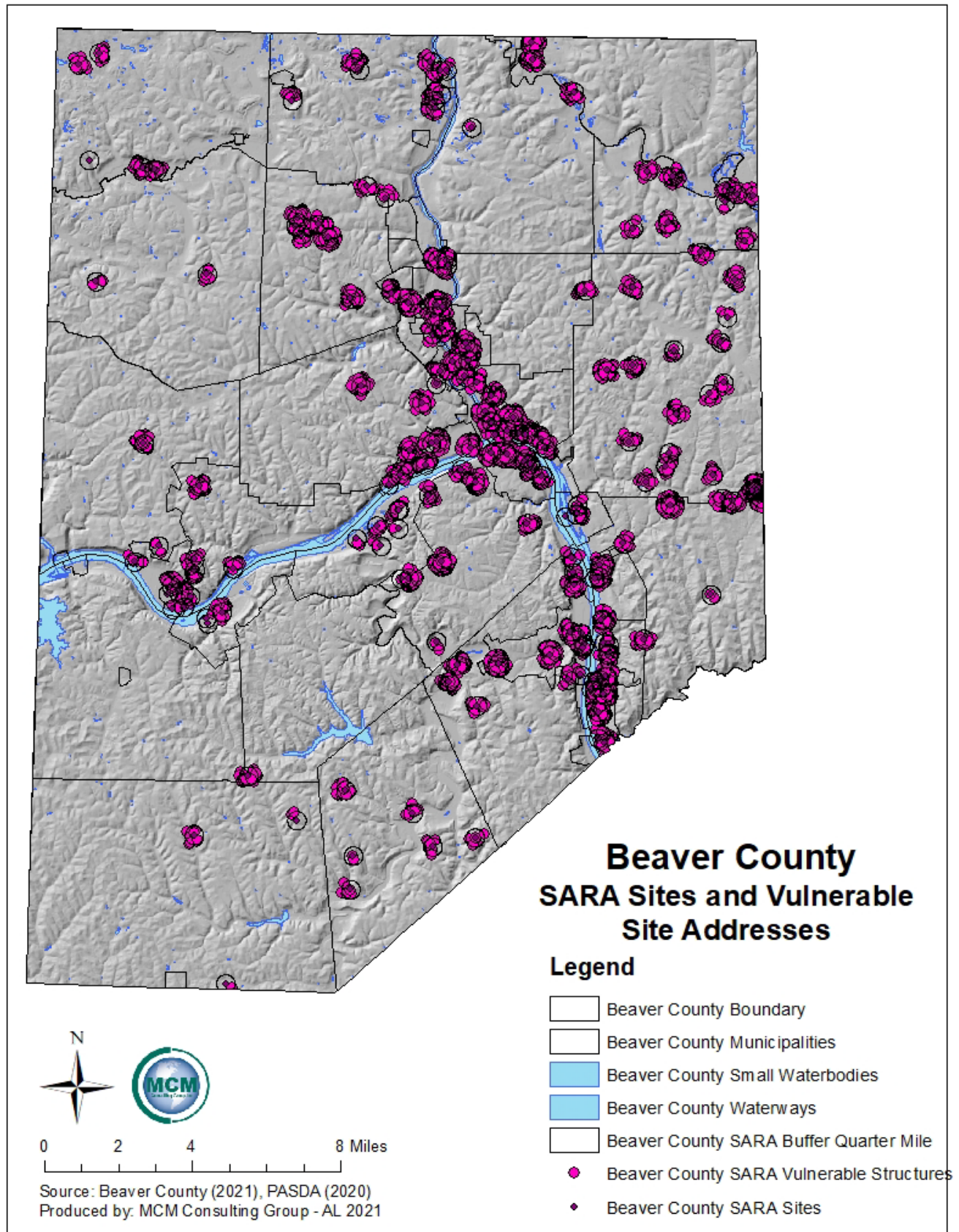
Oil and Gas Wells per Municipality				
Municipality	Oil and Gas Wells			
	Active	Abandoned and Orphan	Plugged or Inactive	Proposed
Aliquippa City	0	1	1	0
Ambridge Borough	0	2	1	0
Baden Borough	9	0	1	0
Beaver Borough	0	0	3	0
Beaver Falls City	0	6	1	0
Big Beaver Borough	5	0	3	4
Bridgewater Borough	0	1	0	0
Brighton Township	1	1	0	4
Center Township	0	2	0	0
Chippewa Township	2	1	2	7
Darlington Township	6	3	4	8
Daugherty Township	1	0	3	0
Economy Borough	158	2	28	8
Greene Township	2	9	22	3
Hanover Township	17	6	11	17
Harmony Township	0	0	1	0
Hopewell Township	7	3	12	0
Independence Township	24	2	3	25
Industry Borough	2	0	0	2
Marion Township	31	1	0	22
New Sewickley Township	63	2	11	15
North Sewickley Township	0	0	2	0
Ohioville Borough	10	2	6	20
Potter Township	0	2	0	0
Raccoon Township	3	0	1	0
Rochester Township	0	1	0	0
Shippingport Borough	0	0	0	1
South Beaver Township	21	6	6	20
South Heights Borough	0	0	1	0

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Municipality	Oil and Gas Wells			
	Active	Abandoned and Orphan	Plugged or Inactive	Proposed
White Township	0	0	6	0

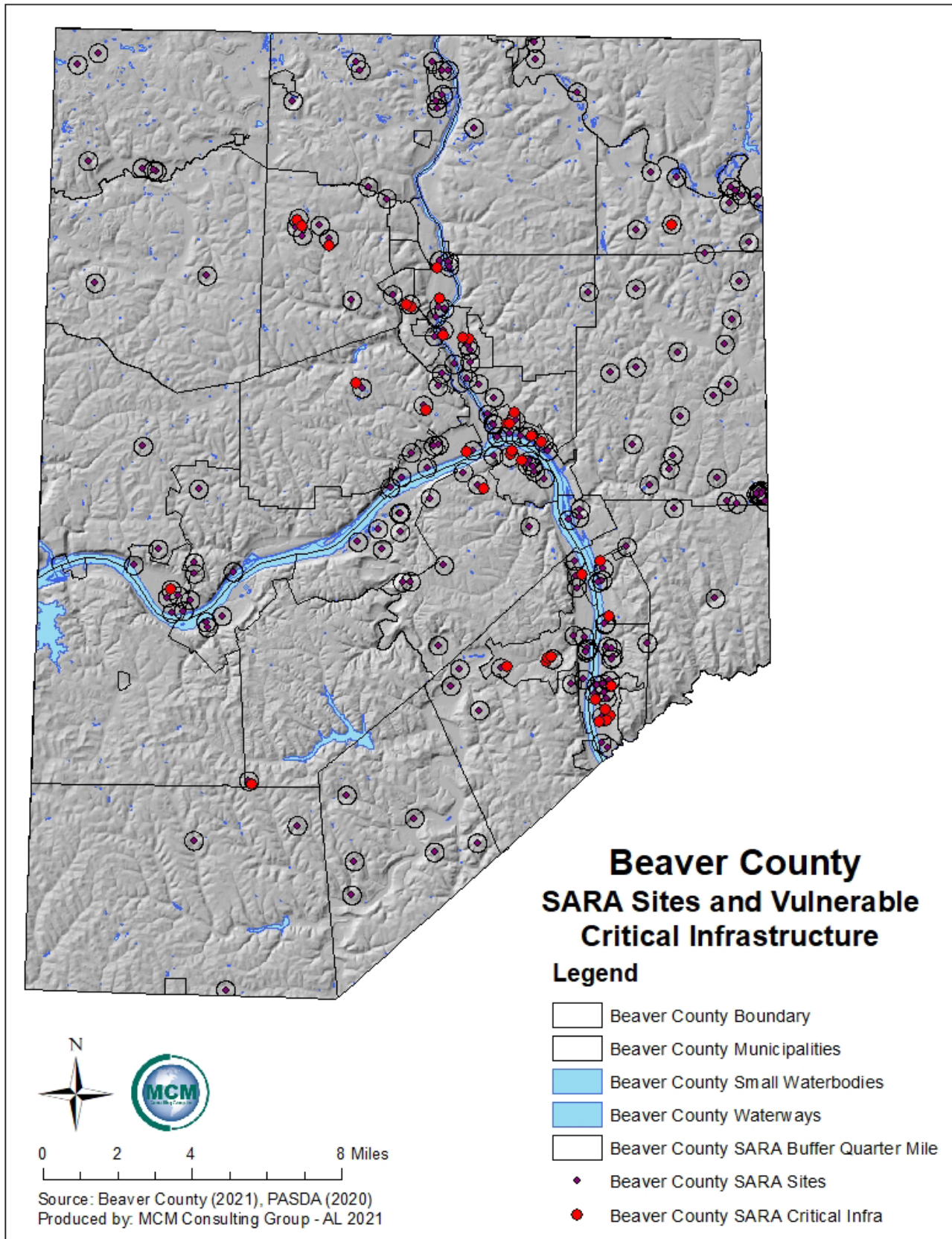
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Figure 32 - SARA Facility Vulnerability Map

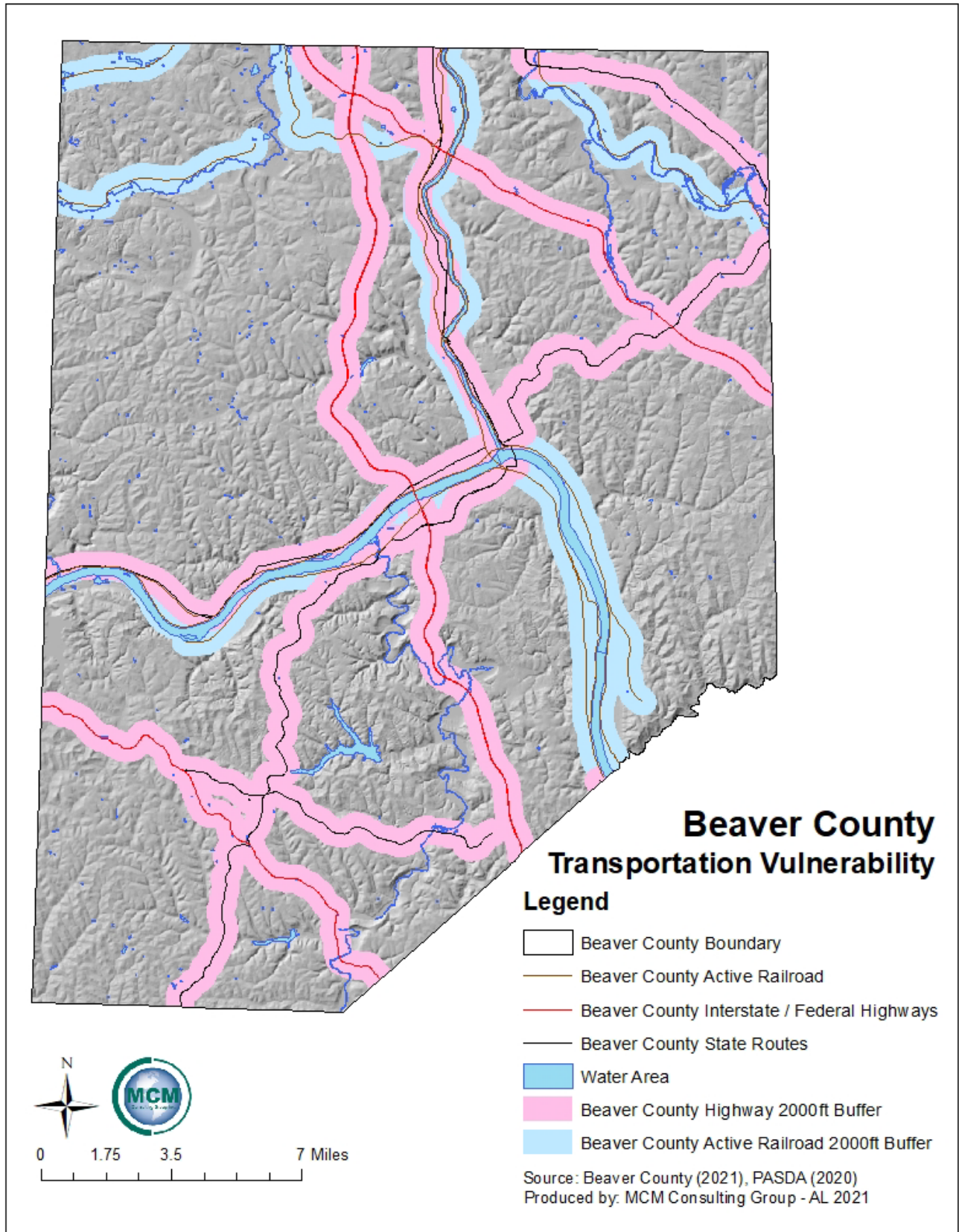


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Figure 33 - SARA Critical Infrastructure Vulnerability Map

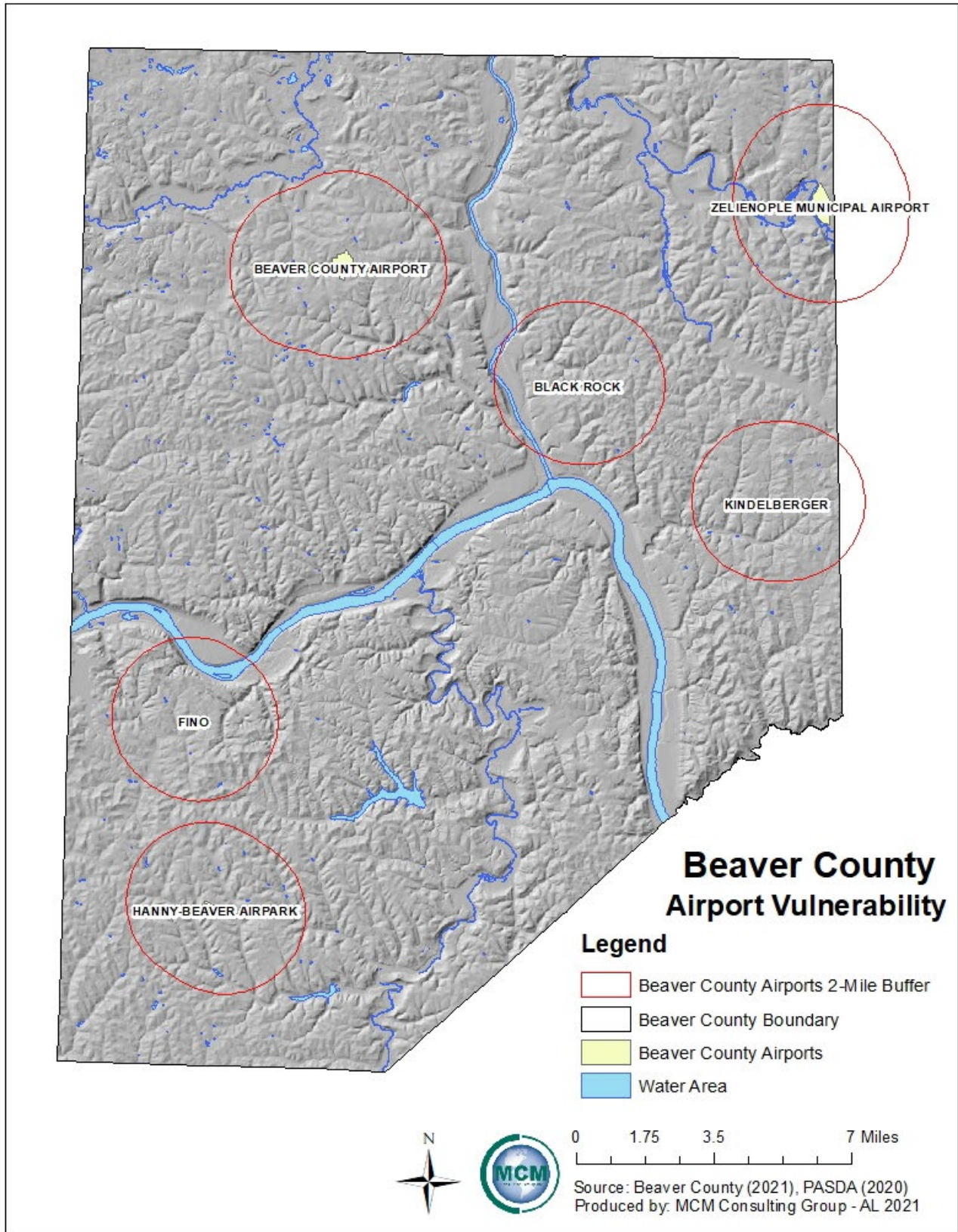


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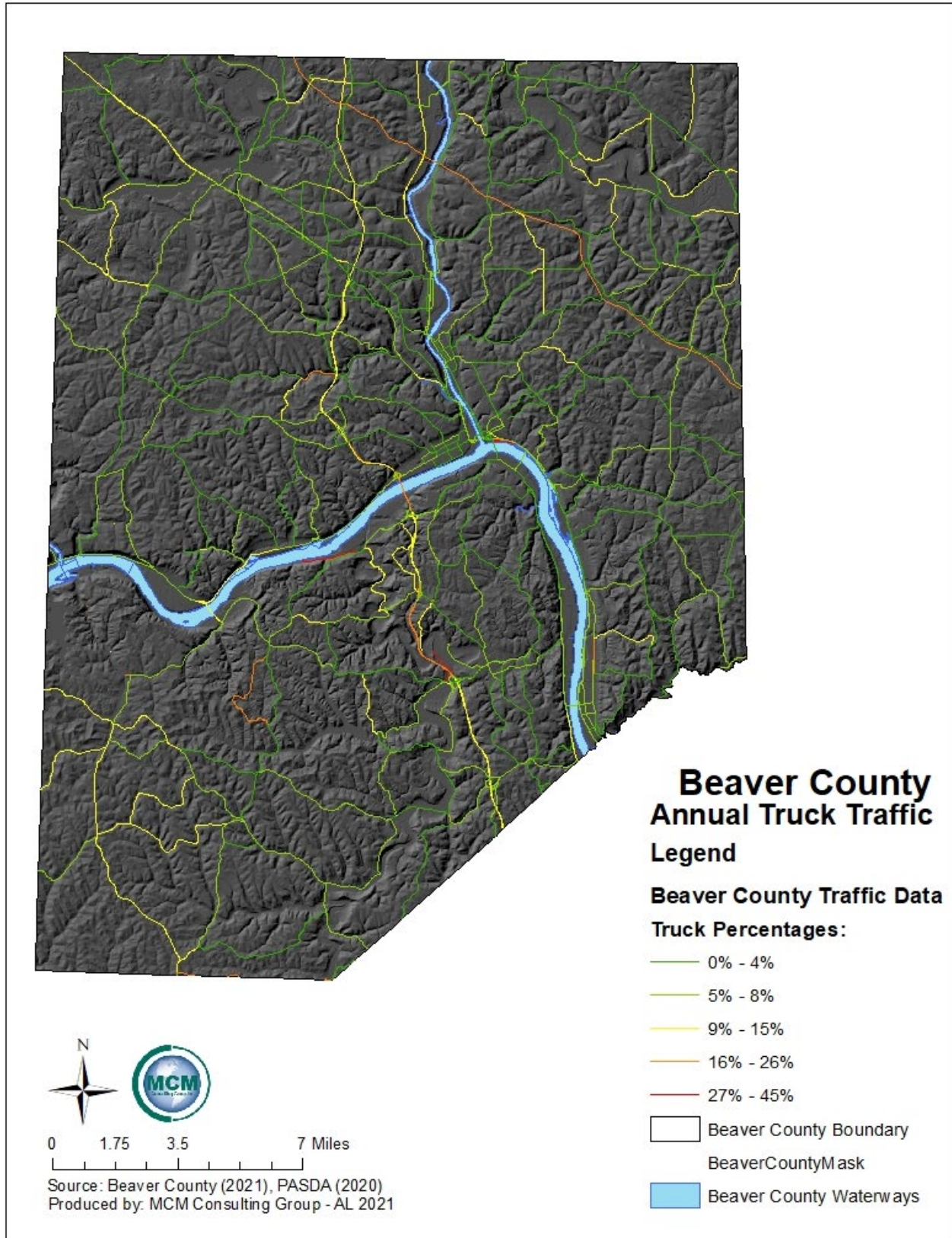
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Figure 35 - Environmental Hazard Airport Vulnerability Map



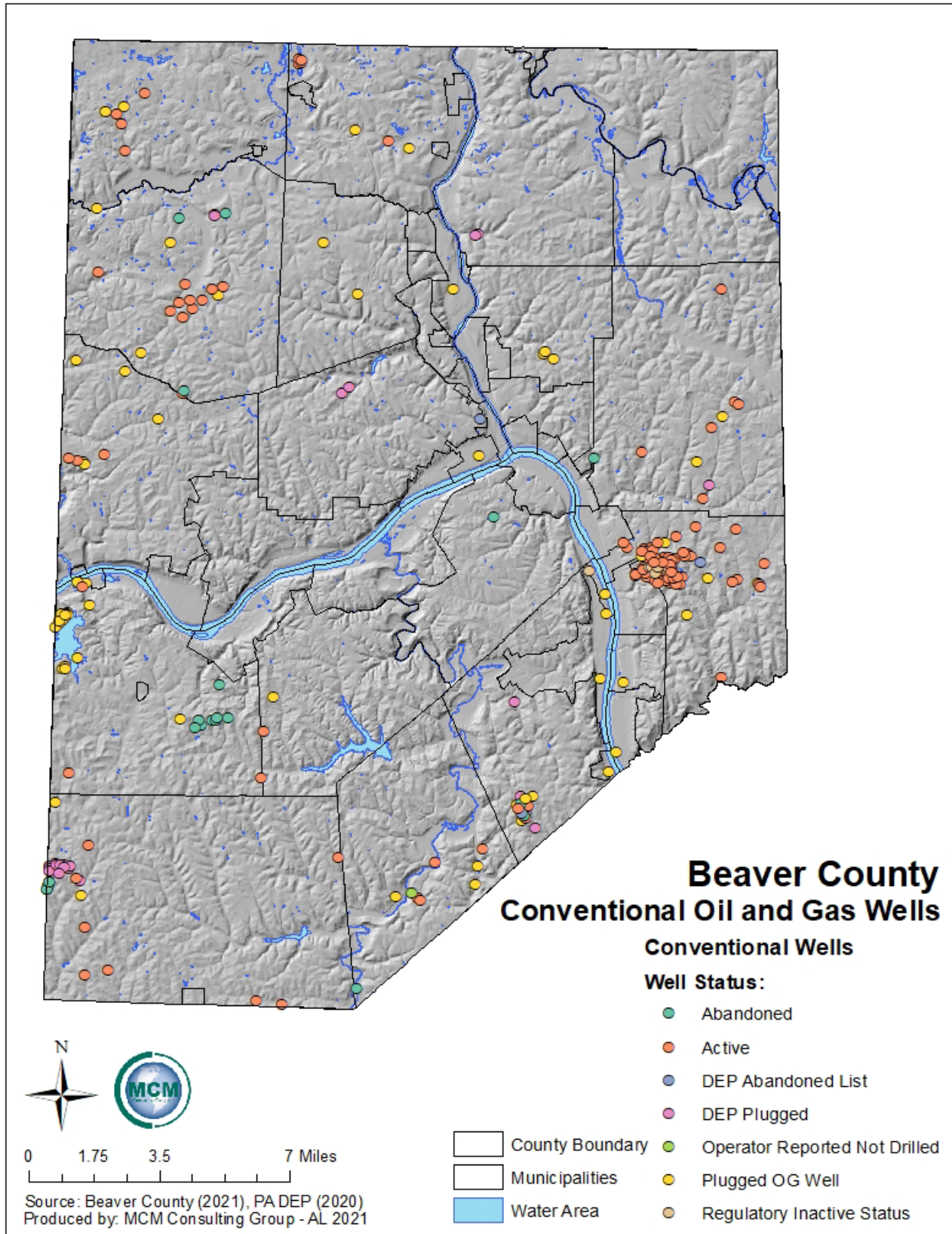
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Figure 36 - Annual Truck Traffic



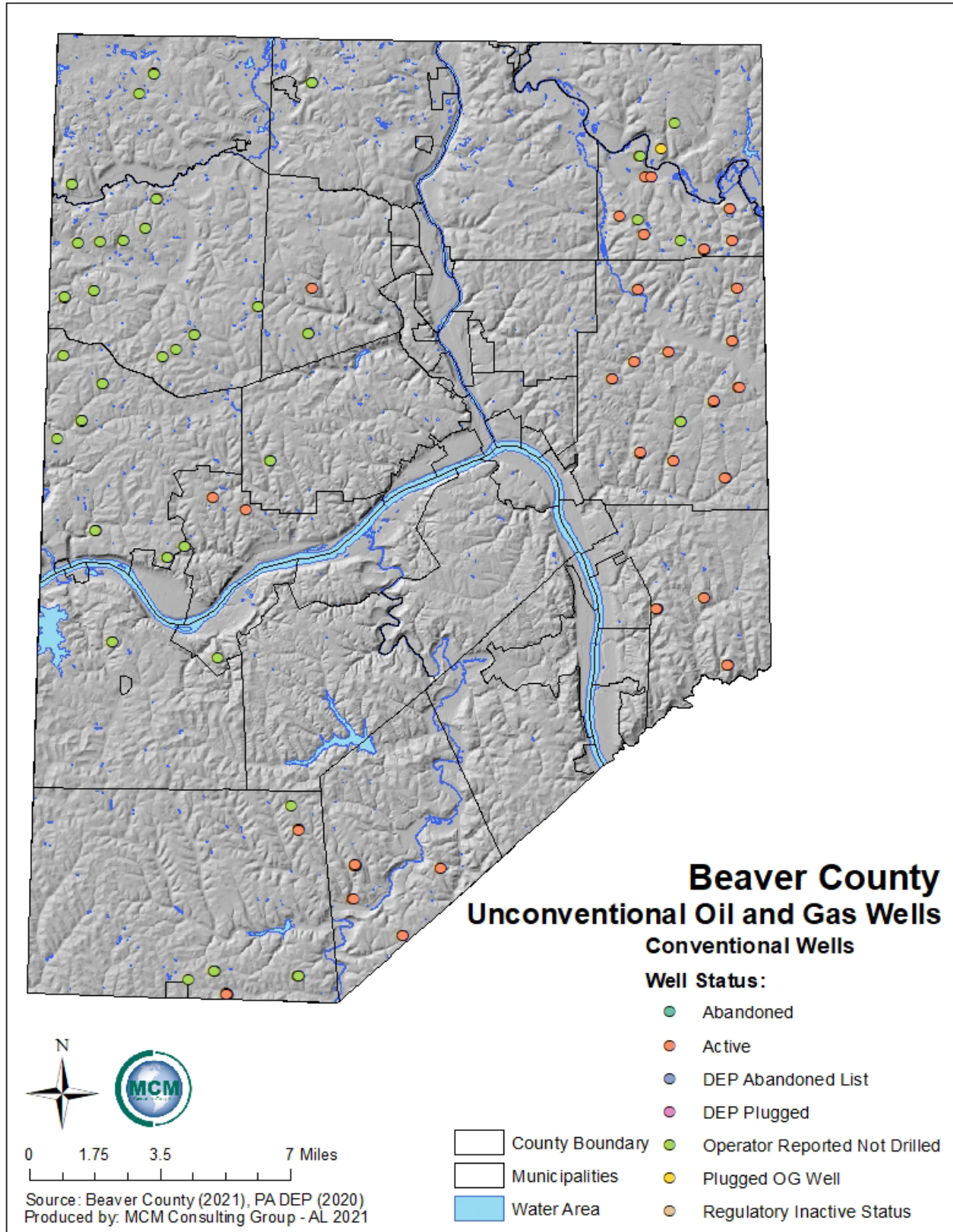
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Figure 37 - Oil and Gas Well Locations - Conventional



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Figure 38 - Oil and Gas Well Locations - Unconventional



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4.3.14. Nuclear Incidents

4.3.14.1 Location and Extent

Nuclear hazards and incidents generally refer to incidents involving (1) a release of significant levels of radioactive materials or (2) exposure of workers or the general public to radiation. Primary concerns following a nuclear incident or accident are: the impact on public health from direct exposure to a radioactive plume; inhalation of radioactive materials; ingestion of contaminated food, water, and milk; and long-term exposure to deposited radioactive materials in the environment that may lead to either acute (radiation sickness or death) or chronic (cancer) health effects.

Within the Commonwealth of Pennsylvania are five nuclear power generation stations. The Beaver Valley Power Station (BVPS) is in central Beaver County, specifically in Shippingport Borough, and is the station of most relevance to county hazard profiling. BVPS maintains two pressurized water reactor units on a 453-acre site, producing 1,872 megawatts of electricity. It is unique in that it is the only nuclear generating station in the country whose emergency planning zone (EPZ) reaches three states – Pennsylvania, Ohio, and West Virginia.

The power plant was expected to close in 2021, but *Energy Harbor Corporation*, the new name for the formerly bankrupt *FirstEnergy Solutions*, announced in March 2020 that it would keep the plant open. The owners cited the Pennsylvania governor’s decision in October 2019 to join the *Regional Greenhouse Gas Initiative* – a program for capping and gradually decreasing carbon dioxide emissions from the power sector in northeastern states – with their change of plans. The initiative requires coal, gas, and oil-fired plants in the participating states to pay a fee for their carbon emissions, beginning to “level the playing field for carbon-free nuclear generators” (Pittsburgh Post-Gazette, March 13, 2020). The Pennsylvania Department of Environmental Protection drafted a regulation to guide Pennsylvania’s participation in the initiative and, at the writing of this plan, had just closed public comment on it. The goal is to join the program in 2022.

The nuclear industry has adopted pre-determined, site-specific emergency action levels (EAL). The EALs provide the framework and guidance for observing, addressing, and classifying the severity of site-specific incidents and conditions that are communicated to off-site emergency response organizations (Nuclear Regulatory Commission [NRC] 2008). Additional EALs specifically deal with issues of security, such as threats of airborne attack, hostile action within the facility, or attack on the facility. These EALs ensure that appropriate notifications of a security threat will occur in a timely manner.

The NRC encourages the use of Probabilistic Risk Assessments (PRA) to estimate quantitatively the potential risk to public health and safety considering the design, operations, and maintenance practices at nuclear power plants. PRAs typically focus on accidents that can severely damage the core and that may challenge containment. The Federal Emergency Management Agency (FEMA), Pennsylvania Emergency Management Agency (PEMA), and county governments have formulated radiological emergency response plans to prepare for radiological emergencies at the five nuclear

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power-generating facilities in the Commonwealth of Pennsylvania.

One of these five plants has begun the decommissioning process and, at the time of the writing of this plan, was for sale; it must still adhere to many of the tenets of emergency response plans.

These plans include a plume exposure pathway EPZ (an area with a radius of about ten miles from each nuclear power facility), and an ingestion exposure pathway EPZ (an area with a radius of about fifty miles from each facility).

Should an accident occur at the BVPS facility, the area within the Ingestion Exposure Pathway EPZ could be affected by radioactive contamination. The amounts are of little concern in terms of external exposure. A bigger threat is internal exposure through the contamination of the food chain, particularly milk from local dairy cattle. Should an accident occur, state and federal agencies would sample and monitor milk, livestock feed, storage crops, and water supplies within the Ingestion Exposure Pathway EPZ. Beaver County Emergency Services may be asked to assist in gathering samples, and if requested by the state agencies, also participate in implementing control of foods, foodstuffs, and water.

4.3.14.2 Range of Magnitude

In accordance with regulations specified by FEMA and NRC, each facility is required to notify jurisdictional agencies of an incident or occurrence within that facility. NRC uses four classification levels for nuclear incidents (NRC 2008) in the country, as listed below:

Unusual Event

Incidents are occurring or have occurred that indicate potential degradation in the level of safety of the plant. No release of radioactive material requiring off-site response or monitoring is expected unless further degradation occurs.

Alert

Incidents are in process or have occurred that involve actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the U.S. Environmental Protection Agency (EPA) Protective Action Guides (PAG).

Site Area Emergency

Incidents are in process or have occurred that resulted in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed EPA PAGs except near the site boundary.

General Emergency

Incidents are in process or have occurred that have caused actual or imminent substantial core damage or melting of reactor fuel with potential for loss of containment integrity. Radioactive releases during a general emergency can reasonably be expected to exceed the EPA PAGs over more than the immediate site area.

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In the event of a nuclear facility disaster, radioactive contamination would be the main danger for Beaver County. Exposure to this radioactive contamination can cause radiation sickness as a result of physical and chemical changes in the cells of the body. If a person would receive a large dose of radiation, that person could die in a very short time. Nonlethal doses in varying degrees would cause radiation sickness among the survivors.

The plume exposure pathway refers to whole-body external exposure to radiation from a radioactive plume and from deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to days. Given that the entire county is within the fifty-mile ingestion exposure pathway EPZ, the county would also focus on the impact of radiation exposure to water or foods such as milk, fresh vegetables, and other consumable products.

Nuclear facility accidents are classified into three categories, and exposure to radiation can stem from any of the three:

- Criticality accidents: Involves loss of control of nuclear assemblies or power reactors.
- Loss-of-coolant accidents: Occurs whenever a reactor coolant system experiences a break or opening large enough so that the coolant inventory in the system cannot be maintained by the normally operating make-up system.
- Loss-of-containment accidents: Involves the release of radioactivity from materials such as tritium; fission products; plutonium; and natural, depleted, or enriched uranium. Points of release have been containment vessels at fixed facilities or damaged packages during transportation accidents.

A worst-case scenario for Beaver County would be a general emergency at BVPS, forcing the evacuation of county residents, disrupting daily life with the potential for long-term economic and health effects, including business interruptions, disruptions in the food supply, psychological stress to evacuees, and long-term risk of radiation sickness. During the immediate event aftermath, regions in the county or in neighboring counties and jurisdictions that are outside the prescribed ten-mile EPZ or evacuation areas may become temporary staging locations for the thousands of residents that would be seeking safety outside of the ten-mile EPZ.

4.3.14.3 Past Occurrence

There have been no major incidents at the BVPS facility. Beaver County Emergency Services has been notified of multiple unusual events and two alerts in the past. Most events reported to the *Knowledge Center* have been exercises or drills performed at BVPS. No General Emergency or Site Area Emergency has occurred to date.

Pennsylvania is home to the only recorded nuclear generating station emergency in the United States. In 1979, the Three Mile Island Nuclear Generating Station declared a General Emergency following an internal system failure. Repercussions from this event were swift, with sweeping changes to NRC

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oversight that included assignment of responsibility to FEMA for outside support. Growth in the nuclear power industry immediately slowed, with the number of facilities decreasing over the next decade. In addition, public confidence in the nuclear industry decreased considerably.

While reports show conflicting information regarding medical impacts on the residential population following the disaster, costs of the cleanup phase of this incident exceeded \$1 billion. No FEMA disaster declarations have since occurred regarding nuclear emergencies in Pennsylvania.

4.3.14.4 Future Occurrence

Within the United States, the low frequency of fixed-facility nuclear incidents that exceed the alert level indicates the stability of the industry. Based on the Risk Factor Methodology Probability Criteria noted in the 2021 mitigation plan, probability of an incident at the BVPS facility is classified as *highly likely*. In addition, Energy Harbor Corporation, the new parent company to BVPS, continues to communicate with local, state, and federal entities in accordance with industry practices and federal and state requirements.

4.3.14.5 Vulnerability Assessment

Effects from a radiological incident at a fixed facility would vary depending on the product released (type of radiation), amount of radiation released, current weather conditions, and time of day. The priority following an incident at any of the facilities within the Commonwealth of Pennsylvania is the life and safety of all individuals within the area impacted. Secondary to health and safety would be effects on critical infrastructure, environment, property, and the economy.

Contamination of agriculture, livestock, and production can lead to loss of commerce with other regions of the state, country, and even the world. Many countries halted imports of products from Japan for fear of contamination following the tsunami-related nuclear incident at the Fukushima Power Plant. This loss in revenue compounded losses that Japan and its region were already encountering following the initial disaster.

Impacts within the affected area can include loss of utility service, contamination of local crops and livestock, loss of residential property due to measurable quantities of nuclear materials, and increased risk to health and wellbeing of individuals within the area.

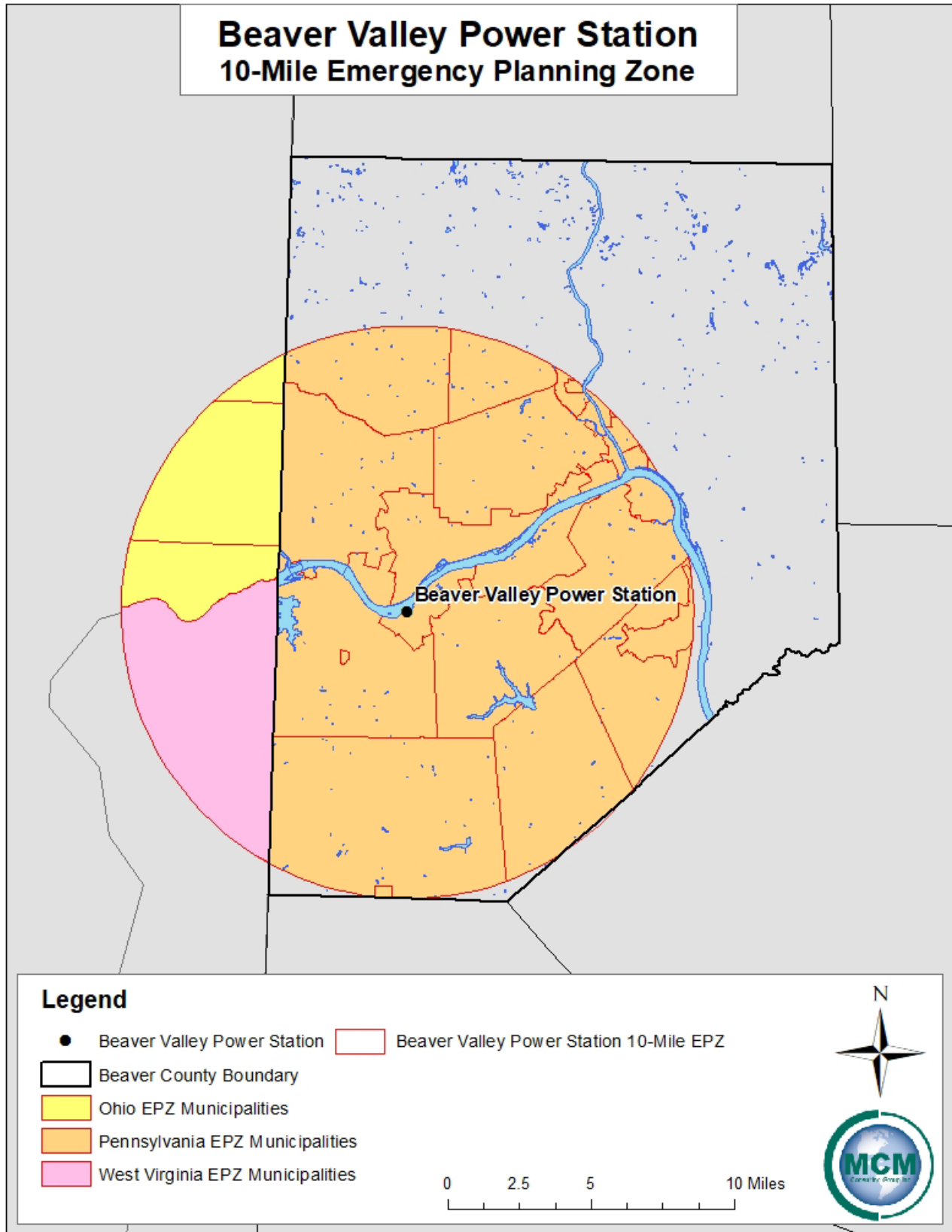
Recognizing the vulnerability, Beaver County maintains a Radiological Emergency Response Plan. This plan was developed in accordance with regulations specified by the NRC, FEMA, and PEMA. The plan addresses actions to respond to and mitigate a possible radiological release. To support the radiological response plan, Beaver County participates in exercises designed to validate planning described within county documents and required by the joint NRC-FEMA Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants: Final Report (NUREG-0654/FEMA-REP-1, Revision 2). The county has coordinated and participated in command and mobile command exercises with neighboring jurisdictions relevant to the BVPS facility and has toured BVPS as part of Region 13 and PEMA initiatives for planning awareness.

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Figure 40 – Beaver County Jurisdictions in the Ten-Mile EPZ and Figure 41 – Beaver Valley Power Station Fifty-Mile Planning Zone and Table 55 – Beaver County Jurisdictions in the Ten-Mile and Fifty-Mile EPZs provide visual and jurisdictional representations of the municipalities that fall within the two EPZs surrounding the BVPS facility in Beaver County. These jurisdictions are most vulnerable to an incident at the facility. Approximately 108,414 residents are located within the ten-mile EPZ, a number about 5% lower than reported in the 2016 mitigation plan. Beaver County residents account for 58,388 of them, roughly 36% of the county’s total population. (*BVPS 2020 Population Update Analysis*, KLD Engineering, P.C.). All of the county, as well as some neighboring jurisdictions in Pennsylvania, Ohio, and West Virginia, fall in the fifty-mile EPZ. Critical infrastructure is discussed further in Section 4.3.13.5 of this Plan.

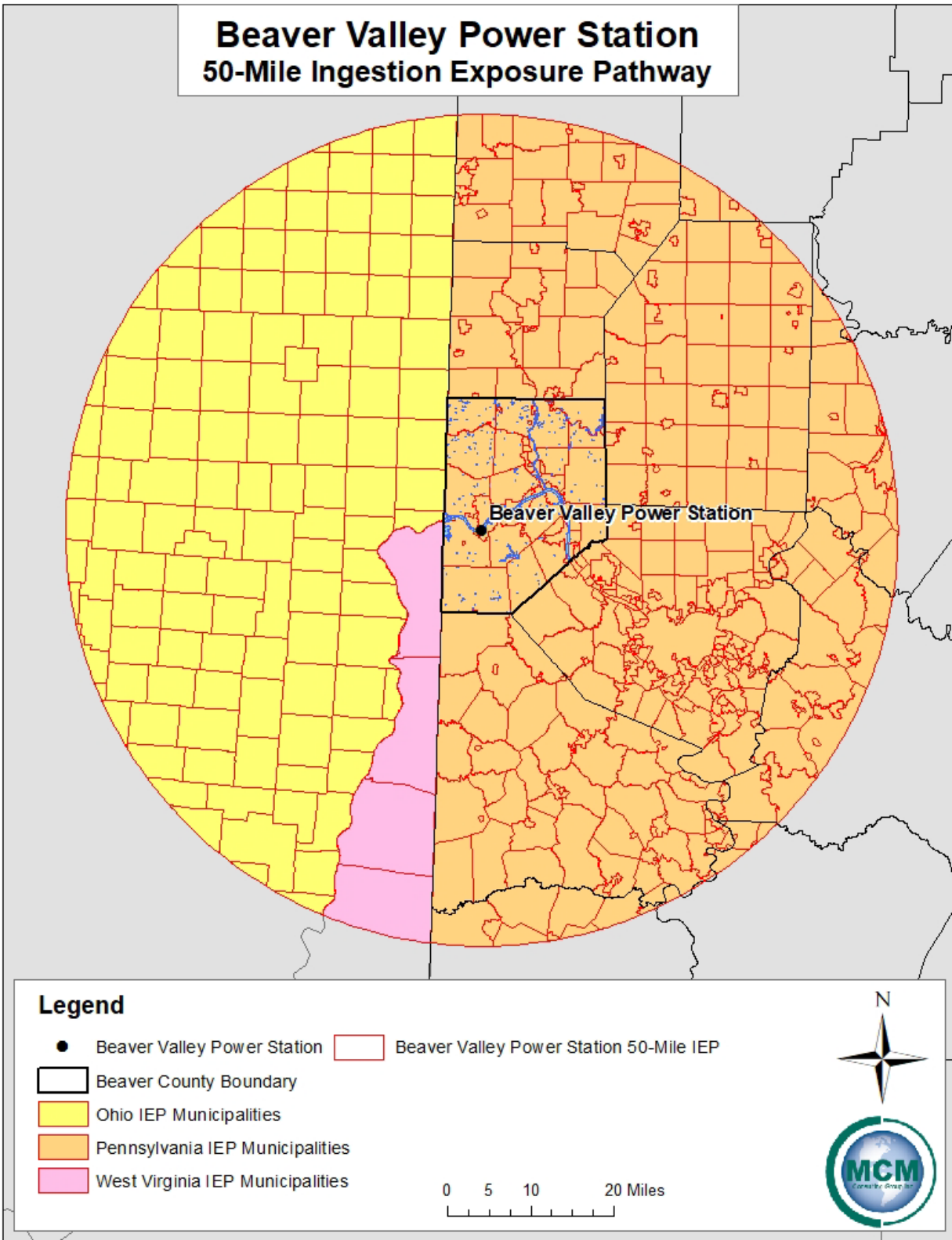
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Figure 39 - Beaver County Jurisdictions in the Ten-Mile EPZ



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Figure 40 - Beaver Valley Power Station Fifty-Mile Planning Zone



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Table 55 - Beaver County Jurisdictions in the Ten-Mile and Fifty-Mile EPZs

Beaver County Jurisdictions in the Ten-Mile and Fifty-Mile EPZs		
Jurisdiction	Ten-Mile Plume Exposure Pathway Zone	Fifty-Mile Ingestion Exposure Pathway Zone
Beaver County	Yes	Yes
City of Aliquippa	Yes	Yes
Ambridge Borough	No	Yes
Baden Borough	No	Yes
Beaver Borough	Yes	Yes
City of Beaver Falls	No	Yes
Big Beaver Borough	No	Yes
Bridgewater Borough	Yes	Yes
Brighton Township	Yes	Yes
Center Township	Yes	Yes
Chippewa Township	Yes	Yes
Conway Borough	No	Yes
Darlington Borough	No	Yes
Darlington Township	No	Yes
Daugherty Township	No	Yes
East Rochester Borough	Yes	Yes
Eastvale Borough	No	Yes
Economy Borough	No	Yes
Fallston Borough	Yes	Yes
Frankfort Springs Borough	Yes	Yes
Franklin Township	No	Yes
Freedom Borough	No	Yes
Georgetown Borough	Yes	Yes
Glasgow Borough	Yes	Yes
Greene Township	Yes	Yes
Hanover Township	Yes	Yes
Harmony Township	No	Yes
Homewood Borough	No	Yes
Hookstown Borough	Yes	Yes
Hopewell Township	Yes	Yes
Independence Township	Yes	Yes
Industry Borough	Yes	Yes

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Jurisdiction	Ten-Mile Plume Exposure Pathway Zone	Fifty-Mile Ingestion Exposure Pathway Zone
Koppel Borough	No	Yes
Marion Township	No	Yes
Midland Borough	Yes	Yes
Monaca Borough	Yes	Yes
New Brighton Borough	Yes	Yes
New Galilee Borough	No	Yes
New Sewickley Township	No	Yes
North Sewickley Township	No	Yes
Ohioville Borough	Yes	Yes
Patterson Township	Yes	Yes
Patterson Heights Borough	Yes	Yes
Potter Township	Yes	Yes
Pulaski Township	No	Yes
Raccoon Township	Yes	Yes
Rochester Borough	Yes	Yes
Rochester Township	Yes	Yes
Shippingport Borough	Yes	Yes
South Beaver Township	Yes	Yes
South Heights Borough	No	Yes
Vanport Township	Yes	Yes
West Mayfield Borough	No	Yes
White Township	No	Yes

4.3.15. Opioid Epidemic

4.3.15.1 Location and Extent

Pennsylvania and the United States at large have been experiencing an epidemic of opioid drug abuse. Opioids are a class of drug that interact with receptors on nerve cells in the body and brain, producing euphoria and pain relief (NIH, 2017). Opioid drugs are highly addictive, and the Commonwealth and country at large have been experiencing an epidemic of opioid addiction and abuse, resulting 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 be especially likely when opioids are combined with alcohol or anti-anxiety drugs. While generally prescribed with good intentions, opioids can be over-prescribed, resulting in addiction.

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While other addictive substances such as methamphetamines and alcohol can be problematic for the health of individuals and the community in Beaver 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.

4.3.15.2 Range of Magnitude

According to the Center for Disease Control and Prevention (CDC), more than 192 Americans die every day from an opioid overdose. In 2014, 2,732 overdose deaths were reported across Pennsylvania. This number increased to 3,264 reported overdose deaths in 2015, an increase of 19.5% (DEA, 2015). Reported overdose deaths increased again in 2016 to 4,627, an increase of 41.7% from 2015, then again to a total of 5,388 deaths in 2017. From 2015 - 2017, the increase in reported drug related overdose deaths in Pennsylvania increased 65%. This increased the need for the gubernatorial disaster declaration in Pennsylvania on January 10, 2018. 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.

4.3.15.3 Past Occurrence

In 2018, there were a total of 67,367 drug-related overdose deaths in the United States. Beaver County experienced a total of 385 drug related deaths from 2015 - 2020.

In 2017, the national average of drug related overdose deaths was twenty-two deaths per 100,000 people. The death rate in Pennsylvania is nearly double this national average, at almost forty-three deaths per 100,000 people. The year of 2015 saw a total of thirty-three drug related overdose deaths and the year of 2016 had a total of 104 drug related overdose deaths. In 2017, Beaver County had approximately eighty-five opioid related overdose deaths. The year 2018 saw a total of forty-two opioid related deaths. The estimates for the years of 2019 and 2020 are approximately sixty-three and fifty-nine deaths respectively. *Table 56 – Beaver County Overdose Death History 2015 - 2020* illustrates recorded overdose deaths for Beaver County as reported by the Pennsylvania's Coroner's Office and Overdose Free Pa. *Figure 42 – Opioid Overdose Deaths in Pennsylvania 2020* illustrates the number of deaths per county in the entire Commonwealth of Pennsylvania for the calendar year 2020. *Figure 43 – Opioid Overdose Deaths in Pennsylvania 2019* illustrates the number of deaths per county in the entire Commonwealth of Pennsylvania for the calendar year 2019. From 2015 - 2020, there had been a significant increase in the abuse of fentanyl in Pennsylvania. Fentanyl is the most prevalent opioid drug trafficked, abused, and overdosed on in Pennsylvania, and is found in 70% of

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overdose victims in 2018 in Pennsylvania. This is illustrated in *Table 57 – Drugs Present in 2018 Pennsylvania Overdose Deaths*.

Table 56 - Beaver County Overdose Death History 2015 - 2020

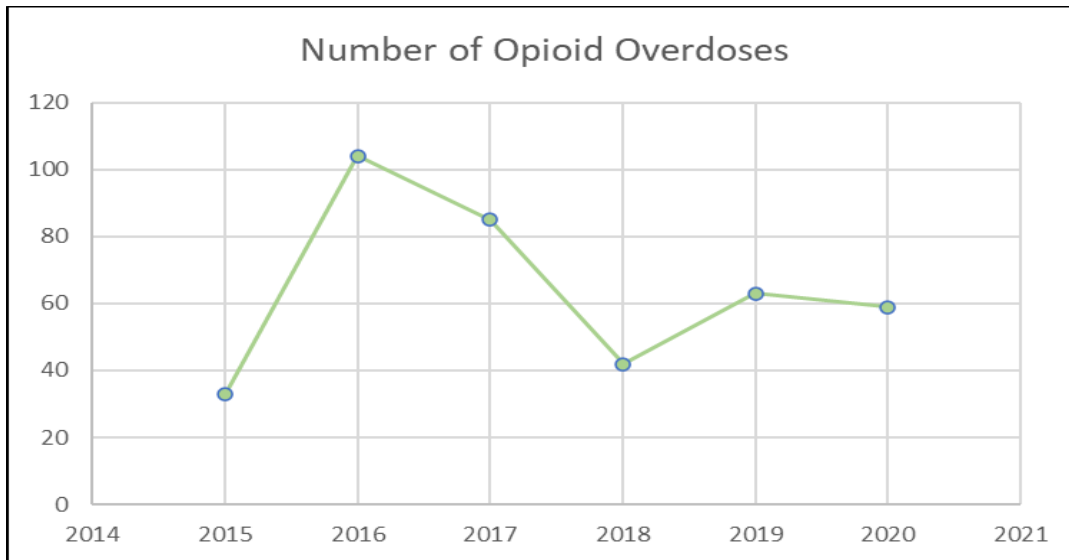
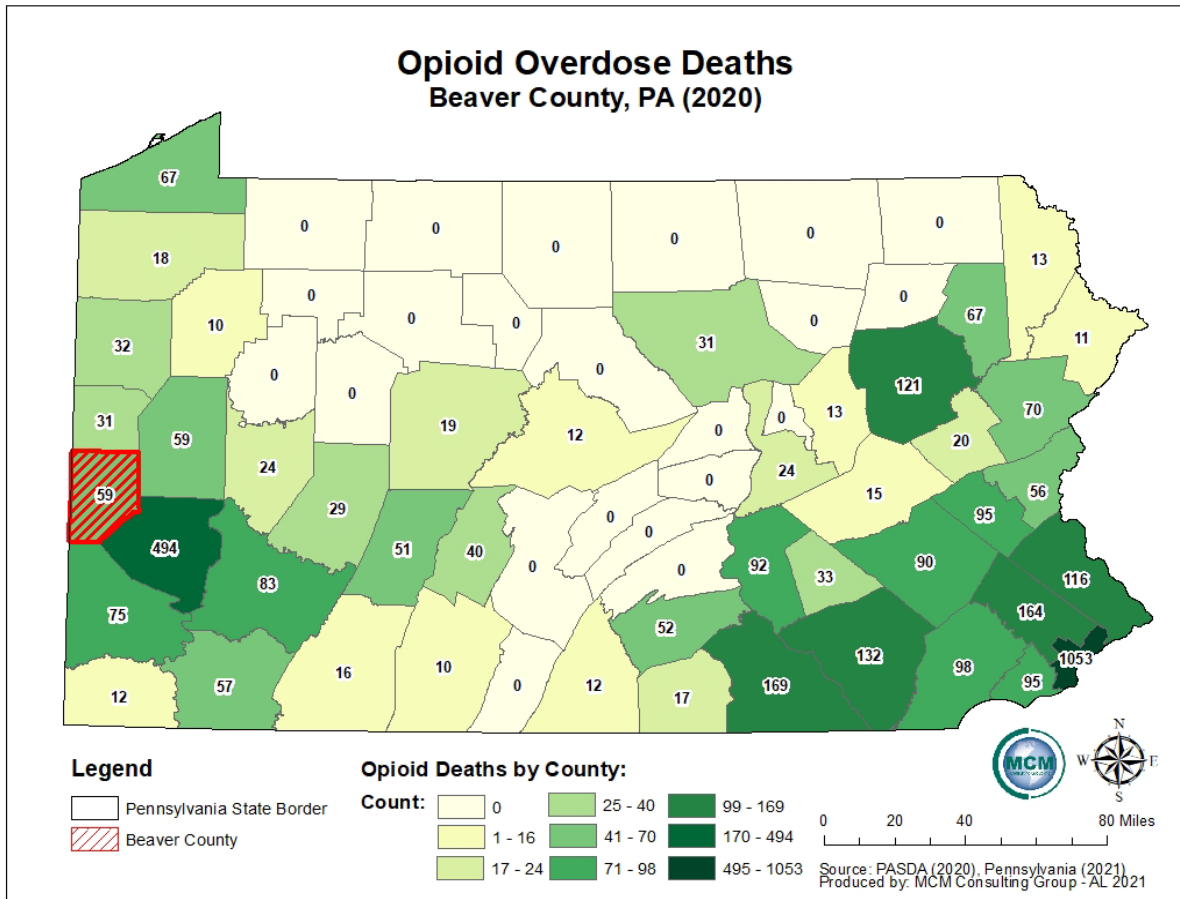


Table 57 - Drugs Present in 2018 Pennsylvania Overdose Deaths

Drugs Present in 2018 PA Overdose Deaths (DEA & Pitt, 2018)	
Drug Category	Percent Reported Among 2018 Decedents
Fentanyl	70%
Heroin	35%
Cocaine	33%
Benzodiazepines	28%
Prescription Opioids	23%
Ethanol	18%
FRSs & NPSO	18%
Other Illicit Drugs	14%

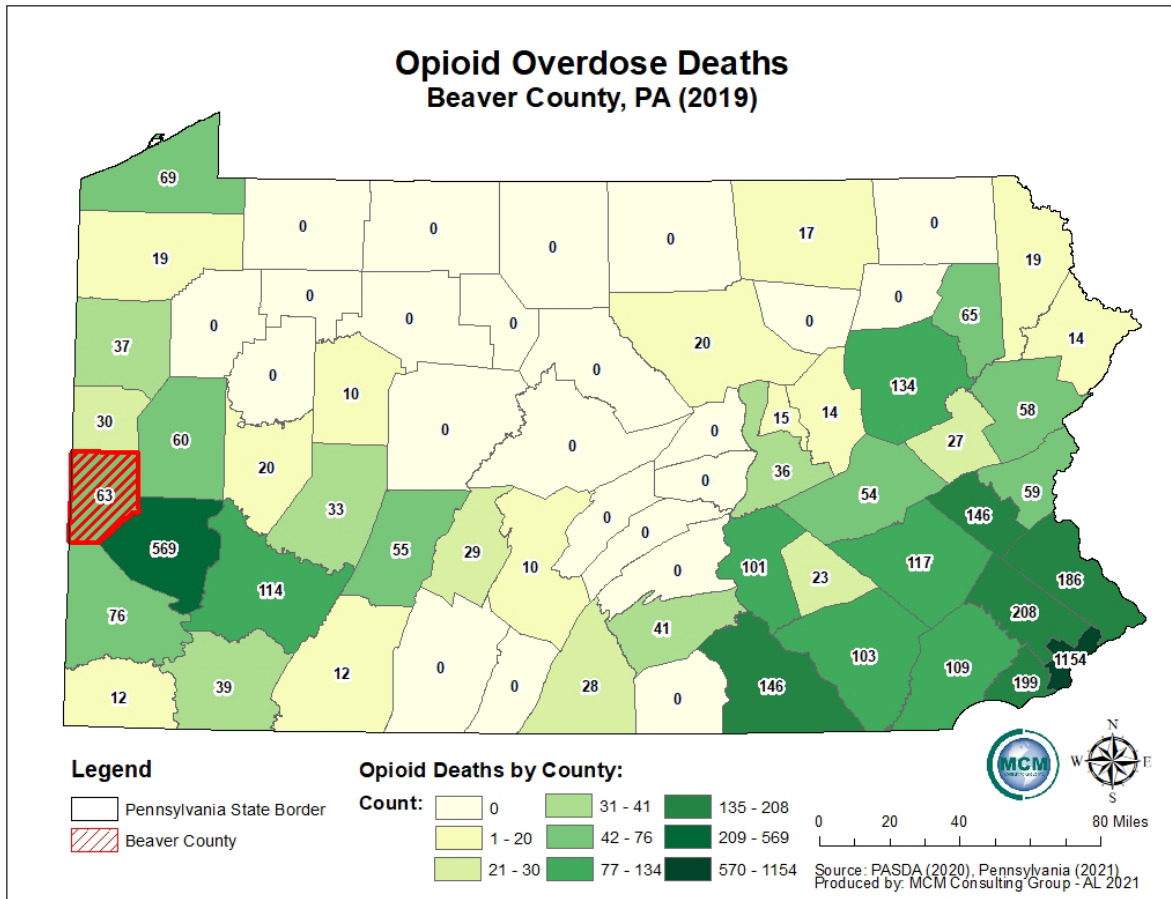
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Figure 41 - Opioid Overdose Deaths in Pennsylvania 2020



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Figure 42 - Opioid Overdose Deaths in Pennsylvania 2019



4.3.15.4 Future Occurrence

In the event of an opioid overdose, death can sometimes be prevented with the use of the drug naloxone. Emergency medical responders have access to the treatment, and as of 2015, naloxone is available without a prescription in Pennsylvania. Furthermore, 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 (DEA & PITT, 2018). While the introduction of naloxone has been a significant benefit to the fight against opioid abuse, efforts to prevent overdoses are still underway.

Rather than reduce pain, in some cases high doses of opioid painkillers can increase pain due to a phenomenon known as opioid-induced hyperalgesia (OIH). It is difficult to know how much of an influence OIH has on the opioid epidemic. Some researchers think that OIH could be

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increasing patients' pain and in turn, increasing their dosages and dependence on opioid drugs, suggesting that patients should work with lower dosages of opioids (Servick, 2016). However, other researchers are unsure of the importance of OIH for opioid users (Servick, 2016).

Opioid drugs have been a problematic and addictive solution 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 Beaver 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 (Lynch & Campbell, 2011), inflammation (Burstein, 2015), anxiety (Scuderi et al., 2009) and even psychosis (Iseger & Bossong, 2015). CBD is legal without a prescription throughout the United States of America.

4.3.15.5 Vulnerability Assessment

Deaths from prescription opioid drugs like oxycodone, hydrocodone, and methadone have increased more than four-fold since 1999. Opioid overdoses have resulted in many tragic deaths in Pennsylvania and most 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 well being of addicts, a burden to their families and communities, and a strain to the emergency response system that cares for overdose victims.

While opioid addiction is often viewed as a criminal problem, a more productive way to view the epidemic can be to view opioid addiction as a chronic disease. This paradigm shift moves away from faulting the abuser and incentivizing quick cures, to viewing the abuser as a patient and working towards long-term management of the disease. In general, it is important to consider alternative approaches to pain treatment in order to avoid beginning a dependence on highly addictive prescribed opioids.

There have been several reports nationally of first responders accidentally overdosing on fentanyl or carfentanyl 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" (Moss et al., 2017). Their official position paper suggests that "the risk of clinically significant exposure to emergency responders is extremely low" (Moss et al., 2017).

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4.3.16. Terrorism

4.3.16.1 Location and Extent

Following several serious international and domestic terrorist incidents during the 1990's and early 2000's, 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)

The Federal Bureau of Investigation (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 its 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.”

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 of the major highways and marginalized groups such as LGBTQ persons and racial minorities.

4.3.16.2 Range of Magnitude

Terrorism may include use of weapons of mass destruction (WMD) (including biological, chemical, explosive, nuclear, and radiological weapons) of arson; incendiary, explosive, armed attacks, industrial sabotage, intentional hazardous materials releases, 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;

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- Biological agent;
- Chemical agent;
- Conventional bomb or bomb threat;
- Cyber terrorism;
- Hijacking;
- Intentional hazardous material release;
- Kidnapping;
- Nuclear bomb; and
- 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 for the deployment of police, EMS and/or fire units.

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 Beaver and the city of Aliquippa, 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 a 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.

Terrorism events can be minor, such as a bomb threat at a vacant gymnasium on a school campus, but more significant ones can severely disrupt life in the county. A worst-case scenario for a terrorist incident in Beaver County is a radioactive or “dirty” bomb detonated at the nuclear power facility in Shippingport. This could result in a large explosion at the facility itself coupled with long-term nuclear radiation exposure from the power plant’s fuel. This type of incident could also cause long-term health issues ranging from cancers to post-traumatic stress disorder, in addition to widespread food supply shortages and power outages.

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

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delay. The largest threat to institutions from cyber terrorism comes from any processes that are networked and controlled via computer.

Ransomware continues to be the leading threat, with Maze ransomware accounting for nearly half of all known cases in 2020. Yet the Acronis Cyberthreats Report points to a growing trend of cybercriminals trying to maximize their financial gain. Cybercriminals not only collect ransoms to decrypt infected data, but they also steal proprietary data before encrypting it, threatening to publicly release the stolen files if the victims do not pay the ransom.

4.3.16.3 Past Occurrence

Beaver County has never suffered an international terrorist attack. However, Beaver County has experienced domestic terrorism. In 1972, a bomb was detonated in the Beaver County Courthouse, causing considerable structural damage. The Beaver Valley Power Station's location within the county also makes security against terrorist acts there essential; a contract security guard at the station was removed from her position in 2016 after lying to investigators about an out-of-service sign on a machine that detects explosive materials on visitors and employees (Beaver County Times).

Beaver County found itself in a heightened level of alertness in the aftermath of the terrorist events occurring on September 11, 2001. Across the county, suspicious activities were reported in multiple locations. The Beaver County Hazardous Materials Team responded to numerous calls, all of which showed negative results for Anthrax (Beaver County 2010).

Some recent events captured in Knowledge Center are noted in *Table 58 - Terrorist Activity History*.

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 2020, there was a total of twenty-eight mass shooting incidents in the United States according to the FBI. Often these shooters are homegrown violent extremists (HVE). Two significant events have occurred in Pennsylvania in recent history. The first event took place on October 27, 2018, when eleven people were killed by a gunman in the Pittsburgh neighborhood of Squirrel Hill. The gunman (an HVE) attacked the congregation at the *Tree of Life* Synagogue that targeted the Jewish population and was fueled by the gunman's anti-Semitic, anti-immigrant, and anti-refugee sentiments. The second event took place in January 2019 when 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.

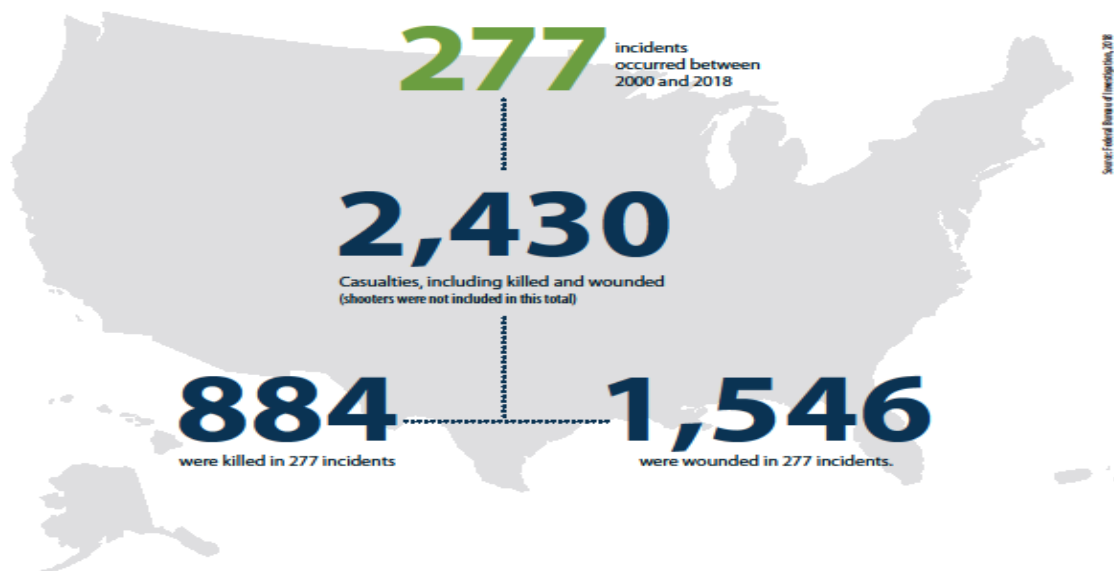
A few other significant active shooter events include those that occurred at Virginia Tech (April 2007), Sandy Hook Elementary School (December 2012), San Bernardino, California (December

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2015), an Aurora, Colorado movie theater (July 2012) and a church in Charleston, South Carolina (June 2015). A 2014 study by the FBI concluded that there has been a significant recent increase in frequency of active shooter incidents, and the vast majority (154 of 160 shooters between 2000 and 2013) were male (FBI, 2014). Of these 160 incidents, 45.6% took place in commercial environments, 24.3% took place in an educational environment, and the remaining 30.1% took place at other locations such as open spaces, military and other government properties, residential locations, houses of worship, and health care facilities (FBI, 2019). The annual report on the study may be found here:

<https://www.justice.gov/usao-mdpa/page/file/1272096/download>. See *Figure 44, Active Shooter Incidents 2000-2018* from that same report.

Figure 43 - Active Shooter Incidents 2000-2018 (FBI, 2019)



Significant international terrorism incidents in the United States include the World Trade Center bombing in 1993 and the September 11, 2001 attacks on the World Trade Center and The Pentagon. One of the aircrafts hijacked in the September 11, 2001 attack crash landed in Somerset County, Pennsylvania before it reached its intended target. Fatalities and destruction at the intended target were avoided, but 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 real life or via the internet, and who may struggle with mental health issues or idleness constraints caused by the on-going pandemic. Hate groups such as the *Ku Klux Klan* (KKK), *Aryan Nation* and, more recently, the *Alt-Right*, *Antifa*, *Proud Boys*, plus conspiracy theorist believers/promoters such as *QAnon*, have been a part of domestic terrorism in different forms. Supporters of former President Donald Trump from one or more of these groups stormed

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the United States Capitol on January 6, 2021 to disrupt certification of the 2020 presidential election, resulting in five deaths and evacuation of the Congress.

In 1995, an American anti-government domestic terrorist named Timothy McVeigh carried out an Oklahoma City bombing that killed 168 people and injured more than 680 others and destroyed 1/3 of the Alfred P. Murrah Federal Building.

Table 58 - Terrorist Activity History has some recordings of local threats; however, these incidents are not all inclusive of the history of terrorism nor are they necessarily real terrorism as defined by the FBI. Entries vary due to the recorder's selection of category and description.

Table 58 - Terrorist Activity History

Terrorist Activity History		
Title	Location	Date
Bomb Threat	Pulaski Township	10/30/2006
Bomb Threat	Monaca Borough	11/29/2006
Bomb Threat	Beaver Borough	12/12/2006
Bomb Threat	City of Beaver Falls	01/16/2007
Bomb Threat	Rochester Borough	02/01/2007
Bomb Threat	Midland Borough	02/06/2007
Abridge School on Lockdown	Ambridge Borough	04/20/2007
School Threat	Chippewa Township	04/22/2007
Bomb Threat	Economy Borough	04/30/2007
Bomb Threat	New Sewickley Township	05/01/2007
Suspicious Container	Baden Borough	05/11/2007
Bomb Threat	Center Township	08/20/2007
Bomb Threat	North Beaver Township	10/10/2007
Bomb Threat	Center Township	02/22/2008
Bomb Threat	Beaver Borough	02/27/2008
Bomb Threat	Aliquippa City	11/23/2008
Suspicious Substance	Aliquippa City	02/11/2009
Bomb Threat	Brighton Township	06/01/2009
Bomb Threat	Rochester Borough	11/17/2009
Bomb Threat	Greene Township	03/29/2010
Bomb Threat	North Sewickley Township	04/21/2011
Suspicious Activity	Eastvale Borough	09/16/2011
Bomb Threat	Center Township	10/21/2011
Bomb Threat	Hopewell Township	11/09/2011

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Title	Location	Date
Suspicious Person	Hanover Township	09/06/2011
Bomb Threat	Hopewell Township	01/07/2012
Bomb Threat	New Sewickley Township	03/04/2012
Bomb Threat	Center Township	04/28/2013
Bomb Squad Requested	Aliquippa City	06/24/2013
Bomb Threat	Center Township	12/26/2013
School Bomb Threat	Center Township	05/22/2014
Bomb Threat	Ambridge Borough	11/06/2014
Bomb Threat	Economy Borough	11/18/2014
Bomb Threat	Economy Borough	12/08/2015
Bomb Threat	New Sewickley Township	04/09/2015
Bomb Threat	Hopewell Township	10/16/2015
School Bomb Threat	Economy Borough	11/20/2015
Suspicious Device	East Rochester Borough	02/18/2016
Bomb Threat	Rochester Township	03/18/2016
Bomb Threat	Economy Borough	05/25/2016
School Bomb Threat	Monaca Borough	01/20/2017
Bomb Threat	Ambridge Borough	02/22/2017
Bomb Threat	Harmony Township	05/01/2017
Ransomware Attack	Brighton Township	06/27/2017
Suspicious Pack in Emergency Room	Brighton Township	08/12/2017
Bomb Threat	Daugherty Township	12/19/2017
Suspicious Person	Franklin Township	02/14/2018
School Bomb Threat	New Sewickley Township	12/13/2018
Suspicious Package	City of Beaver Falls	05/15/2020
Explosive Device	Ambridge Borough	07/10/2020

4.3.16.4 Future Occurrence

The likelihood of Beaver County being a primary target for a major international terrorist attack is small. More likely terrorist activity in Beaver County includes bomb threats or other incidents at schools. Beaver County has sixteen school districts consisting of over forty public schools; it also houses two four-year colleges and one two-year community college. Bomb threats at schools are typically experienced at least once a year across the county. In addition to direct threats within the county, the county's proximity to Pittsburgh, Pennsylvania may increase the likelihood of secondary effects (for example, a drain on emergency response resources and medical facilities) as a result of an attack on this major metropolitan area.

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4.3.16.5 Vulnerability Assessment

Beaver County should stay prepared to terrorism type incidents. The existence of industrial commerce, interstate highways and freight railroad activity creates soft targets that could be used to interfere with the focus of day-to-day life that the county enjoys. Use of and exposure to biological agents via such soft targets can remain unknown for several days until the infected group, person, livestock, or crops begin to experience symptoms or show damages. Often such agents are contagious, and the infected carrier and persons must be quarantined, livestock culled, and/or crops destroyed.

Although previous events have not resulted in what are considered 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 (CBRNE Terrorism Newsletter, 2013).

The Acronis Cyberthreats Report 2020 contains an in-depth review of the current cyber 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 2021 will bring aggressive cybercrime activity as criminals pivot their attacks from data encryption to data exfiltration. Takeaways of the report are the following:

- **Attacks against remote workers will increase.** While 31% of global companies reported daily cyberattacks in 2020, the frequency of attacks targeting their remote workers is projected to increase in 2021, since the defenses for systems outside of the corporate network are more easily compromised, giving bad actors access to that organization's data.
- **Ransomware will look for new victims, become more automated.** Rather than continuing to cast a wide net, ransomware attackers will focus on targets that provide a bigger return on their efforts. Breaking into one network to steal data from several companies is more profitable than attacking individual organizations. So, while small businesses will still be targeted, cloud environments and organizations like managed service providers will become more valued targets because their systems can provide access to the data of multiple clients.
- **Legacy solutions will struggle to keep up.** Blocking the new malware has rendered traditional antimalware solutions obsolete, as they cannot keep pace with the increased sophistication and frequency of new threats. The average lifespan of a malware sample in 2020 was just 3.4 days. As attackers continue to utilize automation, the number of malware samples will continue to climb. Organizations will need to find new approaches to protection that are agile and designed to stay ahead of new threats. Simple standalone security and backup solutions will no longer be enough.

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And, according to a study carried out on the data sourced from FBI, Pennsylvania ranks second worst when it comes to handling cyber-attacks (outranked only by Hawaii). The study made by Information Network Associates - an international security consulting company – reports there was an increase of 25% in commonwealth cyber-attacks between 2016 and 2017.

The probability of terrorist activity is more difficult to quantify than some other hazards, especially since terrorists have commonly sent chemical or biological agents through the mail. Instead of considering likelihood of occurrence, vulnerability is assessed in terms of specific assets. By identifying potentially at-risk terrorist targets in a community, planning efforts can be put in place to reduce the risk of attack. Planning should work towards identifying potentially at-risk critical facilities and systems in the community, prioritizing those assets and locations, and identifying their vulnerabilities relative to known potential threats.

All communities in Beaver County are vulnerable to terrorism. Specific vulnerable sites to note in Beaver County include the following:

- Military installations, such as the Pennsylvania National Guard and U.S. Army Reserve facilities in Beaver Falls;
- County and municipal government facilities;
- Beaver County Jail – Hopewell Township;
- State/federal government facilities;
- Pennsylvania State Police – Beaver Barracks;
- U.S. Postal facilities;
- Communications centers (911);
- Commercial facilities, particularly multinational or international firms;
- Industrial facilities, particularly those storing large quantities of hazardous materials or those involved in military development;
- Utility facilities including power generation plants, dams, and water treatment plants;
- Law enforcement facilities;
- Facilities housing important political or religious figures;
- Historical sites;
- Transportation infrastructure;
- High-profile events attracting large amounts of people or very important persons;
- Educational facilities, especially colleges and universities;
- Major waterways in Beaver County, including the Ohio and Beaver rivers;
- Abortion or family planning clinics/organizations associated with controversial issues; and
- Places of worship.

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Damage to or disruption of activity at these facilities could have impacts – from concerning to profound – on Beaver County’s population.

4.3.17. Transportation Accidents

4.3.17.1 Location and Extent

Highways

Transportation accidents will claim more lives annually and cause more injuries than any other hazard. With rail, air, and highway transportation available all over Pennsylvania, every county in the commonwealth is susceptible to this hazard. Beaver County is served by two interstate highways (I-76 [Turnpike] and I-376 [Beaver Valley Expressway]), U.S. Route 30 and Pennsylvania Routes 65, 68, 18, and 51. With the state-maintained and local roads, there are approximately 1,689 miles of roads within Beaver County.

According to PennDOT there are 894 bridges on state roads in Beaver County and sixty bridges on local roads.

Railways

Railways in Beaver County are mostly located along the valleys of major waterways, including the Ohio River, Beaver River and Connoquenessing Creek. These railways serve large industrial areas in Beaver County, to include Koppel, Midland, Aliquippa, Port Ambridge, and Shippingport. The Conway Yard is a major rail hub located in Conway Borough and is operated by Norfolk Southern Corporation. In addition to transporting goods and materials, the railways also transport people. Amtrak operates along a Norfolk Southern Corporation line. According to the Federal Railroad Administration, there are five main railway operators in Beaver County:

- Amtrak
- Buffalo and Pittsburgh Railroad (BPRR)
- CSX Transportation (CSXT)
- Norfolk Southern Corporation (NS)
- Genesee Wyoming Railroad

Rail accidents can be divided into the following categories:

- Derailment – one or more cars of the train leaves the rails.
- Collision – a train strikes another train or a vehicle.
- Other – including striking objects on the rails (to include pedestrians), fires, or explosions.

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Aviation

Beaver County has two public and ten private airports. The Beaver County Airport in Chippewa Township, and the Zelienople Municipal Airport in Franklin Township are more susceptible to larger-scale aviation incidents due to being public airports.

Aviation accidents are often devastating incidents that may result in serious injuries or fatalities. The Federal Aviation Administration (FAA) and the National Transportation Safety Board (NTSB) are responsible for monitoring air travel and investigating accidents. Some of the most common causes of aviation accidents occur because of violations to FAA and NTSB regulations. Some other causes of accidents include, but are not limited to:

- Pilot or flight crew errors – Pilot error is the number-one cause of aviation accidents and accounts for the highest number of fatalities.
- Faulty equipment – Faulty aircraft equipment or mechanical features is another common cause of aviation accident.
- Aircraft design flaws – The manufacturer of an aircraft is responsible for an aviation accident if the structural design is flawed and results in an accident.
- Failure to properly fuel or maintain the aircraft – If any regulations and safety standards set by the FAA or NTSB are violated, an accident may occur.
- Negligence of Federal Air Traffic Controllers – Failure of air traffic controllers to properly monitor the airways is another cause of aviation accident.

4.3.17.2 Range of Magnitude

In terms of transportation, the maximum threat to Beaver County is when the incident occurs in or near a heavily populated area. Each mode of public transit experiences accidents on an annual basis. Each of these incidents can occur on both small and large scales.

Highways

Automobile accidents can occur on any roadway. These traffic accidents are most common during periods of inclement weather. Hazardous material spills are the most common secondary effect of transportation accidents.

Railways

Rail accidents can vary widely in terms of injuries, fatalities, property damage, and interruption of service, depending on the nature and severity of the accident.

Aviation

Aircraft accidents can vary from a single engine aircraft having a “hard landing” and causing damage to the aircraft, to a crash of a large jet aircraft causing deaths and or damage to

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infrastructure on the ground. Aviation accidents also can involve radio-controlled or drone aircraft devices.

4.3.17.3 Past Occurrence

Highways

Table 59 – Beaver County Automotive Crashes outlines Beaver County automobile crash data to include the total number of crashes in both Beaver County and Pennsylvania, the number of fatal crashes in the county and the total number of fatalities each year for both the county and the state.

Table 59 - Beaver County Automotive Crashes

Beaver County Automotive Crashes								
Year	Total crashes			# of Fatal crashes in Beaver County	Total fatalities		Pedestrian Deaths	
	Beaver County	Percentage of seat belt usage in crashes for Beaver County	Pennsylvania		Beaver County	Pennsylvania	Beaver County	Pennsylvania
2010	1,524	66%	121,312	10	10	1,324	0	148
2011	1,408	67%	125,395	24	24	1,286	2	149
2012	1,458	67%	124,092	19	19	1,310	3	168
2013	1,459	68%	124,149	11	12	1,208	1	151
2014	1,404	69%	121,317	10	10	1,195	0	166
2015	1,445	72%	127,127	12	12	1,200	1	153
2016	1,301	70%	129,395	4	5	1,188	1	172
2017	1,265	71%	128,188	16	17	1,137	0	150
2018	1,361	75%	128,420	14	15	1,190	1	201
2019	1,385	74%	125,267	11	16	1,059	0	154

Source: Pennsylvania Department of Transportation

Railways

The Pennsylvania Department of Transportation reported that between 2010 and 2019 there was only one train versus vehicle accident in Beaver County, this occurred in 2011 and resulted in one death.

There were five derailments between 2015 and 2020 identified on Knowledge Center™, four of which were in Conway Borough and one in Freedom Borough. These are outlined below:

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- July 20, 2015, there was a report of a train off the tracks along State Route 65 South, Freedom Borough, with seven refrigerated cars involved. The roadway was not affected and there was no spill involved.
- May 18, 2016, Conway Borough, Norfolk Southern Railroad reported a freight train derailed at mile post PC 24.5 Main 1. This is one of two main lines and the line was expected to be closed for approximately eight hours. There were no hazardous materials involved.
- February 8, 2020, Norfolk Southern Railroad reported six tanker cars derailed in the Conway Terminal yard. A total of two ounces of crude oil spilled from two of the cars. The spill was contained and to be cleaned up by Hepaco.
- July 16, 2020, there was a report of three cars containing hazardous materials derailed, there was no potential for any release as all the cars were upright in Conway Borough.
- October 17, 2020, two rail cars derailed in the Conway Yard spilling thirty tons of Polyethylene pellets onto the ballast.

Aviation

Aircraft and aviation accidents are less frequent than railway and highway accidents. Most aircraft incidents are minor, such as sliding off the end of the runways or reporting landing gear malfunctions.

There were three aviation accidents identified on Knowledge Center™ between January 2015 and December 2020. These are outlined below:

- January 29, 2015, a private aircraft made a landing at Zelienople Municipal Airport and slid past the end of the runway. There were no injuries.
- September 16, 2017, a Piper Cub airplane crashed. There were two patients with head injuries.
- August 12, 2019, Beaver County Airport Tower reported a disabled plane. The plane was on the ground when the landing gear collapsed. One person was evaluated by EMS.

All transportation modes

Table 60 – Beaver County Transportation Accidents lists all transportation related accidents or incidents in Beaver County between January 2013 and December 2020, as identified on Knowledge Center™.

Table 60 - Beaver County Transportation Accidents

Beaver County Transportation Accidents		
Date	Municipality	Information
01/04/2013	Hookstown Borough	Truck rollover

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Date	Municipality	Information
01/20/2013	Rochester Borough	Vehicle accident with entrapment
02/20/2013	New Sewickley Township	Vehicle accident with entrapment
03/07/2013	Georgetown Borough	Vehicle accident with road closure
03/10/2013	New Beaver Borough	Vehicle accident with entrapment
03/30/2013	Hanover Township	Vehicle accident with entrapment
04/27/2013	Marion Township	Motorcycle accident
05/03/2013	Hopewell Township	Tanker rollover
05/05/2013	North Sewickley Township	Vehicle accident with entrapment
05/08/2013	New Sewickley Township	Accident on PA Turnpike
05/15/2013	North Sewickley Township	Vehicle accident with entrapment
06/04/2013	Aliquippa City	Vehicle accident with entrapment
06/06/2013	Aliquippa City	Vehicle accident
06/22/2013	Darlington Township	Motorcycle accident
07/03/2013	Hanover Township	Vehicle accident with entrapment
07/08/2013	South Beaver Township	Vehicle accident with ejection
07/10/2013	Industry Borough	Vehicle accident with entrapment
07/16/2013	Independence Township	Vehicle accident with entrapment
08/11/2013	Raccoon Township	Vehicle accident with entrapment and fatality
08/18/2013	Hanover Township	Vehicle accident with fatality
08/31/2013	Hopewell Township	Vehicle accident with entrapment
09/04/2013	Big Beaver Borough	Vehicle accident with fatality
09/06/2013	Chippewa Township	Aircraft down
09/12/2013	Franklin Township	Vehicle accident with entrapment
09/12/2013	Franklin Township	Vehicle accident with entrapment
09/13/2013	Potter Township	CSX train derailment
09/19/2013	Greene Township	Vehicle accident
09/23/2013	City of Beaver Falls	Vehicle accident with entrapment
10/07/2013	Big Beaver Borough	Vehicle accident with road closure
10/13/2013	Rochester Township	Vehicle accident
10/15/2013	New Sewickley Township	Asphalt tanker accident
10/16/2013	Ohioville borough	Vehicle accident

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Date	Municipality	Information
10/17/2013	Industry Borough	Vehicle accident
10/26/2013	Hopewell Township	Vehicle accident with injuries
10/27/2013	Beaver Falls City	Train versus pedestrian accident
10/31/2013	New Brighton Borough	Vehicle accident
11/26/2013	Aliquippa City	Accident with sheriff's vehicle and hazardous materials
11/30/2013	New Sewickley Township	Vehicle roll-over with entrapment
12/03/2013	Baden Borough	Vehicle accident
12/11/2013	Economy Borough	Vehicle accident
12/12/2013	Center Township	Vehicle accident with entrapment
12/17/2013	Ambridge Borough	Vehicle accident with road closure
12/25/2013	Center Township	Vehicle accident
12/30/2013	Aliquippa City	Vehicle accident
01/10/2014	Aliquippa City	Vehicle accident injuring an officer
01/19/2014	Ambridge Borough	Vehicle versus pedestrian accident
01/23/2014	New Sewickley Township	Vehicle accident with entrapment
01/29/2014	North Beaver Township	Vehicle accident with fatality
01/29/2014	Hanover Township	Vehicle accident
02/03/2014	Ohioville Borough	Vehicle accident with fatality
02/05/2014	Greene Township	Vehicle accident with injuries
02/08/2014	Homewood Borough	Accident involving a fire truck with injuries
02/12/2014	Chippewa Township	Vehicle accident with entrapment
02/14/2014	Darlington Township	Vehicle accident
02/28/2014	Chippewa Township	Vehicle accident with entrapment
03/14/2014	Aliquippa City	Child hit by a vehicle
03/16/2014	Beaver Falls City	Pedestrian hit by a train
03/21/2014	Beaver Falls City	Motorcycle accident
04/12/2014	Big Beaver Borough	Motorcycle accident
04/21/2014	Ohioville Borough	Vehicle into a house
05/08/2014	Big Beaver Borough	Vehicle accident with entrapment
05/15/2014	New Brighton Borough	Vehicle accident with a school bus
05/22/2014	Center Township	Vehicle accident with entrapment
05/26/2014	Potter Township	Motorcycle accident
05/29/2014	South Beaver Township	Vehicle accident

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Date	Municipality	Information
06/12/2014	Aliquippa City	Vehicle accident
06/15/2014	Raccoon Township	Vehicle accident with entrapment
06/15/2014	Chippewa Township	Vehicle into a house with entrapment
07/07/2014	Conway Borough	Vehicle accident with fatality and road closure
07/15/2014	Greene Township	Vehicle accident with entrapment
07/20/2014	Patterson Township	Vehicle accident with multiple injuries
07/21/2014	Big Beaver Borough	Pedestrian struck by a train
07/29/2014	Chippewa Township	Tractor-trailer accident
08/17/2014	Big Beaver Township	Vehicle accident with road closure
08/18/2014	Hopewell Township	Motorcycle accident
08/18/2014	New Sewickley Township	Vehicle accident with entrapment
09/02/2014	South Beaver Township	Vehicle accident with wires down
09/06/2014	Greene Township	Vehicle versus pedestrian accident
09/07/2014	Baden Borough	Vehicle accident involving a police cruiser with injuries
09/14/2014	Franklin Township	Aircraft emergency
09/18/2014	Brighton Township	Vehicle accident with entrapment
10/04/2014	Big Beaver Brough	Vehicle accident involving a police cruiser
10/11/2014	Koppel Borough	Vehicle into a building
10/12/2014	Rochester Township	Vehicle into a building
10/20/2014	Vanport Township	Vehicle accident with hazardous materials spill
10/31/2014	Aliquippa City	Vehicle accident with fatality
11/12/2014	Freedom Borough	Vehicle accident involving a police cruiser
12/16/2014	Conway Borough	Railroad car on fire
12/16/2014	Brighton Township	Vehicle accident
01/06/2015	Aliquippa City	Vehicle accident with entrapment
01/10/2015	New Sewickley Township	Vehicle accident with fatality
01/16/2015	Ambridge Borough	Vehicle accident with entrapment
01/26/2015	Glasgow Borough	Vehicle into a house
01/29/2015	Franklin Township	Aircraft incident
02/11/2015	Shippingport Borough	Vehicle accident with injuries and road closure
02/22/2015	Ohioville Borough	Vehicle accident with possible ejection
02/23/2015	Hanover Towshihp	Vehicle accident
03/04/2015	Franklin Township	Vehicle accident with fatality

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Date	Municipality	Information
03/11/2015	Greene Township	Vehicle accident
03/15/2015	Big Beaver Borough	Vehicle accident with road closure
04/06/2015	Darlington Township	Vehicle accident with entrapment
04/11/2015	Baden Borough	Officer struck by a vehicle
05/01/2015	Chippewa Township	Vehicle into a house
05/03/2015	New Galilee Borough	Train versus vehicle
05/04/2015	Beaver Falls City	Vehicle accident on the railroad tracks
05/08/2015	North Sewickley Township	Vehicle accident with request for medical helicopter
05/20/2015	Hanover Township	Vehicle accident with entrapment and road closure
05/21/2015	Beaver Falls City	Train versus pedestrian
05/21/2015	Hanover Township	Vehicle accident with entrapment
05/29/2015	Darlington Township	Vehicle accident with entrapment
05/31/2015	North Sewickley Township	EMS unit involved in an accident
06/02/2015	Baden Borough	School bus accident
06/13/2015	Homewood Borough	Vehicle versus pedestrian
06/13/2015	Beaver Falls City	Motorcycle accident
06/13/2015	New Sewickley Township	Vehicle accident with fire
06/15/2015	Big Beaver Borough	Vehicle accident with ejection and injuries
06/23/2015	Chippewa Township	Vehicle accident with injuries
06/27/2015	Baden Borough	Vehicle accident with road closure
07/02/2015	Chippewa Township	Motorcycle accident with an SUV
07/05/2015	Baden Borough	Vehicle accident with fatality
07/05/2015	Big Beaver Borough	Vehicle accident with injuries
07/08/2015	Daugherty Township	Vehicle accident with fatality
07/10/2015	Hopewell Township	Vehicle accident with fatality
07/11/2015	Economy Borough	Vehicle rollover with entrapment
07/16/2015	Center Township	Bus accident
07/20/2015	Freedom Borough	Train derailment
07/20/2015	New Sewickley Township	Vehicle accident with entrapment
07/25/2015	Chippewa Township	Motorcycle accident
07/25/2015	Big Beaver Borough	Motorcycle accident
07/28/2015	Beaver Borough	Vehicle versus pedestrian accident

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Date	Municipality	Information
07/31/2015	New Brighton Borough	Vehicle accident
08/02/2015	Raccoon Township	Vehicle into a house
08/07/2015	North Sewickley Township	UPS truck into a house
08/14/2015	Franklin Township	Vehicle accident with road closure
08/17/2015	North Sewickley Township	Vehicle accident with entrapment
09/23/2015	Ambridge Borough	Vehicle accident with entrapment
09/23/2015	Center Township	Vehicle accident with injuries
09/25/2015	Darlington Township	Vehicle accident with injuries
10/03/2015	New Galilee Borough	Bus into a creek
10/10/2015	Koppel Borough	Vehicle accident
10/20/2015	Potter Township	Vehicle accident with hazardous materials
10/21/2015	Beaver Borough	Vehicle accident
10/27/2015	Independence Township	Vehicle versus pedestrian accident
10/28/2015	Pulaski Township	Vehicle accident with entrapment
11/18/2015	South Beaver Township	Vehicle accident with injuries
11/24/2015	North Sewickley Township	Vehicle accident with road closure
12/21/2015	South Heights Borough	Tanker trailer accident with entrapment
12/21/2015	Franklin Township	Vehicle accident with injuries
01/06/2016	Independence Township	Vehicle into a house
01/09/2016	Darlington Township	Vehicle accident with entrapment
01/12/2016	Raccoon Township	Vehicle accident with road closure
01/27/2016	Aliquippa City	Vehicle accident with entrapment
02/02/2016	Big Beaver Borough	Vehicle accident with injuries
02/02/2016	Rochester Borough	Tractor trailer accident with hazardous materials
02/02/2016	Potter Township	Vehicle accident with entrapment
02/17/2016	Hopewell Township	Vehicle accident with bridge damage
02/23/2016	Raccoon Township	Vehicle accident involving a school bus
02/25/2016	Economy Borough	Vehicle accident
02/26/2016	Greene Township	Vehicle accident with a fuel leak
02/28/2016	Aliquippa City	Vehicle accident involving a police cruiser
03/11/2016	South Beaver Township	Vehicle accident with injuries
03/18/2016	Freedom Borough	Vehicle accident involving a school minivan
05/08/2016	Aliquippa City	Vehicle accident with entrapment

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Date	Municipality	Information
05/08/2016	Hopewell Township	Vehicle accident with entrapment
05/18/2016	Conway Borough	Train derailment
05/23/2016	Industry Borough	Vehicle accident with entrapment
06/06/2016	Chippewa Township	Vehicle accident with multiple injuries
06/09/2016	Hopewell Township	Vehicle accident with entrapment
07/12/2016	Darlington Township	Vehicle accident with multiple injuries
07/26/2016	Raccoon Township	Vehicle accident
07/30/2016	Pulaski Township	Vehicle accident involving fire apparatus
08/03/2016	North Sewickley Township	Vehicle accident
08/21/2016	Ambridge Borough	Two pedestrians struck by a train
08/24/2016	Ambridge Borough	Vehicle versus mini-bus accident
08/28/2016	Big Beaver Borough	Vehicle rollover with entrapment
09/26/2016	North Sewickley Township	School bus accident
10/05/2016	Ambridge Borough	Vehicle into a building
11/10/2016	New Sewickley Township	Vehicle accident with road closure
11/27/2016	Industry Borough	Vehicle versus pedestrian accident
11/29/2016	Economy Borough	Vehicle accident with entrapment
11/30/2016	Center Township	Vehicle accident with entrapment involving a school bus
12/20/2016	Hanover Township	Vehicle accident with road closure
12/24/2016	Conway Borough	Locomotive versus train
01/30/2017	North Sewickley Township	Vehicle accident with fatality
02/07/2017	Aliquippa City	Child struck by a vehicle
02/11/2017	Brighton Township	Vehicle accident
02/12/2017	Big Beaver Borough	Vehicle rollover
02/20/2017	Hanover Township	Vehicle accident
02/20/2017	Hanover Township	Vehicle accident with fatality
04/06/2017	Center Township	Fire fighter struck by a vehicle
04/25/2017	Brighton Township	Vehicle accident with chemical spill
05/17/2017	New Sewickley Township	Vehicle over a bridge and into a creek
05/17/2017	Big Beaver Borough	Vehicle accident with possible entrapment

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Date	Municipality	Information
05/21/2017	Conway Borough	Vehicle accident with entrapment and road closure
05/26/2017	South Beaver Township	Vehicle accident with entrapment
06/06/2017	Chippewa Township	Vehicle accident with entrapment
06/29/2017	Industry Borough	Vehicle accident with fatality
07/16/2017	North Sewickley Township	Vehicle into a house with entrapment
07/17/2017	Midland Borough	Vehicle accident
07/19/2017	New Sewickley Township	Vehicle accident
08/02/2017	Brighton Township	Vehicle accident with entrapment
08/17/2017	South Beaver Township	Vehicle accident with road closure, hit and run
09/02/2017	Darlington Township	Vehicle accident
09/08/2017	Beaver Falls City	Vehicle accident
09/16/2017	Hanover Township	Airplane crash
09/19/2017	Big Beaver Borough	Vehicle versus pedestrian accident
10/20/2017	Darlington Township	Vehicle accident
10/31/2017	Greene Township	Vehicle accident with entrapment
12/01/2017	Chippewa Township	Vehicle accident
12/04/2017	Conway Borough	Vehicle accident with possible fatality
12/12/2017	Hanover Township	Vehicle accident with road closure
12/12/2017	Industry Borough	Vehicle accident with entrapment
12/12/2017	Hopewell Township	Vehicle accident with road closure
12/18/2017	Hookstown Borough	Vehicle accident with ejection
01/08/2018	County-wide	Weather related accidents
01/17/2018	Greene Township	Vehicle accident with entrapment and road closure
01/20/2018	City of Beaver Falls	Vehicle accident with bridge closure
02/08/2018	Aliquippa City	Police officer involved in a vehicle accident
02/09/2018	Bridgewater Borough	Vehicle into a structure
02/16/2018	Chippewa Township	Vehicle accident involving a police cruiser
02/17/2018	New Sewickley Township	Vehicle accident involving a police cruiser
03/07/2018	Hopewell Township	Vehicle accident involving a school bus
03/15/2018	Beaver Falls City	Vehicle accident with entrapment
04/01/2018	Greene Township	Vehicle accident involving fire apparatus
04/27/2018	Aliquippa City	Vehicle accident with ejection
07/11/2018	Independence Township	Vehicle accident involving a police cruiser

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Date	Municipality	Information
07/20/2018	Darlington Borough	Motorcycle accident
08/11/2018	Daugherty Township	Motorcycle accident
08/16/2018	Industry Borough	Vehicle accident
08/17/2018	Independence Township	Vehicle accident
09/23/2018	Darlington Township	Vehicle accident
10/30/2018	Chippewa Township	Child struck by a vehicle
11/03/2018	Daugherty Township	Vehicle accident with fatality
11/08/2018	Greene Township	Vehicle accident
11/25/2018	Chippewa Township	Vehicle accident with road closure
12/15/2018	Big Beaver Borough	Tractor trailer rollover
01/05/2019	Brighton Township	Vehicle accident
01/05/2019	Shippingport Borough	Vehicle accident involving a police cruiser
01/10/2019	Hopewell Township	Vehicle accident with entrapment and road closure
02/02/2019	Rochester Borough	Vehicle accident with entrapment
02/07/2019	New Brighton Borough	Vehicle into a structure
02/07/2019	Hopewell Township	Vehicle accident with fatality
02/10/2019	Independence Township	Vehicle accident with road closure
03/03/2019	Monaca Borough	Vehicle accident with road closure
03/03/2019	Marion Township	Vehicle rollover with partial ejection
03/14/2019	Aliquippa City	Vehicle accident with entrapment
03/15/2019	Big Beaver Borough	Vehicle accident with injuries
03/17/2019	Darlington Township	Vehicle accident with fatality
03/17/2019	Hanover Township	Vehicle accident
03/27/2019	Greene Township	Vehicle accident
03/29/2017	Industry Borough	Train versus semi-truck
03/29/2019	Daugherty Township	Vehicle accident
03/31/2019	New Sewickley Township	Vehicle accident with entrapment
03/31/2019	Big Beaver Borough	Vehicle accident with unknown injuries
03/31/2019	Big Beaver Borough	Vehicle accident with entrapment
04/02/2019	New Sewickley Township	Tractor-trailer accident
04/11/2019	North Sewickley Township	Vehicle accident with possible entrapment
04/21/2019	Harmony Township	Vehicle accident with entrapment
05/23/2019	Daugherty Township	Vehicle accident with road closure

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Date	Municipality	Information
05/29/2019	Aliquippa City	Vehicle rollover
06/05/2019	Midland Borough	Motorcycle accident
06/07/2019	New Brighton Borough	Vehicle accident with road closure
06/09/2019	Aliquippa City	Vehicle accident with entrapment
06/28/2019	Marion Township	Vehicle accident with fuel leak
06/29/2019	Chippewa Township	Vehicle accident with road closure
06/30/2019	Center Township	Vehicle accident with injuries
07/07/2019	Freedom Borough	Vehicle accident with entrapment
07/11/2019	Freedom Borough	Vehicle accident
07/13/2019	Aliquippa City	Vehicle accident involving a police officer
07/18/2019	Hopewell Township	Vehicle versus pedestrian accident
08/04/2019	Monaca Borough	Vehicle accident involving a police cruiser
08/08/2019	Potter Township	Police officer struck by a vehicle
08/12/2019	Unknown	Twin engine plane crash
08/13/2019	Brighton Township	Vehicle accident
08/13/2019	Center Township	Vehicle accident with entrapment
08/28/2019	Raccoon Township	Vehicle accident with injuries and entrapment
08/28/2019	Independence Township	Vehicle accident involving a firefighter with injuries
09/01/2019	Raccoon Township	Vehicle accident with injuries and entrapment
09/01/2019	New Sewickley Township	Vehicle rollover
09/01/2019	Beaver Township	Vehicle accident involving a fire truck
09/18/2019	Center Township	Motorcycle accident
09/29/2019	Brighton Township	Motorcycle accident
10/03/2019	Big Beaver Borough	Vehicle accident with entrapment and fatality
10/10/2019	New Sewickley Township	Vehicle accident with fuel leak
10/12/2019	New Sewickley Township	Vehicle accident with entrapment
10/28/2019	New Sewickley Township	Tractor-trailer accident with fuel spill
10/31/2019	Hopewell Township	Vehicle accident with fatality
11/19/2019	Economy Borough	Vehicle accident
12/23/2019	Conway Borough	Vehicle accident with road closure
12/29/2019	Hanover Township	Vehicle accident with road closure
01/05/2020	Ambridge Borough	Officer involved vehicle accident

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Date	Municipality	Information
01/18/2020	Marion Township	Vehicle accident with entrapment
01/24/2020	Hanover Township	Vehicle accident
02/04/2020	New Brighton Borough	Vehicle accident with entrapment
02/08/2020	Conway Borough	Rail incident
02/14/2020	Aliquippa City	Vehicle accident
02/18/2020	Big Beaver Borough	Vehicle accident on the PA Turnpike
02/19/2020	Center Township	Vehicle accident with road closure
03/08/2020	Aliquippa City	Vehicle accident with road closure
03/09/2020	Ambridge Borough	Vehicle accident with road closure
03/20/2020	New Sewickley Township	Vehicle accident on the PA Turnpike
03/22/2020	Conway Borough	Rail worker struck by a train
03/30/2020	Potter Township	Tri-axle accident
05/30/2020	Baden Borough	Vehicle accident
06/02/2020	Hookstown Borough	Vehicle accident with power outage
06/18/2020	Franklin Township	Vehicle accident
06/23/2020	North Sewickley Township	Tractor-trailer fire with closure on the PA Turnpike
06/25/2020	New Sewickley Township	Vehicle accident with entrapment
07/02/2020	Koppel Borough	Motorcycle accident, over a hillside
07/05/2020	Aliquippa City	Motorcycle accident
07/13/2020	Aliquippa City	Motorcycle accident
07/16/2020	Greene Township	Vehicle accident with road closure
07/16/2020	Conway Borough	Train derailment
07/29/2020	New Sewickley Township	Truck fire on the PA Turnpike
08/04/2020	New Sewickley Township	Tractor-trailer accident on the PA Turnpike
08/12/2020	Industry Borough	Vehicle accident with fatality
08/5/2020	Beaver Falls City	Vehicle accident into a house
08/22/2020	Franklin Township	Vehicle accident with entrapment
08/22/2020	Center Township	Vehicle accident with injuries
08/23/2020	New Sewickley Township	Vehicle accident
08/27/2020	Rochester Township	Vehicle into a gas meter with a large gas leak

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Date	Municipality	Information
09/21/2020	Center Township	Dump truck accident
09/25/2020	Big Beaver Borough	Commercial vehicle accident
09/25/2020	Bever Falls City	Train versus car
10/15/2020	Fallston Borough	Vehicle accident with entrapment
10/17/2020	Conway Borough	Rail car derailment
10/17/2020	Bridgewater Borough	Vehicle accident with entrapment
10/24/2020	Aliquippa City	Vehicle accident into a building with partial collapse
10/25/2020	Chippewa Township	Vehicle accident with entrapment
10/29/2020	Big Beaver Borough	Overtuned box truck on the PA Turnpike
11/15/2020	City of Beaver Falls	Vehicle accident involving a police cruiser
11/17/2020	Chippewa Township	Vehicle accident into a house
11/26/2020	Franklin Township	Vehicle accident
12/01/2020	South Heights Borough	Vehicle accident with entrapment
12/13/2020	Harmony Township	Vehicle accident
12/21/2020	Hopewell Township	Vehicle accident
12/23/2020	South Beaver Township	Vehicle accident with road closure
12/30/2020	New Sewickley Township	Vehicle accident into a house

4.3.17.4 Future Occurrence

The probability of a transportation accident is highly likely. Automobile accidents, ranging from minor to fatal, will occur more frequently than a railway or aviation accident.

Transportation hazards 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 municipality base maps. Certain characteristics that contribute to the occurrence or increase vulnerability to these hazards can be identified, particularly, in areas that may be prone.

Assuming that transportation accidents are as likely to occur in the future as they have occurred in the past, and based on the available data, Beaver County can expect the following each year:

- Approximately 1,401 vehicle accidents (This number may be much higher or lower; however, this figure is based on the ten-year average of vehicle accidents captured from PennDOT.)
- 0 to 1 railway incidents, most likely involving a pedestrian or vehicle being struck by a train.
- 0 to 1 aviation accidents.

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4.3.17.5 Vulnerability Assessment

The vulnerability for accidents; highway, railway, or aviation, are directly related to the population and traffic density within the accident location. The vulnerability increases if there are hazardous materials involved. Hazards associated with transportation can be natural hazards that affect the environment such as winter storms or heavy rains causing slippery roadways or mud slides; to windstorms or tornadoes that cause high-profile vehicles or train cars to be toppled over.

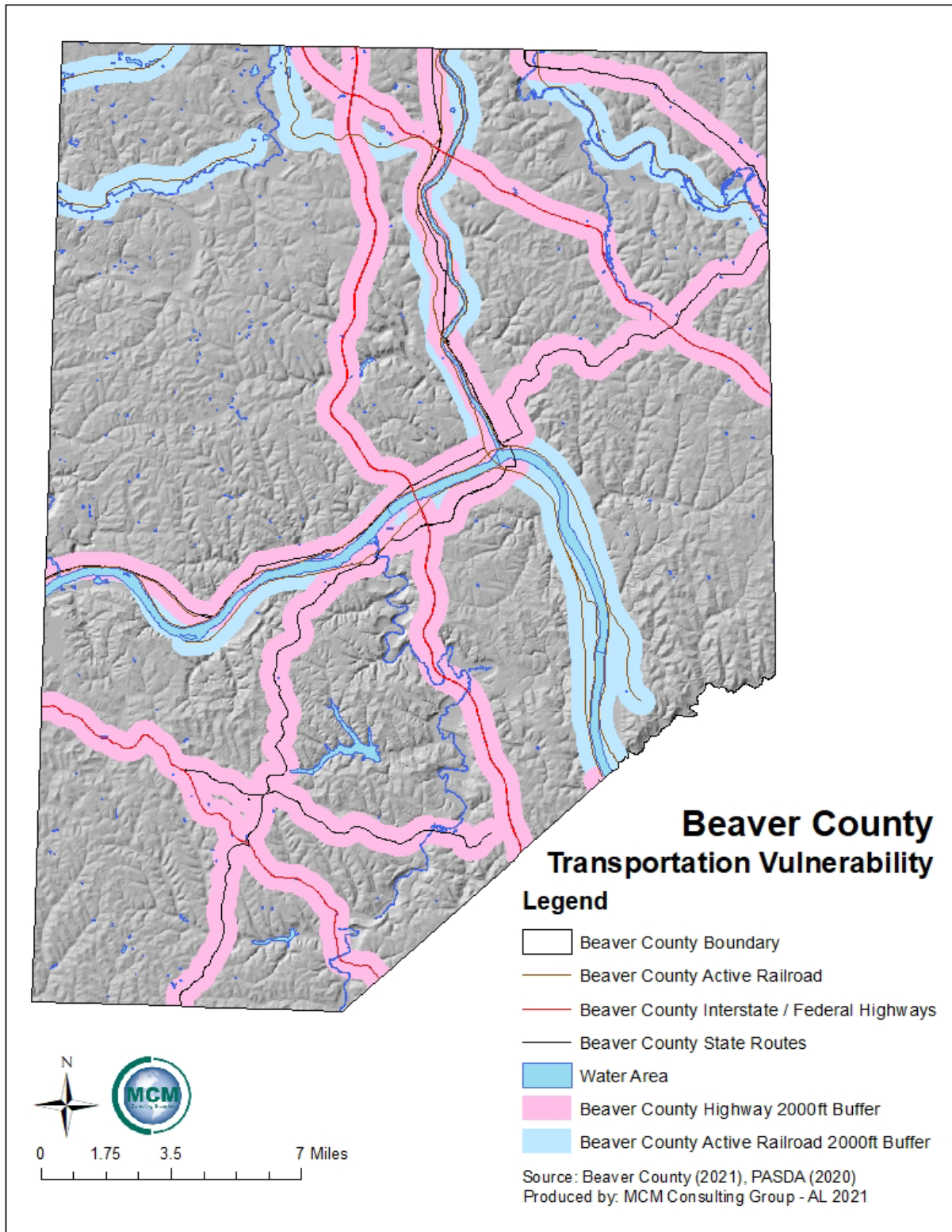
Loss of roadway use, and public transportation services would affect thousands of commuters, employment, day-to-day operations within the county, and delivery of critical municipal and emergency services. Disruption of one or more of the modes of transportation in use in Beaver County can lead to congestion of other modes and affect both the county and the region.

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 45 – Transportation Vulnerability Map identifies the vulnerable roadways and railways in Beaver County. There are numerous critical facilities within a ¼ mile vulnerability zone along each mode of transportation. These critical facilities are more vulnerable to a transportation related accident than critical facilities that are not within that vulnerability zone. Some vulnerabilities would include vehicles into structures or susceptibilities to hazardous materials released in an accident. *Figure 46 – Airport Vulnerability Map* identifies the vulnerable areas within a 2-mile radius of each airport within Beaver County.

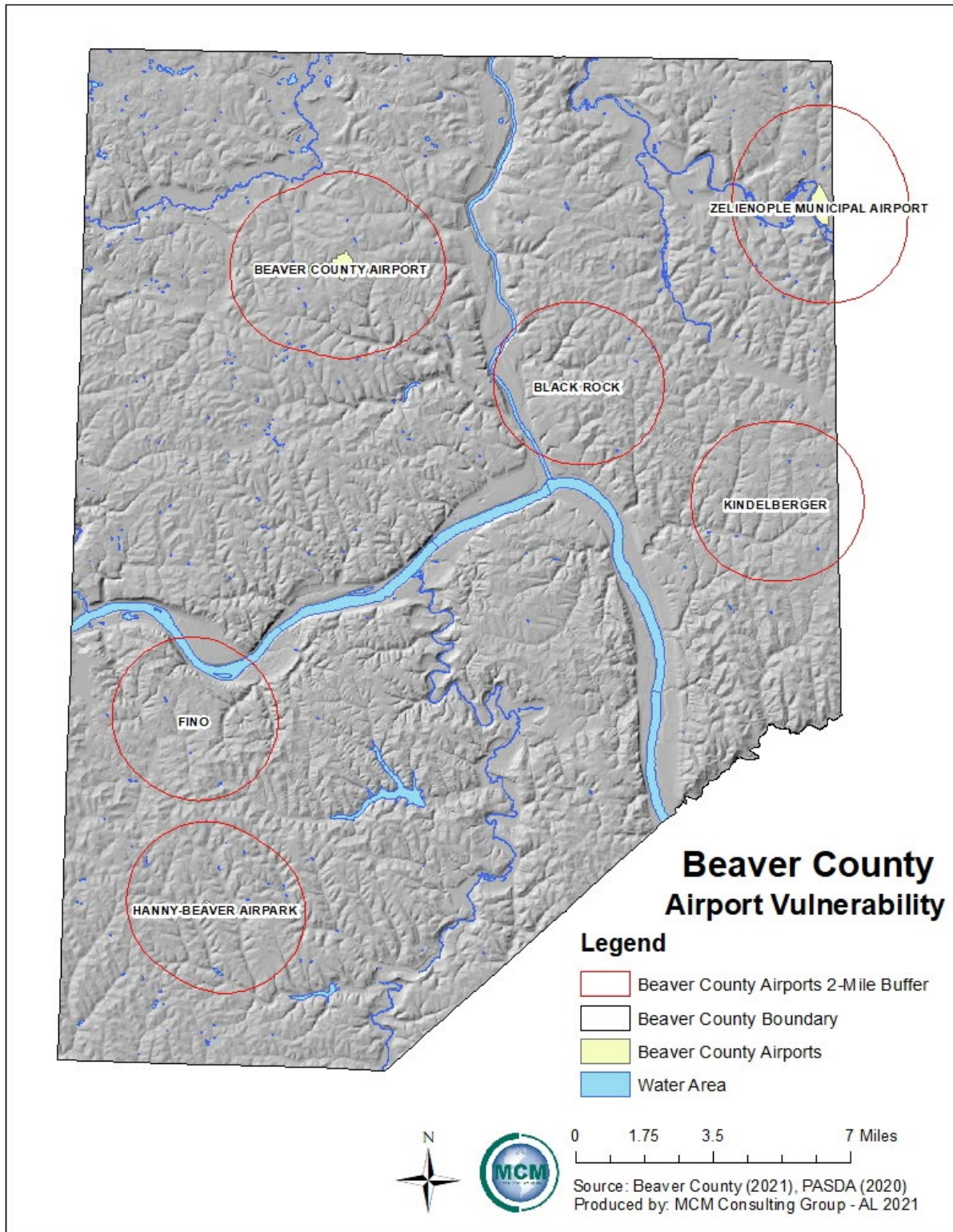
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Figure 44 - Transportation Vulnerability Map



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Figure 45 - Airport Vulnerability Map



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4.3.18. Urban Fire and Explosions

4.3.18.1 Location and Extent

An urban fire involves a structure or property within an urban or developed area. Structural and urban fires within Beaver County have had a detrimental impact on life, property, and the local economy over the past decade. The age of many residential structures within the region combined with changes in building construction and materials has increased the threat of fire loss that is occurring on a regular basis.

As defined by the National Fire Protection Agency (NFPA) in the *NFPA 901: Standard Classifications for Incident Reporting and Fire Protection Data*, a structure fire is defined as “any fire inside, on, under, or touching a structure”. This definition includes any mobile residential structure such as a mobile or modular home but does not include roadworthy vehicles such as recreation vehicles (*NFPA 2011*). Significant urban fires are limited to densely populated areas of the county that contain large and/or multiple buildings. Urban fires may start in a single structure but spread to nearby buildings, or throughout a large building if adequate fire control measures are not in place.

An explosion is defined as a violent expansion in which energy is transmitted outward as a shock wave. Significant explosions are most common in densely populated areas and at industrial facilities that utilize combustible hazardous materials. Explosions can also occur in conjunction with automobile, boat, and rail accidents. All such explosions can turn into fires, spreading to nearby structures.

The presence of meth-labs can be the cause of severe fires and/or explosions due to the volatile chemicals involved in this illegal practice. Another hazardous condition with the potential for fires and explosions is Marcellus Shale natural gas sites, during drilling, flaring, or production.

4.3.18.2 Range of Magnitude

The severity of urban fires is measured according to the losses associated with the incident. The impact to the local economy is minimal with the loss of a residential structure, but effects of the loss of a large manufacturing facility that employs many people can be extensive. Likewise, the impact to the local environment from a single residential fire is minimal, while the impact from an industrial or commercial fire can take years to measure. Finally, the loss of life caused by urban fires appears to be opposite of the previous two impacts. The loss of life is more likely to be associated with a residential fire than an industrial or commercial building fire. Building compositions combined with the time of day of the incident are risk factors that can increase the chance for the loss of life during a residential-type fire.

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The effects of a major (industrial) explosion include minor to serious property damage, loss of life, environmental damage, and residential or industrial displacement. Severe explosions result in extensive damage to residential, commercial, and/or public property. Lives may be lost, and people are often displaced. Additionally, major explosions may result in hazardous materials mitigation issues. Explosion severity has two classifications: supersonic and subsonic. Supersonic explosions are created by high explosives and known as detonations and travel via shock waves. Subsonic explosions are created by low explosives through a slower combustion process known as deflagration.

The urban fires within Beaver County are usually small and generally affect residential structures. These fires are limited in duration. While the average fire is small, the threat from a large or even catastrophic fire is always present. Many operations within larger industrial and commercial sites within Beaver County are prone to and have experienced small fires that if improperly contained can (and do) lead to catastrophic fire losses. Combined with the presence of volatile materials, threats of fires and explosions are ever changing and increasing within the region. Vacant buildings (both residential and commercial) pose a particular threat concerning urban fires.

A worst-case scenario for fire would be a large urban fire destroying residential and industrial building, which would potentially cause additional environmental hazard effects. A worst-case scenario for explosions would be a massive explosion causing numerous fatalities in a facility as well as the surrounding area and leading to a secondary urban fire.

4.3.18.3 Past Occurrence

Table 61 – Reported Structural Fires 1999-2015 shows an annual fire report for Beaver County from 1999 to October 13, 2015. These fires were reported to the Pennsylvania Emergency Management Agency (PEMA) through the Pennsylvania Emergency Incident Response System (PEIRS). This table also shows the number of brush fires and fatalities. The worst year on record in Beaver County for fire hazards was 2000, when eleven people lost their lives due to fires. Between 2003 and 2007 was the worst five-year period for structure fires with an average of 1,339 fires a year within Beaver County.

Table 61 - Reported Structural Fires 1999-2015

Beaver County Reported Structural Fires 1999-2015			
Year	Structure Fires	Brush Fires	Fatalities
1999	952	575	6
2000	841	380	11
2001	751	307	2
2002	601	360	2
2003	1,275	488	1

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Year	Structure Fires	Brush Fires	Fatalities
2004	1,315	226	5
2005	1,224	524	2
2006	1,324	647	0
2007	1,557	372	0
2008	796	289	0
2009	594	361	2
2010	472	251	0
2011	48	2	2
2012	74	6	1
2013	71	2	0
2014	72	5	1
2015	78	3	0
Total	12,046	4,798	35

Source: Pennsylvania Emergency Incident Response System (PEIRS) reports for 1999 to 2010; Knowledge Center 2011 to October 12, 2015. Note: One fire event in 2013 was listed as both a structure fire and brush fire. This event was recorded under both categories; however, the total number of reported fires in 2013 is 72.

Table 62 – Reported Structural Fires 2015-2020 (Corvena 2021) outlines structural fires, from residential to commercial, and identifies those with reported entrapments or fatalities. It should be noted that 2015 is listed in the two separate tables outlining fires in Beaver County, and that the table below has all structure fires for that year identified. In 2015 one residential structure fire resulted in the death of two individuals; while the most recent fire fatality occurred on August 25, 2020 in Industry Borough where one person died because of the fire.

Table 62 - Reported Structural Fires 2015-2020 (Corvena 2021)

Beaver County Reported Structural Fires 2015-2020 (Corvena 2021)									
Year	Structural Fires						Commercial		Total
	Residential	with entrapment	with fatalities	Barn	Multiple structures	Functional Needs Facilities (to include schools)	Commercial/ Industrial (to include churches and apartment buildings)	with fatalities	
2015	57	3	1	2	4	0	16	0	83
2016	28	4	0	0	0	5	14	0	51
2017	26	0	0	0	0	1	5	0	32

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Year	Structural Fires						Commercial		Total
	Residential	with entrapment	with fatalities	Barn	Multiple structures	Functional Needs Facilities (to include schools)	Commercial/Industrial (to include churches and apartment buildings)	with fatalities	
2018	29	0	0	1	0	1	11	0	42
2019	21	0	0	1	0	1	14	0	37
2020	34	0	1	1	0	1	13	0	50

Several explosions have occurred in Beaver County. These incidents were primarily industrial in nature and resulted in one or more of the following: extensive use of resources, loss of jobs, or impact to the community.

- In 1984, an explosion at the Valvoline Plant in Freedom caused multiple fatalities. In addition, heavy smoke conditions caused road closures and forced evacuations of surrounding buildings.
- In July 2010, an explosion at the Horsehead Corporation, a zinc smelting plant in Monaca, killed two people (Chemical Safety Board [CSB] 2015).
- In February 2011, an explosion at a Marcellus Shale natural gas well site in Independence Township led to minimal environmental damage, however; there was a large fire and injuries to three employees (WTAE 2011).
- In July 2014, a home in South Beaver exploded and resulted in the death of two residents. The explosion was heard from several miles away. Investigators identified both a basement stove and outside propane tank as possible causes for the explosion (Pittsburgh CBS Local News 2014).

Between January 2015 and December 2020 there were only seven incidents that either had an explosion or had the potential for explosions. These incidents were identified on Corvena and are:

- January 18, 2017, a military ordinance was found.
- January 22, 2017, a mobile meth lab was found in Hopewell Township.
- February 12, 2017, a meth lab was discovered inside a residence in Franklin Township.
- August 30, 2017, while police were assisting with a medical emergency, they discovered a mini meth lab in the apartment.
- September 10, 2018, there was a gas line explosion and fire in Center Township.

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- December 13, 2018, Beaver County Detectives received a bomb threat at the courthouse, via an email.
- November 18, 2020, there was a structural fire with explosion reported in Big Beaver Borough. This is also listed in the structural fires table above.

4.3.18.4 Future Occurrence

Structure fires are hard to predict, however there are some initiatives that if utilized can prevent fires from becoming a devastating event. NFPA fire sprinkler initiative, 2019, reports that the U.S. experiences on average more than 255,000 home fires annually. These fires cause more than 2,500 civilian fire deaths and nearly 11,600 civilian fire injuries. Nearly 80% of fire deaths occur at home. First issued in 1975, *NFPA 13D, Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes* proposed home fire sprinklers as a solution. In 2006, *NFPA 5000, Building Construction and Safety Code®*, included a building code requirement for sprinklers in one- and two-family dwellings. There is a myth that the fire problem is only in older homes; the fact is, new homes have larger open spaces, unprotected, lightweight construction materials; and furniture stuffed with combustible materials, all factors that lead to homes burning hotter and faster. Fire sprinklers are green and:

- Reduce water use to fight a fire by 90% compared to a fire hose.
- Reduce greenhouse gases by 98%.
- Reduce fire damage by up to 97%.

Section 13,7.1.8 of the *Fire Code* contains criteria for the general installation of smoke alarms, including requirements for the interconnection of smoke alarms in new construction. NFPA has two source documents regarding smoke alarms, *NFPA 101 (The Life Safety Code)* regulates where smoke alarms are required, and *NFPA 72 (The National Fire Alarm and Signaling Code)* regulates how smoke alarms are installed.

By using smoke alarms and having a home fire sprinkler system can reduce the devastating effects of fires, in loss of life and financial losses. However, with the decline in the number of volunteer firefighters within the commonwealth, any structure fire may have an extended period prior to more defined mitigation efforts (by fire departments) being applied. With increased limitations to manpower, single alarm fires of the past are now being handled as multiple-alarm events. This means that fire departments are calling for assistance from neighboring fire companies more often to meet the necessary requirements of properly fighting (mitigating) fires and explosions.

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4.3.18.5 Vulnerability Assessment

The potential for fire and or explosions exists county-wide. Human error can play an important role in creating the potential for a major urban fire or explosion. The vulnerability of the citizens and property of Beaver County to fire and related incidents depends on many factors. On the negative side, homes and businesses within the county have their risk of loss increased each year they go without fire safety updates.

In Pennsylvania, the most vulnerable population groups to fires are those 65 years of age and over, and the low-income earners.

4.3.19. Utility Interruptions

4.3.19.1 Location and Extent

Utility interruptions in Beaver County include disruptions in fuel, water, electric, and telecommunications capabilities within the county, with a primary focus on electric power failures. Power failure is often a secondary impact of another hazard event. For example, severe thunderstorms or winter storms could bring down power lines and cause widespread disruptions in electricity service. Strong heat waves may result in rolling blackouts where power may not be available for an extended period. Local outages may be caused by traffic accidents or wind damage. Utility interruptions can occur anywhere in the county, to include residential, commercial, and along service lines.

4.3.19.2 Range of Magnitude

Utility loss can have serious effects on the health, safety, and general welfare of Beaver County's citizens. Functional need populations are the most vulnerable to a loss of heat or air conditioning during extreme weather events. Those that rely on electricity to supply medical equipment are also at risk.

Severe utility interruptions could be classified as regional or widespread power and or telecommunications outages. Most often these events are short-term, however, there is the possibility of a large storm hindering the repair of power lines resulting in outages that last several days.

Efficient and effective communications and adequate water supply are critical resources for first responders and their efforts to assist the public during an emergency or disaster.

Potential impacts from utility interruptions could include:

- Downed power lines could pose a wildfire or structure fire hazard, or electrocution of individuals that could encounter charged lines.
- Water line breaks could have hazardous materials infiltrate potable water systems.

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- A breakdown of communications could cause any/all emergencies that occur within the county left unmitigated properly.
- A loss of electricity can cause:
 - Loss of heat or air conditioning.
 - Basement flooding due to sump pump failure.
 - Loss of water supply due to well pump failure.

Some of these issues can be 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 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.

4.3.19.3 Past Occurrence

Minor power outages occur annually. The continued documentation of these failures may provide opportunities for Beaver County to mitigate such service failures. The nationwide oil embargo of 1973 through 1974, the severe winter of 1976, and the national gasoline shortage of 1979 emphasized the vulnerability of all residents in Beaver County to energy emergencies.

Power outages in Beaver County are most often associated with winter storms and windstorms. *Table 63 – Utility Interruptions* identifies events as identified in Corvena™ for Beaver County.

Table 63 - Utility Interruptions

Beaver County Utility Interruptions 2006-2020								
Year	9-1-1 issue	Gas	Phone	Power/ Electrical	Sewer	Water	Other	Total
2006	2	0	0	0	0	1	0	3
2007	0	1	4	2	0	2	1	10
2008	0	1	1	8	0	2	2	14
2009	2	1	2	1	0	1	2	9
2010	0	1	1	2	0	3	0	7
2011	0	1	0	3	0	5	0	9
2012	0	3	1	8	0	3	1	16
2013	0	1	1	2	0	3	1	8
2014	0	1	1	6	0	5	2	15
2015	0	3	0	1	0	2	1	7
2016	0	1	1	0	0	4	0	6
2017	0	0	0	2	1	2	0	5

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Year	9-1-1 issue	Gas	Phone	Power/ Electrical	Sewer	Water	Other	Total
2018	0	2	3	1	0	6	0	12
2019	0	2	1	6	0	2	0	11
2020	0	1	0	7	0	5	0	13

Source: Corvena™ 2021

4.3.19.4 Future Occurrence

Minor power failure events (i.e., short-term outage) may occur several times a year for any given area in the county, while major events (i.e., widespread, long-term outage) take place once every few years. Power failures are likely occurrences during severe weather and should be anticipated.

An aging infrastructure also poses a threat to potential utility interruptions. Constant wear and tear of the service deteriorates equipment. There is often a mix of new and old equipment along the line, as total replacement is not a feasible solution for any utility company.

4.3.19.5 Vulnerability Assessment

Emergency medical facilities, retirement homes and senior centers are particularly vulnerable to power outages. While back-up power generators are often used at these facilities, loss of electricity may result in hot or cold temperature extremes to which elderly populations are particularly vulnerable.

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. Critical infrastructure is 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 Beaver County's population.

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.

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Well contamination or water shortages due to drought could pose a high vulnerability to local water distribution.

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 lines 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 Beaver 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 Beaver County are 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.

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.

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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 64 – 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:

$$\text{Risk Factor Value} = [(\text{Probability} \times .30) + (\text{Impact} \times .30) + (\text{Spatial Extent} \times .20) + (\text{Warning Time} \times .10) + (\text{Duration} \times .10)]$$

Table 64 – Risk Factor Approach Summary 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.

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Table 64 - Risk Factor Approach Summary

Summary of Risk Factor Approach Used to Rank Hazard Risk.					
RISK ASSESSMENT CATEGORY	DEGREE OF RISK			WEIGHT VALUE	
	LEVEL	CRITERIA	INDEX		
PROBABILITY <i>What is the likelihood of a hazard event occurring in a given year?</i>	UNLIKELY	LESS THAN 1% ANNUAL PROBABILITY	1	30%	
	POSSIBLE	BETWEEN 1 & 10% ANNUAL PROBABILITY	2		
	LIKELY	BETWEEN 10 & 100% ANNUAL PROBABILITY	3		
	HIGHLY LIKELY	100% ANNUAL PROBABILITY	4		
IMPACT <i>In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?</i>	MINOR	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES.	1	30%	
	LIMITED	MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY.	2		
	CRITICAL	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.	3		
	CATASTROPHIC	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.	4		
SPATIAL EXTENT <i>How large of an area could be impacted by a hazard event? Are impacts localized or regional?</i>	NEGLIGIBLE	LESS THAN 1% OF AREA AFFECTED	1	20%	
	SMALL	BETWEEN 1 & 10% OF AREA AFFECTED	2		
	MODERATE	BETWEEN 10 & 50% OF AREA AFFECTED	3		
	LARGE	BETWEEN 50 & 100% OF AREA AFFECTED	4		
WARNING TIME <i>Is there usually some lead time associated with the hazard event? Have warning measures been implemented?</i>	MORE THAN 24 HRS	SELF-DEFINED	(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)	1	10%
	12 TO 24 HRS	SELF-DEFINED		2	
	6 TO 12 HRS	SELF-DEFINED		3	
	LESS THAN 6 HRS	SELF-DEFINED		4	
DURATION <i>How long does the hazard event usually last?</i>	LESS THAN 6 HRS	SELF-DEFINED	(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)	1	10%
	LESS THAN 24 HRS	SELF-DEFINED		2	
	LESS THAN 1 WEEK	SELF-DEFINED		3	
	MORE THAN 1 WEEK	SELF-DEFINED		4	

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4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, *Table 65 – Risk Factor Assessment* lists the risk factor calculated for each of twenty potential hazards identified in the 2021 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 65 - Risk Factor Assessment

Beaver County Hazard Ranking Based on RF Methodology.							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED(H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Pandemic and Infectious Disease (N)	4	4	4	1	4	3.7
	Opioid Epidemic (H)	4	4	2	4	4	3.6
	Nuclear Incident (H)	2	4	4	4	4	3.4
	Winter Storm (N)	4	3	4	1	3	3.3
	Emergency Services (H)	4	2	4	1	4	3.1
	Utility Interruptions (N)	4	2	3	4	3	3.1
	Flash Flooding (H)	4	3	2	2	3	3
	Transportation Accident (H)	4	2	2	4	3	2.9
	Dam Failure (N)	2	3	3	4	4	2.9
	Cyber Terrorism (H)	4	2	1	4	4	2.8
	Radon Exposure (N)	4	1	4	1	4	2.8
	Invasive Species (N)	3	2	2	4	4	2.7
	Environmental Hazards - Fixed Facility (H)	4	1	2	4	4	2.7
	Environmental Hazards - Transportation HazMat (H)	4	1	2	4	3	2.6
	Civil Disturbance (H)	3	2	2	4	3	2.6
	Terrorism (H)	2	3	2	4	3	2.6
	Wind Storm (N)	3	2	4	1	2	2.6
	Earthquake (N)	2	2	4	4	1	2.5
MODERATE	Flood (100 Year) (N)	2	3	2	1	3	2.3
	Environmental Hazards - Gas or Oil Well Incidents (H)	2	2	1	4	4	2.2

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Beaver County Hazard Ranking Based on RF Methodology.							
HAZARD RISK	HAZARD NATURAL(N) OR HUMAN-CAUSED(H)	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	ECONOMIC IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Landslide (N)	3	1	1	4	4	2.2
	Tornado (N)	2	2	2	4	1	2.1
	Urban Fire and Explosion (H)	2	2	1	4	3	2.1
	Ice Jam Flooding (N)	2	2	2	1	3	2
LOW	Drought (N)	1	1	4	1	4	1.9
	Criminal Activity (H)	4	1	1	1	1	1.9

Based on these results, there are eighteen high risk hazards, six moderate risk hazards and two low risk hazards in Beaver County. Mitigation actions were developed for all high, moderate, and low risk hazards (see sections 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 66 – Countywide Risk Factor by Hazard* shows the different municipalities in Beaver County and whether their risk is greater than (>), less than (<), or equal to (=) the risk factor assigned 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 4.3.19.

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Table 66 - Countywide Risk Factor by Hazard

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk										
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR										
JURISDICTION	Pandemic and Infectious Disease (N)	Opioid Epidemic (H)	Nuclear Incident (H)	Winter Storm (N)	Emergency Services (H)	Utility Interruptions (N)	Flash Flooding (H)	Transportation Accident (H)	Dam Failure (N)	Cyber Terrorism (H)
	3.7	3.6	3.4	3.3	3.1	3.1	3	2.9	2.9	2.8
Ambridge Borough	=	>	=	=	>	=	=	=	=	=
Baden Borough	=	=	=	=	=	=	=	=	=	=
Beaver Borough	=	=	=	=	=	=	>	=	=	=
Big Beaver Borough	=	=	=	=	<	=	=	=	=	=
Bridgewater Borough	=	<	=	=	=	=	>	=	=	=
Brighton Township	<	<	=	<	=	>	=	>	=	=
Center Township	<	=	<	=	=	>	<	>	<	=
Chippewa Township	=	=	=	=	=	=	=	=	=	=
City of Aliquippa	>	=	=	=	=	=	=	=	=	=
City of Beaver Falls	=	>	=	=	=	=	=	>	=	=
Conway Borough	=	=	=	=	=	=	=	=	=	=
Darlington Borough	=	=	=	=	=	=	=	=	=	=
Darlington Township	=	=	=	=	=	=	=	=	=	=
Daugherty Township	=	=	=	=	>	=	<	=	=	=
East Rochester Borough	=	=	=	=	=	=	=	=	=	=
Eastvale Borough	Not completed by municipality									
Economy Borough	<	<	<	=	<	<	>	>	<	>
Fallston Borough	=	=	=	=	>	=	<	=	=	=
Frankfort Springs Borough	=	=	=	=	=	=	=	=	=	=
Franklin Township	=	<	<	=	=	>	>	=	<	=
Freedom Borough	=	<	>	=	=	=	=	>	<	=
Georgetown Borough	<	<	=	=	=	=	<	=	=	<
Glasgow Borough	<	<	=	=	=	>	=	>	>	<
Greene Township	=	=	=	=	=	=	=	=	=	=
Hanover Township	=	=	=	=	<	=	=	=	=	=

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Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk										
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR										
JURISDICTION	Pandemic and Infectious Disease (N)	Opioid Epidemic (H)	Nuclear Incident (H)	Winter Storm (N)	Emergency Services (H)	Utility Interruptions (N)	Flash Flooding (H)	Transportation Accident (H)	Dam Failure (N)	Cyber Terrorism (H)
	3.7	3.6	3.4	3.3	3.1	3.1	3	2.9	2.9	2.8
Harmony Township	=	=	=	=	>	>	=	=	=	>
Homewood Borough	<	<	<	<	>	<	>	>	<	>
Hookstown Borough	<	<	=	=	=	=	>	=	=	<
Hopewell Township	<	=	=	=	=	=	=	=	=	<
Independence Township	=	=	=	=	=	=	=	=	=	=
Industry Borough	Not completed by municipality									
Koppel Borough	=	=	=	=	=	=	<	=	=	=
Marion Township	Not completed by municipality									
Midland Borough	Not completed by municipality									
Monaca Borough	Not completed by municipality									
New Brighton Borough	=	=	=	=	>	=	<	=	=	=
New Galilee Borough	=	=	=	=	<	=	=	=	=	=
New Sewickley Township	=	=	=	=	=	=	=	=	<	=
North Sewickley Township	Not completed by municipality									
Ohioville Borough	>	>	=	=	<	<	=	>	=	=
Patterson Township	=	=	=	=	=	=	=	=	<	=
Patterson Heights Borough	Not completed by municipality									
Potter Township	=	=	=	=	=	=	=	=	>	=
Pulaski Township	=	=	=	=	>	=	<	=	=	=
Raccoon Township	Not completed by municipality									
Rochester Borough	=	=	<	=	<	<	<	<	<	=
Rochester Township	=	=	=	=	=	=	=	=	=	=
Shippingport Borough	=	=	=	=	=	=	=	=	=	=
South Beaver Township	Not completed by municipality									
South Heights Borough	>	<	<	<	<	<	<	<	<	<
Vanport Township	=	=	=	=	=	=	=	=	>	<
West Mayfield Borough	Not completed by municipality									

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Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk										
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR										
JURISDICTION	Pandemic and Infectious Disease (N)	Opioid Epidemic (H)	Nuclear Incident (H)	Winter Storm (N)	Emergency Services (H)	Utility Interruptions (N)	Flash Flooding (H)	Transportation Accident (H)	Dam Failure (N)	Cyber Terrorism (H)
		3.7	3.6	3.4	3.3	3.1	3.1	3	2.9	2.9
White Township	=	=	=	=	=	=	=	=	=	=

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk										
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR										
JURISDICTION	Radon Exposure (N)	Invasive Species (N)	Environmental Hazards - Fixed Facility (H)	Environmental Hazards - Transportation HazMat (H)	Civil Disturbance (H)	Terrorism (H)	Wind Storm (N)	Earthquake (N)	Flood (100 Year) (N)	Environmental Hazards - Gas or Oil Well Incidents
		2.8	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.3
Ambridge Borough	=	=	=	=	=	>	=	=	=	=
Baden Borough	=	=	=	=	=	=	=	=	=	=
Beaver Borough	=	>	=	=	<	=	=	=	=	=
Big Beaver Borough	=	=	=	=	=	=	=	=	=	=
Bridgewater Borough	=	=	=	>	<	=	=	=	=	<
Brighton Township	=	=	=	>	=	=	=	=	<	<
Center Township	=	=	=	=	=	=	<	=	=	>
Chippewa Township	=	=	=	=	=	=	=	=	=	=
City of Aliquippa	=	=	=	=	=	=	=	=	=	=
City of Beaver Falls	=	=	=	>	>	=	=	=	=	<

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Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk										
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR										
JURISDICTION	Radon Exposure (N)	Invasive Species (N)	Environmental Hazards - Fixed Facility (H)	Environmental Hazards - Transportation HazMat (H)	Civil Disturbance (H)	Terrorism (H)	Wind Storm (N)	Earthquake (N)	Flood (100 Year) (N)	Environmental Hazards - Gas or Oil Well Incidents
	2.8	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.3	2.2
Conway Borough	=	=	=	>	=	=	=	=	=	>
Darlington Borough	=	=	=	=	=	=	=	=	=	=
Darlington Township	=	=	=	=	=	=	=	=	=	=
Daugherty Township	<	=	<	>	=	=	=	=	=	=
East Rochester Borough	=	=	=	=	=	=	=	=	=	=
Eastvale Borough	Not completed by municipality									
Economy Borough	=	>	=	>	<	<	>	<	>	=
Fallston Borough	<	=	=	=	=	=	=	=	=	<
Frankfort Springs Borough	=	=	=	=	=	=	=	=	=	=
Franklin Township	<	<	<	<	<	<	>	<	>	>
Freedom Borough	=	=	=	>	=	=	=	=	=	=
Georgetown Borough	<	=	<	>	<	<	>	<	<	<
Glasgow Borough	<	=	=	>	>	=	>	=	=	<
Greene Township	=	=	>	<	<	<	=	=	=	=
Hanover Township	=	<	=	=	=	=	=	=	=	<
Harmony Township	=	>	=	=	=	=	=	=	=	=
Homewood Borough	<	<	<	>	<	<	<	<	<	<
Hookstown Borough	<	=	<	>	<	<	>	<	<	<
Hopewell Township	<	<	=	=	<	<	>	<	>	<
Independence Township	=	=	=	=	=	=	=	=	=	=
Industry Borough	Not completed by municipality									
Koppel Borough	=	=	=	=	=	=	=	=	<	<
Marion Township	Not completed by municipality									
Midland Borough	Not completed by municipality									
Monaca Borough	Not completed by municipality									
New Brighton Borough	<	=	=	=	=	=	=	=	=	<
New Galilee Borough	=	=	=	=	=	=	=	=	=	=

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Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk										
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR										
JURISDICTION	Radon Exposure (N)	Invasive Species (N)	Environmental Hazards - Fixed Facility (H)	Environmental Hazards - Transportation HazMat (H)	Civil Disturbance (H)	Terrorism (H)	Wind Storm (N)	Earthquake (N)	Flood (100 Year) (N)	Environmental Hazards - Gas or Oil Well Incidents
	2.8	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.3	2.2
New Sewickley Township	=	=	=	=	=	=	=	=	=	>
North Sewickley Township	Not completed by municipality									
Ohioville Borough	=	<	=	=	=	=	<	>	=	<
Patterson Township	=	=	=	=	=	=	=	=	=	<
Patterson Heights Borough	Not completed by municipality									
Potter Township	=	=	=	=	=	=	=	=	=	>
Pulaski Township	<	=	=	=	=	=	=	=	=	<
Raccoon Township	Not completed by municipality									
Rochester Borough	<	<	<	=	<	<	<	=	=	<
Rochester Township	=	=	=	=	=	=	=	=	=	=
Shippingport Borough	=	=	=	=	=	=	=	=	=	=
South Beaver Township	Not completed by municipality									
South Heights Borough	<	<	<	<	<	<	<	<	<	<
Vanport Township	=	=	=	=	=	=	<	=	=	=
West Mayfield Borough	Not completed by municipality									
White Township	=	=	=	=	=	=	=	=	=	=

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Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk										
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR										
JURISDICTION	Landslide (N)	Tornado (N)	Urban Fire and Explosion (H)	Ice Jam Flooding (N)	Drought (N)	Criminal Activity (H)				
	2.2	2.1	2.1	2	1.9	1.9				
Ambridge Borough	=	=	>	=	=	=				
Baden Borough	=	=	=	=	=	=				
Beaver Borough	>	=	=	=	=	=				
Big Beaver Borough	<	=	=	=	=	=				
Bridgewater Borough	>	=	=	>	=	<				
Brighton Township	>	=	>	<	<	=				
Center Township	=	=	=	<	=	>				
Chippewa Township	=	=	=	=	=	=				
City of Aliquippa	=	=	=	=	=	=				
City of Beaver Falls	=	=	>	=	=	>				
Conway Borough	=	=	=	=	=	>				
Darlington Borough	=	=	=	=	=	=				
Darlington Township	=	=	=	=	=	=				
Daugherty Township	>	=	>	<	=	=				
East Rochester Borough	=	=	=	=	=	=				
Eastvale Borough	Not completed by municipality									
Economy Borough	>	=	<	<	>	<				
Fallston Borough	>	=	>	<	=	=				
Frankfort Springs Borough	=	=	=	=	=	=				
Franklin Township	<	>	<	>	>	=				
Freedom Borough	=	=	=	=	=	=				
Georgetown Borough	=	<	<	<	=	<				
Glasgow Borough	>	=	=	>	>	>				
Greene Township	=	=	=	=	=	=				
Hanover Township	=	=	=	>	=	=				
Harmony Township	=	=	=	=	=	>				
Homewood Borough	<	<	<	<	<	<				

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Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk										
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR										
JURISDICTION	Landslide (N)	Tornado (N)	Urban Fire and Explosion (H)	Ice Jam Flooding (N)	Drought (N)	Criminal Activity (H)				
	2.2	2.1	2.1	2	1.9	1.9				
Hookstown Borough	=	=	<	<	=	<				
Hopewell Township	>	=	=	=	=	<				
Independence Township	=	=	=	=	=	=				
Industry Borough	Not completed by municipality									
Koppel Borough	=	=	=	<	=	=				
Marion Township	Not completed by municipality									
Midland Borough	Not completed by municipality									
Monaca Borough	Not completed by municipality									
New Brighton Borough	>	=	>	<	=	=				
New Galilee Borough	=	=	=	=	=	=				
New Sewickley Township	=	=	=	=	=	=				
North Sewickley Township	Not completed by municipality									
Ohioville Borough	<	<	>	>	=	<				
Patterson Township	<	=	=	<	=	=				
Patterson Heights Borough	Not completed by municipality									
Potter Township	=	=	=	=	=	=				
Pulaski Township	>	=	>	<	=	=				
Raccoon Township	Not completed by municipality									
Rochester Borough	<	<	<	=	<	=				
Rochester Township	=	=	=	<	>	=				
Shippingport Borough	=	=	=	=	=	=				
South Beaver Township	Not completed by municipality									
South Heights Borough	<	<	<	<	<	<				
Vanport Township	=	<	=	=	=	=				
West Mayfield Borough	Not completed by municipality									
White Township	=	=	=	=	=	=				

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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 Beaver 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 Beaver 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 Beaver County are estimated to equal \$264.27 million with \$82.95 million 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 \$495.32 million.

4.4.4. Future Development and Vulnerability

The 2019 estimated population for Beaver County is 163,346 which is 6,561 less than the 2010 census. There was an overall decrease of 3.8% in population based on the estimate. Three municipalities have seen population increases while the remaining had decreases in the period

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between 2010 and the 2019 estimate as identified in *Table 67 – Population Change in Beaver County from 2010-2019*. Vulnerability to all hazards in Beaver County is slightly decreased as a result of the estimated 3.8% decrease in population. Currently, a Shell Cracker Plant is being constructed in a region of the County. This region, currently, has an increase of population due to the temporary workers. The Beaver County LPT will continue to assess the change in vulnerability in this area once the Shell Cracker Plant becomes operational.

Table 67 - 2010-2019 Population Change

Population Change in Beaver County from 2010-2019				
Municipality	2010 Census	2015 Estimates	2019 Estimates	Percent of Change 2010-2019 Estimate
Ambridge Borough	7,050	6,853	6,601	-6.4%
Baden Borough	4,135	4,018	3,880	-6.2%
Beaver Borough	4,531	4,412	4,266	-5.8%
Big Beaver Borough	1,970	1,918	1,857	-5.7%
Bridgewater Borough	704	691	825	+7.2
Brighton Township	8,227	8,347	8,267	-4.9%
Center Township	11,795	11,559	11,459	-2.8%
Chippewa Township	7,620	7,745	7,560	-0.8%
City of Aliquippa	9,438	9,180	8,844	-6.3%
City of Beaver Falls	8,987	8,665	8,332	-7.3%
Conway Borough	2,176	2,138	2,067	-5.0%
Darlington Borough	254	247	236	-7.0%
Darlington Township	1,962	1,940	1,873	-4.5%
Daugherty Township	3,187	3,111	3,004	-5.7%
East Rochester Borough	567	551	531	-6.3%
Eastvale Borough	225	214	207	-8.0%
Economy Borough	8,970	9,286	9,098	+1.4%
Fallston Borough	266	252	244	-8.3%
Frankfort Springs Borough	130	129	122	-6.1%
Franklin Township	4,052	3,956	3,834	-5.4%
Freedom Borough	1,569	1,528	1,472	-6.2%
Georgetown Borough	174	168	162	-6.9%
Glasgow Borough	60	60	58	-3.3%
Greene Township	2,356	2,371	2,353	-1.2%

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Municipality	2010 Census	2015 Estimates	2019 Estimates	Percent of Change 2010-2019 Estimate
Hanover Township	3,690	3,682	3,604	-2.3%
Harmony Township	3,197	3,111	2,996	-6.3%
Homewood Borough	109	109	105	-3.7%
Hookstown Borough	147	143	138	-6.1%
Hopewell Township	12,593	12,424	12,585	-6.3%
Independence Township	2,503	2,409	2,336	-6.7%
Industry Borough	1,835	1,779	1,711	-6.7%
Koppel Borough	762	741	721	-5.4%
Marion Township	913	896	869	-4.8%
Midland Borough	2,635	2,564	2,469	-6.3%
Monaca Borough	5,737	5,631	5,421	-5.5%
New Brighton Borough	6,025	5,883	5,679	-5.7%
New Galilee Borough	379	367	352	-7.1%
New Sewickley Township	7,360	7,412	7,160	-2.7%
North Sewickley Township	5,488	5,487	5,370	-2.1%
Ohioville Borough	3,533	3,404	3,284	-7.0%
Patterson Township	3,029	2,960	2,850	-5.9%
Patterson Heights Borough	636	617	597	-6.1%
Potter Township	548	582	566	+3.3%
Pulaski Township	1,500	1,461	1,405	-6.3%
Raccoon Township	3,064	3,001	2,902	-5.3%
Rochester Borough	3,657	3,564	3,440	-6.0%
Rochester Township	2,802	2,730	2,635	-6.0%
Shippingport Borough	214	198	189	-11.7%
South Beaver Township	2,717	2,729	2,651	-2.4%
South Heights Borough	475	459	443	-6.7%
Vanport Township	1,321	1,295	1,249	-5.4%
West Mayfield Borough	1,239	1,204	1,164	-6.0%
White Township	1,394	1,354	1,303	-6.5%
TOTAL	169,907	167,535	163,346	-3.8%

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5. Capability Assessment

5.1. Update Process Summary

The capability assessment is an evaluation of Beaver County's governmental structure, political framework, legal jurisdiction, fiscal status, policies and programs, regulations and 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 Beaver County officials. These meetings were designed to seek input from 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 fifty-three 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. These capability assessments, therefore, consider the various characteristics and capabilities of municipalities under study.

The evaluation of the following categories – political framework, legal jurisdiction, 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 Beaver County and its municipalities have the capacity to do and provides an understanding of what must be changed to mitigate loss.

Beaver County has a number of 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.

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5.2. Capability Assessment Findings

Forty-seven municipalities in Beaver County completed and submitted a capability assessment survey. 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 local 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, and 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. Adoption of the Pennsylvania Floodplain Management Act (Act 166 of 1978) established higher 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 Beaver County and municipal legal capabilities to mitigate the profiled hazards. It identifies the county's and the municipalities' 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 existing in that area. Consequently, structures that are built according to applicable codes are inherently resistant to many hazards, such as strong 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

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buildings. The UCC has many advantages. It 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 PA 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 Beaver County adhere to the standards of the Pennsylvania Uniform Construction Code (Act 45). Of the forty-seven municipalities that completed a capability assessment, forty-two indicated that they have opted-in on building code enforcement.

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; 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. All fifty-three municipalities in Beaver County have their own zoning regulations.

Subdivision Ordinance

Subdivision and land development ordinances include regulations to control the layout of streets, the planning of lots and the provision of utilities and other site improvements. The objectives of a subdivision and land development ordinance are to: coordinate street patterns; assure adequate utilities and other improvements are provided in a manner that will not pollute streams, wells and/or soils; reduce traffic congestion; and provide sound design standards as a guide to developers, the elected officials, planning commissions and other municipal officials. Article V of the Municipality Planning Code authorizes municipalities to prepare and enact a subdivision

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and land development ordinance. Subdivision and land development ordinances provide for the division and improvement of land. All municipalities in Beaver County utilize some form of land use and land development regulation.

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 DEP, which may grant an extension of time to 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, so they are current. 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 regulation 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 ordinances depends on the extent of existing and projected 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. Of the forty-seven municipalities that completed a capability assessment, thirty-nine indicated that they have a stormwater management plan in place.

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 Planning 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.

With regard to 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,

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suggests that the plan gives consideration to 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 and recommends considering storm drainage and floodplain management.

Article III of the MPC enables municipalities to prepare a comprehensive plan; however, development of a comprehensive plan is voluntary. The most current comprehensive plan in place in Beaver County is dated May 2010 and is titled “Beaver County Comprehensive Plan: Rebuilding Prosperity Through Balanced Growth, Redevelopment, & Conservation”. The Beaver County Office of Planning and Redevelopment has plans to update the current comprehensive plan in the near future.

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. Beaver County does not have any capital improvement plans in place.

Participation in the National Flood Insurance Program (NFIP)

Floodplain management is the operation of programs or activities that may consist of both corrective and preventive 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) requires every municipality identified by the Federal Emergency Management Agency (FEMA) to participate in the National Flood Insurance Program (NFIP) 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 makes sure that the risk of flood damage is not increased by property development.

The Pennsylvania DCED provides communities, based on their 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:

1. Prohibiting manufactured homes in the floodway.

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2. Prohibiting manufactured homes within the area measured 50 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 structures.
5. Prohibiting new construction and development within the area measured 50 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 establishes 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.

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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. The Pennsylvania Department of Community and Economic Development (DCED) 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 establishes 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.

All fifty-three municipalities that reside in Beaver County have floodplain regulations in place that meet requirements set forth by the NFIP. Currently, zero municipalities in Beaver County have completed or started to complete the CRS program.

In an effort 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, thirty-six municipalities submitted an NFIP survey. These surveys can be found in Appendix C of this plan.

5.2.2. Administrative and Technical Capability

There are twenty-nine boroughs, twenty-two townships, and two cities within Beaver 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. Others choose to operate on their own. Municipalities vary in staff

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size, resource availability, fiscal status, service provision, constituent population, overall size and vulnerability to the profiled hazards.

County Planning Commission

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 as to what form an agency will possess. A governing body can create a planning commission, a planning department, or both. The Beaver County Office of Planning and Redevelopment assists all municipalities in the county as needed. The county employs a county planner on an annual basis.

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. Currently, there aren't any municipalities within Beaver County that employ a municipal engineer.

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 Beaver County Office of Planning and Redevelopment. There are no members of the Beaver County GIS Department that have completed Basic HAZUS-MH.

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.

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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 §7503:

- Prepare and maintain a current disaster emergency management plan.
- Establish, equip, and staff an emergency operations center.
- Provide individuals and organizations 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 general public.
- Participate in all tests, drills and exercises, including remedial drills and exercises, scheduled by the agency or by the federal government.

Title 35 requires Beaver County and its municipalities to have an emergency management coordinator.

The Beaver County Office of Emergency Management coordinates countywide emergency management efforts. Each municipality has a designated local emergency management coordinator who possesses a unique knowledge of the impact hazard events have on their community.

The Emergency Management Services Code (PA Title 35) requires that all municipalities in the Commonwealth have a local emergency operations plan (EOP) which is updated every two years. All fifty-three municipalities have adopted the county EOP. The notification and resource section of the plan was developed individually by each municipality.

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.

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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. Of the municipalities that responded, none of the municipalities completed this section with a numerical response. *Table 68 – Beaver County Community Political Capability* summarizes the results of political capability.

Table 68 - Beaver County Community Political Capability

Beaver County Community Political Capability						
Municipality Name	Capability Ranking					
	0	1	2	3	4	5
Ambridge Borough					X	
Baden Borough						X
Beaver Borough				X		
Big Beaver Borough					X	
Bridgewater Borough						X
Brighton Township					X	
Center Township	Not completed by municipality					
Chippewa Township				X		
City of Aliquippa	Not completed by municipality					
City of Beaver Falls						X
Conway Borough				X		
Darlington Borough				X		
Darlington Township				X		
Daugherty Township						X
East Rochester Borough	Not completed by municipality					
Eastvale Borough	Not completed by municipality					
Economy Borough					X	
Fallston Borough					X	
Frankfort Springs Borough				X		
Franklin Township					X	
Freedom Borough						X

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Municipality Name	Capability Ranking					
	0	1	2	3	4	5
Georgetown Borough			X			
Glasgow Borough					X	
Greene Township					X	
Hanover Township				X		
Harmony Township						X
Homewood Borough	Not completed by municipality					
Hookstown Borough			X			
Hopewell Township					X	
Independence Township				X		
Industry Borough			X			
Koppel Borough				X		
Marion Township				X		
Midland Borough	Not completed by municipality					
Monaca Borough					X	
New Brighton Borough						X
New Galilee Borough					X	
New Sewickley Township				X		
North Sewickley Township	Not completed by municipality					
Ohioville Borough				X		
Patterson Township					X	
Patterson Heights Borough	Not completed by municipality					
Potter Township				X		
Pulaski Township				X		
Raccoon Township	Not completed by municipality					
Rochester Borough				X		
Rochester Township						X
Shippingport Borough						X
South Beaver Township					X	
South Heights Borough	Not completed by municipality					
Vanport Township						X
West Mayfield Borough	Not completed by municipality					
White Township				X		

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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 the mechanisms that could enhance or further such strategies. In response to the survey questionnaire, local officials classified each of the capabilities as either “L = limited” “M = moderate” or “H = high.” *Table 69 – Capability Self-Assessment Matrix* summarizes the results of the self-assessment survey. Nineteen municipalities returned this section of the assessment completed.

Table 69 - Capability Self-Assessment Matrix

Beaver County Capability Self-Assessment Matrix				
Municipality Name	Capability Category			
	Planning and Regulatory Capability	Administrative and Technical Capability	Fiscal Capability	Community Political Capability
Ambridge Borough	M	H	M	M
Baden Borough	H	H	H	H
Beaver Borough	M	M	L	M
Big Beaver Borough	L	M	M	L
Bridgewater Borough	M	M	M	M
Brighton Township	M	M	M	M
Center Township	Not completed by municipality			
Chippewa Township	M	M	M	M
City of Aliquippa	Not completed by municipality			
City of Beaver Falls	M	M	M	M
Conway Borough	L	L	L	M
Darlington Borough	M	M	L	L
Darlington Township	M	M	L	L
Daugherty Township	H	H	M	H
East Rochester Borough	L	L	L	L
Eastvale Borough	Not completed by municipality			
Economy Borough	H	H	M	L
Fallston Borough	L	L	L	M

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Municipality Name	Capability Category			
	Planning and Regulatory Capability	Administrative and Technical Capability	Fiscal Capability	Community Political Capability
Frankfort Springs Borough	L	L	L	L
Franklin Township	M	M	M	M
Freedom Borough	H	H	H	H
Georgetown Borough	M	L	L	L
Glasgow Borough	L	L	L	L
Greene Township	H	H	H	H
Hanover Township	M	L	L	M
Harmony Township	H	H	H	H
Homewood Borough	Not completed by municipality			
Hookstown Borough	M	M	M	L
Hopewell Township	M	H	M	H
Independence Township	M	M	L	M
Industry Borough	L	L	L	L
Koppel Borough	M	M	L	H
Marion Township	M	M	M	M
Midland Borough	L	L	L	L
Monaca Borough	H	H	H	H
New Brighton Borough	H	H	M	H
New Galilee Borough	M	L	L	M
New Sewickley Township	L	L	L	L
North Sewickley Township	Not completed by municipality			
Ohioville Borough	M	M	H	M
Patterson Township	M	M	M	M
Patterson Heights Borough	Not completed by municipality			
Potter Township	M	M	M	M
Potter Township	M	M	M	M
Pulaski Township	L	L	L	M
Raccoon Township	Not completed by municipality			
Rochester Borough	L	L	L	L
Rochester Township	H	H	H	H
Shippingport Borough	L	L	L	L
South Beaver Township	H	M	L	M

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Municipality Name	Capability Category			
	Planning and Regulatory Capability	Administrative and Technical Capability	Fiscal Capability	Community Political Capability
South Heights Borough	L	L	L	L
Vanport Township	M	M	M	M
West Mayfield Borough	Not completed by municipality			
White Township	L	L	M	L

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 municipalities 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 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 a large number of 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”.

Capital Improvement Financing

Because most 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

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municipalities have very limited local tax funds for capital projects. Grants and other funding is always a priority.

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 recreation facilities. Voter approval 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 or 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 or 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 among the principal activities of the local government facilities' financing authorities. An operating water authority issues bonds to purchase existing facilities or 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.

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Circuit Riding Program (Engineer)

The Circuit Riding Program is an example of intergovernmental cooperation. This program offers municipalities the ability to join together 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

Beaver County conducts an education and outreach program. The Beaver County Office of Emergency Management conducts public outreach at public events to update the citizens and visitors of the county on natural and human-caused hazards. The county conservation district also conducts outreach on various activities and projects in the county. Many of these projects are related to or directly impact hazard mitigation projects.

Educational activities that directly impact hazard mitigation in Beaver County predominantly revolve around the first responders. Providing fire, medical and search and rescue training and education enhances the response and recovery capabilities of response agencies in the county. Additional training is always a goal within Beaver County.

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 Beaver County Local Planning Team will identify actions necessary to complete this.

5.2.5. Plan Integration

The Beaver County Comprehensive Plan, May 2010, was utilized for various sections of the 2021 Beaver County HMP update. The Beaver County Comprehensive Plan provided useful information on historical context, population and housing, land use, economic development, transportation, facilities, and utilities.-The existing land use county overview section was utilized when developing section 2.4 of the community profile which provided valuable information on land use trends in Beaver County. The population and socioeconomic profile found on page seven of the comprehensive plan was also used in section 2.3 population and demographics and provided information on housing, education, and general economics.

Section II – creating the future vision (found on page 187), consists of a vision statement, goals and objectives, the future land use plan, target economic development sites, and a statement of compatibility. The comprehensive plan consists of eleven goals which include the following topics: land use, housing, economic development, transportation, public facilities and utilities, community facilities and services, historical sites and preservation, environmental features, and

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parks and recreation. Each goal from this plan provided numerous objectives which were used during the development of the mitigation action plan found in section 6.4. The following are some of the goals and actions from the 2010 comprehensive plan, followed by the 2021 HMP mitigation actions that were developed or supported by the goals and actions from the 2010 comprehensive plan:

- An identified objective in the county comprehensive plan mentions the promotion of programs for rehabilitation of existing housing and removal of substandard, blighted homes. The 2021 HMP local planning team developed mitigation action 1.1.5 which discusses the removal of blight/abandoned buildings in Beaver County. Additionally, action 1.1.3 discusses the acquisition/relocation of vulnerable structures to protect them from future damage.
- An identified objective in the county comprehensive plan mentions the need to support local municipalities that need to upgrade their existing water and sewer infrastructure. The 2021 HMP local planning team developed mitigation action 1.3.5 which mentions the separation of combined stormwater and sanitary sewer systems to reduce flooding and the negative impact of overflows. Additionally, objective 1.3.3 also mentions the importance of conducting regular maintenance on stormwater management structures and replacing as needed.
- An identified objective in the county comprehensive plan mentions the need to provide and/or upgrade infrastructure (including telecommunications). The 2021 HMP local planning team developed mitigation action 1.2.1 which identifies Beaver County and municipalities working with PennDOT/Southwestern Pennsylvania Commission (SPC)/DEP to improve roads that are highly susceptible to flooding. Additionally, action 1.2.5 mentions municipalities participating in the Transportation Improvement Program (TIP) which is dedicated to the improvement of roadways in Beaver County.
- An identified objective in the county comprehensive plan mentions consolidation or sharing of services between municipalities. The 2021 HMP local planning team developed objective 2.3 which promotes strong and supportive inter-municipal relationships that encourage resource sharing and strengthen municipalities with limited resources.

Although specific portions of the comprehensive plan outlined projects, actions or specific planning items that would support hazard mitigation, the information will be more comprehensive with the integration of new hazard mitigation principles and data from the 2021 Beaver County HMP update. During discussion with county planning personnel as part of this hazard mitigation plan update, discussions about the importance of hazard mitigation integration during the next comprehensive plan update was expressed. Specifically, the risk assessment

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section and mitigation strategy section hold vital information that requires integration into the next plan update. Identification of hazard areas, vulnerable structures and developments and future risk is critical in the determination of and management of economic growth and development to areas in the county. Numerous mitigation opportunity forms have been received during the planning period and would provide beneficial information for the next comprehensive plan update as well.

Beaver County Emergency Operations Plan

The Pennsylvania Emergency Management Services Code, 35 PA C.S. Sections 7701-7707, as amended, requires each county and municipality to prepare, maintain and keep current an Emergency Operations Plan (EOP). Beaver County Department of Emergency Services is responsible for preparing and maintaining the county's EOP, which applies to both the county and municipal emergency management operations and procedures.

The EOP is reviewed at least annually. Whenever portions of the plan are implemented in an emergency event or training exercise, a review is performed, and changes are made where necessary. These changes are then distributed to the county's municipalities.

The complete risk assessment section, mitigation actions and mitigation project opportunities identified in the Beaver County Hazard Mitigation Plan will assist with decreasing hazard specific risk and vulnerability. Understanding the risks and vulnerability in the county and municipalities will allow for emergency management and other response agencies to better direct planning, response, and recovery aspects.

Beaver County Emergency Services will consider the Beaver County Hazard Mitigation Plan during its annual review of the county EOP. Recommended changes to the HMP will then be coordinated with the hazard mitigation local planning team.

Plan Interrelationships

Ensuring consistency between these planning mechanisms is critical. In fact, Section 301 (4.1) of the Pennsylvania Municipalities Planning Code requires that comprehensive plans include a discussion of the interrelationships among their various plan components, "which may include an estimate of the environmental, energy conservation, fiscal, economic development and social consequences on the environment."

To that end, Beaver County and its municipalities must ensure that the components of the hazard mitigation plan are integrated into existing community planning mechanisms and are generally consistent with goals, policies, and recommended actions. Beaver County and the hazard mitigation planning team will utilize the existing maintenance schedule of each plan to incorporate the goals, policies and recommended actions as each plan is updated.

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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 eighteen objectives identified in the 2016 hazard mitigation plan. The 2021 Beaver County Hazard Mitigation Plan Update has four goals and thirteen objectives. Objectives have been added and arranged in order to associate them with the most appropriate goal. These changes are noted in *Table 70 – 2016 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 thirty-four actions identified in the 2016 mitigation strategy. A review of the 2016 mitigation actions was completed by the local planning team. The results of this review are identified in *Table 70 – 2016 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 70 - 2016 Mitigation Goals and Objectives

2016 Mitigation Goals and Objectives Review		
GOAL Objective	Description	Review Comments
GOAL 1	<i>Protect lives, property, environmental quality, and natural resources of the County.</i>	The LPT decided that it would be best to eliminate "...of the County" from this goal.
Objective 1.1	Encourage homeowners, renters, and businesses to insure their properties against all hazards, including flood coverage under the National Flood Insurance Program (NFIP).	The LPT decided this objective should be removed as it is duplicative of objective 5.1. The LPT decided that municipalities should be involved in this objective.

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GOAL Objective	Description	Review Comments
Objective 1.2	Acquire, relocate, elevate, and/or retrofit existing structures located in hazard areas.	The LPT decided this should objective should now read: “ Complete actions and projects to decrease the impact of flooding and to acquire, elevate, demolish or demolish/reconstruct properties, repetitive loss properties and severe repetitive loss properties. “
Objective 1.3	Acquire, relocate, elevate, and/or retrofit repetitive loss properties from flood- prone areas.	Remove this objective as 1.2 is duplicative.
Objective 1.4	Identify transportation routes with high-hazard vulnerability—especially for potential HazMat events, flooding, or steep slopes—and in regard to possible injury, death, or property damage.	The LPT decided this should be more all-hazard in nature. “Identify transportation routes with high-hazard vulnerability in regard to possible injury, death, or property damage.”
Objective 1.5	Improve the county’s stormwater management systems.	The LPT decided this goal should be changed so it is all-encompassing of privately owned stormwater management systems, not just County-owned.
Objective 1.6	Address hazard issues from Marcellus Shale natural gas extraction operations and surface mining, and explore mitigation options including pipelines, compressor stations, Shell petrochemical plant, and multi-modal transportation of oil and gas.	The LPT decided that this goal shouldn’t read specific business names. This objective should be less specific.
GOAL 2	<i>Enhance consistent coordination, collaboration, and communication among stakeholders.</i>	The LPT decided that this goal should be included in the 2021 update.

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GOAL Objective	Description	Review Comments
Objective 2.1	Develop and maintain partnerships with external federal, State, municipal, and stakeholder agencies that have a role in hazard mitigation.	The LPT decided that this objective should be included in the 2021 update.
Objective 2.2	Coordinate, promote, and sponsor local events where hazard mitigation, risk reduction, and emergency management is emphasized.	The LPT decided that this objective should be included in the 2021 update.
Objective 2.3	Promote strong and supportive inter-jurisdictional and inter-municipal relationships that encourage resource sharing and strengthen municipalities with limited resources.	The LPT decided that this objective should be included in the 2021 update.
GOAL 3	<i>Provide a framework for active hazard mitigation planning and implementation.</i>	Add in “recovery” to this goal.
Objective 3.1	Support mitigation action implementation, inclusion of mitigation planning and actions in local documents, and regular mitigation meetings.	The LPT decided that this objective should be included in the 2021 update.
Objective 3.2	Encourage local participation in the Community Rating System (CRS) Program.	The LPT decided that this objective should be included in the 2021 update.
GOAL 4	<i>Build political support and secure funding for mitigation efforts.</i>	The LPT decided that this goal should be included in the 2021 update.
Objective 4.1	Track and/or recommend local, County, State, and federal legislation and regulations related to hazard mitigation.	The LPT decided that this objective should be included in the 2021 update.
Objective 4.2	Develop and maintain local regulations that reduce vulnerability to hazards.	The LPT decided that this objective should be included in the 2021 update.
Objective 4.3	Track and promote mitigation and emergency management funding opportunities to local jurisdictions and relevant stakeholders.	Add an objective about HHPD program under goal 4.
GOAL 5	<i>Increase awareness, understanding, and preparedness.</i>	The LPT decided that this goal should be included in the 2021 update.

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GOAL Objective	Description	Review Comments
Objective 5.1	Encourage homeowners, renters, and businesses to insure their properties against all hazards—including flood coverage under NFIP—and with emphasis on repetitive loss properties.	The LPT decided that this objective should be included in the 2021 update.
Objective 5.2	Improve public alert, warning, and communications systems by promoting redundant and multi-faceted communication methods.	The LPT decided that this objective should be included in the 2021 update.
Objective 5.3	Conduct a coordinated public information program related to hazards and their impacts throughout the County.	The LPT decided that this objective should be included in the 2021 update.
Objective 5.4	Encourage residents to implement hazard mitigation and preparedness measures on their properties.	The LPT decided that this objective should be included in the 2021 update.

Table 71 - Beaver County Mitigation Actions Review Worksheet

2016 Beaver County Mitigation Actions Review Worksheet						
Existing Mitigation Actions (2016 HMP)	Status					Review Comments
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
Action 1.1.1 – Increase advertisement of public meetings.			X			Change to: “Continue to advertise public meetings as needed.”

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<i>Existing Mitigation Actions (2016 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
Action 1.1.2 – Develop and post on the county website hazard mitigation and other information and resources and links outside agency resources.		X				Change to: “Continue to utilize the county website and post the HMP and other plans as well as useful links as a resource to the public.”
Action 1.1.3 – Provide information on the county website on evacuation and shelter in place procedures for residences and continuity of operations plans and procedures for businesses.	X					The LPT decided this action should remain the same.
Action 1.1.4 – Development and distribute to the public information on potential hazards in Beaver County.			X			Change to: “Develop and distribute to the public...”
Action 1.1.5 – Evaluate and refine the county's repetitive loss structures list by ranking properties based on the number of losses and the value of the claims paid and target the priority properties for buyout opportunities.					X	The LPT decided this was no longer relevant to Beaver County.
Action 1.1.6 - Disseminate informational pamphlets for residents that explains the risk of hazards, outlines precautionary measures that can be taken to help reduce impacts of disasters to themselves and their property, and emphasizes the value of hazard mitigation.			X			The LPT decided this action should remain the same.

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<i>Existing Mitigation Actions (2016 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
Action 1.2.1 - Work with municipalities to regularly inspect culverts.					X	The LPT decided this was no longer relevant to Beaver County.
Action 1.2.2 - Work with municipalities to create and maintain a County-wide database of streams prone to backup and flooding.		X				Change to: "Create a county-wide map of streams prone to backup and flooding."
Action 1.3.1 - Conduct a thorough critical facilities vulnerability assessment and impact analysis using HMP's GIS-based critical infrastructure history.			X			Change to: Conduct a thorough critical facilities vulnerability assessment and impact analysis using critical infrastructure historical event data.
Action 1.3.2 - Conduct analysis on the future demand for expanded infrastructure.			X			"Continue to evaluate the demand for expanded infrastructure in Beaver County."
Action 2.1.1 – Encourage the development of safety buffers between industrial facilities and the population.			X			The LPT decided this action should remain the same.
Action 2.1.2 - Encourage the requirement of special use permits for hazard-prone areas.			X			Change to: "Encourage municipalities to require the use of special use permits for hazard-prone areas."

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<i>Existing Mitigation Actions (2016 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
Action 2.1.3 - Adopt a countywide post-disaster recovery and reconstruction ordinance using the model ordinance included in the APA/FEMA PAS Report No. 483/484.					X	The LPT decided this was no longer relevant to Beaver County.
Action 2.1.4 - Ensure county and municipal subdivision and land development ordinances are consistent with Chapter 102 Erosion & Sedimentation Control Requirements.			X			The LPT decided this action should remain the same.
Action 2.1.5 - Adopt/continue to enforce zoning ordinances that prevent construction in hazard prone areas.			X			Encourage municipalities to continue adoption and enforcement of zoning ordinances that prevent construction in hazard prone areas.
Action 2.2.1 - Encourage the review of planned infrastructure to ensure that it will be developed outside of hazard-prone areas.					X	This is a repeat of the previous action.
Action 2.2.2 - Coordinate with the municipal zoning boards to stop growth in the floodplain.			X			“Coordinate with the municipal zoning boards to prevent development in the floodplain.”
Action 2.4.1 - Conduct outreach to municipalities to ensure compliance with NFIP.			X			Change to: “Continue to...”

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<i>Existing Mitigation Actions (2016 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	No Progress/ Unknown	In Progress/Not Yet Complete	Continuous	Completed	Discontinued	
Action 2.4.2 - Develop informational workshops on risk and mitigation for property owners in areas prone to flooding.			X			The LPT decided this action should remain the same.
Action 3.1.1 - Encourage the involvement of private industry with plan revisions.			X			The LPT decided this action should remain the same.
Action 3.1.2 - Integrate the 5-year maintenance cycle of the hazard mitigation plan with both the 10-year and biennial review and maintenance cycles of the county comprehensive plan and county regional emergency operations plan, respectively.			X			The LPT decided this action should remain the same.
Action 3.2.1 - Implement a countywide electronic damage assessment management tool to increase the efficiency of county and municipal damage survey and reporting.			X			The LPT decided this action should remain the same.
Action 3.2.2 - Create a GIS dataset of the locations of the SARA facilities in Beaver County to analyze their vulnerability to potential hazards.			X			Get rid of “GIS” in this sentence.

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<i>Existing Mitigation Actions (2016 HMP)</i>	<i>Status</i>					<i>Review Comments</i>
	<i>No Progress/ Unknown</i>	<i>In Progress/Not Yet Complete</i>	<i>Continuous</i>	<i>Completed</i>	<i>Discontinued</i>	
Action 3.2.3 - Review and approve the Beaver County DFIRM information and incorporate the data into the County GIS.			X			The LPT decided this action should remain the same.
Action 3.3.1 – Conduct an audit of information systems and technology.					X	This was completed at the EOC level.
Action 3.4.1 - Maintain a web-based inventory of the county's at- risk populations to strengthen emergency response and evacuations.			X			“Enhance overall situational awareness for at-risk populations in Beaver County.”
Action 3.5.1 - Maintain a list of repetitive loss structures from the Governor's Center for Local Government Service's NFIP Coordinator and incorporate the data into the county hazard mitigation planning project.					X	Repeat of 1.1.5
Action 3.5.2 - Continue to work with municipalities to identify and incorporate hazard mitigation project opportunity forms to include in the 5-year update of the HMP.			X			The LPT decided this action should remain the same.
Action 3.5.3 - Collect and analyze data on the specific impacts identified in the Beaver County Hazard Mitigation Plan.			X			“Conduct post-incident review to identify HMP effectiveness.”

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Existing Mitigation Actions (2016 HMP)	Status					Review Comments
	No Progress/ Unknown	In Progress/ Not Yet Complete	Continuous	Completed	Discontinued	
Action 4.1.1 - Conduct training sessions on hazard mitigation during county commissioners' meetings or COG meetings.			X			The LPT decided this action should remain the same.
Action 4.2.1 - Promote outreach opportunities with municipalities in Beaver County.			X			The LPT decided this action should remain the same.
Action 5.1.1 - Locate and secure funding streams for emergency response and support services.			X			The LPT decided this action should remain the same.
Action 5.1.2 - Update the Beaver County Emergency Operations Plan to be consistent with the National Response Framework.				X		Completed in 2021. Change this to a maintenance item.
Action 5.1.3 - Continue to encourage multi-jurisdictional exercises and drills.			X			Change to: Continue to encourage participation in multi-jurisdictional exercises and drills.

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 six goals and eighteen corresponding objectives was developed. *Table 72 – 2021 Goals and Objectives* details the mitigation goals and objectives established for the 2021 Beaver County Hazard Mitigation Plan.

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Table 72 - 2021 Goals and Objectives

2021 Mitigation Goals and Objectives	
GOAL Objective	Description
GOAL 1	Protect lives, property, environmental quality, and natural resources.
Objective 1.1	Complete actions and projects to decrease the impact of flooding and to acquire, elevate, demolish or demolish/reconstruct properties, repetitive loss properties and severe repetitive loss properties.
Objective 1.2	Identify transportation routes with high-hazard vulnerability in regards to possible injury, death, or property damage.
Objective 1.3	Improve both county and privately-owned stormwater management systems.
Objective 1.4	Address hazard issues from Marcellus shale natural gas extraction operations and surface mining, and explore mitigation options including pipelines, compressor stations, petrochemical plants, multi-modal transportation, and more.
GOAL 2	Enhance consistent coordination, collaboration, and communication among stakeholders.
Objective 2.1	Develop and maintain partnerships with external federal, State, municipal, and stakeholder agencies that have a role in hazard mitigation.
Objective 2.2	Coordinate, promote, and sponsor local events where hazard mitigation, risk reduction, and emergency management is emphasized.
Objective 2.3	Promote strong and supportive inter-jurisdictional and inter-municipal relationships that encourage resource sharing and strengthen municipalities with limited resources.
GOAL 3	Provide a framework for active hazard mitigation planning, implementation, and recovery efforts.
Objective 3.1	Support mitigation action implementation, inclusion of mitigation planning and actions in local documents, and regular mitigation meetings.
Objective 3.2	Encourage local participation in the Community Rating System (CRS) Program.
GOAL 4	Build political support and secure funding for mitigation efforts.

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GOAL Objective	Description
Objective 4.1	Track and/or recommend local, County, State, and federal legislation and regulations related to hazard mitigation.
Objective 4.2	Develop and maintain local regulations that reduce vulnerability to hazards.
Objective 4.3	Track and promote mitigation and emergency management funding opportunities to local jurisdictions and relevant stakeholders.
GOAL 5	Increase awareness, understanding, and preparedness.
Objective 5.1	Encourage homeowners, renters, municipalities, and businesses to insure their properties against all hazards—including required flood coverage under NFIP—and with emphasis on repetitive loss properties.
Objective 5.2	Improve public alert, warning, and communications systems by promoting redundant and multi-faceted communication methods.
Objective 5.3	Conduct a coordinated public information program related to hazards and their impacts throughout the County.
Objective 5.4	Encourage residents to implement hazard mitigation and preparedness measures on their properties.
Objective 5.5	Improve training and cross-training opportunities for emergency management, response, and local government personnel.
GOAL 6	Participate in FEMA’s High-Hazard Potential Dam Program (HHPD).
Objective 6.1	Educate property owners, stakeholders, municipalities, and businesses about the HHPD program and enhance local mitigation policies and programs that address high hazard potential dams.

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

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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 structures or protects the structure from a specific hazard. The new or renovated structures are therefore protected or have a reduced impact of hazards.

Natural Resource 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

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- 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 impact of hazards.

Table 73 – 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 74 – 2021 Mitigation Action Plan*.

Table 73 - Mitigation Strategy Technique Matrix

Beaver County Mitigation Strategy Technique Matrix				
HAZARD	MITIGATION TECHNIQUE			
	Local Plans and Regulations	Structural and Infrastructure	Natural Systems Protection	Education and Awareness
Drought	X		X	X
Landslides	X	X		X
Flooding	X	X	X	X
Invasive Species	X		X	X
Pandemic and Infectious Disease	X			X

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HAZARD	MITIGATION TECHNIQUE			
	Local Plans and Regulations	Structural and Infrastructure	Natural Systems Protection	Education and Awareness
Disorientation	X	X		X
Radon Exposure	X	X		X
Tornado/Windstorm	X	X		X
Wildfires	X	X		X
Winter Storms	X	X		X
Hurricane/Tropical Storm	X	X		X
Subsidence and Sinkholes	X	X		X
Dam/Levee Failure	X		X	X
Emergency Services	X			X
Environmental Hazards	X	X		X
Civil Disturbance	X	X		X
Nuclear Incidents	X	X		X
Terrorism/Cyber Terrorism	X			X
Transportation Accidents	X	X		X
Utility Interruptions	X	X		X

6.4. Mitigation Action Plan

The Beaver County Hazard Mitigation Local Planning Team (LPT) immediately began work on the mitigation strategy section of the 2021 hazard mitigation plan (HMP) update after the risk assessment section was completed. The LPT started this section by reviewing the 2016 HMP mitigation strategy section. A review of the previous goals, objectives, actions and project opportunities documented in the 2016 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 conference calls due to COVID-19. 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.

Beaver County, Pennsylvania 2021 Hazard Mitigation Plan

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 2021 Beaver County HMP are listed in the mitigation action plan. *Table 74 – 2021 Mitigation Action Plan* is the 2021 Beaver County Mitigation Action Plan. This plan outlines mitigation actions and projects that comprise a strategy for Beaver 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. The Beaver County Local Planning Team prioritized all mitigation actions during the mitigation strategy update process. Mitigation actions ranked as high priority should be addressed first within each jurisdiction in Beaver County. However, other actions labeled as medium or low priority should also be considered as funding becomes available. Therefore, the ranking of each action should be considered as a preliminary ranking, which will evolve based on prevailing priorities and discretion of local governments, the public, PEMA, and FEMA as the plan update is implemented. 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 74 – 2021 Mitigation Action Plan* is a matrix that identifies the county and/or municipalities responsible for mitigation actions in the new mitigation action plan.

Beaver County, Pennsylvania 2021 Hazard Mitigation Plan

Table 74 - 2021 Mitigation Action Plan

Beaver County 2021 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	Local plans and regulations	Maintain compliance with and good standing in the NFIP, including adoption and enforcement of floodplain management requirements (e.g., regulating all new and substantially improved construction in special-hazard flood areas), floodplain identification and mapping, and flood insurance outreach to the community. Further meet and/or exceed the minimum NFIP standards and criteria through the following NFIP-related continued compliance actions identified in subsequent initiatives.	Flooding		X		2021 - 2025	Local	Beaver County Municipalities
1.1.2	Education and awareness	Applicable municipalities will communicate with property owners or renters within the special flood hazard area regarding potential flood hazards. Letters may include the following information: local flood hazard, flood safety, flood insurance information, property protection measures, natural and beneficial functions of the local floodplain, a map of the local flood hazard area, information about hazard notification systems, floodplain development permit requirements, and substantial improvement/damage requirements.	Flooding		X		2021 - 2025	Local	Beaver County Municipalities
1.1.3	Structure and infrastructure	Support the mitigation of vulnerable structures via retrofit (e.g. elevation, flood-proofing) or acquisition/relocation to protect them from future damage; repetitive loss and severe repetitive loss properties should be a priority, when applicable.	Flooding		X		2021 - 2025	Local	Beaver County Planning Commission/Beaver County Municipalities

Beaver County, Pennsylvania 2021 Hazard Mitigation Plan

Beaver County 2021 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
1.1.4	Structure and infrastructure	Municipalities will collect or update information on the number and location of all severe repetitive loss properties and provide it to Beaver County.	Flooding		X		2021 - 2025	Local	Beaver County Municipalities
1.1.5	Structure and infrastructure	Remove blight/abandoned buildings in Beaver County.	Urban Fire and Explosion		X		2021 - 2025	Local	Beaver County Municipalities
1.2.1	Structure and infrastructure	Beaver County and municipalities will continue to work with PennDOT/SPC/DEP to improve roads that are highly susceptible to flooding.	Flooding /Transportation Accidents		X		2021 - 2025	Local	Beaver County Government/Beaver County Municipalities
1.2.2	Structure and infrastructure	Work with county and power companies to identify roads within the Township/Borough considered “critical;” these would be the first priority for clearing after an event involving downed power lines.	Utility Interruptions		X		2021 - 2025	Local	Beaver County Municipalities
1.2.3	Structure and infrastructure	Perform studies on high-risk roadways to ensure they are adequate for travel.	Transportation Accidents/Environmental Hazards		X		2021 - 2025	Local	Beaver County EMA/Beaver County Planning Commission
1.2.4	Local plans and regulations	Encourage municipalities to work with businesses and developers to ensure proper traffic patterns/flow.	Transportation Accidents		X		2021 - 2025	Local	Beaver County Municipalities
1.2.5	Local plans and regulations	Encourage municipalities to participate in Transportation Improvement Program (TIP).	Transportation Accidents		X		2021 - 2025	Local	Beaver County Planning Commission

Beaver County, Pennsylvania 2021 Hazard Mitigation Plan

Beaver County 2021 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
1.2.6	Local plans and regulations	Maintain the county's Commodity Flow Study (CFS) to identify transportation/critical infrastructure most traveled and identify hazardous materials that travel through Beaver County	Transportation Accidents		X		2021 - 2025	Local	Beaver County Planning Commission
1.3.1	Local plans and regulations	Encourage municipalities to prepare and enact stormwater management ordinances consistent with Act 167 Stormwater Management Plans.	Flooding		X		2021 - 2025	Local	Beaver County Planning Commission
1.3.2	Structure and infrastructure	Conduct regular maintenance on stormwater management structures in compliance with MS4 guidelines. Encourage regular maintenance on stormwater management structures and replace as needed.	Flooding		X		2021 - 2025	Local	Beaver County Municipalities
1.3.3	Education and awareness	Encourage non MS4 communities to perform regular maintenance on stormwater management structures and replace as needed.	Flooding		X		2021 - 2025	Local	Beaver County Municipalities
1.3.4	Local plans and regulations/Natural Systems Protection	Maintain stormwater management plans and/or pollutant reduction plans.	Flooding		X		2021 - 2025	Local	Beaver County Municipalities
1.3.5	Structure and infrastructure/Natural Systems Protection	Where feasible, separate combined stormwater and sanitary sewer systems to reduce flooding and the negative impacts of overflows. For instance, 75% of Rochester Borough has combined sewers or no storm sewers at all, making this project highly needed.	Flooding /Utility Interruption	X			2021 - 2025	CDBG	Beaver County Municipalities
1.4.1	Local plans and regulations	Continue to map potential natural gas and petroleum transmission lines.	Environmental Hazards	X			2021 - 2025	Local	Beaver County GIS

Beaver County, Pennsylvania 2021 Hazard Mitigation Plan

Beaver County 2021 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
1.4.2	Education and awareness	Follow up with any reported concerns on drinking water contamination, especially when associated with fracking and environmental hazards.	Environmental Hazards		X		2021 - 2025	Local	Beaver County Government
2.1.1	Local plans and regulations	The Beaver County Planning Commission will work with DCED, other State agencies, and the municipalities to provide model zoning regulations for floodplain restrictions that comply with the PA MPC.	Flooding		X		2021 - 2025	Local	Beaver County Planning Commission
2.1.2	Local plans and regulations	Develop and maintain a comprehensive list of relevant regional agencies, including Council of Governments, River Basin Commissions, and MPOs.	All-Hazards		X		2021 - 2025	Local	Beaver County Planning Commission
2.1.3	Education and awareness/Natural Systems Protection	Collaborate with partnering agencies to promote awareness of invasive species (i.e. spotted lantern fly, emerald ash borer.)	Invasive Species	X			2021 - 2025	Local	Beaver County Government
2.1.4	Education and awareness	Encourage residents to follow recommendations made by the Center for Disease Control (CDC), PA Health Department, and local health authorities to protect themselves from current/future risks.	Pandemic and Infectious Disease	X			2021 - 2025	Local	Beaver County Health Departments
2.1.5	Education and awareness	Continue to collaborate with local law enforcement and authorities to promote awareness of the prevention of drug abuse in Beaver County.	Opioid Epidemic	X			2021 - 2025	Local	Beaver County EMA/Beaver County Planning Commission/Beaver County Municipalities

Beaver County, Pennsylvania 2021 Hazard Mitigation Plan

Beaver County 2021 Mitigation Action Plan									
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization			Implementation		
	Category	Description/ Action Items		High	Medium	Low	Schedule	Funding	Local Champion
2.1.6	Education and awareness	Continue to regularly meet with Beaver County Drug Coalition to further mitigate against drug abuse.	Opioid Epidemic	X			2021 - 2025	Local	Beaver County Government
2.1.7	Education and awareness	Continue use in Narcan program and use of Dropbox locations in Beaver County.	Opioid Epidemic	X			2021 - 2025	Local	Beaver County Government
2.2.1	Education and awareness	Establish all-hazard resource centers located in the County Courthouse and all municipal buildings. Centers could serve as repositories for information such as flyers maps factsheets...etc for all hazards listed in the HMP. Using flooding as an example, centers would display literature about the NFIP...etc.	All-Hazards		X		2021 - 2025	Local	Beaver County Municipalities
2.3.1	Local plans and regulations	Support equipment needs for local public works departments to ensure readiness for sudden onset hazard events.	Utility Interruption		X		2021 - 2025	Local	Beaver County Municipalities
3.1.1	Education and awareness	Participate in emergency planning for applicable hazard and emergency response events. Specific types of planning relevant to the county and its municipalities include EAPs for dams, radiological emergency plans for nuclear incidents, winter preparedness plans, evacuation signage plans, Phase II Act 167 Stormwater Management Plan, and commodity flow studies. Additionally, other plans should be reviewed to ensure coordination with hazard mitigation planning techniques.	Nuclear Incident/ Winter Storm/Flooding/ Transportation Accidents	X			2021 - 2025	Local	Beaver County EMA/Beaver County Municipalities
3.1.2	Local plans and regulations	Planning Commission and applicable municipal offices will review their comprehensive plans to ensure that designated growth areas are not within high-hazard areas identified in this plan.	All-Hazards		X		2021 - 2025	Local	Beaver County Planning Commission

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Beaver County 2021 Mitigation Action Plan									
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization			Implementation		
	Category	Description/ Action Items		High	Medium	Low	Schedule	Funding	Local Champion
3.1.3	Local plans and regulations	Encourage all critical government facilities to have COOP and COG plans and to begin implementing appropriate backup systems.	Utility Interruption		X		2021 - 2025	Local	Beaver County Planning Commission
3.1.4	Local plans and regulations	Continue to use and improve GIS capability to identify and prioritize hazards and critical infrastructure for mitigation.	All-Hazards		X		2021 - 2025	Local	Beaver County GIS
3.1.5	Local plans and regulations	Continue development of Continuity of Operations Plan in response to COVID-19.	Pandemic and Infectious Disease	X			2021 - 2025	Local	Beaver County Health Departments
3.2.1	Education and awareness	Support participation in the NFIP/ CRS program by attending CRS workshop(s) if offered within the County. Join the CRS program if adequate resources to support long-term participation can be dedicated.	Flooding		X		2021 - 2025	Local	Beaver County EMA/Beaver County Municipalities
4.1.1	Education and awareness	Participate and seek further education about hazard mitigation through FEMA's Emergency Management Institute (EMI).	All-Hazards	X			2021 - 2025	Local	Beaver County EMA
4.2.1	Local plans and regulations	Promote or adopt higher regulatory and zoning standards to manage flood hazard risk; specifically, through updates to the building codes, flood ordinances, and subdivision and land development ordinances. Goals of increased standards are to ensure new buildings and infrastructure are discouraged or prohibited in high-hazard areas in their jurisdiction.	Flooding		X		2021 - 2025	Local	Beaver County Municipalities
4.2.2	Structure and infrastructure	Implement a building- hardening program for critical facilities and infrastructure to protect against terrorism.	Terrorism		X		2021 - 2025	Local	Beaver County Municipalities

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Beaver County 2021 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Local Champion
4.2.3	Local plans and regulations	Municipalities will aggressively enforce building and safety codes for all buildings, including industrial uses.	Utility Interruption/Dam Failure/Landslide		X		2021 - 2025	Local	Beaver County Municipalities
4.3.1	Local plans and regulations	Seek funding and/or grants to enhance emergency management functions and improve overall public safety in Beaver County.	Emergency Services/All-Hazards	X			2021 - 2025		Beaver County EMA
4.3.2	Local plans and regulations	Investigate the possibility of a county burn building to assist the training of volunteer fire departments.	Emergency Services		X		2021 - 2025		Beaver County EMA
4.3.3	Education and awareness	Support residents and local businesses in testing properties for radon exposure.	Radon Exposure		X		2021 - 2025		Beaver County Municipalities
5.1.1	Local plans and regulations	Identify insurable county and municipal-owned, flood-prone buildings and infrastructure, and take appropriate mitigation methods if located in a SFHA. Continually monitor and update, as necessary.	Flooding		X		2021 - 2025	Local	Beaver County EMA
5.2.1	Local plans and regulations	Develop and implement an enhanced all-hazards, public outreach / education / mitigation information program on natural hazard risks, and outline the ways in which the program(s) can strengthen community mitigation and preparedness efforts.	All-Hazards	X			2021 - 2025	Local	Beaver County EMA
5.2.2	Structure and infrastructure	Assess and update emergency operations center equipment to improve communication. Targeted needs include repeaters to strengthening radio signals, providing base station and replacement portable radio batteries, and installing PEMARS radio antennae, as well as generators/ backup power in municipal buildings, police stations, and public works garages.	Emergency Services/All-Hazards		X		2021 - 2025	Local	Beaver County EMA

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Beaver County 2021 Mitigation Action Plan									
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization			Implementation		
	Category	Description/ Action Items		High	Medium	Low	Schedule	Funding	Local Champion
5.2.3	Education and awareness	Promote reverse notification systems in high-hazard areas	All-Hazards		X		2021 - 2025	Local	Beaver County EMA
5.3.1	Education and awareness	Utilize social media to disseminate preparedness tips to the public.	All-Hazards	X			2021 - 2025	Local	Beaver County EMA
5.4.1	Education and awareness	Disseminate information to Beaver County property owners about the importance of creating an emergency kit and being prepared for a 2-week period without supplies.	All-Hazards		X		2021 - 2025	Local	Beaver County EMA
5.5.1	Education and awareness	Encourage municipalities to attend the PA Association of Floodplain Managers yearly training.	Flooding		X		2021 - 2025	Local	Beaver County Municipalities/Beaver County Planning Commission
5.5.2	Education and awareness	Hold annual meetings to ensure that mitigation, planning, preparedness, and response personnel are (1) cross-trained in each other's area of expertise, (2) aware of ongoing activities, and (3) fostering increased communication.	All-Hazards	X			2021 - 2025	Local	Beaver County EMA
5.5.3	Education and awareness	Reinstate the Beaver County CERT program to recruit and train interested citizens in Beaver County to assist first responders at specified emergencies throughout the County.	All-Hazards	X			2021 - 2025	Local	Beaver County EMA
6.1.1	Education and awareness/Natural Systems Protection	Hold educational workshops to educate Beaver County residents about FEMA's HHPD program.	Dam Failure		X		2021 - 2025	Local	Beaver County EMA

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Beaver County 2021 Mitigation Action Plan									
Action Number	Mitigation Actions		Hazard Vulnerability	Prioritization			Implementation		
	Category	Description/ Action Items		High	Medium	Low	Schedule	Funding	Local Champion
6.1.2	Local plans and regulations/Natural Systems Protection	Review, update and exercise high-hazard dam plans.	Dam Failure	X			2021 - 2025	Local	Beaver County EMA
6.1.3	Education and awareness/Natural Systems Protection	Utilize County social media pages to educate Beaver County residents about FEMA's HHPD program.	Dam Failure	X			2021 - 2025	Local	Beaver County EMA

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
- PDM: Pre-Disaster Mitigation Grant, 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
- HMRP: Hazardous Material Response Fund, administered by the Pennsylvania Emergency Management Agency
- HMERP: Hazard Mitigation Emergency Response Program by the Pennsylvania Emergency Management Agency
- HHPD: High-hazard potential dam by the Federal Emergency Management Agency

Beaver County, Pennsylvania 2021 Hazard Mitigation Plan

Table 75 - 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	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5
Aliquippa City	X	X	X	X	X	X	X	X	X	X
Ambridge Borough	X	X	X	X	X	X	X	X	X	X
Baden Borough	X	X	X	X	X	X	X	X	X	X
Beaver Borough	X	X	X	X	X	X	X	X	X	X
Beaver Falls City	X	X	X	X	X	X	X	X	X	X
Big Beaver Borough	X	X	X	X	X	X	X	X	X	X
Bridgewater Borough	X	X	X	X	X	X	X	X	X	X
Brighton Township	X	X	X	X	X	X	X	X	X	X
Center Township	X	X	X	X	X	X	X	X	X	X
Chippewa Township	X	X	X	X	X	X	X	X	X	X
Conway Borough	X	X	X	X	X	X	X	X	X	X
Darlington Borough	X	X	X	X	X	X	X	X	X	X
Darlington Township	X	X	X	X	X	X	X	X	X	X
Daugherty Township	X	X	X	X	X	X	X	X	X	X
East Rochester Borough	X	X	X	X	X	X	X	X	X	X
Eastvale Borough	X	X	X	X	X	X	X	X	X	X
Economy Borough	X	X	X	X	X	X	X	X	X	X
Fallston Borough	X	X	X	X	X	X	X	X	X	X
Frankfurt Springs Borough	X	X	X	X	X	X	X	X	X	X
Franklin Township	X	X	X	X	X	X	X	X	X	X
Freedom Borough	X	X	X	X	X	X	X	X	X	X
Georgetown Borough	X	X	X	X	X	X	X	X	X	X
Glasgow Borough	X	X	X	X	X	X	X	X	X	X
Greene Township	X	X	X	X	X	X	X	X	X	X
Hanover Township	X	X	X	X	X	X	X	X	X	X
Harmony Township	X	X	X	X	X	X	X	X	X	X
Homewood Borough	X	X	X	X	X	X	X	X	X	X
Hookstown Borough	X	X	X	X	X	X	X	X	X	X
Hopewell Township	X	X	X	X	X	X	X	X	X	X
Independence Township	X	X	X	X	X	X	X	X	X	X
Industry Borough	X	X	X	X	X	X	X	X	X	X
Koppel Borough	X	X	X	X	X	X	X	X	X	X
Marion Township	X	X	X	X	X	X	X	X	X	X
Midland Borough	X	X	X	X	X	X	X	X	X	X
Monaca Borough	X	X	X	X	X	X	X	X	X	X
New Brighton Borough	X	X	X	X	X	X	X	X	X	X

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Municipal Hazard Mitigation Actions Checklist										
Municipality	1.1.1	1.1.2	1.1.3	1.1.4	1.1.5	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5
New Galilee Borough	X	X	X	X	X	X	X	X	X	X
New Sewickley Township	X	X	X	X	X	X	X	X	X	X
North Sewickley Township	X	X	X	X	X	X	X	X	X	X
Ohioville Borough	X	X	X	X	X	X	X	X	X	X
Patterson Heights Borough	X	X	X	X	X	X	X	X	X	X
Patterson Township	X	X	X	X	X	X	X	X	X	X
Potter Township	X	X	X	X	X	X	X	X	X	X
Pulaski Township	X	X	X	X	X	X	X	X	X	X
Raccoon Township	X	X	X	X	X	X	X	X	X	X
Rochester Borough	X	X	X	X	X	X	X	X	X	X
Rochester Township	X	X	X	X	X	X	X	X	X	X
Shippingport Borough	X	X	X	X	X	X	X	X	X	X
South Beaver Township	X	X	X	X	X	X	X	X	X	X
South Heights Borough	X	X	X	X	X	X	X	X	X	X
Vanport Township	X	X	X	X	X	X	X	X	X	X
West Mayfield Borough	X	X	X	X	X	X	X	X	X	X
White Township	X	X	X	X	X	X	X	X	X	X
Beaver County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	1.2.6	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.4.1	1.4.2	2.1.1	2.1.2
Aliquippa City	X	X	X	X	X	X	X	X	X	X
Ambridge Borough	X	X	X	X	X	X	X	X	X	X
Baden Borough	X	X	X	X	X	X	X	X	X	X
Beaver Borough	X	X	X	X	X	X	X	X	X	X
Beaver Falls City	X	X	X	X	X	X	X	X	X	X
Big Beaver Borough	X	X	X	X	X	X	X	X	X	X
Bridgewater Borough	X	X	X	X	X	X	X	X	X	X
Brighton Township	X	X	X	X	X	X	X	X	X	X
Center Township	X	X	X	X	X	X	X	X	X	X
Chippewa Township	X	X	X	X	X	X	X	X	X	X
Conway Borough	X	X	X	X	X	X	X	X	X	X
Darlington Borough	X	X	X	X	X	X	X	X	X	X
Darlington Township	X	X	X	X	X	X	X	X	X	X
Daugherty Township	X	X	X	X	X	X	X	X	X	X

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Municipal Hazard Mitigation Actions Checklist										
Municipality	1.2.6	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.4.1	1.4.2	2.1.1	2.1.2
East Rochester Borough	X	X	X	X	X	X	X	X	X	X
Eastvale Borough	X	X	X	X	X	X	X	X	X	X
Economy Borough	X	X	X	X	X	X	X	X	X	X
Fallston Borough	X	X	X	X	X	X	X	X	X	X
Frankfurt Springs Borough	X	X	X	X	X	X	X	X	X	X
Franklin Township	X	X	X	X	X	X	X	X	X	X
Freedom Borough	X	X	X	X	X	X	X	X	X	X
Georgetown Borough	X	X	X	X	X	X	X	X	X	X
Glasgow Borough	X	X	X	X	X	X	X	X	X	X
Greene Township	X	X	X	X	X	X	X	X	X	X
Hanover Township	X	X	X	X	X	X	X	X	X	X
Harmony Township	X	X	X	X	X	X	X	X	X	X
Homewood Borough	X	X	X	X	X	X	X	X	X	X
Hookstown Borough	X	X	X	X	X	X	X	X	X	X
Hopewell Township	X	X	X	X	X	X	X	X	X	X
Independence Township	X	X	X	X	X	X	X	X	X	X
Industry Borough	X	X	X	X	X	X	X	X	X	X
Koppel Borough	X	X	X	X	X	X	X	X	X	X
Marion Township	X	X	X	X	X	X	X	X	X	X
Midland Borough	X	X	X	X	X	X	X	X	X	X
Monaca Borough	X	X	X	X	X	X	X	X	X	X
New Brighton Borough	X	X	X	X	X	X	X	X	X	X
New Galilee Borough	X	X	X	X	X	X	X	X	X	X
New Sewickley Township	X	X	X	X	X	X	X	X	X	X
North Sewickley Township	X	X	X	X	X	X	X	X	X	X
Ohioville Borough	X	X	X	X	X	X	X	X	X	X
Patterson Heights Borough	X	X	X	X	X	X	X	X	X	X
Patterson Township	X	X	X	X	X	X	X	X	X	X
Potter Township	X	X	X	X	X	X	X	X	X	X
Pulaski Township	X	X	X	X	X	X	X	X	X	X
Raccoon Township	X	X	X	X	X	X	X	X	X	X
Rochester Borough	X	X	X	X	X	X	X	X	X	X
Rochester Township	X	X	X	X	X	X	X	X	X	X
Shippingport Borough	X	X	X	X	X	X	X	X	X	X
South Beaver Township	X	X	X	X	X	X	X	X	X	X
South Heights Borough	X	X	X	X	X	X	X	X	X	X
Vanport Township	X	X	X	X	X	X	X	X	X	X

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Municipal Hazard Mitigation Actions Checklist										
Municipality	1.2.6	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.4.1	1.4.2	2.1.1	2.1.2
West Mayfield Borough	X	X	X	X	X	X	X	X	X	X
White Township	X	X	X	X	X	X	X	X	X	X
Beaver County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	2.1.3	2.1.4	2.1.5	2.1.6	2.1.7	2.2.1	2.3.1	3.1.1	3.1.2	3.1.3
Aliquippa City	X	X	X	X	X	X	X	X	X	X
Ambridge Borough	X	X	X	X	X	X	X	X	X	X
Baden Borough	X	X	X	X	X	X	X	X	X	X
Beaver Borough	X	X	X	X	X	X	X	X	X	X
Beaver Falls City	X	X	X	X	X	X	X	X	X	X
Big Beaver Borough	X	X	X	X	X	X	X	X	X	X
Bridgewater Borough	X	X	X	X	X	X	X	X	X	X
Brighton Township	X	X	X	X	X	X	X	X	X	X
Center Township	X	X	X	X	X	X	X	X	X	X
Chippewa Township	X	X	X	X	X	X	X	X	X	X
Conway Borough	X	X	X	X	X	X	X	X	X	X
Darlington Borough	X	X	X	X	X	X	X	X	X	X
Darlington Township	X	X	X	X	X	X	X	X	X	X
Daugherty Township	X	X	X	X	X	X	X	X	X	X
East Rochester Borough	X	X	X	X	X	X	X	X	X	X
Eastvale Borough	X	X	X	X	X	X	X	X	X	X
Economy Borough	X	X	X	X	X	X	X	X	X	X
Fallston Borough	X	X	X	X	X	X	X	X	X	X
Frankfurt Springs Borough	X	X	X	X	X	X	X	X	X	X
Franklin Township	X	X	X	X	X	X	X	X	X	X
Freedom Borough	X	X	X	X	X	X	X	X	X	X
Georgetown Borough	X	X	X	X	X	X	X	X	X	X
Glasgow Borough	X	X	X	X	X	X	X	X	X	X
Greene Township	X	X	X	X	X	X	X	X	X	X
Hanover Township	X	X	X	X	X	X	X	X	X	X
Harmony Township	X	X	X	X	X	X	X	X	X	X
Homewood Borough	X	X	X	X	X	X	X	X	X	X
Hookstown Borough	X	X	X	X	X	X	X	X	X	X
Hopewell Township	X	X	X	X	X	X	X	X	X	X

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Municipal Hazard Mitigation Actions Checklist										
Municipality	2.1.3	2.1.4	2.1.5	2.1.6	2.1.7	2.2.1	2.3.1	3.1.1	3.1.2	3.1.3
Independence Township	X	X	X	X	X	X	X	X	X	X
Industry Borough	X	X	X	X	X	X	X	X	X	X
Koppel Borough	X	X	X	X	X	X	X	X	X	X
Marion Township	X	X	X	X	X	X	X	X	X	X
Midland Borough	X	X	X	X	X	X	X	X	X	X
Monaca Borough	X	X	X	X	X	X	X	X	X	X
New Brighton Borough	X	X	X	X	X	X	X	X	X	X
New Galilee Borough	X	X	X	X	X	X	X	X	X	X
New Sewickley Township	X	X	X	X	X	X	X	X	X	X
North Sewickley Township	X	X	X	X	X	X	X	X	X	X
Ohioville Borough	X	X	X	X	X	X	X	X	X	X
Patterson Heights Borough	X	X	X	X	X	X	X	X	X	X
Patterson Township	X	X	X	X	X	X	X	X	X	X
Potter Township	X	X	X	X	X	X	X	X	X	X
Pulaski Township	X	X	X	X	X	X	X	X	X	X
Raccoon Township	X	X	X	X	X	X	X	X	X	X
Rochester Borough	X	X	X	X	X	X	X	X	X	X
Rochester Township	X	X	X	X	X	X	X	X	X	X
Shippingport Borough	X	X	X	X	X	X	X	X	X	X
South Beaver Township	X	X	X	X	X	X	X	X	X	X
South Heights Borough	X	X	X	X	X	X	X	X	X	X
Vanport Township	X	X	X	X	X	X	X	X	X	X
West Mayfield Borough	X	X	X	X	X	X	X	X	X	X
White Township	X	X	X	X	X	X	X	X	X	X
Beaver County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	3.1.4	3.1.5	3.2.1	4.1.1	4.2.1	4.2.2	4.2.3	4.3.1	4.3.2	4.3.3
Aliquippa City	X	X	X	X	X	X	X	X	X	X
Ambridge Borough	X	X	X	X	X	X	X	X	X	X
Baden Borough	X	X	X	X	X	X	X	X	X	X
Beaver Borough	X	X	X	X	X	X	X	X	X	X
Beaver Falls City	X	X	X	X	X	X	X	X	X	X
Big Beaver Borough	X	X	X	X	X	X	X	X	X	X
Bridgewater Borough	X	X	X	X	X	X	X	X	X	X

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Municipal Hazard Mitigation Actions Checklist										
Municipality	3.1.4	3.1.5	3.2.1	4.1.1	4.2.1	4.2.2	4.2.3	4.3.1	4.3.2	4.3.3
Brighton Township	X	X	X	X	X	X	X	X	X	X
Center Township	X	X	X	X	X	X	X	X	X	X
Chippewa Township	X	X	X	X	X	X	X	X	X	X
Conway Borough	X	X	X	X	X	X	X	X	X	X
Darlington Borough	X	X	X	X	X	X	X	X	X	X
Darlington Township	X	X	X	X	X	X	X	X	X	X
Daugherty Township	X	X	X	X	X	X	X	X	X	X
East Rochester Borough	X	X	X	X	X	X	X	X	X	X
Eastvale Borough	X	X	X	X	X	X	X	X	X	X
Economy Borough	X	X	X	X	X	X	X	X	X	X
Fallston Borough	X	X	X	X	X	X	X	X	X	X
Frankfurt Springs Borough	X	X	X	X	X	X	X	X	X	X
Franklin Township	X	X	X	X	X	X	X	X	X	X
Freedom Borough	X	X	X	X	X	X	X	X	X	X
Georgetown Borough	X	X	X	X	X	X	X	X	X	X
Glasgow Borough	X	X	X	X	X	X	X	X	X	X
Greene Township	X	X	X	X	X	X	X	X	X	X
Hanover Township	X	X	X	X	X	X	X	X	X	X
Harmony Township	X	X	X	X	X	X	X	X	X	X
Homewood Borough	X	X	X	X	X	X	X	X	X	X
Hookstown Borough	X	X	X	X	X	X	X	X	X	X
Hopewell Township	X	X	X	X	X	X	X	X	X	X
Independence Township	X	X	X	X	X	X	X	X	X	X
Industry Borough	X	X	X	X	X	X	X	X	X	X
Koppel Borough	X	X	X	X	X	X	X	X	X	X
Marion Township	X	X	X	X	X	X	X	X	X	X
Midland Borough	X	X	X	X	X	X	X	X	X	X
Monaca Borough	X	X	X	X	X	X	X	X	X	X
New Brighton Borough	X	X	X	X	X	X	X	X	X	X
New Galilee Borough	X	X	X	X	X	X	X	X	X	X
New Sewickley Township	X	X	X	X	X	X	X	X	X	X
North Sewickley Township	X	X	X	X	X	X	X	X	X	X
Ohioville Borough	X	X	X	X	X	X	X	X	X	X
Patterson Heights Borough	X	X	X	X	X	X	X	X	X	X
Patterson Township	X	X	X	X	X	X	X	X	X	X
Potter Township	X	X	X	X	X	X	X	X	X	X
Pulaski Township	X	X	X	X	X	X	X	X	X	X

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Municipal Hazard Mitigation Actions Checklist										
Municipality	3.1.4	3.1.5	3.2.1	4.1.1	4.2.1	4.2.2	4.2.3	4.3.1	4.3.2	4.3.3
Raccoon Township	X	X	X	X	X	X	X	X	X	X
Rochester Borough	X	X	X	X	X	X	X	X	X	X
Rochester Township	X	X	X	X	X	X	X	X	X	X
Shippingport Borough	X	X	X	X	X	X	X	X	X	X
South Beaver Township	X	X	X	X	X	X	X	X	X	X
South Heights Borough	X	X	X	X	X	X	X	X	X	X
Vanport Township	X	X	X	X	X	X	X	X	X	X
West Mayfield Borough	X	X	X	X	X	X	X	X	X	X
White Township	X	X	X	X	X	X	X	X	X	X
Beaver County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	5.1.1	5.2.1	5.2.2	5.2.3	5.3.1	5.4.1	5.5.1	5.5.2	5.5.3	6.1.1
Aliquippa City	X	X	X	X	X	X	X	X	X	X
Ambridge Borough	X	X	X	X	X	X	X	X	X	X
Baden Borough	X	X	X	X	X	X	X	X	X	X
Beaver Borough	X	X	X	X	X	X	X	X	X	X
Beaver Falls City	X	X	X	X	X	X	X	X	X	X
Big Beaver Borough	X	X	X	X	X	X	X	X	X	X
Bridgewater Borough	X	X	X	X	X	X	X	X	X	X
Brighton Township	X	X	X	X	X	X	X	X	X	X
Center Township	X	X	X	X	X	X	X	X	X	X
Chippewa Township	X	X	X	X	X	X	X	X	X	X
Conway Borough	X	X	X	X	X	X	X	X	X	X
Darlington Borough	X	X	X	X	X	X	X	X	X	X
Darlington Township	X	X	X	X	X	X	X	X	X	X
Daugherty Township	X	X	X	X	X	X	X	X	X	X
East Rochester Borough	X	X	X	X	X	X	X	X	X	X
Eastvale Borough	X	X	X	X	X	X	X	X	X	X
Economy Borough	X	X	X	X	X	X	X	X	X	X
Fallston Borough	X	X	X	X	X	X	X	X	X	X
Frankfurt Springs Borough	X	X	X	X	X	X	X	X	X	X
Franklin Township	X	X	X	X	X	X	X	X	X	X
Freedom Borough	X	X	X	X	X	X	X	X	X	X
Georgetown Borough	X	X	X	X	X	X	X	X	X	X

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Municipal Hazard Mitigation Actions Checklist										
Municipality	5.1.1	5.2.1	5.2.2	5.2.3	5.3.1	5.4.1	5.5.1	5.5.2	5.5.3	6.1.1
Glasgow Borough	X	X	X	X	X	X	X	X	X	X
Greene Township	X	X	X	X	X	X	X	X	X	X
Hanover Township	X	X	X	X	X	X	X	X	X	X
Harmony Township	X	X	X	X	X	X	X	X	X	X
Homewood Borough	X	X	X	X	X	X	X	X	X	X
Hookstown Borough	X	X	X	X	X	X	X	X	X	X
Hopewell Township	X	X	X	X	X	X	X	X	X	X
Independence Township	X	X	X	X	X	X	X	X	X	X
Industry Borough	X	X	X	X	X	X	X	X	X	X
Koppel Borough	X	X	X	X	X	X	X	X	X	X
Marion Township	X	X	X	X	X	X	X	X	X	X
Midland Borough	X	X	X	X	X	X	X	X	X	X
Monaca Borough	X	X	X	X	X	X	X	X	X	X
New Brighton Borough	X	X	X	X	X	X	X	X	X	X
New Galilee Borough	X	X	X	X	X	X	X	X	X	X
New Sewickley Township	X	X	X	X	X	X	X	X	X	X
North Sewickley Township	X	X	X	X	X	X	X	X	X	X
Ohioville Borough	X	X	X	X	X	X	X	X	X	X
Patterson Heights Borough	X	X	X	X	X	X	X	X	X	X
Patterson Township	X	X	X	X	X	X	X	X	X	X
Potter Township	X	X	X	X	X	X	X	X	X	X
Pulaski Township	X	X	X	X	X	X	X	X	X	X
Raccoon Township	X	X	X	X	X	X	X	X	X	X
Rochester Borough	X	X	X	X	X	X	X	X	X	X
Rochester Township	X	X	X	X	X	X	X	X	X	X
Shippingport Borough	X	X	X	X	X	X	X	X	X	X
South Beaver Township	X	X	X	X	X	X	X	X	X	X
South Heights Borough	X	X	X	X	X	X	X	X	X	X
Vanport Township	X	X	X	X	X	X	X	X	X	X
West Mayfield Borough	X	X	X	X	X	X	X	X	X	X
White Township	X	X	X	X	X	X	X	X	X	X
Beaver County	X	X	X	X	X	X	X	X	X	X

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Municipal Hazard Mitigation Actions Checklist									
Municipality	6.1.2	6.1.3							
Aliquippa City	X	X							
Ambridge Borough	X	X							
Baden Borough	X	X							
Beaver Borough	X	X							
Beaver Falls City	X	X							
Big Beaver Borough	X	X							
Bridgewater Borough	X	X							
Brighton Township	X	X							
Center Township	X	X							
Chippewa Township	X	X							
Conway Borough	X	X							
Darlington Borough	X	X							
Darlington Township	X	X							
Daugherty Township	X	X							
East Rochester Borough	X	X							
Eastvale Borough	X	X							
Economy Borough	X	X							
Fallston Borough	X	X							
Frankfurt Springs Borough	X	X							
Franklin Township	X	X							
Freedom Borough	X	X							
Georgetown Borough	X	X							
Glasgow Borough	X	X							
Greene Township	X	X							
Hanover Township	X	X							
Harmony Township	X	X							
Homewood Borough	X	X							
Hookstown Borough	X	X							
Hopewell Township	X	X							
Independence Township	X	X							
Industry Borough	X	X							
Koppel Borough	X	X							
Marion Township	X	X							
Midland Borough	X	X							
Monaca Borough	X	X							
New Brighton Borough	X	X							
New Galilee Borough	X	X							

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Municipal Hazard Mitigation Actions Checklist									
Municipality	6.1.2	6.1.3							
New Sewickley Township	X	X							
North Sewickley Township	X	X							
Ohioville Borough	X	X							
Patterson Heights Borough	X	X							
Patterson Township	X	X							
Potter Township	X	X							
Pulaski Township	X	X							
Raccoon Township	X	X							
Rochester Borough	X	X							
Rochester Township	X	X							
Shippingport Borough	X	X							
South Beaver Township	X	X							
South Heights Borough	X	X							
Vanport Township	X	X							
West Mayfield Borough	X	X							
White Township	X	X							
Beaver County	X	X							

7. Plan Maintenance

7.1. Update Process Summary

Monitoring, evaluating, and updating this plan, is critical to maintaining its value and success in Beaver 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. The Beaver County HMP Local Planning Team decided to alter the current maintenance procedures. The 2021 HMP update establishes a review of the plan within thirty days of a disaster event in addition to continuing with an annual plan evaluation. This HMP update also defines the municipalities’ role in updating and evaluating the plan. Finally, the 2021 HMP update encourages continued public involvement and how this plan may be integrated into other planning mechanisms in the county.

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7.2. Monitoring, Evaluating and Updating the Plan

Hazard mitigation planning in Beaver County is a responsibility of all levels of government (i.e., county and local), as well as the citizens of the county. The Beaver 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 data and risk analysis reflect 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 Beaver 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 within the county.
- Complete a review and update of capability assessment section. Identify any capability weaknesses.
- Complete a review of the mitigation strategy section. Review the goals and objectives identified in the 2021 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.

Beaver County Emergency Services will maintain a copy of these records and place them in Appendix I of this plan. Beaver 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. During the annual plan review, Beaver County will discuss and evaluate how the 2021 Beaver County Hazard Mitigation Plan can be further integrated into other

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planning documents and initiatives. All jurisdictions within Beaver County will incorporate the 2021 Beaver County Hazard Mitigation Plan into local planning efforts and initiatives to further advance local hazard mitigation planning. For example, local jurisdictions will incorporate the updated HMP into any comprehensive municipal plans. Beaver County Emergency Management Agency has integrated the 2016 Beaver County Hazard Mitigation Plan Risk Assessment section into the Beaver County Emergency Operations Plan. The Risk Assessment section, specifically the vulnerability assessment of each hazard profile is utilized to enhance the Emergency Operations Plan for future use.

7.3. Continued Public Involvement

Beaver County Emergency Services will ensure that the 2021 Beaver County Hazard Mitigation Plan is posted and maintained on the Beaver County website and will continue to encourage public review and comment on the plan. The Beaver County website that the plan will be located at is as follows: www.beavercountypa.gov/Depts/EMS/HazardMitigation.aspx

The public will have access to the 2021 HMP through their local municipal office, the Beaver County Office of Planning and Redevelopment, or Beaver County 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 Beaver County are encouraged to submit their comments to elected officials and/or members of the Beaver County HMP Local Planning Team. To promote public participation, the Beaver County Local Planning Team will post a public comment form as well 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 Beaver County Hazard Mitigation Planning Team.

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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 2021 Beaver County Hazard Mitigation Plan. Copies of the adopting resolutions are included in this plan in Appendix J. FEMA Region III in Philadelphia is the final approval authority for the Hazard Mitigation Plan. PEMA also reviews the plan before submission to FEMA.

***Beaver County, Pennsylvania
2021 Hazard Mitigation Plan***

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 Special Needs Facilities
APPENDIX F:	2021 HAZUS Reports
APPENDIX G:	2021 Mitigation Project Opportunities
APPENDIX H:	2021 Mitigation Action Evaluation & Prioritization
APPENDIX I:	Annual Review Documentation
APPENDIX J:	Beaver County & Municipal Adoption Resolutions