BERKELEY & MORGAN COUNTY 2022

HAZARD MITIGATION PLAN UPDATE

PREPARED FOR:

Region 9
Regional Planning & Development
226 Pilot Way, Suite E
Martinsburg, West Virginia, 25405

PREPARED BY:

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Harrisburg, Pennsylvania 17110

CERTIFICATION OF ANNUAL REVIEW MEETINGS

Year	Date of Meeting	Public Outreach Addressed?*	Signature
2022			
2023			
2024			
2025			
2026			
2027			
2028			
2029			

**Confirm here annually and describe on record of changes page.*

RECORD OF CHANGES

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

REMINDER: Please attach all associated meeting agendas, sign-in sheets, handouts, and minutes.

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Acknowledgements

Recognition and special thanks is hereby extended to the following project partners for their leadership, expertise, resources, and dedication devoted to the preparation of this 2022 hazard mitigation plan update.

Eastern Panhandle Regional (Region 9) Planning and Development Council

Steering Committee Members:

Berkeley County Council
Berkeley County Office of Homeland Security and Emergency Management
Berkeley County Planning Department
Town of Hedgesville
City of Martinsburg
Berkeley County Development Authority
Martinsburg-Berkeley County Chamber of Commerce
Berkeley County Ambulance Authority
Berkeley County E-911

Morgan County Commission
Morgan County Office of Homeland Security and Emergency Management
Morgan County Economic Development Authority
Morgan County Planning Commission
Morgan County E-911
Town of Paw Paw
Town of Bath

Consultants:

Michael Baker International
Harrisburg, Pennsylvania

Hazus Analysis Provided by:
West Virginia University
Morgantown, WV

Funding for this project was made available through the Hazard Mitigation Grant Program (HMGP) administered within West Virginia by the West Virginia Emergency Management Division (WVEMD). In addition, funding and in-kind services were also provided by the Eastern Panhandle Regional (Region 9) Planning and Development Council.

1. Introduction

1.1. Background

Hazard Mitigation is defined by the Federal Emergency Management Agency (FEMA) as "any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards ". The hazard mitigation planning process involves the coordination of actions taken to reduce injuries, deaths, property damage, economic losses, and degradation of natural resources caused by natural and human-caused disasters. Hazard mitigation is considered one of four phases in the emergency management cycle. Others include emergency preparedness, emergency response, and recovery.

- Hazard mitigation activities involve actions that reduce or eliminate the probability of an occurrence or reduce the impact of a disaster. The goal of the mitigation phase is to make communities more resistant to disasters and thereby decrease the need for a response. Mitigation occurs long before a disaster.
- Preparedness activities include planning and preparing for when a disaster strikes and includes response capability actions to ensure an effective and efficient use of resources and efforts to minimize damage. Preparedness occurs just before a disaster.
- Emergency response activities include providing emergency assistance to victims and minimizing property loss. The response phase begins during or immediately after the onset of a disaster.
- Recovery activities include short and long-term activities that help return individuals and communities to normalcy as soon as possible. Recovery actions involve clean-up efforts, temporary housing, and replacement of infrastructure. Recovery activities typically commence several days or weeks after a disaster and are long-term.

Accordingly, the Berkeley and Morgan County Hazard Mitigation Steering Committees (HMSC), composed of government leaders from each County, in cooperation with the elected officials of the County and its municipalities, have prepared this Hazard Mitigation Plan (HMP) update. The Plan is the result of work by citizens of each county to develop a pre-disaster multi-hazard mitigation plan that will not only guide both counties towards greater disaster resistance but will also respect the character and needs of the community.

The Eastern Panhandle Regional Planning and Development Council (Region 9) is a council created by the State of West Virginia to provide regional comprehensive planning services utilizing federal, state, and local funding. Region 9 was heavily involved in the planning process for this 2022 HMP update.

1.2. Purpose

This project will update the 2017 Region 9 Eastern Panhandle Regional Hazard Mitigation Plan for

Berkeley and Morgan County, which was approved by FEMA in 2017. Region 9 will evaluate the previously identified natural hazards and risk assessments to determine if any revisions or additions are needed. The consultant will provide an updated asset inventory, risk assessment, and mapping of critical facilities within the plan area. The consultant will provide Hazus Flood Analysis reports and loss estimates for each identified hazard for participating counties.

This Hazard Mitigation Plan was developed for the purpose of:

- Providing a blueprint for reducing property damage and saving lives from the effects of future natural and human-caused disasters in Berkeley and Morgan County;
- Identifying, introducing, and implementing cost-effective hazard mitigation measures in order to accomplish county goals and objectives and to raise awareness and acceptance of hazard mitigation.
- Complying with state and federal legislative requirements for county mitigation in order for the county to be eligible for federal and technical assistance from state and federal hazard mitigation programs; and
- Demonstrating a firm local commitment to hazard mitigation principles; and improving community resiliency following a disaster event.

Adoption of this plan ensures that Berkeley and Morgan County and participating jurisdictions continue to be eligible to apply for and receive certain federal grant funds that are administered by the State of West Virginia for FEMA. This plan complies with the requirements of the Disaster Mitigation Act of 2000 and its implementing regulations published in Title 44 of the Code of Federal Regulations (CFR) Section 201.6.

1.3. Scope

This 2022 Hazard Mitigation Plan Update has been prepared to meet requirements set forth by the Federal Emergency Management Agency (FEMA) and the West Virginia Emergency Management Division (WVEMDD) in order for Berkeley and Morgan County to be eligible for funding and technical assistance from state and federal hazard mitigation programs. It will be updated and maintained to address both natural and human-caused hazards determined to be probable and/or present a risk for multiple deaths/injuries and property damages to the local municipalities within the region. Updates will take place following significant disasters or at a minimum this plan will be subject to review and update on an annual basis.

In February of 2021, Region 9 contracted with Michael Baker International, Inc. to support HMP Update development in compliance with the requirements of the Disaster Mitigation Act of 2000. The HMP Update was funded by Hazard Mitigation Assistance (HMA) funds from FEMA and administered by the WVEMDD. The Plan Update is a multi- jurisdictional plan that covers Berkeley and Morgan County and their 4 municipalities.

It should be noted that future funding for certain mitigation projects will be contingent upon having each jurisdiction in Berkeley and Morgan County adopt the plan after the counties adopt the Update. Any jurisdiction that does not adopt the 2022 Plan Update will become ineligible for FEMA pre- and post-disaster mitigation funds.

Organization of the Plan

The 2022 Hazard Mitigation Plan Update consists of eight chapters, each focusing on a different aspect of the planning process. Chapter 1 includes the prerequisites of the Plan including its purpose and scope. Chapter 2 introduces the plan update process and includes an overview of the socio-economic and demographic characteristics. Chapter 3 discusses the planning process. Chapter 4 comprises the hazard identification and risk assessment and examines vulnerability and the potential losses from the top priority hazards. Chapter 4 also includes a historic profile of hazard types and associated losses, and a vulnerability assessment, which analyzes the potential for future damages due to the hazards identified. Chapter 5 contains a capability assessment including a review of existing plans and ordinances from the counties and municipalities. Chapter 6 discusses the mitigation strategy including updated mitigation goals and objectives, mitigation actions, and the method for prioritization and implementation of mitigation actions. Chapter 7 outlines how Region 9 and its municipalities will implement the Plan once it is adopted and ways to monitor progress and ensure continued public involvement. Chapter 8 includes letters of adoption by the county's Commission and the individual 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; and
- National Flood Insurance Act of 1968, as amended, 42 U.S.C. 4001 et seq.

Authority for this plan originates from the following State of West Virginia source:

- West Virginia Code § 15-5 Public Safety
- WVEMDD: *West Virginia Statewide Standard Hazard Mitigation Plan Update 2018*

The following FEMA guides and reference documents were used to prepare this document:

- FEMA 386-1: *Getting Started*. September 2002.
- FEMA 386-2: *Understanding Your Risks: Identifying Hazards and Estimating Losses*. August 2001.
- FEMA 386-3: *Developing the Mitigation Plan*. April 2003.

- FEMA 386-4: *Bringing the Plan to Life*. August 2003.
- FEMA 386-5: *Using Benefit-Cost Review in Mitigation Planning*. May 2007.
- FEMA 386-6: *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning*. May 2005.
- FEMA 386-7: *Integrating Manmade Hazards into Mitigation Planning*. September 2003.
- FEMA 386-8: *Multijurisdictional Mitigation Planning*. August 2006.
- FEMA 386-9: *Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects*. August 2008.
- FEMA: *Local Mitigation Planning Handbook.* March 2013.
- FEMA: *Local Mitigation Plan Review Guide.* October 2011.
- FEMA: *National Fire Incident Reporting System 5.0: Complete Reference Guide*. January 2008.
- FEMA: *Hazard Mitigation Assistance Unified Guidance*. February 2015.
- FEMA: *Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials*. March 2013
- FEMA: *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.* January 2013.
- FEMA: *National Flood Insurance Program Fact Sheet*. May 2016.
- FEMA P-758: *Substantial Improvement / Substantial Damage Desk Reference*. May 2010.

The following additional guidance documents were used to update this plan:

- NFPA 1600: *Standard on Disaster/Emergency Management and Business Continuity Programs*. 2007
- WVEMDD. *West Virginia Statewide Standard Hazard Mitigation Plan, 2018 Update.*
- PEMA: *Pennsylvania's Hazard Mitigation Planning Standard Operating Guide*. August 2020.
- Berkeley County Council. *Berkeley County Comprehensive Plan, 2016 Update.*
- Morgan County Commission, *Morgan County Comprehensive Plan, 2017 Update.*
- City of Martinsburg, *Comprehensive Plan, 2018 Update.*

2. Community Profile

This section includes a profile of Berkeley and Morgan County. Information on each county's geographic profile, climate, demographic profile, and employment and industry profile are included below. While some information such as the study area boundaries and geography have remained unchanged, and derived from the 2017 Plan, other information such as the demographic, employment, and industry information have been developed using the latest U.S. Census, the Comprehensive Plans, and other recent Economic Development Strategy and Planning documents.

2.1. Geography and Environment

Berkeley County covers approximately 322 square miles and Morgan County contains about 230 square miles. The two counties are divided by Cherry Run and the Sleepy Creek Wildlife Management Area. Berkeley, Morgan, and Jefferson County are the northeastern-most counties of West Virginia and make up the Eastern Panhandle Region. This geography can be seen in Figure 2.1-1. Berkeley and Morgan County are within the Valley and Ridge physiographic province, an area characterized by eroded features of sedimentary rock formations seen in the steep anticlines and synclines of the Appalachian Mountains (USGS, 2015). Both counties contain two municipalities, as seen in Table 2.1-1. The County Seat for Berkeley County is located in Martinsburg, while the County Seat for Morgan County is located in Bath (Berkeley Springs).

Adjacent areas include Maryland to the north, Virginia to the south, Jefferson County east of Berkeley County, and Hampshire County southwest of Morgan County. It is important to note this region's proximity to Washington, D.C., and the National Capital Region (NCR), as Berkeley and Morgan County would likely receive an influx of people and major roads would receive heavy traffic if a disaster were to strike the NCR.

The most significant watercourses are the Potomac River, which forms the northern border of both counties, Opequon Creek, Cherry Run, Sleepy Creek, Back Creek, and the Cacapon River. Water bodies make up approximately 0.3 percent of Berkeley and Morgan County's combined geographic area. Figure 2.1-2, displays the watersheds and major water areas in Berkeley and Morgan County, which are the Cacapon River Watershed and Potomac River Direct Drains Watershed. Figure 2.1-3 shows the average annual precipitation in Berkeley and Morgan County. Southeast Morgan County appears to receive the least precipitation, while an area along the southern border between Berkeley and Morgan County appears to receive the most.

Table 2.1-1 Municipalities Covered under 2022 HMP

Name	Type	County
Martinsburg	City	Berkeley
Hedgesville	Town	Berkeley
Bath (Berkeley Springs)	Town	Morgan
Paw Paw	Town	Morgan

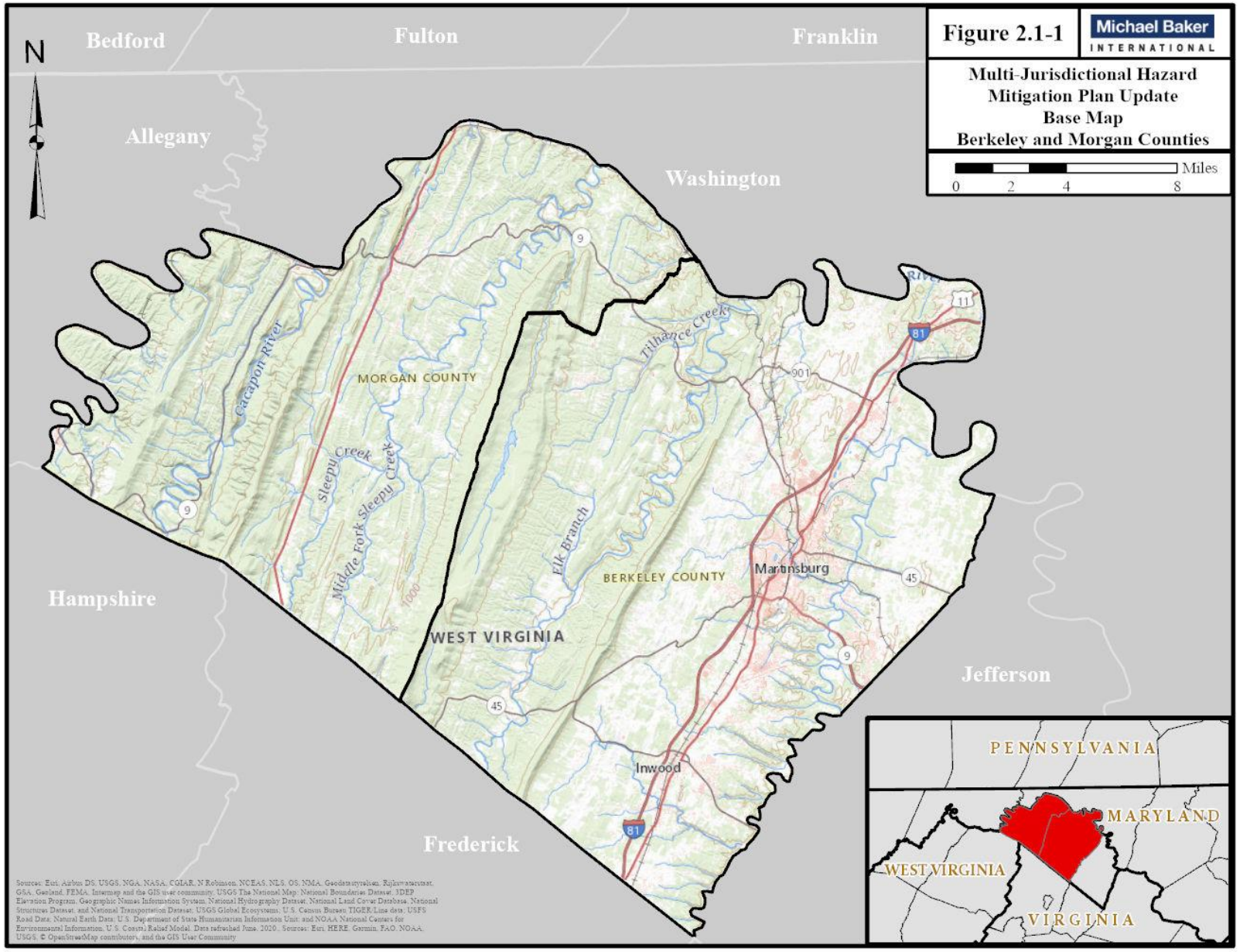


Figure 2.1-1
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Base Map
Berkeley and Morgan Counties
Miles
0 2 4 8
N
Bedford
Fulton
Franklin
Allegany
Washington
Hampshire
Jefferson
Frederick
MORGAN COUNTY
BERKELEY COUNTY
WEST VIRGINIA
Martinsburg
Inwood
Cacapon River
Sleepy Creek
Middle Fork Sleepy Creek
Elk Branch
Tilhance Creeks
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA

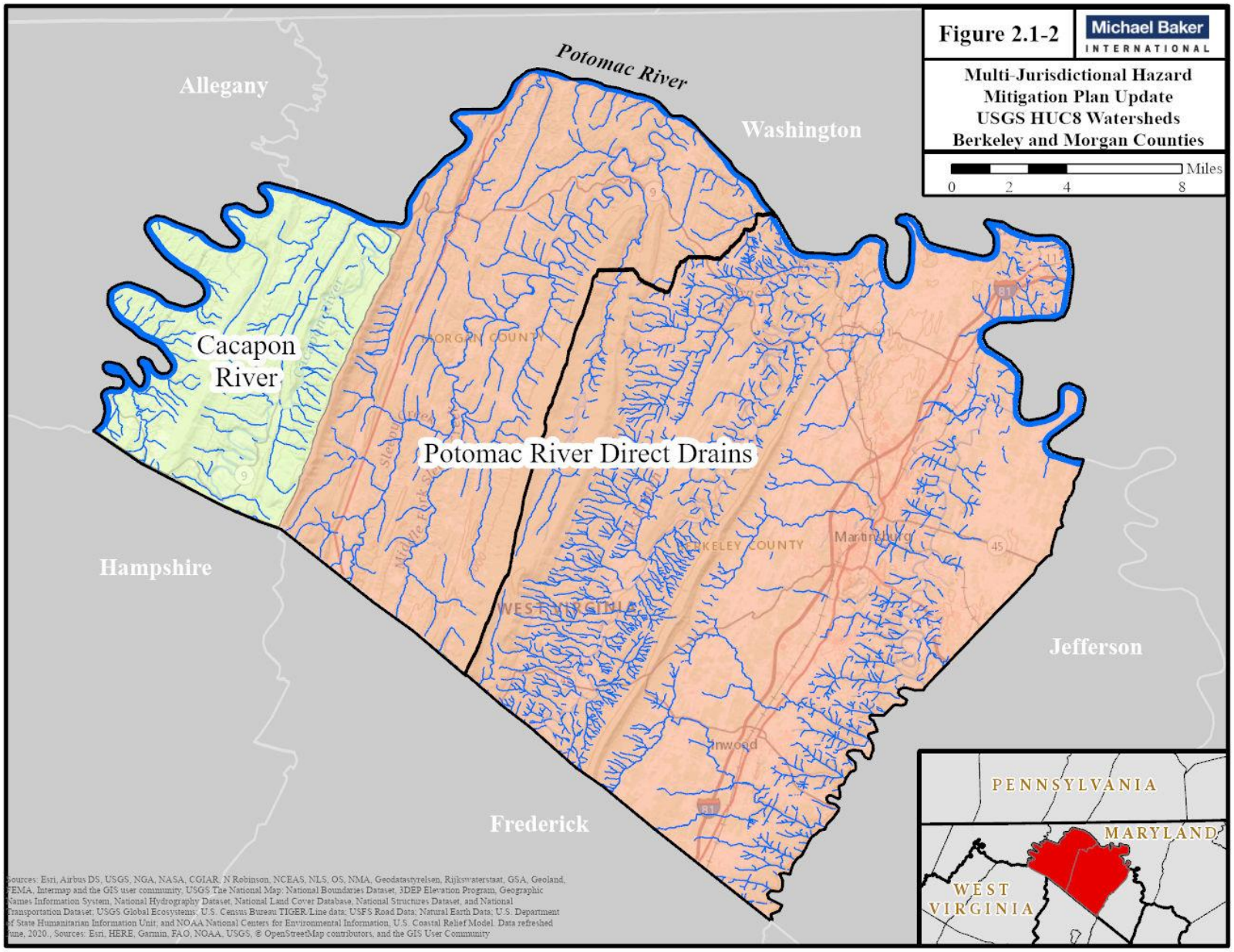


Figure 2.1-2
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
USGS HUC8 Watersheds
Berkeley and Morgan Counties
Miles
0 2 4 8
Potomac River
Allegany
Washington
Cacapon River
Potomac River Direct Drains
Hampshire
Jefferson
Frederick
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed June, 2020., Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

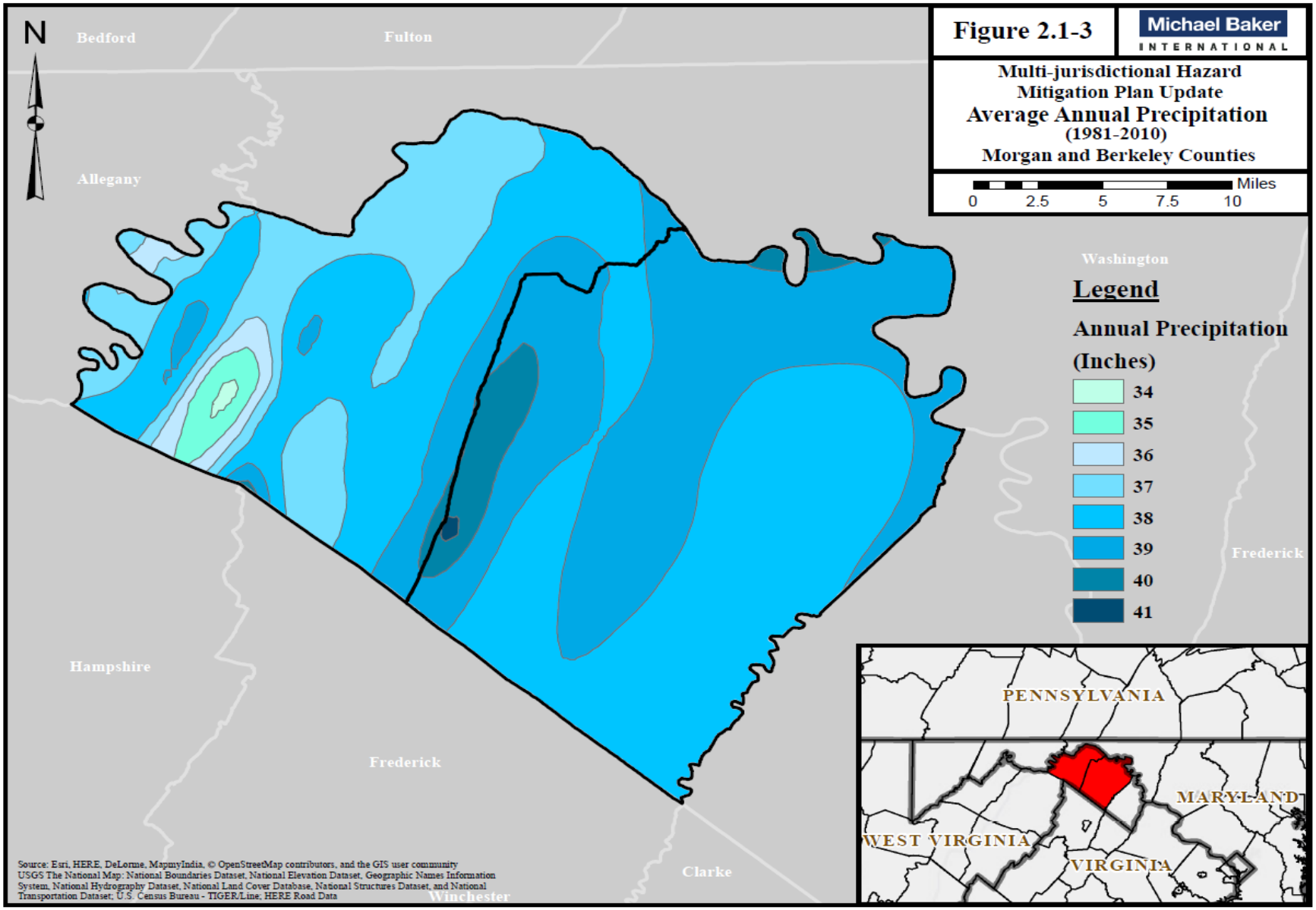


Figure 2.1-3
Michael Baker INTERNATIONAL
Multi-jurisdictional Hazard Mitigation Plan Update
Average Annual Precipitation
(1981-2010)
Morgan and Berkeley Counties
Miles
0 2.5 5 7.5 10
N
Bedford
Fulton
Allegany
Washington
Frederick
Hampshire
Frederick
Clarke
Winchester
Legend
Annual Precipitation
(Inches)
34
35
36
37
38
39
40
41
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA
Source: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data

2.2. Community Facts

History

Berkeley County was formed from Frederick County, Virginia in 1772 and named for Norborne Berkeley, Governor of Virginia from 1768 to 1770. The County Seat was established in the colonial village of Martinsburg, named for Thomas Bryan Martin, Lord Fairfax's nephew, and was incorporated in 1778. The arrival of the B&O Railroad in the 1840's gave Martinsburg and Berkeley County an economic boost. Today, Martinsburg continues to be the focus of the business area of Berkeley County, although continued development throughout the county, particularly in the Tabler Station, Inwood, and Spring Mills areas is altering the county's landscape. The county's economy is continuing its transition from agriculture and manufacturing to more service oriented and government related businesses. However, with the recent decision by Proctor & Gamble to develop a large manufacturing facility, it is clear manufacturing will continue to have a role in Berkeley County (Berkeley County, 2016).

Morgan County was created by an act of the Virginia General Assembly in 1820. It was formed from parts of both Berkeley and Hampshire counties, and named in honor of the revolutionary war general, Daniel Morgan. The first settlers to this area are believed to be squatters who arrived in the 1730s, with the first known cabin being built in 1745. Due to the area's popular warm springs, Lord Thomas Fairfax had the area surveyed in 1748. Due to limited growth of its public infrastructure and the scenic charm of its rural seclusion, the county experienced increasing growth along its rivers and streams into the mid-1900s (Morgan County, 2017).

Transportation

The transportation network of the region includes four main highways:

- Interstate 81
- US Route 11
- US Route 522
- WV Route 9

Several other state routes also serve as secondary transportation routes. The highways serve importance not only locally, but nationally. They serve motorists going in and out of the NCR and traveling north-south along the eastern United States.

Economy

In both counties, the economy (i.e., local work force) is driven by educational services, health care, transportation, and retail trade industries. Other industries with significant work forces vary considerably from county to county. Table 2.2-1 shows the top four industries in each county, with the number of individuals employed by each.

Table 2.2-1 Top Industries by County, 2015-2019 American Community Survey 5-Year Estimates (US Census Bureau, 2019)				
County (# of total employed)	**Industry 1 (# of employees)**	**Industry 2 (# of employees)**	**Industry 3 (# of employees)**	**Industry 4 (# of employees)**
Berkeley (59,463)	Educational services, health care, and social assistance (14,018)	Retail trade (8,034)	Manufacturing (6,859)	Transportation and Warehousing, and utilities (5,931)
Morgan (7,914)	Educational services, health care, and social assistance (1,881)	Retail trade (1,045)	Arts, Entertainment, and recreation, and accommodation and food services (864)	Construction (811)

Both Berkeley and Morgan County have available space for development, primarily commercial/business, but also some space for industrial development. Both counties employ Economic Development Authorities (EDAs) that work to bring development and jobs to the counties. The top employers, by jurisdiction, are as follows.

Berkeley County (Berkeley County Development Authority, 2020):

- Berkeley County Board of Education
- Macy's Corporate Services, Inc.
- United States Department of Veteran Affairs
- WVU Medicine
- Proctor & Gamble Manufacturing Company

Morgan County (Berkeley Springs – Morgan County Chamber of Commerce):

- Morgan County Board of Education
- Valley Health Systems, Inc.
- Caperton Furniture Works, LLC.
- Berkeley Springs Center, LLC.
- West Virginia Division of Natural Resources
- U.S. Silica Company

Utilities

Utilities are provided by many different companies. Major utility provider breakdowns are as follows:

- Berkeley County
  - **Electricity:** Potomac Edison
  - **Natural Gas:** Mountaineer Gas

  - **Water:** Berkeley County Public Service Water District, City of Martinsburg, Valley Water and Sewer
  - **Sewer:** City of Martinsburg, Berkeley County Public Service Sewer District
  - **Telephone:** Frontier Communications
  - **Wireless carriers** are AT&T, US Cellular, Verizon, and some Sprint. There are some areas where service is virtually non-existent.

- Morgan County
  - **Electricity:** Potomac Edison
  - **Water:** Paw Paw Water Works, Berkeley Springs Water Works
  - **Sewer:** Warm Springs Public Service District
  - **Telephone:** Frontier Communications
  - **Wireless carriers:** AT&T, US Cellular, and some Verizon & Sprint. There are some areas where service is virtually non-existent.

Schools

There is a much larger number of schools in Berkeley County than Morgan County due to its greater population. Schools in Berkeley County are concentrated around Martinsburg and major transportation routes, especially US Route 81 and WV Route 9. Morgan County schools are concentrated around Bath, Paw Paw, US Route 522, and WV Route 9. School locations can be seen in Figure 2.2-1.

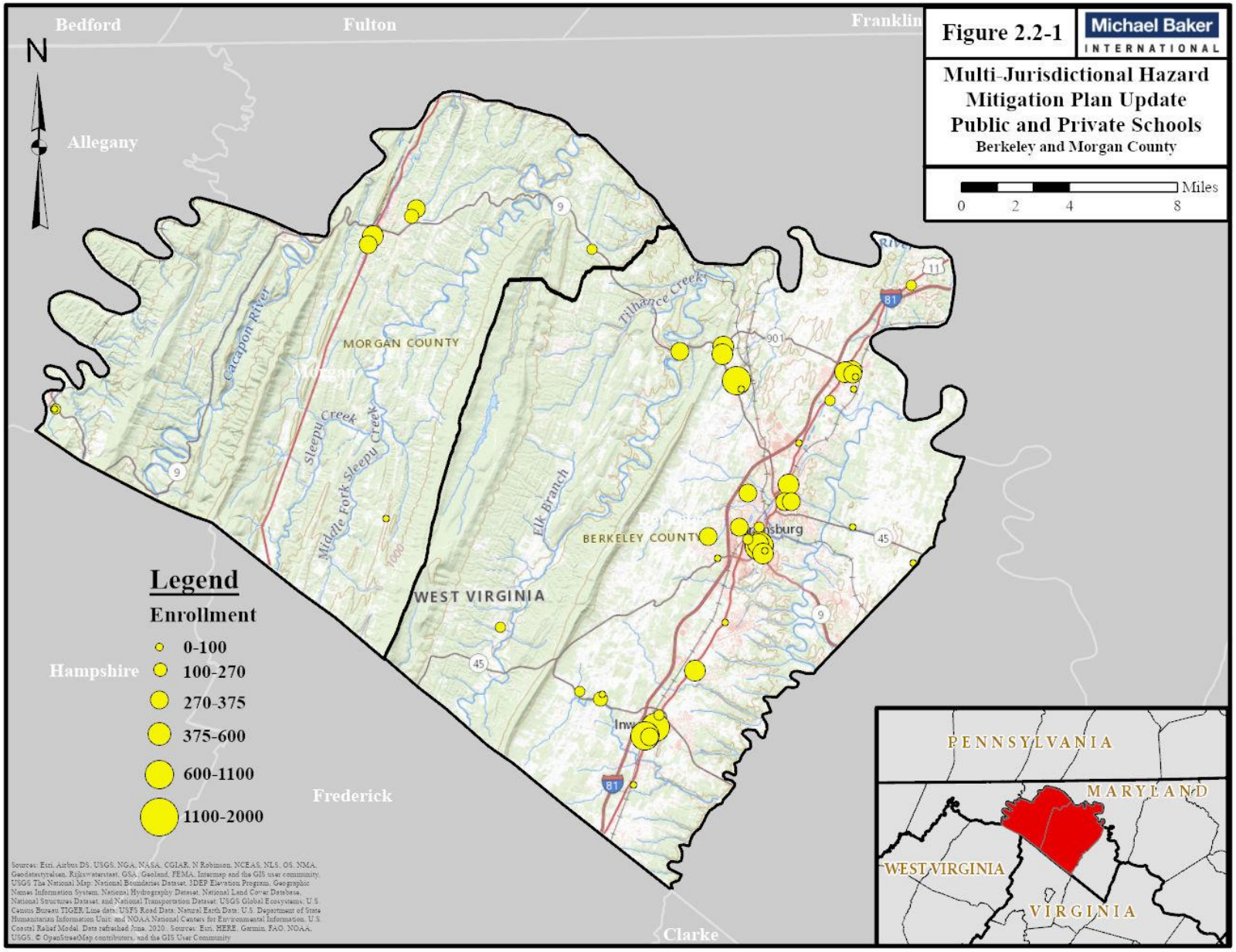


Figure 2.2-1
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Public and Private Schools
Berkeley and Morgan County
Miles
0 2 4 8
N
Bedford
Fulton
Franklin
Allegany
Hampshire
Frederick
Clarke
MORGAN COUNTY
BERKELEY COUNTY
WEST VIRGINIA
Cacapon River
Sleepy Creek
Middle Fork Sleepy Creek
Elk Branch
Tilhance Creeks
Legend
Enrollment
0-100
100-270
270-375
375-600
600-1100
1100-2000
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA

2.3. Population and Demographics

Table 2.3-1 shows current population estimates for Berkeley and Morgan County. The total population of both counties is estimated to be 137,015. Berkeley County's population is currently growing and is much younger than the population in Morgan County. According to the American Community Survey 5-year estimates (2015-2019), the median age in Berkeley County is 38.8 and in Morgan County it is 47.9. Additionally, the elderly population is growing quickly in each county. The percentage of Berkeley County's population that is age 65 and older has increased from 13.6 percent of the population in 2015 to 15.0 percent in 2019. In Morgan County, the population has increased from 21.8 percent in 2015 to 23.8 percent in 2019. With more than 20 percent of Morgan County residents being 65 years or older, the impact of hazards on elderly populations must be carefully considered. The age of the population may also impact which outreach methods work best for hazard mitigation awareness or education actions. Actions involving the internet or cell phones may exclude many seniors. Furthermore, this aging trend is contributing to a slow stagnation in the population growth of Morgan County (U.S. Census Bureau, 2019).

Table 2.3-1 Berkeley and Morgan County Population Estimates (U.S. Census Bureau, 2020 and U.S Census Bureau, 2019)

Population (2020 Decennial Census)	Berkeley County	Morgan County
Population Estimates, 2020	122,076	17,063
Population Percent Change - 2010 to 2020	17.19%	-2.72%
Age (ACS 2019 5-Year Estimates)		
Persons under 5 years	6.1%	4.1%
Persons under 18 years	23.0%	17.7%
Persons 65 years and over	15.0%	23.8%

Table 2.3-2 shows the municipalities located within each county and their corresponding population and population growth. The Martinsburg area and I-81 corridor are some of the fastest growing areas in the region. Morgan County population is also seeing some growth within the municipalities.

Table 2.3-2 Municipality Population Estimates (U.S. Census Bureau, 2020)

Municipality	2020 Decennial Census	2015 Population Estimate	Population Change
Berkeley County			
Martinsburg	18,777	17,564	6.91%
Hedgesville	300	283	6.00%
Morgan County			
Bath	753	580	29.83%
Paw Paw	410	504	-18.65%

The median income of households (according to 2015-2019 estimates) in Berkeley County is $62,515 and $51,715 in Morgan County. County statistics report that 10.7 percent of the Berkeley County population and 10.5 percent of the Morgan County population live in poverty. According to 2019 estimates, approximately 58,545 total housing units are estimated in both counties, with 48,578 in Berkeley County and 9,967 in Morgan County. The median monthly housing costs for mortgaged homeowners is $1,323 in Berkeley County and $1,168 in Morgan County. The median rent is $995 per month in Berkeley County and $732 in Morgan County. Ethnic origins of each county can be seen in Table 2.3-3.

Table 2.3-3 Race and Ethnic Origin in each county as a percentage of the population, 2020 (U.S. Census Bureau, 2020)

Race and Ethnic Origin (2020 Decennial Census)	Morgan County	Berkeley County
White Alone	93.7%	88.4%
Black or African American Alone	<1%	7.5%
American Indian and Alaska Native Alone	<1%	0.1%
Asian Alone	<1%	1.2%
Native Hawaiian and Other Pacific Islander Alone	<1%	<1%
Two or More Races	4.5%	5.9%
Hispanic or Latino	<1%	5.6%

2.4. Land Use and Development

Most of Berkeley and Morgan County fall under the deciduous forest land use category, followed by hay and pasture. There are also significant amounts of open water, cultivated crop, and evergreen forest scattered across both counties. Developed land uses are found concentrated in areas of higher population density and near major travel routes. This can be seen in Figure 2.4-1.

The region as a whole continues to see significant development as a part of the National Capital Region (NCR); however, population growth and influx of industry is more apparent in Berkeley County. As such, the potential for development is likely to continue. The proximity of the Interstate 81 (I-81) and US-522 corridors help to drive this development of the region. Topography often drives development to flatter areas which are often in or near floodplains in mountainous areas. Much of the population in Berkeley County is centered in Martinsburg, along I-81. Based on the 2016 Berkeley County Comprehensive Plan, future growth is expected to remain concentrated in these urban areas around the City of Martinsburg and the Town of Hedgesville. Based on the 2017 Morgan County Comprehensive Plan, the bulk of Morgan County's population growth has always and continues to be in the Central Valley Region. According to the Plan, the growth rate is shifting slightly towards the southern districts of Timber Ridge and Rock Gap.

With growing population and development comes a myriad of concerns for vulnerability to natural and man-made hazards. Some of the specific concerns cited by stakeholders include increase in

drought vulnerability by spreading the source water thinner throughout more people, as well as an increase in invasive species by intermodal travel. Stakeholders were particularly concerned with the ongoing COVID-19 pandemic, and significant gaps in the community, state, and federal response in protecting the population.

Increase in flooding may be the most cited cause of concern during development. Local floodplain development regulations carefully balance the needs for economic development and growth in the employment sector with a basic responsibility to buffer potential and existing businesses from the effects of hazards. Both counties indicated that the majority of the commercial and industrial development in their county is located in or near the municipalities. Several development sites have been established along the primary roadways throughout the region. For example, since the adoption of the 2017 HMP, Berkeley County has seen most of the industry development. The Clorox Co. constructed a 580,000-suqare-foot warehouse space within the Mid-Atlantic 81 Logistics Park in Martinsburg, and P&G also constructed a new warehouse and operating center. Their facility contains a 796,320-suare-foot warehouse and distribution facility, along with a 30,000-square-foot Resource Center and Administration Building and Gatehouse and Trucker's Lounge. Large warehouses and their associated impervious surfaces lend to increasing flood vulnerability, due to decrease permeable surfaces. In 2018, there was significant run-off issues from the P&G facility that caused flooding in a nearby subdivision. The 2016 Berkeley County Growth Management Map can be seen in Figure 2.4-2.

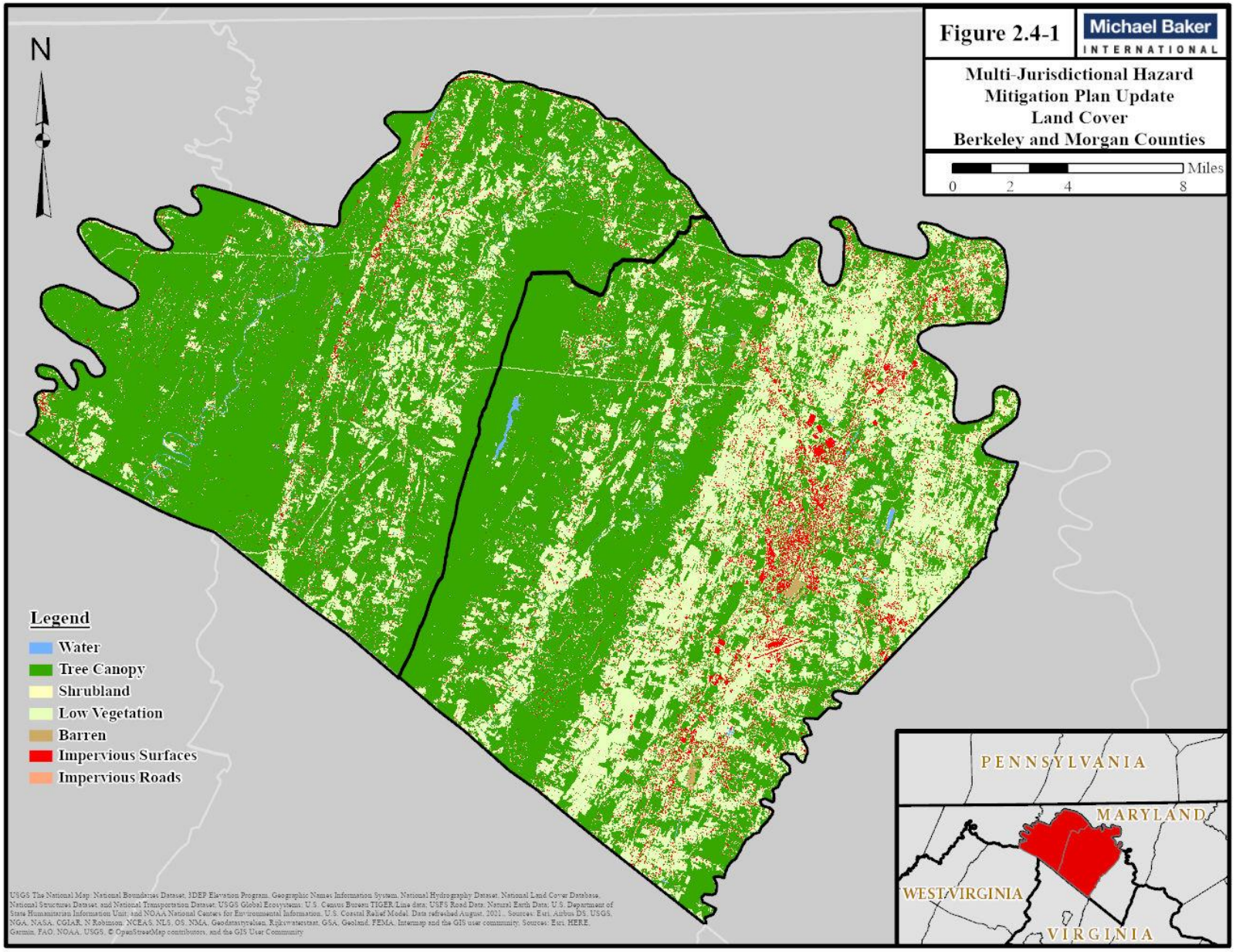
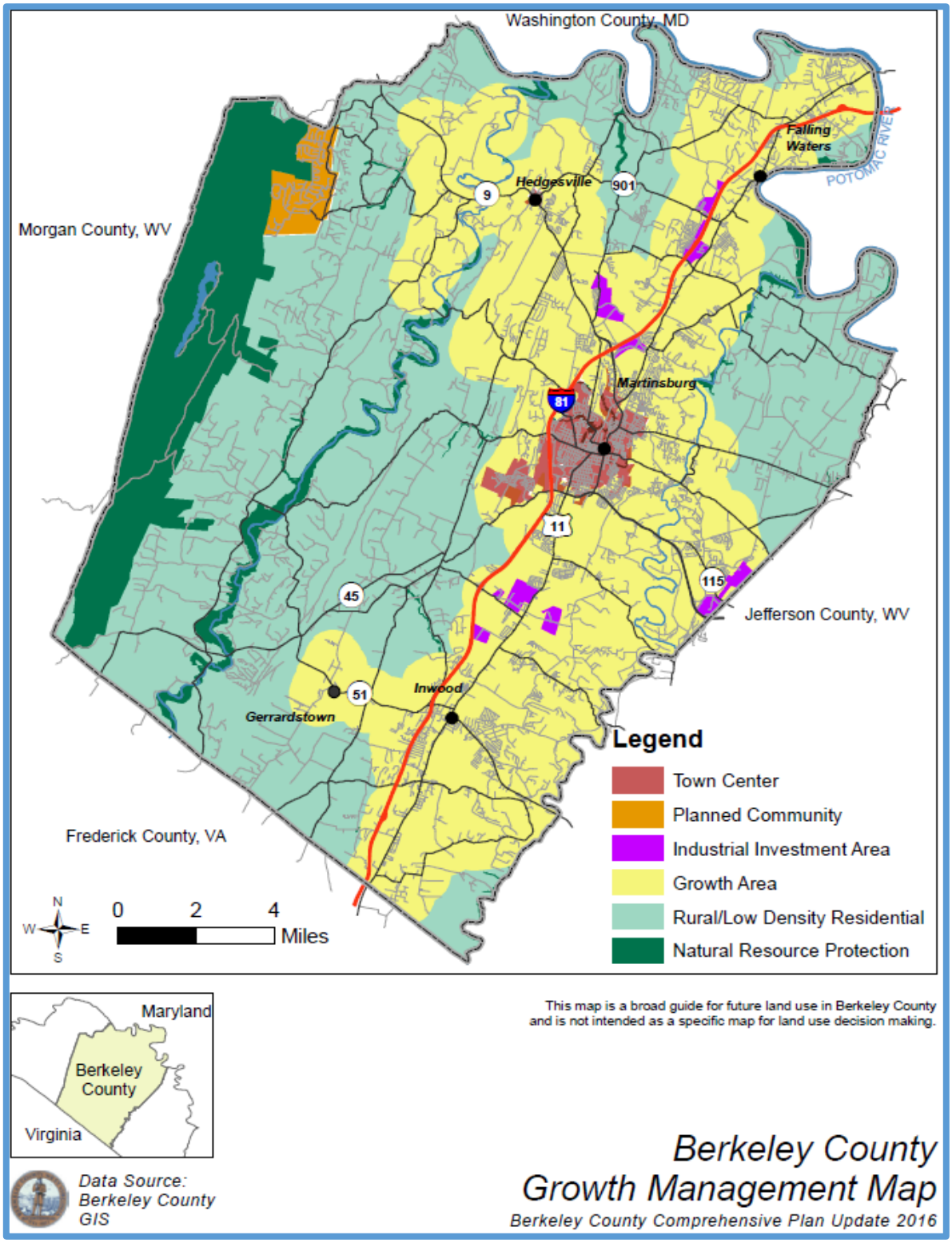


Figure 2.4-1
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Land Cover
Berkeley and Morgan Counties
Miles
0 2 4 8
N
Legend
Water
Tree Canopy
Shrubland
Low Vegetation
Barren
Impervious Surfaces
Impervious Roads
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA

Figure 2.4-2: Berkeley County Growth Management Map (Berkeley County, 2016)



2.5. Data Sources and Limitations

Geographic Information System (GIS) data used in the mapping and analysis of hazards throughout the HMP were provided by a few different sources. Data including West Virginia watersheds, land use, school locations, dam locations, karst features and climate data were retrieved from the online West Virginia State GIS Data Clearinghouse which is maintained by the West Virginia GIS Technical Center (WV GISTC) at West Virginia University (WVU). The WV GISTC also provided Hazus data, including critical facilities, which were used for analysis throughout the HMP. Morgan County transportation features and flood zone areas were obtained from the Morgan County Commission mapping coordinator. The Berkeley County Assessor's Office provided Berkeley County transportation features, streams and waterbodies, and flood zone areas.

Additional information used to complete the risk assessment for this plan was taken from various government agency and non-government agency sources. Those sources are cited where appropriate throughout the plan with full references listed in **Appendix A – Bibliography**. Online local news sources were also used extensively to identify the previous occurrence of a hazard, detail the hazard's extent and impact, and provide photographs. News media is important in hazard mitigation planning as both a source of data and to facilitate public interest and involvement. The news sources cited can be found in Appendix A as well.

In order to assess the vulnerability of different jurisdictions to the hazards, data on past occurrences of damaging hazard events was gathered. For a number of historic natural-hazard events, the National Climatic Data Center (NCDC) database was utilized. NCDC is a division of the US Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Information on hazard events is compiled by NCDC from data gathered by the National Weather Service (NWS), another division of NOAA. NCDC then presents it on their website in various formats. The data used for this plan came from the US Storm Events database, which "documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce" (NOAA, 2006). Due to changes in the data collection procedures over time, there may be more events available for certain kinds of natural hazards; incidences listed in this plan reflect data housed in the NCDC Storm Events Database as of June 2021.

This HMP evaluates the vulnerability of the area's critical facilities. For the purposes of this plan, critical facilities are those entities that are essential to the health and welfare of the community. This includes, police departments, fire stations, emergency medical services (EMS), schools, and hospitals and medical centers. Types of critical facilities varies between Berkeley and Morgan County, as each county defined and supplied data for critical facilities separately. For a full list of critical facilities, please see **Appendix E – Critical Facilities.**

3. Planning Process

3.1. Update Process and Participation Summary

A successful planning process builds partnerships and brings together members representing government agencies, the public, and other stakeholders to reach consensus on how the community will prepare for and respond to hazards that are most likely to occur. Applying a comprehensive and transparent process adds validity to the Plan. Those involved gain a better understanding of the problem or issue and how solutions and actions were devised. The result is an updated set of common community values and widespread support for directing financial, technical, and human resources to an agreed-upon action. The planning process has been an integral part of updating the Berkeley and Morgan County Multi-Jurisdictional HMP. This section describes Berkeley and Morgan County's update process and how the HMP evolved since it was first approved by the Federal Emergency Management Agency (FEMA).

At the beginning of the 2022 HMP update, Hazard Mitigation Steering Committees (HMSC) were formed for each county, consisting of county planning staff, local emergency management officials, and municipal representatives. Region 9 staff and Michael Baker International were also present at steering committee meetings. Stakeholders including news media, staff from local utilities, educators, healthcare professionals, regional employers, neighboring communities, and the public were also invited to participate in HMP draft review process as part the Planning Team. All four municipalities in Berkeley and Morgan County were considered in the vulnerability assessment and the development of the Mitigation Strategy to address these vulnerabilities. Details on the members of the HMSC and Planning Team are included in Section 3.2 – The Planning Team.

To begin this process, each county hosted an Internal County Kick-Off on May 4, 2021. During this meeting, attendees reviewed the Hazard Mitigation Planning process, as well as changes to the planning process promoted by FEMA's release of updated planning guidance. Additionally, the attendees discussed the scheduling of HMSC and public meetings and HMSC participation for the 2022 update process. Details on this and other meetings are included in Section 3.3 – Meetings and Documentation.

In addition to stakeholders from Berkeley County, Morgan County, and local municipalities, the HMSC identified additional stakeholders to be included in the HMP planning process. Detailed information about stakeholder participation is included in Section 3.4 – Public & Stakeholder Participation. The municipal involvement in developing the 2022 HMP Update is detailed in Section 3.5 – Multi-Jurisdictional Planning. All four municipalities in Berkeley and Morgan County met the participation requirements in the 2022 update process.

The HMSC used several worksheets to gather information from each municipality and participant in the planning process. These worksheets were designed to collect information about the hazards that

affect the entire region, and how those hazards impacted each of the municipalities, as well as information about the Mitigation Strategy, including a review of the 2017 goals, objectives, and actions to determine their efficacy and identify edits or additional information to include in the 2022 update. The use of these forms is detailed in Section 3.3 – Meetings and Documentation and the submitted forms are included in Appendix C – Meeting and Other Participation Documentation.

In accordance with the Disaster Mitigation Act (DMA) of 2000, the HMP Update documents the following topics:

- Planning Process;
- Hazard Identification;
- Risk Assessment;
- Mitigation Strategy: Goals, Objectives, and Actions;
- Formal Adoption by the Participating Jurisdictions; and
- WVEMD and FEMA approval.

The report format is structured in accordance with the most current planning guidance from FEMA, Local Mitigation Handbook (2013), and PEMA, Standard Operating Guide (SOG) (August 2020). PEMA guidance was consulted because there is no SOG for WV. The Plan Update was led by the Hazard Mitigation Plan Steering Committee (HMPSC) and informed by the Hazard Mitigation Planning Team (HMPT). Community leaders and other agency and organizational stakeholders were invited by Region 9 to participate in the Plan Update process.

3.2. The Planning Team

The Planning Team assembled for the 2022 HMP included both county's HMSC members. These HMSCs was assembled to guide the overall direction of the HMP Update and make decisions pertaining to its completion in conjunction with Region 9 and the Michael Baker consultant team. Table 3.2-1 details the members of the 2022 Planning Team.

Table 3.2-1 2022 MJHMP Invited Steering Committee		
Name	**Organization**	**Title**
Berkeley County Hazard Mitigation Steering Committee		
James Barnhart	Berkeley County Council	Council Member
Brian Ross*	Berkeley County Council	Engineering Director
Doug Copenhaver	Berkeley County Council	Council Member
Jim Whitacre	Berkeley County Council	Council Member
Mark Schiavone	Berkeley County Council	Executive Director
Zach Walburn*	Berkeley County Council	MS4 Administrator
Randy Lilly*	Berkeley County Office of Homeland Security and Emergency Management	OES Director
Eddie Gochenour*	Berkeley County Office of Homeland Security and Emergency Management	Director
Alan Davis*	Berkeley County Administrator	County Administrator
Nathan Harmon*	Berkeley County	Sheriff
Bill Kearns	Berkeley County Health Department	Executive Director
Heather Williams*	Berkeley County Planning Department	Planning Director
Greg Rhoe	Berkeley County Public Service Water District	Chairman
Steve DeRidder*	Berkeley County Public Service Water District	Superintendent of Operations
Curtis Keller	Berkeley County Public Service Sewer District	General Manager
Jim Ouellet	Berkeley County Public Service Sewer District	Executive Director
Carey Gano	The Town of Hedgesville	Mayor
Ronnie Good*	The Town of Hedgesville	Treasurer
Harriet Johnson	The City of Martinsburg	Mayor
Andy Blake*	The City of Martinsburg	Assistant City Manager
Mark Baldwin	The City of Martinsburg	City Manager
Jim Kelly*	The City of Martinsburg	Public Works Director
Jeff Wilkerson*	The City of Martinsburg	Utility Director
Jared Tomlin*	The City of Martinsburg	Stormwater Coordinator
Kim Petrucci*	The City of Martinsburg	City Engineer
George Swartwood*	The City of Martinsburg Police Department	Police Chief
Erin Gibbons*	The City of Martinsburg Police Department	Deputy Chief
J.D. Hummingbird*	Martinsburg Fire Department	Fire Chief

W. Brian Costello	Berkeley County Ambulance Authority	EMS Director
Chad Winebrenner	Berkeley County Ambulance Authority	EMS Cheif
Jennifer Swisher*	Berkeley County E-911	Central Dispatch
Maneesh Sharma*	WV GIS Tech Center	GIS Project Lead
Kurt Donaldson*	WV GIS Tech Center	Senior Project Manager
Rachel Snavely*	Region 9	Director
David Deamer*	Region 9	Implementation Coordinator
Troy Truax*	Michael Baker International	Technical Consultant
Angela Welt*	Michael Baker International	Technical Consultant
Kelly Asselin*	Michael Baker International	Technical Consultant
Morgan County Hazard Mitigation Steering Committee		
Bill Clark*	Morgan County Commission	Commissioner
Joel Tuttle*	Morgan County Commission	Commissioner
Dick Myers*	Morgan County Office of Homeland Security and Emergency Management	Director
Anna Padilla*	Morgan County Grant Administrator	Commission Secretary/Grants Administrator
Lyn Goodwin*	Morgan County Economic Development Authority	Director
Alex Moore*	Morgan County Planning Commission	GIS/Planning Director
Stefanie Allemong*	Morgan County Administrator	County Administrator
Audrey Morris	Morgan County Starting Points	Director
Ron Davis*	The Town of Paw Paw	Town Administrator
Robert Palmer*	The Town of Paw Paw	Mayor
Scott Merki	Town of Bath	Mayor
Ron Jaininney	Town of Bath	Council
Jennifer Schetrompf*	Berkeley-Morgan County Board of Health	Threat Preparedness/Health Promotion Coordinator
Rachel Snavely*	Region 9	Director
David Deamer*	Region 9	Implementation Coordinator
Troy Truax*	Michael Baker International	Technical Consultant
Angela Welt*	Michael Baker International	Technical Consultant
Kelly Asselin*	Michael Baker International	Technical Consultant

***Denotes Member attended at least one meeting**

The primary roles of the HMSC included providing risk assessment, determining capability updates, and providing technical expertise and mitigation action development. In order to represent the diverse stakeholders in each county, stakeholders were also invited to meetings during the planning process. The stakeholders listed in Table 3.2-2 were sent invitations to participate in the planning process through attendance at meetings, completion of assessment surveys, or submission of comments. All invited stakeholders and other participation documentation including meeting sign-in sheets are provided in **Appendix C – Meeting and Other Participation Documentation.**

Table 3.2-2 2022 MJHMP Invited Stakeholders		
Name	**Organization**	**Title**
James Squires	Allegany County, MD	Planning Commission Chief
Lesley Hower	Argos	HR Coordinator
Elaine Bobo*	Berkeley County Board of Education	Director of Communications
Matthew Umstead	Berkeley County Council	Director, Office of Strategic Planning and Communications
Tim Czaja*	Berkeley County Council	Community Corrections Director
Monique Boots*	Berkeley County Council	Planner
Jim Golden	Berkeley County Council	County Engineer
Laura Hoffmaster	Berkeley County Council	Planner
Shawn Wolford*	Berkeley County	Planner
Breanna Sims	Berkeley County OEM	Administrative Assistant
Sandy Hamilton*	Berkeley County Development Authority	Program Manager
Allen Corbin	Berkeley County Parks and Rec	Director
Tom Young	Berkeley County Sherriff's Office	Sheriff
Susan Starliper*	Berkeley County Schools	Coordinator
Cindy Strovel	Berkeley County Senior Center	Executive Assistant
Lori Hansroth	Berkeley Springs – Morgan County Chamber of Commerce	Executive Director
Milo D. Zahnow, III	Berkeley Springs Volunteer Fire Company	Assistant Chief
Cynthia Hull	Blue Ridge CTC	Associate Dean of Career Advancement Education
Frank Rodgers*	Cacapon Institute	Executive Director
Jennifer Jones	Cacapon & Lost Rivers Land Trust	Board Member
Jeff Blount*	Cacapon Institute, Warm Springs Watershed, Sleepy Creek Watershed	CommuniTree Coordinator
Brandon Stidham	Clarke County, VA	Director of Planning
Margaret Butts	Clorox	Senior Business Support Manager
Paul Comes	Comcast	Director Govt & Comm Affairs
Joe Taylor	CSX	Senior Manager of Hazardous Materials
Jeremy Slayer	Eastern Panhandle Conservation District	Director

Elaine Bartoldson*	Eastern Panhandle Transit Authority	Director
Nicholas Diehl	Eastern WV Regional Airport	Executive Director
Randall Rude	EcoLab	Plant Manager
Matt McCullough*	FEMA Region 3	Hazard Mitigation Planner
Casey Garnett*	FEMA Region 3	Hazard Mitigation Planner
Candace Perkins	Frederick County, VA	Assistant Planning Director
Rich Fowler*	Frontier Communications	Director
Cindy Littleton*	Frontier Communications	Account Executive
Michael Ketterman	Hampshire County, WV	Planner/Floodplain Manager
Donna VanMetre	James Rumsey Technical Institute	Director
Jennifer M. Brockman	Jefferson County, WV	County Planner
Allan Schreiner*	Knauff Insulation	Director
Susan Huber	Macy's	Director of Business Intelligence and Business Solutions
Tina Combs	Martinsburg-Berkeley County Chamber of Commerce	President & CEO
Dana Keith*	Martinsburg City Planning Commission	City Planner
Kristen Tuttle	Morgan County Board of Education	Superintendent
William Grow	Morgan County Homeless Coalition	President
Jeremy Dueller*	Morgan County Schools	Director
Rob Brown	Orgill	Vice President
Lucas Cade	Potomac Edison	Senior Advisor
Steve O'Brien	Proctor and Gamble	HR DIrector
Todd Marino	QuadGrahics	Plant Director
Jesse Hott*	Red Cross	Disaster Program Manager
Sherye Cullen	Rust-Oleum	Manager
Tammy Kees	Senior Life Services of Morgan County	Executive Director
Jim Klien	Shepherd-Martinsburg Center	Director
Charles Marsh*	Sleepy Creek Watershed Association	President
Shane Farthing	The City of Martinsburg	Director, Economic & Community Development
Breanna Francis	The Journal	Reporter
Earl Myers*	The Town of Paw Paw	Town Administrator

Jennifer Cotting*	University of Maryland Environmental Finance Center	Assistant Director
Chris Barrett	US Silica	Supervisor
Levy Rogers*	Valley Health	Program Manager, Safety & Emergency Managment
Katie Lehman	Warm Springs Run Watershed	President
Douglas Long	Winchester & Western	General Manager
Monica Whyte*	WV BPH	Environmental Resource Specialist III
Kristen Bisom*	WV Conservation Agency	Conservation Specialist
Alana Hartman	WV DEP	Coordinator
Jim Linsenmeyer	WV DOH	Regional Manager
Tim Keaton*	WVEMD	Planner
Lonnie Faircloth*	WV State Police	Sergeant
Ken Clohan	WV DOH	Traffic Engineer
Jennifer Blood*	167 Airlift Wing	Emergency Manger
Adam Carder*	167 Airlift Wing	Sergeant
Jim Van Metre*	Stonebridge Lake Dam	Dam Owner
Brandon Keplinger	Sleepy Creek Dam	Dam Owner
Robert Dugan*	Warm Springs No. 5	Dam Owner
Remie Goodman	Warm Springs No. 7	Dam Owner
R. Stotler	Warm Springs No. 1	Dam Owner

***Denotes Member attended at least one meeting**

Attempts were made to contact all dam owners in the region; however, county contact lists were incomplete. Dam owners who could be reached were invited to the August 24, 2021 Draft Plan Review Meeting.

3.3. Meetings and Documentation

The following meetings were held during the plan update process. Invitations, agendas, sign-in sheets, and minutes for these meetings are included in **Appendix C.**

Hazard Mitigation Steering Committee Kick-Off Meeting – May 4, 2021: Held in person and virtually, to introduce the project to local municipalities, inform community representatives of the HMP process and schedule, and evaluate hazards and risk within each county. Invitations were sent to each municipality and the other county departments and stakeholders listed in Table 3.2.1. Meeting attendees were asked to fill out the hazard identification and risk assessment worksheets in order to inform the communities' vulnerabilities in the plan. A photograph of the Morgan County meeting can be seen in Figure 3.3-1.

Figure 3.3-1: Morgan County Hazard Mitigation Plan Kick-Off Meeting

Eastern Panhandle Watershed Group Gathering – June 8, 2021: The Eastern Panhandle Conservation District hosted the Eastern Panhandle Watershed Group Gathering virtually. The event lasted approximately 4 hours and included a variety of presentations related to water quality. 15 groups presented brief updates during the Watershed Highlights session, which allowed watershed associations and other local organizations to update their peers on their activities, accomplishments, and challenges during the past year. Invited speakers gave more formal presentations on outreach tools, wetlands, natural systems protections, changes to conservation law in West Virginia, and the development of the Multi-Jurisdictional Hazard Mitigation Plan. Participants were encouraged to get involved in the plan, and multiple resources from all presenters were shared with the group. There were 44 participants total, and the event was recorded and shared so that others could view the gathering. A photograph of the presentation title slide can be seen in Figure 3.3-2, and the meeting materials can be viewed in **Appendix C.**

Figure 3.3-2: Eastern Panhandle Watershed Group Gathering Presentation

Risk Assessment and Mitigation Solutions Workshop (RAMS) – July 15, 2021: Held in-person and virtually to discuss Berkeley and Morgan County's hazard vulnerability and new hazards to be profiled in the 2022 HMP. Participants discussed progress of mitigation actions from the 2017 Plan Update and identified additional mitigation actions that would help reduce or eliminate potential losses. This meeting included discussion between municipalities and state agencies about possible paths forward for delayed mitigation actions. The public notice published on the Region 9 website can be seen in Figure 3.3-3. A photograph of the Berkeley County workshop can be seen in Figure 3.3-4.

Figure 3.3-3: Morgan County Risk Assessment and Mitigation Solutions Workshop

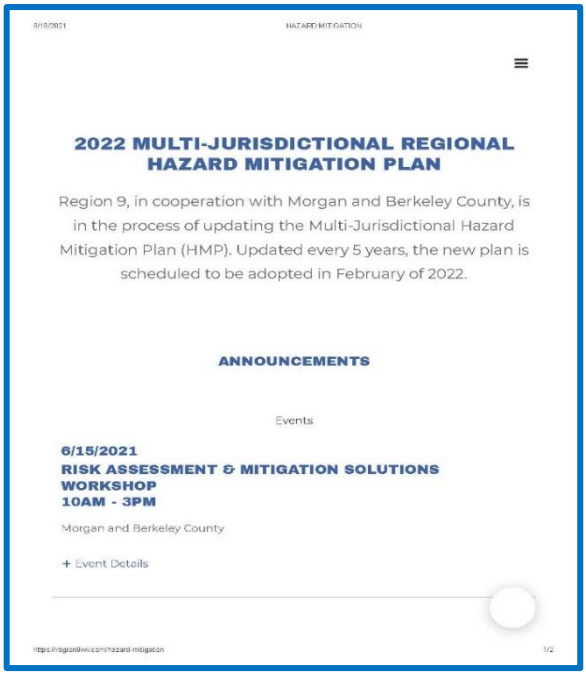
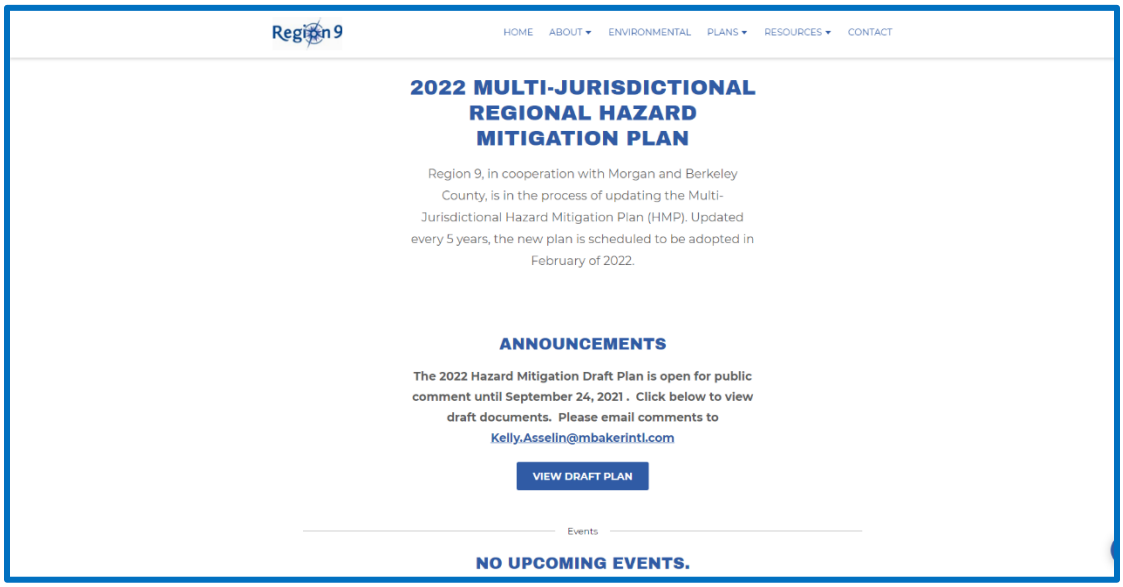


Figure 3.3-4: Berkeley County Risk Assessment and Mitigation Solutions Workshop

Town of Bath and Region 9 Phone Call – June 16, 2021: The Town of Bath in Morgan County was unable to participate in the previous two meetings regarding the 2022 HMP. In order to solicit participation from The Town of Bath, introduce them to the HMP update process, and garner their input on hazard risk and mitigation, a representative from Region 9 spoke on the phone with Town of Bath Mayor Scott Merki on June 16, 2021. During the meeting, Region 9 introduced the Mayor to the 5-year HMP process and guided him through the Kick-Off and RAMS meeting presentations. Region 9 then discussed and provided copies of the worksheets distributed thus far. Region 9 gave the Mayor action items to complete, including completing and returning the worksheets.

Public Meeting – August 24, 2021: The purpose of this final HMPT meeting was to provide information about the update process, evaluation, and general findings in the Berkeley Morgan County HMP. After noting comments received, the HMSC reminded participants about how to review and submit comments on the Draft HMP, as well as a final timeline for the review and submission of the HMP to WVEMD and FEMA. The WV GIS Technical Center also provided a short presentation on the WV Flood Tool and Flood Hazus results for Berkeley and Morgan County.

Figure 3.3-5: Project website for the Berkeley Morgan 2022 HMP



3.4. Public & Stakeholder Participation

Each municipality was given multiple opportunities to participate in the plan update process through invitation to above outlined meetings, review of risk assessment results and mitigation actions, and an opportunity to comment on a final draft of the 2022 Hazard Mitigation Plan Update. The tools listed below were distributed with meeting invitations, at meetings, and on the plan update website to solicit information, data, and comments from both local municipalities and other key stakeholders in Berkeley and Morgan County. Responses to these worksheets and surveys are included in **Appendix C: Meeting and Other Participation Documentation.**

1. **Evaluation of Identified Hazards and Risk Worksheet:** Collects information from the HMPT regarding whether there have been changes to the frequency of occurrence, magnitude of impact, or geographic extent of hazards identified in the 2017 plan. In addition, the form asks members of the HMPT to select any additional hazards they believe should be considered for inclusion in the 2022 Plan.

2. **New Mitigation Action Worksheet**: This form was provided to communities that wanted to

include a new action in the HMP. The purpose was to collect details about the action, including priority, responsible parties, potential partners, potential funding sources, implementation timeframe, and more.

3. **Mitigation Action Progress Report Form:** This form was specific to each jurisdiction and included all actions for that jurisdiction in the 2017 HMP with space to provide the current status of each action and document any progress made.

4. **Capability Assessment Survey:** Collects information on local planning, regulatory, administrative, technical, fiscal, political, and resiliency capabilities that can be included in the plan's Capability Assessment section.

5. **National Flood Insurance Policy (NFIP) Survey:** Collects information on each municipality's floodplain management and ordinance enforcement related to NFIP standards and requirements.

6. **2022 Comment Survey:** In order to garner additional public participation, the HMPSC developed a survey open to the public regarding the HMP. Participants answered questions involving hazards in their community, and how prepared they felt to handle them. The intent was to use any guidance shared to inform the overall 2022 planning process and HMP update. The 2022 survey link was also posted on the project website and made publicly available.

Community participation and comment were encouraged throughout the planning process. During the Morgan County Kick-off meeting, there was an active discussion amongst participants regarding planning ideas and stakeholder engagement. Participants discussed how current programs could be improved, as well as the shortcomings of communication during the COVID-19 pandemic, and in rural areas with limited internet. The Berkeley County Kick-off meeting also included discussions related to project ideas, capability assessment, and mitigation strategies. Participants discussed potential stakeholders, as well as municipal capability.

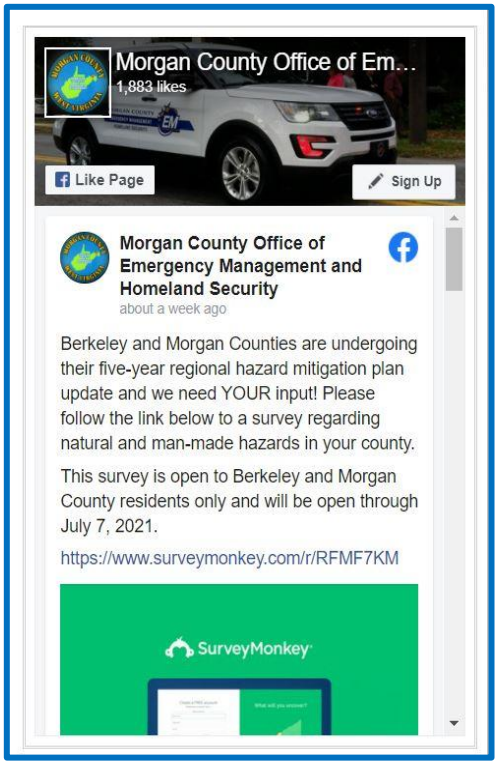
During the Morgan County RAMS meeting, participants discussed the proposed 2022 hazard rankings. The county mentioned their great progress in flood mitigation and utility interruption through the cutting of trees near power lines since the last HMP. At the Berkeley County RAMS meeting, the participants also engaged in an active discussion regarding proposed hazard rankings. Conversations were held regarding the Opioid Addiction hazard name change to Substance Use Disorder, and how the police monitor civil disturbance events.

At the Draft Plan Review Meeting, participants discussed remaining ideas for new mitigation actions, particularly regarding transportation accidents and substance use disorder hazards. The WV GIS Technical Center also provided an overview of the WV Flood Tool and Flood Hazus and asked for municipal assistance on verifying information in the Tool.

Public input was also solicited through an online hazard mitigation survey composed by Region 9 and

disseminated on the Region 9, Berkeley County, and Morgan County websites. The survey collected demographic data of respondents, had respondents assess hazard risks, asked for mitigation action ideas, and gauged respondents' participation in public hazard mitigation efforts. About 890 residents participated, a large increase from the 140 participants in the 2017 survey. Participants were most concerned about winter storms, cyber terrorism, opioid addiction (changed to substance use disorder after the survey was published), thunderstorms, transportation accidents, and utility interruption. Overall, residents agreed that cellphone alerts are the most effective way for the community to alert and advise them during a hazard event, however a considerable amount also suggested email. Participants were most concerned with not having electrical power for an extended period, not having access to clean water during a hazard event not having police or fire protection, and not being able to get warning messages or other information regarding the hazard. Many participants also highlighted lack of comprehensive planning during the COVID-19 pandemic. Others noted they would like to see more paid fire service positions. A posting made to Morgan County Office of Emergency Management and Homeland Security Facebook notifying residents of the survey can be seen in Figure 3.4-1. The survey results were shared with each municipality, who were encouraged to incorporate its findings into New Mitigation Actions. Survey results will be available to be reviewed and discussed by each jurisdiction during annual HMP reviews and annual LEPC meetings. This discussion will be led by Region 9 with a strong focus on the recommended actions each community can take to reduce the impact of disasters to the community. Full Survey results can be found in Appendix C.

Figure 3.4-1: Hazard Mitigation Survey Link posted to Morgan County OEM Facebook.



Region 9 and their consultant participated in two radio shows discussing the HMP update. The radio shows provided an opportunity to answer the public's questions and involve them in the planning process. The radio shows covered topics such as what is an HMP, what the benefits of having an HMP in place are, and how the HMP update process works. A June 18, 2021 radio appearance on the show Eastern Panhandle Talk on WRNR Talk radio FM 106.5/AM 740 can be replayed at https://www.talkradiowrnr.com/local-talk-show-programs/2021/06/rob-dave-6-18-21-dr-kevin-mclaughlin-kenny-roberts-matt-pennington-troy-truax-mike-caryl-joe-ferretti-john-doyle/. A June 29, 2021 radio appearance on the show Panhandle Live on 93.7 & 1340 WEPM and 93.5 & 1010 WCST

can be replayed at https://anchor.fm/panhandle-news-network/episodes/Panhandle-Live--6-29-21-e13l9oh. A posting in the Panhandle Live Facebook page about the show can be seen in Figure 3.4-2.

Figure 3.4-2: Facebook posting of June 29, 2021 HMP radio show.

A newspaper notice was published in the Journal and the Morgan Messenger notifying the citizens of Berkeley and Morgan County of the public meetings held on August 24, 2021. Figure 3.4-3 and Figure 3.4-4 for a copy of the newspaper notices. Notices were also published notifying the public on how they can review the plan and comment on it. All invitations and notices are included in **Appendix C**.

Figure 3.4-3: The Journal posting of the Berkeley County Draft Review Meeting

NOTICE OF PUBLIC MEETING

BERKELEY COUNTY HAZARD MITIGATION PLAN UPDATE

The Berkeley County Hazard Mitigation Plan Update Committee will meet on August 24, 2021 from 1:30 - 3:30 PM at the Berkeley County Council Chambers located at 400 W. Stephen Street, 2nd Floor, Martinsburg, WV 25401. This meeting will include discussion of the draft plan and public survey. All citizens are invited to attend and participate. For further information, please contact Region 9 Planning & Development Council at 226 Pilot Way Ste. E., Martinsburg, WV 25405 or by phone at 304-263-1743.

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Figure 3.4-4: The Morgan Messenger posting of the Morgan County Draft Plan Review Meeting

NOTICE OF PUBLIC MEETING
MORGAN COUNTY HAZARD MITIGATION PLAN UPDATE

The Morgan County Hazard Mitigation Plan Update Committee will meet on August 24, 2021 from 9-11 a.m. at Blue Ridge Community and Technical College located at 109 War Memorial Drive, Berkeley Springs, WV 25411. This meeting will include discussion of the draft plan and public survey. All citizens are invited to attend and participate. For further information, please contact Region 9 Planning & Development Council at 226 Pilot Way Ste. E Martinsburg WV 25405 or by phone at 304-263-1743.

8-4-1tm

All HMSC members and stakeholders were issued invitations to the project website: https://region9wv.com/hazard-mitigation. This website included general resources pertaining to hazard mitigation planning, posts of upcoming events, and project announcements. In addition, meeting and workshop materials were posted including: the agenda, PowerPoint presentation, and worksheets.

The 2022 Draft HMP was posted on Region 9's website beginning August 24, 2021 and a public comment period was held for 30 days. The availability of the draft HMP was made public by disseminating the information to the Planning Team via email and on the project website. Planning team members were instructed to submit comments in writing via the project website or via email to Region 9 staff. No comments were received during the 30-day review period.

Due to the ongoing COVID-19 pandemic during the drafting of this Plan, meetings were held in a hybrid format to reduce in-person contact when necessary. A variety of outreach methods were utilized to ensure robust participation, as noted above; however, the ongoing pandemic may have reduced in person participation and virtual participation may not have been feasible to some stakeholders and members of the public.

3.5. Multi-Jurisdictional Planning

This HMP was developed using a multi-jurisdictional approach. Though county level departments have resources such as technical expertise and data which local jurisdictions may lack; involvement from local municipalities is critical to the collection of local knowledge related to hazard events. Local municipalities also have the legal authority to enforce compliance with land use planning and development issues. The HMSC and HMPT undertook an intensive effort to involve all four municipalities in the planning process.

Table 3.5-1 documents jurisdictional presence at the meetings described in Section 3.3 and other involvement from each jurisdiction throughout the planning process. Each municipality was emailed or mailed invitations to all meetings and, if email addresses were available, received email reminders prior to each meeting. Surveys and forms were provided at meetings and mailed and/or emailed to jurisdictions along with letters requesting that local information be provided. All four municipalities in Berkeley and Morgan County participated in the plan, thus achieving 100 percent participation.

Table 3.5-1 County and Municipal Participation in 2022 HMP Planning Process

Participation Summary		Berkeley County			Morgan County		
		Berkeley County	City of Martinsburg	Town of Hedgesville	Morgan County	Town of Bath	Town of Paw Paw
Meetings	**Steering Committee Kick-Off** May 4, 2021	✓	✓	-	✓	✓[1]	✓
	Risk Assessment/Mitigation Workshop June 15, 2021	✓	✓	✓	✓	✓[1]	✓
	Public Meeting August 24, 2021	✓	✓	-	✓	✓	✓
Worksheet	**Identified Hazards and Risk**	✓	✓	-	✓	-	✓
	Community Capability Assessment	✓	✓	-	✓	-	✓
	Checking in on the NFIP	✓	✓	N/A[2]	✓	✓	-
	Mitigation Action Review	✓	-	✓	✓	✓	✓
	New Mitigation Action	✓	✓	-	✓	✓	✓

1 The Town of Bath was unable to attend the May 4, 2021 or June 15, 2021 meetings, but Region 9 gathered the Town of Bath's feedback during a phone call with Mayor Merki on June 16, 2021. Region 9 walked Mayor Merki through both meeting presentations and all worksheets.

2 Municipality does not participate in NFIP

4. Risk Assessment

4.1. Update Process Summary

To reduce the potential for damage due to hazards, it is necessary to identify hazards that may affect the region. This risk assessment provides a factual basis for activities proposed by the counties in the mitigation strategy. Hazards that may affect Berkeley and Morgan County are identified and defined in terms of location and geographic extent, magnitude of impact, previous events, and likelihood of future occurrence. All information from the previous plan has been included or updated in the 2022 Berkeley and Morgan County HMP Update, unless otherwise indicated. The HMPT reviewed the hazards profiled in the 2017 Berkeley and Morgan County MJHMP Update during the May 4th, 2021 Kick-Off Meeting. The HMPT determined that all the existing hazards should be carried over into the 2022 plan update and decided that Civil Disturbance, Cyber Terrorism, and Substance Use Disorder should be profiled as hazards in the 2022 plan update. The hazards selected by the HMPT were then reviewed at the June 15, 2021 Risk Assessment and Mitigation Solutions Workshop. The municipalities completed an Evaluation of Hazards and Risk Form to indicate their jurisdictional risk to each hazard that would be profiled in the 2022 plan. The HMPSC reviewed comments and feedback to inform the Risk Assessment and Risk Assessment Prioritization Matrix.

Hazard profiles were then developed to define the characteristics of each hazard as it applies to Berkeley and Morgan County. This process was completed using published information and websites that address hazards globally, nationally, within West Virginia, or specifically within the counties, as well as anecdotal information provided by members of the HMPT.

Following hazard identification and profiling, a vulnerability assessment was performed to identify the impact of natural hazard events on people, buildings, infrastructure, and the community. Each natural hazard is discussed in terms of its potential impact on individual communities in Berkeley and Morgan County, including the types of parcels and critical facilities that may be at risk. This assessment allows the region and its municipalities to focus mitigation efforts on areas most likely to be damaged or most likely to require early response to a hazard event. A vulnerability analysis was performed which identifies structures, critical facilities, or people that may be impacted by hazard events and describes what those events can do to physical, social, and economic assets. Depending upon data availability, assessment results consist of an inventory of vulnerable structures or populations.

4.2. Hazard Identification

4.2.1. Table of Presidential Disaster Declarations

Under the Stafford Act, there are two forms of presidential action that authorize federal disaster assistance dollars. Emergency declarations trigger aid that protects property, public health, and safety and lessens or averts the threat of an incident becoming a catastrophic event. Given their purpose,

the emergency declarations may precede an event. A major disaster declaration is generally issued after catastrophes occur and constitutes broader authority for federal agencies to provide supplemental assistance to help state and local governments, families and individuals, and certain nonprofit organizations recover from the incident. (McCarthy, 2014). Because of the difference in these declarations, a single event may qualify for both kinds of declarations.

There is no financial threshold for an Emergency Declaration, but there are two thresholds for Presidential Disaster Declarations established under the Stafford Act: a state and a county threshold. These thresholds are based on a formula that uses the population of the jurisdiction (as recorded in the decennial Census) times a set per capita indicator. As of federal fiscal year 2021, these thresholds are $3.89 per capita for counties and $1.55 per capita for the state. With a population of over 100,000, the Berkeley County threshold is over $389,000, while the smaller population of Morgan County makes the threshold close to $70,000. State and county thresholds must be simultaneously attained for a Presidential Disaster Declaration to be issued. Table 4.2.1-1 identifies Presidential Disaster and Emergency Declarations that have affected Berkeley and Morgan County from most to least recent. Additional declarations beyond 2021 can be found on the FEMA website at: https://www.fema.gov/disasters/disaster-declarations.

Table 4.2.1-1 Presidential Disaster and Emergency Declarations affecting Berkeley and Morgan County, 1954-2021 (FEMA, 2021)			
Declaration #	**County Impacted**	**Date**	**Event**
3450*	Berkeley and Morgan	March 13, 2020	West Virginia COVID-19
4738	Morgan	May 28, 2018	Severe Storms, Flooding, Landslides, And Mudslides
3358*	Berkeley and Morgan	October 29, 2012	Hurricane Sandy
4071	Berkeley	July 23, 2012	Severe Storms and Straight-Line Winds
3345*	Berkeley and Morgan	June 30, 2012	Severe Storms
1903	Berkeley and Morgan	April 23, 2010	Severe Winter Storms and Snowstorms
3221*	Berkeley and Morgan	September 5, 2005	Hurricane Katrina Evacuation
1558	Berkeley and Morgan	September 20, 2004	Severe Storms, Flooding and Landslides
1496	Berkeley and Morgan	September 23, 2003	Hurricane Isabel
1474	Berkeley	June 21, 2003	Severe Storms, Flooding and Landslides
1137	Berkeley and Morgan	September 11, 1996	Hurricane Fran
1096	Berkeley and Morgan	January 25, 1996	Flooding
1084	Berkeley and Morgan	January 13, 1996	Blizzard
3109*	Berkeley and Morgan	March 17, 1993	Severe Snowfall and Winter Storm
753	Berkeley and Morgan	November 7, 1985	Severe Storms, Flooding
344	Berkeley and Morgan	July 3, 1972	Tropical Storm Agnes
* Presidential Emergency Declaration			

Since 1954, declarations have been issued for various hazard events including hurricanes or tropical storms, severe summer and winter storms, flooding, landslides, and blizzards. A unique Presidential Emergency Declaration was issued in September 2005. Through Emergency Declaration 3221, President George W. Bush declared that a state of emergency existed in the State of West Virginia and ordered federal aid to supplement state and local response efforts to help people evacuated from their homes due to Hurricane Katrina. All counties within the state, including Berkeley and Morgan County, were indirectly affected by Hurricane Katrina as a result of evacuee assistance.

In coincidence with Presidential Emergency Declaration 3450, West Virginia Governor declared that a state of emergency existed in the State of West Virginia, in conjunction with the closure of public and governmental spaces, schools, nursing homes, recreation facilities, and retail and food service locations. All counties within the state, were subsequently affected by the COVID-19 pandemic because of these orders.

4.2.2. Summary of Hazards

Each county HMSC was provided a Standard List of Hazards to consider for evaluation in the 2022 HMP. Following a review of the hazards evaluated in the 2017 HMP and the Standard List of Hazards, the HMSCs decided that the 2022 plan should identify, profile, and analyze 23 hazards. All hazards identified in 2017 plan were included in the 2022 HMP update. The hazards were reviewed by the HMPT at the May 4, 2021 Kick-Off Meeting. Each municipal attendee was provided with an Evaluation of Hazards and Risk Form. Following review of this hazards list and completion of the Evaluation of Hazards and Risk Form, the HMPT determined that Civil Disturbance, Cyber Terrorism, and Substance Use Disorder would be added as new hazards in the 2022 HMP Update.

Table 4.2.2-1 contains a complete list of the 23 hazards that have been identified as having the potential to impact Berkeley and Morgan County as identified through risk assessments, public concern, and input from the HMSC members and stakeholders. Hazard profiles are included in Section 4.3 for each of these hazards.

Table 4.2.2-1 Natural and Human-made Hazards included in the 2022 HMP	
Hazard	**Hazard Description**
Natural Hazards	
	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 West Virginia due to the prevalence of farms and other water-dependent industries, water-dependent recreation uses, and residents who depend on wells for drinking water (National Drought Mitigation Center, 2016; Ready.gov, 2018).
	An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10-20 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 persons and disrupt the social and economic functioning of the affected area (Ready.gov, 2018).
	Extreme heat often results in the highest number of annual deaths of all weather-related hazards. In most of the United States, extreme heat is defined as a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees. (Ready.gov, 2018). Extremely cold air comes every winter in at least part of the country and affects millions of people across the United States. The arctic air, together with brisk winds, can lead to dangerously cold wind chill values. People exposed to extreme cold are susceptible to frostbite and hypothermia in a matter of minutes (NWS, 2018).
	Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all the natural hazards in West Virginia. Flooding occurs when excess water from snowmelt or rainfall fills a stream, causing it to overflow onto the stream banks and adjacent floodplains. Floodplains are lowlands adjacent to rivers, streams, and creeks that are subject to recurring floods.
	Hailstorms occur when ice crystals form within a low-pressure front due to the rapid rise of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation in the form of balls or irregularly shaped masses of ice greater than 0.75 inches in diameter. Hailstorms can cause significant damage to homes, vehicles, livestock, and people (FEMA, 2021b; NOAA, 2018).

	Hurricanes and tropical storms are classified as cyclones and are any closed circulation developing around a low-pressure center in which the winds rotate counterclockwise (in the Northern Hemisphere) and whose diameter averages 10-30 miles across. Potential threats from hurricanes include powerful winds, heavy rainfall, storm surges, coastal and inland flooding, rip currents, tornadoes, and landslides. The Atlantic hurricane season runs from June 1 to November 30 (NOAA, 2018; Ready.gov, 2018).
	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 (NOAA, 2018; USDA, 2016).
	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. (USGS, 2018). Land subsidence is a gradual settling or sudden sinking of the ground surface due to the movement of subsurface materials. A sinkhole is a subsidence feature resulting from the sinking of surficial material into a pre-existing subsurface void. Subsidence and sinkholes are geologic hazards that can impact roadways and buildings and disrupt utility services. Subsidence and sinkholes are most common in areas underlain by limestone and can be exacerbated by human activities such as water, natural gas, and oil extraction (USGS, 2018).
	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 disproportional 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 (FEMA, 2018).
	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 (DEP, 2021).

	Lightning is a giant spark of electricity resulting from the build-up of positive and negative charges within a thunderstorm. The flash or "bolt" of light can occur within the thunderstorm cloud or between the cloud and the ground. Lightning is a leading cause of injury and death from weather-related hazards. Although most lightning victims survive, people struck by lightning often report a variety of long-term, debilitating symptoms.
	A wildfire is an unplanned fire that burns in a natural area. Wildfires can cause injuries or death and can ruin homes in their path. Wildfires can be caused by humans or lightning, and can happen anytime, though the risk increases in period of little rain (Ready.gov, 2018).
	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 two hitting West Virginia. Damaging winds exceeding 50-60 miles per hour can occur during tornadoes, severe thunderstorms, winter storms, or coastal storms. These winds can have severe impacts on buildings, pulling off the roof covering, roof deck, or wall siding and pushing or pulling off the windows (Ready.Gov, 2018).
	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. Nor'easters typically develop as extra-tropical storms which can produce winds equivalent to hurricane or tropical storm force as well as heavy precipitation, sometimes in the form of snow. 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 (NOAA, 2018).
Human-made Hazards	
	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 (FEMA, 2021b).

	Cyber terrorism 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." (Denning, 2000).
	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 flooding, hurricanes, earthquakes, and landslides. The consequences of dam failures can include property and environmental damage and loss of life (ASDSO, 2018).
	Hazardous materials (Hazmat) are a concern for West Virginia because of the potential for a spontaneous accidental or intentional illegal release that could endanger human health and safety, property and the environment. Hazardous material releases can contaminate air, water, and soils and have the potential to cause injury or death. Dispersion can take place rapidly when transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events (DHS, 2021).
	Source water refers to the surface water and groundwater used to supply water for public drinking water supply systems. This source water becomes contaminated through the addition of any substance or property preventing the use of or reducing the usability of water for ordinary purposes such as drinking, preparing food, bathing, washing, recreation, and cooling. Contamination can pose a serious risk to public health and welfare (Denchak, 2018).
	The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, (DSM V) by the American Psychiatric Association, recognizes substance-related disorders resulting from the use of 10 separate classes of drugs: alcohol; caffeine; cannabis; hallucinogens (phencyclidine or similarly acting arylcyclohexylamines, and other hallucinogens, such as LSD); inhalants; opioids; sedatives, hypnotics, or anxiolytics; stimulants (including amphetamine-type substances, cocaine, and other stimulants); tobacco; and other or unknown substances. Substance use disorder (SUD) is complex a condition in which there is uncontrolled use of a substance despite harmful consequence. People with SUD have an intense focus on using a certain substance(s) such as alcohol, tobacco, or illicit drugs, to the point where the person's ability to function in day-to-day life becomes impaired. People keep using the substance even when they know it is causing or will cause problems (American Psychiatric Association, 2021).

	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 (FEMA, 2004). Cyber-attacks have become an increasingly pressing concern.
	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.
	Utility interruption hazards are hazards that impair the functioning of important utilities in the energy, telecommunications, public works, and information network sectors. Utility interruption hazards include the following: • Geomagnetic Storms • Fuel or Resource Shortage • Electromagnetic Pulse • Information Technology Failure • Ancillary Support Equipment • Public Works Failure • Telecommunications System Failure • Transmission Facility or Linear Utility Accident • Major Energy, Power, Utility Failure • (Bonner, 2019)

4.3. Hazard Profiles

NATURAL HAZARDS

Natural hazards are naturally occurring physical phenomena caused by geophysical, hydrological, climatological, meteorological, or biological events. Within this HMP, profiled naturals hazards include drought, earthquake, extreme temperatures, flooding, hailstorm, hurricane/tropical storm, invasive species, landslides/land subsidence, pandemic and infectious diseases, radon exposure, thunderstorm/lightning strike, wildfire, windstorm/tornado, and winter storm/Nor'easter.

4.3.1. Drought

Drought is a natural climatic condition which occurs in virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought. This hazard is of particular concern in Morgan and Berkeley County due to the presence of farms as well as water-dependent industries and recreation areas across the Eastern Panhandle. A prolonged drought could severely impact these sectors of the local economy, as well as residents who depend on wells for drinking water and other personal uses.

4.3.1.1. Location and Extent

Droughts are regional climatic events, so when these events occur in the Eastern Panhandle, impacts are often felt across the state or the region. The spatial extent for areas of impact can range from county level to the entire mid-Atlantic Region. Areas with extensive agricultural land use can experience particularly significant impacts.

Locations of droughts nationwide are monitored continuously by USGS, and the National Drought Mitigation Center at the University of Nebraska-Lincoln in concurrence with the NOAA monitors conditions throughout the state. Maps showing locations currently experiencing drought conditions are posted on various websites (including http://waterwatch.usgs.gov) and show locations where stream flow is below normal and where drought conditions exist or are emerging.

The State of West Virginia Emergency Operations plan defines four types of droughts: meteorological, agricultural, hydrological, and socio-economic drought (State of West Virginia, 2016). A meteorological drought is often defined by a period of substantially diminished precipitation for a duration and/or intensity that persists long enough to produce a significant hydrologic imbalance. Agricultural droughts occur when there is inadequate precipitation and/or soil moisture to sustain crop or forage production systems. The water deficit results in serious damage and economic loss to plant or animal agriculture, usually proceeded by a meteorological drought. A hydrologic drought is defined in terms of reduction of stream flows, reduction in lake or reservoir storage and lowering of groundwater levels. This results from a shift in normal weather patterns over an area causing the amount of precipitation to fall significantly below the long-termed average. Socio-economic droughts occur when physical water shortages start to affect the health, well- being and quality of human life, or when the drought starts to affect the supply and demand of an economic product.

4.3.1.2. Range of Magnitude

Droughts can have varying effects, depending on the month in which they occur, as well as the severity, duration, and location of the event. Even short-term droughts can be devastating, especially

in conjunction with extreme temperatures.

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 WVEMD Emergency Operations Plan (EOP) uses a combination of five indices to determine the magnitude of a drought (State of West Virginia, 2016). Descriptions of the indices from the EOP are as follows:

a. Palmer Drought Severity Index

The PDSI attempts to measure the duration and intensity of the long- term drought-inducing circulation patterns. Long-term drought is cumulative, so the intensity of drought during the current month is dependent on the current weather patterns plus the cumulative patterns of previous months.

b. Palmer Z Index

The Palmer Z index is a variation of the PDSI that measures short-term drought on a monthly scale.

c. Crop Moisture Index (CMI)

This index uses a meteorological approach to monitor week-to-week crop conditions by evaluating short-term moisture conditions across major crop-producing regions. It is based on the mean temperature and total precipitation for each week within a climate division, as well as the CMI value from the previous week. The CMI responds rapidly to changing conditions, and it is weighted by location and time so that maps can be used to compare moisture conditions at different locations.

d. Standardized Precipitation Index (SPI)

This is a probability index that considers the probability of recording a given amount of precipitation. The probabilities are standardized so that an index of zero indicates the median precipitation amount where half of the historical precipitation amounts are below the median, and half are above the median. The index is negative for drought, and positive for wet conditions. The SPI is computed by the National Centers for Environmental Information (NCEI) for several time scales, ranging from one (1) month to 24 months, to capture both short-term and long-term drought.

e. National Fire Danger Rating System

A broad scale system that incorporates science, technology, and local experience to analyze the various factors of fuels, weather, topography and risk, in combination, to assess the daily fire potential of an area including the potential for a fire to ignite, spread and require suppression action. Fire

danger is usually expressed in numeric or adjective terms.

Precipitation, ground water, stream flow, reservoir levels, PDSI, CMI, SPI, Fire Weather Forecast, and the Fire Danger drought criteria are assessed by the WVEMD each month, the WVEMD then assigns one of four stages of concern as shown in Table 4.3.1-1.

Table 4.3.1-1 WVEMD EOP Levels of Concern for Drought

Level of Concern	Indices		
	PDSI	CMI	SPI
Normal (Stage I)	Normal levels	Normal levels	Normal levels
Alert (Stage II)	-2.00 to -2.99 Moderate Drought	-1.0 to -1.9 Abnormally Dry	-1.00 to -1.49 Moderately Dry
Conservation (Stage III)	-3.00 to -3.99 Severe Drought	-2.0 to -2.9 Excessively Dry	-1.50 to -1.99 Severely Dry
Emergency (Stage IV)	-4.00 and below Extreme Drought	3.0 or less Severely Dry	-2.00 and less Extremely Dry

I. Alerts are rescinded and drought status returns to normal when the PDSI is above -1, indicating normal or near normal levels.

II. Stage II is reached when the PDSI reads -2.00 to -2.99 and stream, reservoir, and ground water levels are below normal over a several month period and/or the WVEMD Director determines Stage II activities are required. The governor is requested to make a Drought Alert Declaration.

III. Stage III is reached when the PDSI reads -3.00 to -3.99, stream, reservoir, and ground water levels continue to decline, forecasts predict an extended period of below normal precipitation, and/or the WVEMD Director determines Stage III activities are required. A return to Stage II is allowed when precipitation increase, streams, reservoirs, and ground water levels stop declining, the PDSI reaches to -2.99 or higher, and/or the WVEMD Director determines Stage II activities are sufficient and Stage III is no longer required. and to

IV. Stage IV is reached when the PDSI reads -4.00 and/or the WVEMD Director determines Stage IV activities are required. The governor is requested to make a Drought Emergency Declaration when water supplies will be inadequate to meet projected demand and more extreme measures must be undertaken. This declaration allows state agencies to

implement emergency programs and actions according to West Virginia Code and to review the allocation of water supplies in communities that are not adequately responding to their water shortage.

Environmental impacts of drought include:

- Hydrologic effects – lower water levels in reservoirs, lakes, and ponds; reduced streamflow; loss of wetlands; estuarine impacts; groundwater depletion and land subsidence; 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; 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.
- Loss of quality in landscape.
- Loss of water for navigation and recreation.
- Increase in nitrate levels which can have health impacts on pregnant women and children.

4.3.1.3. Past Occurrence

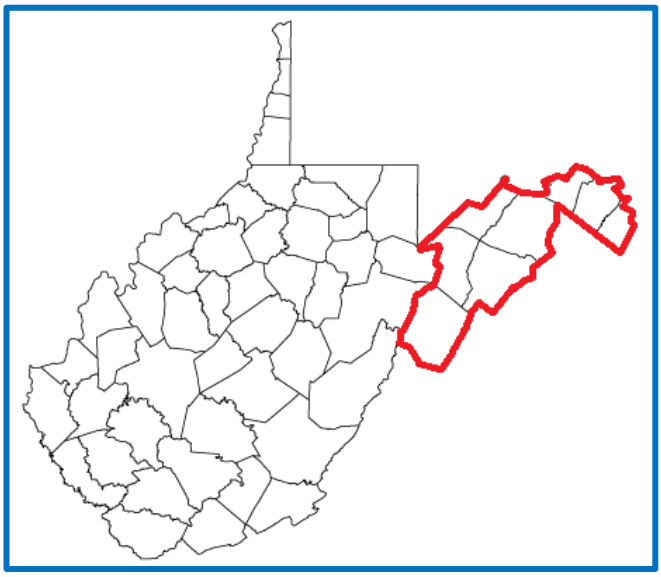
Minor droughts occur frequently in Berkeley and Morgan County, but extended periods of severe drought that creates major disruption and economic loss are rare. The decades with the most severe droughts are 1916-1925, 1926-1935, 1966-1975, and 1996-2005. This is based on data from the National Oceanic and Atmospheric Administration (NOAA) WV Climate Division 6, which encompasses Berkeley and Morgan County, as well as six other counties in Northeastern WV, as seen in Figure 4.3.1-1 (ESRL NOAA, 2021)

The most recent severe drought in Berkeley and Morgan County occurred in 1999. Every month in 1999 had a mean PDSI value of -3.00 or less. (ESRL NOAA, 2016). Between June 1998 and June 1999, the area received about 12 inches less rainfall than average. The local agricultural economy was impacted significantly, and Berkeley County Public service District and the City of Martinsburg enacted emergency water restrictions (Tuckwiller, 1999). President Bill Clinton declared a disaster declaration for the entire state of West Virginia (Tuckwiller, 1999).

On October 3, 2019, West Virginia Governor Jim Justice declared a State of Emergency for all 55 West Virginia counties due to a prolonged shortage of rainfall that caused moderate drought conditions across much of the state and severe drought conditions in southern West Virginia (State of West Virginia Executive Department, 2019). The emergency declaration proclaimed the drought reflected both meteorological and agricultural drought characteristics, and included some restrictions on water

usage, as well as some voluntary measures.

Figure 4.3.1-1: Northeastern WV as Defined by NOAA WV Climate Division 6 (NOAA, 2021)



The United States Department of Agriculture (USDA) Risk Management Agency (RMA) operates and manages the Federal Crop Insurance Corporation program. Since Berkeley and Morgan County farms are eligible for crop insurance, it is possible to determine agricultural losses in the area due to drought. Table 4.3.1-2 displays the crop loss insurance payments by year due to drought (including even mild drought occurrences) in Berkeley and Morgan County since 2010. The most losses occurred in 2010, with corn suffering the most substantial losses as defined by indemnity amount. The 2010 drought also affected a variety of other crops, and Figure 4.3.2-2 shows the owner of Butler Farms in Inwood, WV and the assistant director of the West Virginia Department of Agriculture inspecting agricultural damages from the 2010 drought.

Figure 4.3.1-2: Inspection of 2010 Drought Agricultural Damages near Inwood, WV (McVey, 2010)

Table 4.3.1-2 Crop Loss Insurance Compensation Due to Drought (USDA RMA, 2021)	
Crop Year	**Indemnity Amount**
2010	$560,682
2011	$155,890
2012	$0
2013	$19,837
2014	$2,158
2015	$51,209
2016	$136,930
2017	$10,439
2018	$0
2019	$4385
2020	$21,103
2021 (Year-to-Date)	$0

4.3.1.4. Future Occurrence

It is difficult to forecast the severity or frequency of future drought events with any certainty. However, based on historical drought data between 1896 and 2021, northeastern WV had 93 months of moderate and severe drought (defined as a month with a mean PDSI of -3.00 or less), or spent 6.18 percent of that time in a moderate or severe drought (NOAA, 2021a). While some form of drought condition frequently exists in the region, the impact depends on the duration of the event, severity of conditions, and area affected. Therefore, the probability of drought impacting Berkeley and Morgan County in any given year is *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

4.3.1.5. Vulnerability Assessment

Some of the most significant losses resulting from drought events are typically found in the agricultural sector. Both counties are home to agricultural activity, and the local economy could be severely impaired by prolonged drought. The 1999 drought was estimated to have caused more than $200 million in damage to agriculture across the state, and yields were down as low as 50 or 60 percent (USDA, 2012 a & b; Borger, 1999)). State agencies and the WVU Extension Service are valuable resources in reducing drought vulnerability through education and other services to area farmers.

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.

Long-term water shortages can have a high impact on agribusinesses, hydropower-dependent utilities, and other industries reliant on water for production services; all critical infrastructure in Berkeley and Morgan County are vulnerable to the effects of a drought. Drought can cause municipalities to enforce water rationing and distribution. It also increases the region's vulnerability to other hazards such as severe weather, extreme heat, and public health emergencies. The special needs population of any county must also be considered during drought conditions.

As with many hazards, determining specific risk and vulnerability areas for drought is difficult. Drought is an "overall" hydrologic condition; that is, if one small area was without precipitation but a nearby area was not, it would be difficult to classify the entire area as "in a drought" due to the eventual seepage of said precipitation to the overall groundwater supply. Consequently, drought is said to affect the entire region evenly.

Table 4.3.1-3 2017 Berkeley and Morgan County Agriculture Market Values (USDA, 2017 a & b)

	Market Value of Crops Sold	Market Value of Livestock Sold	Total
Berkeley County	$18,698,000	$7,210,000	$25,909,000
Morgan County	$2,568,000	$710,000	$3,279,000
Total	$21,266,000	$7,920,000	$29,188,000

However, the Berkeley County Public Service Water District is seeking to mitigate impacts of drought on its customer base. In the last two years, it has drilled two new wells in an effort to increase water quality and provide additional source water in the case of drought. Actions like these can be taken by water suppliers and residents and businesses can decrease their water usage in order to mitigate the effects of drought and limit the region's vulnerability.

The Berkeley County Public Service Water District also has its own Drought Contingency Plan (revised in 2019) in place to recognize drought conditions and put water conservation measures in place. Its conservation measures have three stages: drought watch, drought warning, and drought emergency. The stages required are determined by monitoring the following criteria when evaluating drought conditions: USGS Drought Monitoring reports and historical rainfall totals, the level in LeFevre Spring,

water levels in wells, the water levels in the Water District Springs, and flows in the Potomac River. The Berkeley County Public Service Water District Board of Directors holds the authority to determine what action level is necessary. With each stage, water restrictions get more severe. Stage I is comprised of voluntary restrictions, while Stage II mandates these restrictions. Restrictions include the prohibition of non-essential water uses such as washing paved surfaces and building exteriors, ornamental water uses, watering of lawns and golf courses on alternating days, non-commercial washing of vehicles, and the unrequested serving of watering in restaurants. In Stage III, a Water Rationing Plan takes effect as approved by the West Virginia Public Service Commission. With regards to Morgan County, no public water system in Morgan County has a Drought Contingency Plan.

4.3.2. Earthquake

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock, usually within the upper 10-20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. They can also result from human activity like mine blasts and nuclear experiments. Future earthquakes are most likely to occur in the same general regions that have had earthquakes previously. Earthquakes can cause damage to buildings and other rigid superstructures, depending on factors like magnitude, distance of local areas to the epicenter, and local geologic conditions. It remains incredibly difficult to predict when and where an earthquake will occur in the northeast U.S. and West Virginia.

4.3.2.1. Location and Extent

Earthquake events in Berkeley and Morgan County are sporadic and mild. When events occur, they impact relatively small areas. According to a region-specific seismic hazard map, as seen in Figure 4.3.2-1, the eastern half of Berkeley County faces the possibility of marginally more severe earthquake compared to the western half of Berkeley County or Morgan County. Eastern Berkeley County has a 2 percent chance of exceeding a Peak Ground Acceleration (PGA) of 8-10 %g in 50 years compared to a PGA exceedance of 4-8 %g in the rest of the planning area (USGS, 2018a).

The nearest area of seismic activity is the southeast and south-central United States region, which covers a large area of relatively diffuse, low- rate seismicity. Principle areas of activity include the New Madrid Seismic Zone of the central Mississippi Valley and the Southern Appalachian Seismic Zone, extending from Virginia to Alabama (see Figure 4.3.2-2). These areas of seismic activity increase the chances of Berkeley and Morgan County being affected by an earthquake (USGS, 2018a).

Figure 4.3.2-1: WV 2014 USGS Hazard Map, 2 percent Chance of Exceedance in 50 Years (most recent figure available) (USGS, 2018a)

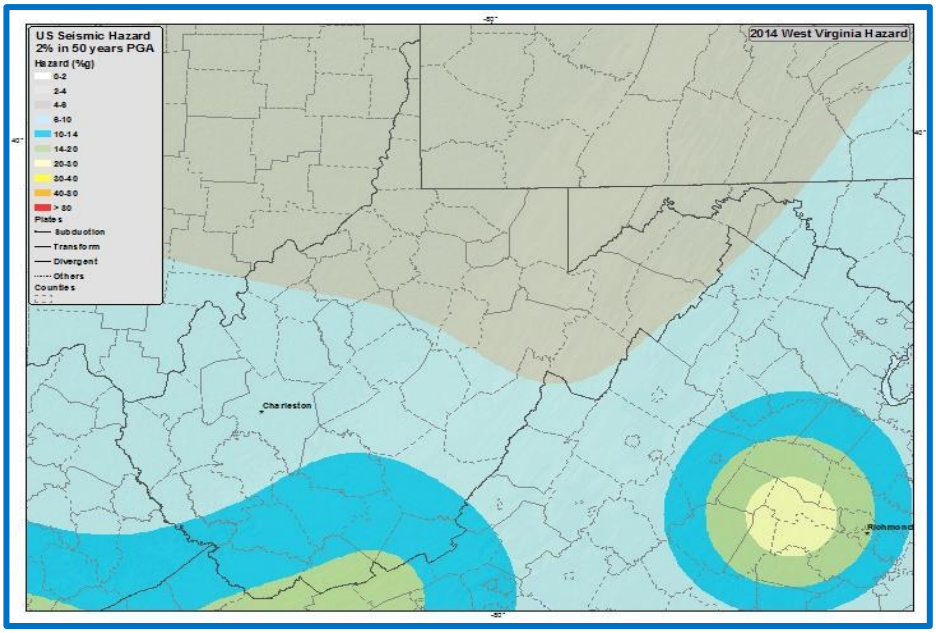
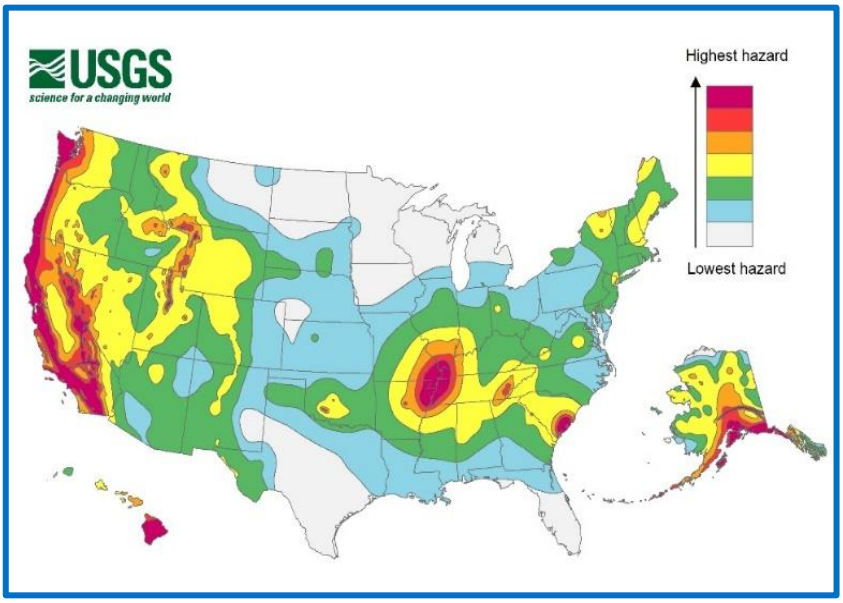


Figure 4.3.2-2: Simplified 2018 USGS Hazard Map, 2% Chance of Exceedance in 50 Years Scaled in Peak Ground Acceleration (PGA) (USGS, 2018a)



4.3.2.2. Range of Magnitude

The map in Section 4.3.2.1 is measured using Peak Ground Acceleration (PGA). This is defined as the maximum acceleration experienced by an area during the motion of an earthquake. This unit of measure is often used because building codes tend to regulate how much horizontal force a building should be able to endure during an earthquake, and force is directly proportional to acceleration. This is measured in %g, referring to the quotient of the PGA divided by the acceleration due to gravity (known as g, which is a constant of 9.80665 m/sec^2) expressed as a percentage. A reference point for this unit of measure is 10%g, which the USGS believes approximates the maximum threshold of damage for pre-1965 or non-earthquake resistant buildings and roughly equates to VI to VII on the Modified Mercalli Intensity Scale, which is defined below (USGS, 2016).

The impact of an earthquake event is often measured in terms of earthquake intensity, which is measured using the Modified Mercalli Intensity (MMI) Scale, shown in Table 4.3.2-1. This scale has a measure of severity from I to XII, and relates to another commonly used scale, the Richter Scale (USGS, 2016).

Table 4.3.2-1 Modified Mercalli Intensity Scale with Associated Impacts.

Scale	Intensity	Description	Corresponding Richter Scale Magnitude
I	Instrumental	Usually detected only on seismographs.	<4.2
II	Feeble	Felt only by a few persons at rest, especially on upper floors of buildings.	
III	Slight	Felt quite noticeably indoors, especially on upper floors. Most people do not recognize it as an earthquake (i.e. a truck rumbling).	
IV	Moderate	Can be felt by people walking; dishes, windows, and doors are disturbed.	
V	Slightly Strong	Sleepers are awoken; unstable objects are overturned.	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves; damage is slight.	<5.4
VII	Very Strong	Damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, and considerable in poorly built or badly designed structures; some chimneys are broken.	<6.1

Table 4.3.2-1 Modified Mercalli Intensity Scale with Associated Impacts.			
Scale	**Intensity**	**Description**	**Corresponding Richter Scale Magnitude**
VIII	**Destructive**	Damage is slight in specially designed structures; considerable in ordinary, substantial buildings. Moving cars become uncontrollable; masonry fractures, poorly constructed buildings damaged.	<6.9
IX	**Ruinous**	Some houses collapse, ground cracks, pipes break open; damage is considerable in specially designed structures; buildings are shifted off foundations.	
X	**Disastrous**	Some well-built wooden structures are destroyed; most masonry and frame structures are destroyed along with foundations. Ground cracks profusely; liquefaction and landslides widespread.	<7.3
XI	**Very Disastrous**	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed.	<8.1
XII	**Catastrophic**	Total destruction; trees fall; lines of sight and level are distorted; ground rises and falls in waves; objects are thrown upward into the air.	>8.1

Earthquake magnitude is often measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake. Table 4.3.2-2 summarizes Richter Scale magnitudes as they relate to the spatial extent of impacted areas. The Richter Scale does not give any indication of the impact or damage of an earthquake, although it can be inferred that higher magnitude events cause more damage. Instead, the Modified Mercalli Intensity Scale is used to measure earthquake intensity (USGS, 2016).

Table 4.3.2-2 Richter Scale Magnitudes and Associated Earthquake Size Effects.	
Richter Magnitudes	**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 up to about 100 kilometers from epicenter.
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.

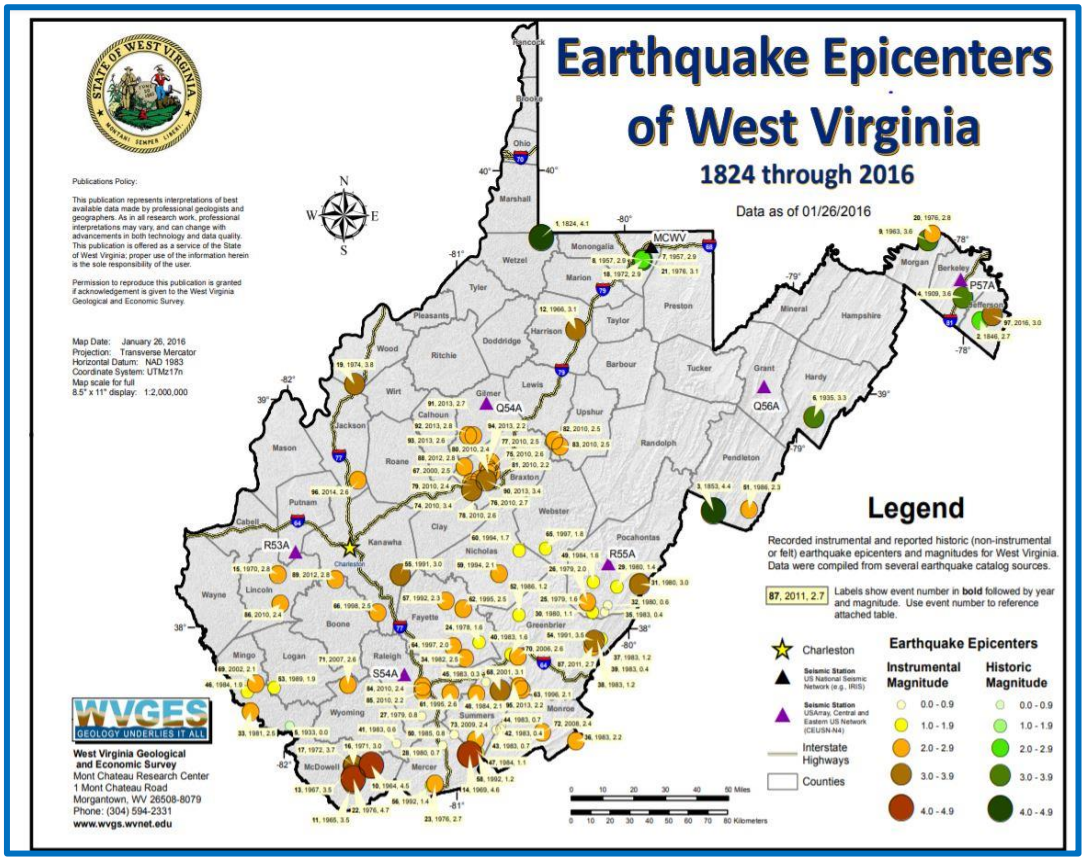
The worst earthquake recorded in West Virginia according to records maintained by The West Virginia Geological and Economic Survey was a magnitude 4.6 (or VI MMI) earthquake centered in Mercer County, WV, a county along the southern border of the state. Therefore, a worst-case scenario for this hazard would likely be if an earthquake of similar magnitude occurred in the Eastern Panhandle region or near the border of adjacent counties, which may cause mild damage in populated areas. Structural damage would not be expected in this scenario for most buildings, but blighted structures or those in a state of disrepair might experience further structural damage (West Virginia Geological and Economic Survey, 2016).

Environmental impacts of earthquakes can be numerous, widespread, and devastating, particularly if indirect impacts like economic impacts are considered. Earthquakes are known for causing induced tsunamis, flooding, landslides, and avalanches; poor water quality; damage to vegetation; and breakage in sewage or toxic material containments. However, because of their geographic location, these impacts are extremely unlikely to occur in Berkeley and Morgan County (USGS, 2016).

4.3.2.3. Past Occurrence

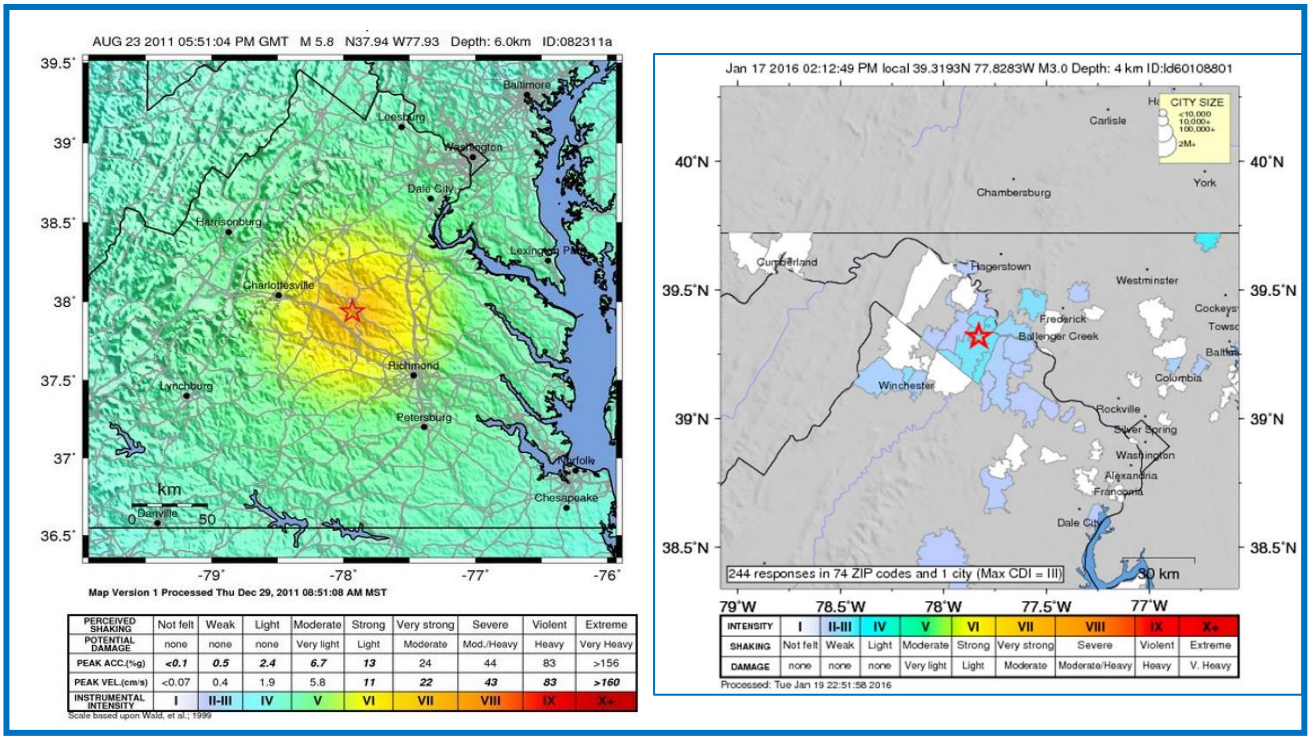
As noted previously, the Eastern Panhandle region does have a history of mild earthquakes. According to the West Virginia Statewide Standard HMP, Morgan County has experienced two small earthquakes with a MMI of I since 1824, while Berkeley County has experienced one earthquake with a MMI of V. This Berkeley County earthquake occurred in the Charles Town-Martinsburg area in April of 1909 (West Virginia Geological and Economic Survey, 2016). It was felt across approximately 6,500 square kilometers. Though certainly noticeable by the public, little damage would be caused by an earthquake of this size. The location of these earthquakes can be seen in Figure 4.3.2-3, as well as other historical earthquake locations throughout West Virginia.

Figure 4.3.2-3: West Virginia Geological and Economic Survey Earthquake Epicenters (WVGES, 2016)



The most high-profile earthquake event to occur near the Potomac Highlands of West Virginia occurred in August 2011. A magnitude (Richter Scale) 5.7 earthquake centered in Louisa, Virginia (less than 100 miles from the City of Martinsburg in Berkeley County) shook structures throughout West Virginia, Pennsylvania, Virginia, Maryland, and New York. Damage to historic structures like the National Cathedral and the Washington Monument were noted in Washington D.C. Evacuations occurred in D.C. as well as New York City because the general population was not accustomed to experiencing an earthquake of that magnitude. However, the intensity of the earthquake was quite low outside of central Virginia, as seen in Figure 4.3.2-4. More recently, in January 2016, an earthquake shook the West Virginia – Virginia state border. The magnitude was 3.0 according to the Richter Scale and the intensity was minimal, but the earthquake was clearly felt up to 28 miles away in Martinsburg (USGS, 2016). According to USGS records of earthquakes from 1900-Present, the 2016 earthquake is the most recent in the area of this scale (USGS, 2016).

Figure 4.3.2-4: USGS ShakeMaps for August 2011 and January 2016 Earthquakes (USGS, 2016)



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.1	0.5	2.4	6.7	13	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	11	22	43	83	>160
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999

INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

4.3.2.4. Future Occurrence

As aforementioned, eastern Berkeley County has a 2 percent chance of exceeding a Peak Ground Acceleration (PGA) of 8-10 %g in 50 years while the western portion of Berkeley County and Morgan County have a PGA exceedance of 4-8 %g in 50 years according to Figure 4.3.2-1. The probability of an earthquake occurring in Morgan County and Berkeley County each year is very low, and the probability of a destructive earthquake is highly improbable. Historical records indicate that the future likelihood of an earthquake is *unlikely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

As of 2021, six seismic monitoring stations exist across West Virginia, with one located in Berkeley County. These stations collect data about any future earthquake events and may help West Virginians further understand their earthquake risk.

4.3.2.5. Vulnerability Assessment

The somewhat random historical occurrences of earthquakes would indicate that all structures throughout Region 9's counties to be equally at risk from earthquakes. The severity of those earthquakes, though, is expected to be very low. Given this low severity, officials in both counties

estimated earthquake losses to be almost non-existent. In a mild earthquake of the magnitude typically experienced in West Virginia, no structural damage is anticipated. In other cases, damages are expected to be limited, and examples of anticipated damages are broken dishes and windows and toppled file cabinets.

However, for earthquakes, the available history covers a period of less than 300 years, which is a relatively short period of time for an examination of earthquakes. Large earthquakes may only affect a location every several centuries or millennia. Environmental impacts of earthquakes can be numerous, widespread, and devastating, particularly if indirect impacts are considered. Some secondary hazards caused by earthquakes may include fire, hazardous material release, landslides, flash flooding, avalanches, tsunamis, and dam failure. These secondary events could also result in disruptions to natural ecosystems, poor water quality, damage to vegetation, and the release of toxic materials and sewage. Impacts to infrastructure could include train derailments, pipe failures, and utility interruptions. A very large earthquake affecting the counties might cause structural damage in dilapidated structures or structures that do not meet current building codes. Thus, the impact of an earthquake might range from negligible to catastrophic. Based on historical data for the counties, damage is likely to be minimal.

Structures identified as potentially at risk of damage due to an earthquake are older structures. All existing buildings have the potential to experience an earthquake. Given no history of damage in the region due to earthquakes, damages are estimated to be limited to the more dilapidated structures and structures with unreinforced masonry.

All future structures will also have the potential to experience an earthquake. However, given that new structures must also meet current building codes and given the expected magnitude of earthquakes in the region, limited property damages are anticipated.

4.3.3. Extreme Temperatures

Extreme temperature includes both hot and cold temperatures. Extreme cold temperatures drop well below what is considered normal for an area during the winter months and often accompany winter storm events. Combined with increases in wind speed, such temperatures in West Virginia can be life threatening to those exposed for extended periods of time. Extreme heat can be described as temperatures that hover 10°F or more above the average high temperature for a region during the summer months.

4.3.3.1. Location and Extent

All of Berkeley and Morgan County are subject to extreme temperatures in the summer and winter seasons. Urban environments are more susceptible to extreme heat as they tend to retain the heat well into the night, leaving little opportunity for dwellings to cool. Demographics also are a

consideration, as large populations of elderly or poor represent those most vulnerable to temperature extremes.

Table 4.3.3-1 shows monthly mean maximum and minimum temperatures between 1981 and 2010 for a location in both Berkeley and Morgan County. It also shows the average number of days where temperatures exceed 90°F or 100°F or drop below 32°F or 0°F. Elevation, topography, and surrounding development may account for much of the difference between these two locations. The Eastern Panhandle reaches its highest maximum mean daily temperature in July. Martinsburg Regional Airport climbs to a mean daily maximum of 85.8 °F in July, while Cacapon State Park reaches 84.4°F. The region reaches its lowest temperatures in January, with Martinsburg Regional Airport dropping to a mean daily minimum of 22.3°F and Cacapon State Park measuring 20.9°F. Table 4.3.4-2 shows similar data for both locations for the year 2020. Monthly Normal Temperature data was not available after 2010, so Global Summary of the Month data was used instead. This data reveals many of the same climatological trends as Table 4.3.4-1. In July, the Martinsburg Regional Airport reaches its highest mean temperature of 90.8°F and Cacapon State Park reaches a mean daily high of 89.0°F. Additionally, in January, Martinsburg Regional Airport reaches its lowest mean daily minimum temperature of 28.4°F and Cacapon State Park reaches its lowest mean daily minimum of 26.0°F. The 2020 data showcases a trend of hotter summers and warmer winters, in general. (NCEI NOAA, 2021).

Table 4.3.3-1 Summary of Monthly Normal Temperatures (°F), 1981-2010, at Weather Station Locations in Berkeley and Morgan County (NCEI NOAA, 2021)

Martinsburg Eastern WV Regional Airport, Berkeley County, WV						
	Mean		Mean Number of Days			
Month	Daily Max	Daily Min	Max >= 100	Max >= 90	Min <= 32	Min <= 0
Jan	39.5	22.3	0.0	0.0	25.7	0.8
Feb	43.2	24.4	0.0	0.0	22.7	0.2
March	52.6	31.4	0.0	0.0	16.5	0.0
April	64.0	40.8	0.0	0.1	4.5	0.0
May	72.7	49.6	0.0	0.8	0.2	0.0
June	81.7	58.9	0.0	3.6	0.0	0.0
July	85.8	63.7	0.3	7.5	0.0	0.0
Aug	83.9	61.8	0.1	5.6	0.0	0.0
Sept	76.7	53.9	0.0	1.5	0.0	0.0
Oct	65.4	42.3	0.0	0.0	3.7	0.0
Nov	54.3	34.1	0.0	0.0	12.1	0.0
Dec	42.8	25.5	0.0	0.0	23.9	0.1
Summary	63.6	42.4	0.4	19.1	109.3	1.1
Cacapon State Park, Morgan County, WV						
	Mean		Mean Number of Days			

Month	Daily Max	Daily Min	Max >= 100	Max >= 90	Min <= 32	Min <= 0
Jan	38.7	20.9	0.0	0.0	26.3	0.8
Feb	42.7	23.1	0.0	0.0	23.8	0.2
March	51.3	29.9	0.0	0.0	18.8	0.0
April	62.9	39.6	0.0	0.1	5.9	0.0
May	71.7	49.0	0.0	0.3	0.1	0.0
June	80.7	58.0	0.0	2.6	0.0	0.0
July	84.4	62.3	0.0	5.3	0.0	0.0
Aug	82.7	60.6	0.1	3.7	0.0	0.0
Sept	75.6	52.5	0.0	1.1	0.0	0.0
Oct	65.0	41.3	0.0	0.0	4.6	0.0
Nov	54.1	33.3	0.0	0.0	14.1	0.0
Dec	42.0	24.2	0.0	0.0	24.9	0.1
Average	62.7	41.2	0.1	13.1	118.5	1.1

Table 4.3.3-2 Global Summary of the Month (°F), for 2020, at Weather Station Locations in Berkeley and Morgan County (NCEI NOAA, 2021)

Martinsburg Eastern WV Regional Airport, Berkeley County, WV						
	Mean		Number of Days			
Month	Daily Max	Daily Min	Max >= 90	Max <= 32	Min <= 32	Min <= 0
Jan	45.7	28.4	0.0	0.0	19.0	0.0
Feb	49.0	31.0	0.0	0.0	19.0	0.0
March	58.9	37.5	0.0	0.0	11.0	0.0
April	61.0	39.3	0.0	0.0	4.0	0.0
May	69.6	50.6	0.0	0.0	0.0	0.0
June	83.0	60.6	2.0	0.0	0.0	0.0
July	90.8	67.0	19.0	0.0	0.0	0.0
Aug	86.5	66.0	11.0	0.0	0.0	0.0
Sept	77.2	53.8	0.0	0.0	2.0	0.0
Oct	68.1	44.1	0.0	0.0	3.0	0.0
Nov	48.6	35.9	0.0	0.0	10.0	0.0
Dec	35.7	27.0	0.0	2.0	26.0	0.0
Average	64.5	45.1	10.7	2.0	12.9	0.0
Cacapon State Park, Morgan County, WV						
	Mean		Number of Days			
Month	Daily Max	Daily Min	Max >= 90	Max <= 32	Min <= 32	Min <= 0
Jan	45.5	26.0	0.0	1.0	22.0	0.0
Feb	46.8	27.5	0.0	1.0	20.0	0.0
March	57.5	33.9	0.0	1.0	18.0	0.0
April	58.9	38.0	0.0	0.0	7.0	0.0
May	67.6	48.1	0.0	0.0	1.0	0.0
June	81.2	58.1	3.0	0.0	0.0	0.0
July	89.0	65.4	19.0	0.0	0.0	0.0
Aug	85.3	63.9	6.0	0.0	0.0	0.0
Sept	74.2	51.0	0.0	0.0	0.0	0.0
Oct	67.9	42.9	0.0	0.0	3.0	0.0
Nov	47.9	35.0	0.0	0.0	4.0	0.0
Dec	42.7	26.5	0.0	1.0	12.0	0.0
Average	63.7	43.0	9.3	1.0	12.0	0.0

4.3.3.2. Range of Magnitude

Cold weather has several effects, most dramatically on the general population mortality rate. The average mortality on a winter day is about 15 percent higher than on a summer day. Cold weather is directly responsible for deaths through hypothermia, influenza, and pneumonia. It is also an indirect factor in several ways such as death and injury from falls, accidents, carbon monoxide poisoning, and house fires all of which are partially attributable to cold. Exposure to heat can also cause health problems indirectly, such as through increased workload on the heart. This can be especially dangerous to individuals with pre-existing medical conditions, typically the elderly (Seltenrich, 2015).

The following impacts can be observed following extreme temperature events:

- ***Health Impacts:*** The health impacts of extreme cold are greater in terms of mortality in humans, but often after more prolonged exposure vs. a cold snap. Extreme heat waves, however, can prove more deadly over a shorter duration. At greatest risk of death in heat waves are the urban-dwelling elderly without access to an air-conditioned environment for at least part of the day.
- ***Transportation:*** Cold weather can impact automotive engines, possibly stranding motorists, and stress metal bridge structures. Highway and railroad tracks can become distorted in high heat. Disruptions to the transportation network and accidents due to extreme temperatures represent an additional risk.
- ***Agriculture:*** Absolute temperature and duration of extreme cold can have devastating effects on trees and winter crops. Livestock is especially vulnerable to heat and crop yields can be impacted by heat waves that occur during key development stages.
- ***Energy***: Energy consumption rises significantly during extreme cold weather, and any fuel shortages or utility failures that prevent the heating of a dwelling place residents in extreme danger. Extreme heat also can result in utility interruptions, and sagging transmission lines due to the heat can lead to shorting out.

The range of these impacts, especially health effects, can be mitigated through improved forecasts, warnings, community preparedness, and appropriate community-based response. A worst-case event for Berkeley or Morgan County would include extreme cold temperatures, with injuries resulting from direct exposure (as a result of an interruption of energy supplies), and from being cut off from medical care due to associated snow or ice impacting travel. Medical afflictions could be a result of direct influence on the coronary circulation system and the respiratory system, and influenza and other infectious diseases would be secondary impacts. Extreme heat could also be disastrous, particularly if mixed with effect of a drought (Seltenrich, 2015).

Temperature advisories, watches, and warnings are issued by the National Weather Service (NWS) relating the above impacts to the range of temperatures typically experienced in West Virginia. Table 4.3.4-3 summarizes thresholds for heat advisories given across the region.

Table 4.3.3-3 Thresholds for Heat Advisories (NWS, 2021)	
Advisory Level	**Description**
Heat Advisories	Criteria for a Heat Advisory is a heat index of 100-104°F. The heat index must remain at or above criteria for a minimum of 2 hours. Heat advisories are issued by county when any location within that county is expected to reach criteria
Excessive Heat Warnings	Criteria for an Excessive Heat Warning is a heat index of 105°F or greater that will last for 2 hours or more. Excessive Heat Warnings are issued by county when any location within that county is expected to reach criteria
Excessive Heat Watches	Issued when Heat Warning criteria is possible (50-79 percent) 1 to 2 days in advance

In terms of human health concerns, extremely high temperatures cause heat stress which can be divided into four categories. Each category is defined by apparent temperature which is associated with a heat index value that captures the combined effects of dry air temperature and relative humidity on humans and animals. Major human risks for these temperatures include heat cramps, heat syncope, heat exhaustion, heatstroke, and death. Note that while the temperatures in Figure 4.3.3-1 serves as a guide for various danger categories, the impacts of high temperatures will vary from person to person based on individual age, health, and other factors. The elderly, the very young, and those with low or no income are most vulnerable to health-related impacts of extreme temperatures (Seltenrich, 2015).

Cold temperatures can be extremely dangerous to humans and animals exposed to the elements. Without heat and shelter, cold temperatures can cause hypothermia, frost bite, and death. Wind chill temperatures are often used in place of raw temperature values because wind can have in drawing heat from the body under cold temperatures (NOAA NWS, 2021). These values represent what temperatures actually feel like to humans and animals under cold, windy conditions. Similarly, to high temperatures, the effect of cold temperatures will vary by individual.

Figure 4.3.3-1 and Figure 4.3.3-2 shows the effects of wind speed on extreme cold events and humidity on extreme heat events. These compounding factors can increase the risk experienced by vulnerable populations and the public.

Figure 4.3.3-1: Danger Posed by Heat and Humidity (NOAA NWS, 2021)

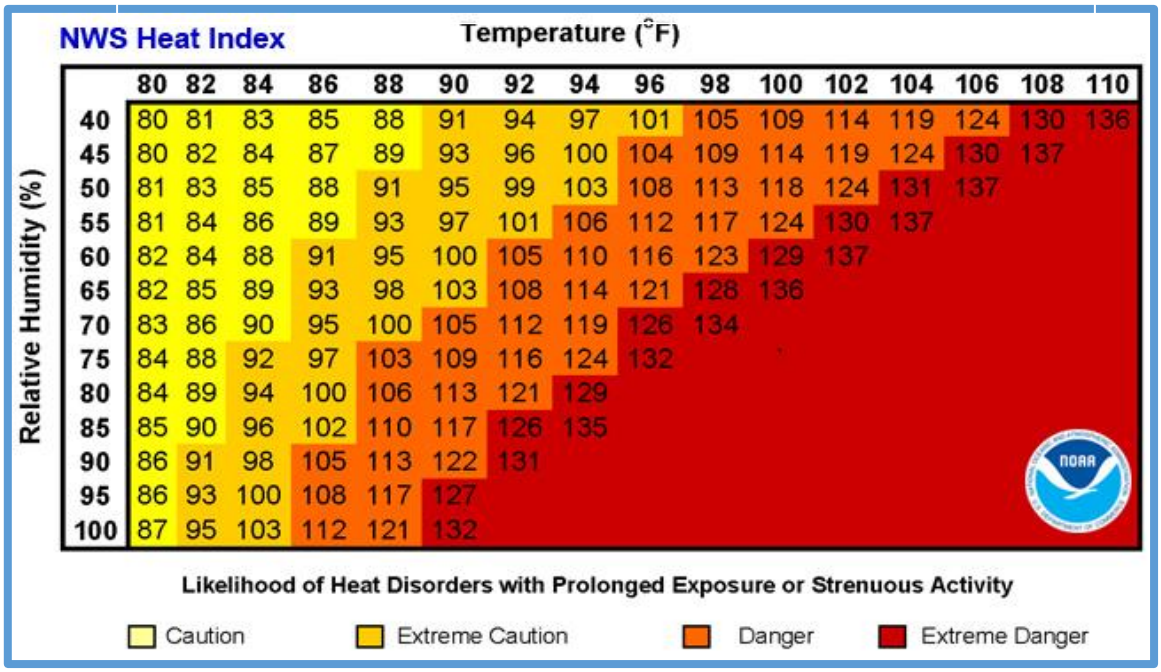
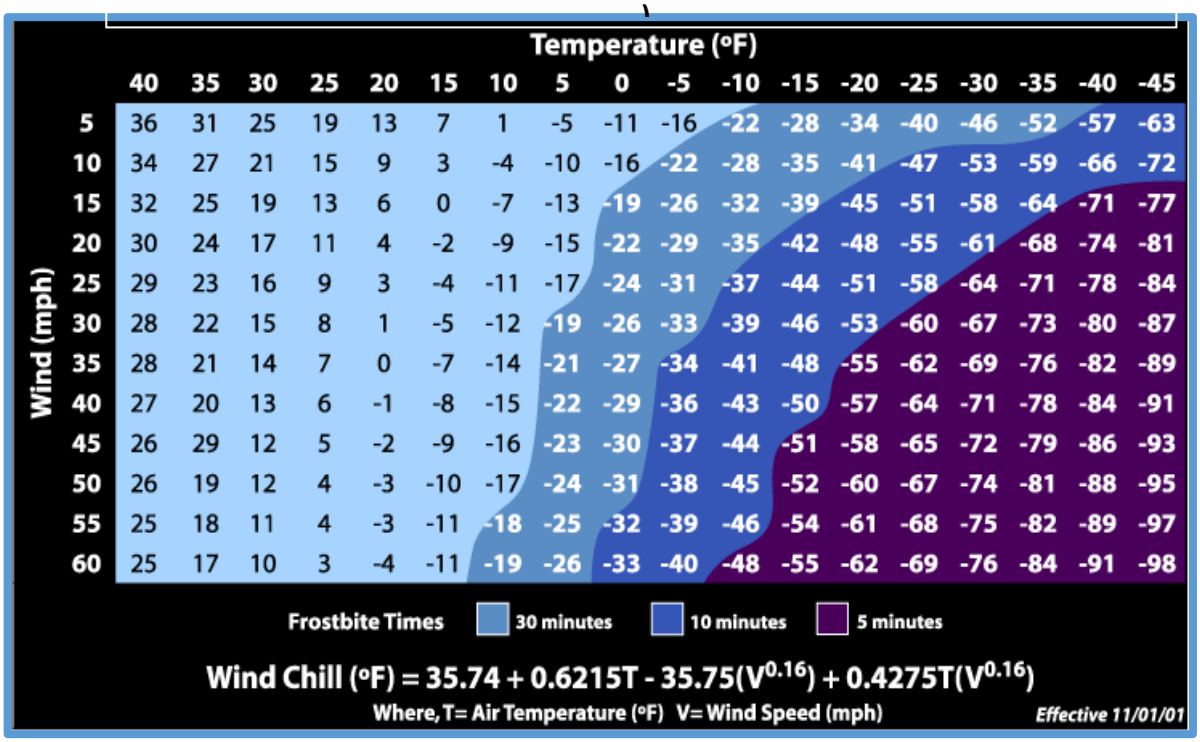


Figure 4.3.3-2: Danger Posed by Low Temperatures and Wind (NOAA NWS, 2021)



4.3.3.3. Past Occurrence

The region has often encountered severe and dangerous temperatures in the past. A map of average minimum temperatures in Berkeley and Morgan County can be seen in Figure 4.3.3-3, and a map of maximum temperatures can be seen in Figure 4.3.3-4 for the years 1981 to 2010. This data was the most current geospatial temperature data available for analysis (NOAA, 2021). Previous temperature extremes impacting Berkeley and Morgan County can be as seen in Table 4.3.3-4. Historically, Martinsburg, WV experienced a WV record of 112°F on July 11, 1936. According to the NWS Heat Index in Figure 4.3.4-1, a temperature of that magnitude presents an extreme danger. On July 17, 1988, temperatures in Cacapon State Park, WV reached a local record of 105°F. On the other end of the spectrum, on January 21, 1994, Berkeley Springs dropped to -27°F and Martinsburg reach -18°F (The Weather Channel, 2016). With wind chill, these cold temperatures could quickly cause frostbite on exposed skin. In general, Berkeley County seems to face the highest temperatures out of the two counties, while Morgan County experiences the lowest temperatures.

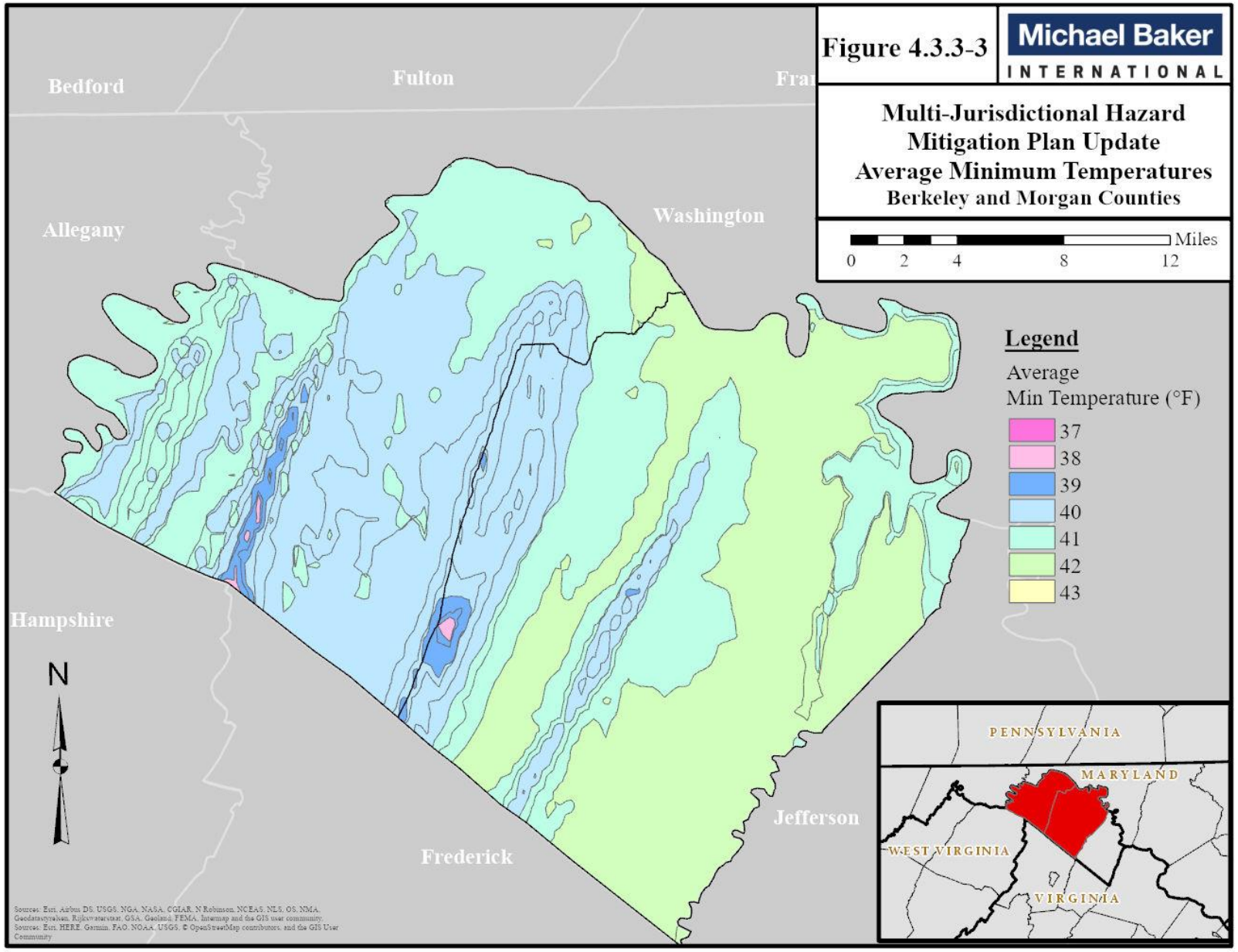


Figure 4.3.3-3
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Average Minimum Temperatures
Berkeley and Morgan Counties
Miles
0 2 4 8 12
Legend
Average Min Temperature (°F)
37
38
39
40
41
42
43
Bedford
Fulton
Allegany
Washington
Hampshire
Frederick
Jefferson
N
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA

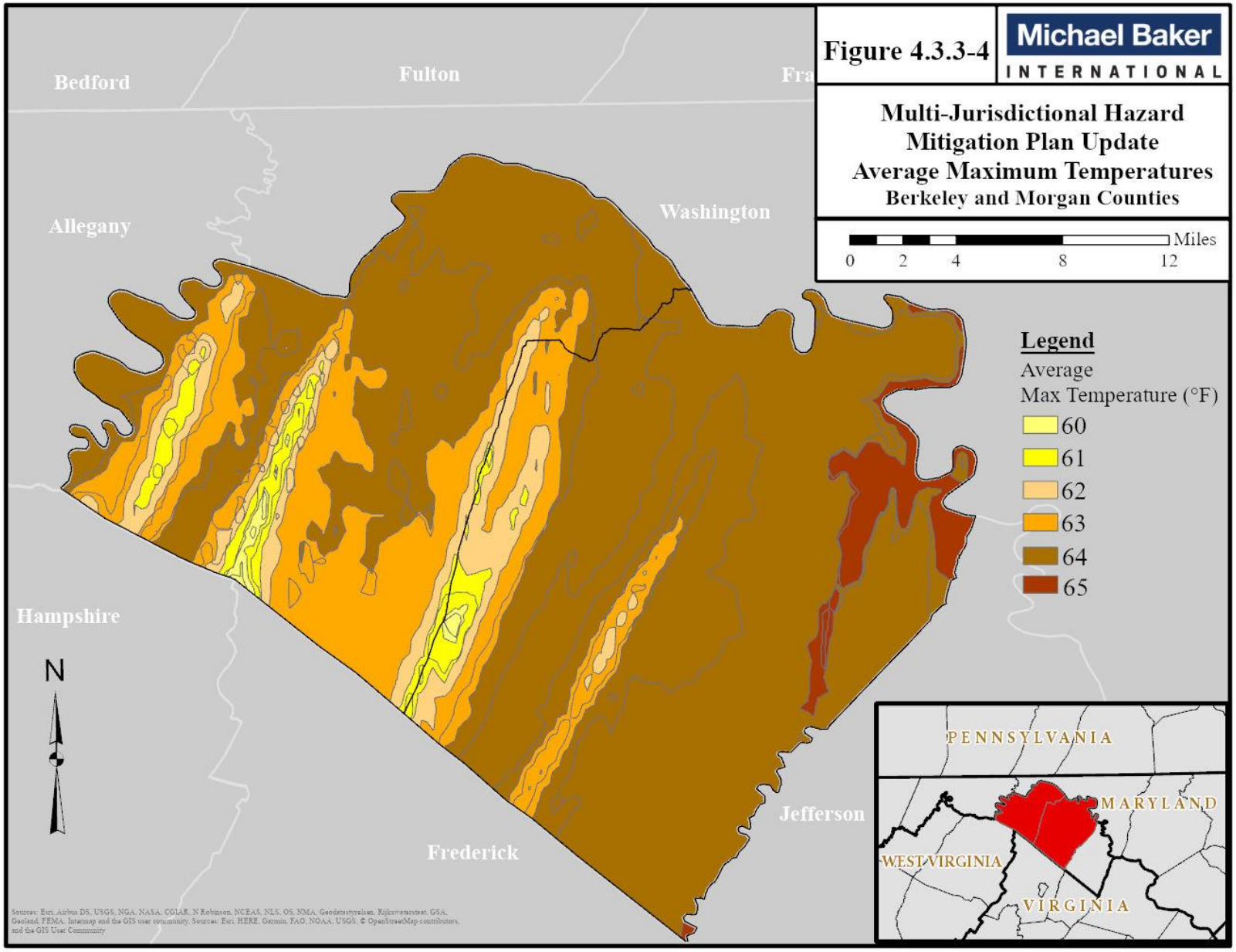


Figure 4.3.3-4
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Average Maximum Temperatures
Berkeley and Morgan Counties
Miles
0 2 4 8 12
Legend
Average Max Temperature (°F)
60
61
62
63
64
65
Bedford
Fulton
Allegany
Washington
Hampshire
Frederick
Jefferson
N
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA

Table 4.3.3-4 Previous Temperature Extremes Impacting Berkeley and Morgan County (2004-2021) (NOAA NCEI, 2021)

Date	County	Event	Deaths	Injuries	Property Damage Recorded	Crop Damage Recorded
1/10/2004	Berkeley	Cold/Wind Chill	0	0	$0.00	$0.00
1/10/2004	Morgan	Cold/Wind Chill	0	0	$0.00	$0.00
1/15/2004	Berkeley	Cold/Wind Chill	0	0	$0.00	$0.00
1/15/2004	Morgan	Cold/Wind Chill	0	0	$0.00	$0.00
1/23/2004	Berkeley	Cold/Wind Chill	0	0	$0.00	$0.00
1/31/2004	Morgan	Cold/Wind Chill	0	0	$0.00	$0.00
1/31/2004	Berkeley	Cold/Wind Chill	0	0	$0.00	$0.00
8/1/2006	Morgan	Heat	0	0	$0.00	$0.00
8/1/2006	Berkeley	Heat	0	0	$0.00	$0.00
7/21/2011	Morgan	Heat	0	0	$0.00	$0.00
7/22/2011	Berkeley	Excessive Heat	0	0	$0.00	$0.00
6/29/2012	Morgan	Heat	0	0	$0.00	$0.00
7/7/2012	Morgan	Heat	0	0	$0.00	$0.00
7/7/2012	Berkeley	Heat	0	0	$0.00	$0.00
1/7/2014	Berkeley	Extreme Cold/Wind	0	0	$0.00	$0.00

Table 4.3.3-4 Previous Temperature Extremes Impacting Berkeley and Morgan County (2004-2021) (NOAA NCEI, 2021)

Date	County	Event	Deaths	Injuries	Property Damage Recorded	Crop Damage Recorded
		Chill				
1/7/2014	Morgan	Extreme Cold/Wind Chill	0	0	$0.00	$0.00
7/25/2016	Berkeley	Heat	0	0	$0.00	$0.00
8/13/2016	Berkeley	Heat	0	0	$0.00	$0.00
8/13/2016	Morgan	Heat	0	0	$0.00	$0.00
7/20/2017	Berkeley	Heat	0	0	$0.00	$0.00
7/20/2017	Morgan	Heat	0	0	$0.00	$0.00
1/5/2018	Morgan	Cold/Wind Chill	0	0	$0.00	$0.00
1/5/2018	Berkeley	Cold/Wind Chill	0	0	$0.00	$0.00
6/18/2018	Morgan	Heat	0	0	$0.00	$0.00
6/18/2018	Berkeley	Heat	0	0	$0.00	$0.00
7/1/2018	Berkeley	Heat	0	0	$0.00	$0.00
7/1/2018	Morgan	Heat	0	0	$0.00	$0.00
7/2/2018	Berkeley	Heat	0	0	$0.00	$0.00
7/2/2018	Morgan	Heat	0	0	$0.00	$0.00
7/3/2018	Berkeley	Heat	0	0	$0.00	$0.00
7/3/2018	Morgan	Heat	0	0	$0.00	$0.00

Table 4.3.3-4 Previous Temperature Extremes Impacting Berkeley and Morgan County (2004-2021) (NOAA NCEI, 2021)

Date	County	Event	Deaths	Injuries	Property Damage Recorded	Crop Damage Recorded
7/4/2018	Berkeley	Heat	0	0	$0.00	$0.00
9/4/2018	Berkeley	Heat	0	0	$0.00	$0.00
9/4/2018	Morgan	Heat	0	0	$0.00	$0.00
1/21/2019	Morgan	Cold/Wind Chill	0	0	$0.00	$0.00
1/21/2019	Berkeley	Cold/Wind Chill	0	0	$0.00	$0.00
1/30/2019	Morgan	Cold/Wind Chill	0	0	$0.00	$0.00
1/30/2019	Berkeley	Cold/Wind Chill	0	0	$0.00	$0.00
7/19/2019	Morgan	Excessive Heat	0	0	$0.00	$0.00
7/19/2019	Berkeley	Excessive Heat	0	0	$0.00	$0.00
7/20/2019	Morgan	Excessive Heat	0	0	$0.00	$0.00
7/20/2019	Berkeley	Excessive Heat	0	0	$0.00	$0.00
7/21/2019	Berkeley	Excessive Heat	0	0	$0.00	$0.00
7/21/2019	Morgan	Heat	0	0	$0.00	$0.00
7/19/2020	Morgan	Heat	0	0	$0.00	$0.00
7/19/2020	Berkeley	Heat	0	0	$0.00	$0.00

Table 4.3.3-4 Previous Temperature Extremes Impacting Berkeley and Morgan County (2004-2021) (NOAA NCEI, 2021)

Date	County	Event	Deaths	Injuries	Property Damage Recorded	Crop Damage Recorded
7/20/2020	Morgan	Heat	0	0	$0.00	$0.00
7/20/2020	Berkeley	Heat	0	0	$0.00	$0.00

4.3.3.4. Future Occurrence

Berkeley and Morgan County are unlikely to face hazardous extreme temperatures in a given year, though temperatures of some concern are commonplace in winter and summer. Due to location and geography, the region is more likely to encounter extreme cold weather than excessive heat. As seen in Table 4.3.3 -1, the region is more likely to experience temperatures under 0°F than over 100°F in a given year. However, topography and vegetation can impact temperature differentials in the area. Therefore, the probability of an extreme temperature event in the region is considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

Officials in both counties rated temperature hazards a low level of concern, but as seen in Table 4.3.4-1, the counties should be aware of a general trend of warming. According to the Fourth National Climate Assessment, which utilized the Intergovernmental Panel on Climate Change's Representative Concentration Pathways (RCP) 4.5 and 8.5 scenarios, the annual average temperature across the United States is projected to increase by 2.5°F (RCP 4.5) or 2.9°F (RCP 8.5) between 2021 and 2050, relative to 1976-2005. The RCP 4.5 scenario assumes moderate measures are taken to reduce emissions, while the 8.5 scenario assumes a lower effort and thus more severe impacts. For the Northeast region, the change in annual average temperature is 3.98°F (RCP 4.5) or 5.09°F (RCP 8.5) by 2036-2065 and 5.27°F (RCP 4.5) or 9.11°F (RCP 8.5) by 2071-2100. These changes translate to approximately 20 to 30 more days above 90°F and 20 to 30 fewer days below freezing in the northeastern parts of the United States by mid-century (RCP 8.5) (Vose et al. 2017).

4.3.3.5. Vulnerability Assessment

The potential for extreme heat and cold always exists in and around the summer and winter months. Meteorologists and weather forecasters can normally predict the temperature with excellent accuracy. Adhering to extreme temperature warnings can significantly reduce the risk of temperature related deaths. Those hardest hit by both heat and cold waves are adults 75 years of age or older, many who are already physically vulnerable. Excessive heat exposure also affects people with certain pre-existing medical conditions, including cardiovascular disease, respiratory illnesses, and obesity.

Efforts to mitigate the impacts should focus on those groups most vulnerable. These groups will more likely be located in Morgan County, where the population is aging; however, affects will be noticed in senior communities and neighborhoods in Berkeley County. For example, both Martinsburg and the Town of Bath have several senior living communities. Officials should also focus on mobile home parks, where populations also tend to be aging. Both Berkeley and Morgan County are vulnerable to extreme temperatures, but vulnerabilities are extremely individualized among the general population and will continue to be extremely difficult to address from a county-wide or even local emergency response standpoint.

4.3.4. Flooding

Flooding is one of the highest priority hazards in both Berkeley and Morgan County, as is the case in most of West Virginia. Flooding is normally the result of a larger event such as a thunderstorm, rapid snowmelt, and/or ice jam. Flooding can be as frequent as the occurrence of a spring rain or summer thunderstorm. The amount of precipitation produced by storm events determines the type of flooding. Flash floods, which typically occur more frequently than general floods, occur along small streams and creeks of the type that are widely present throughout the Eastern Panhandle.

4.3.4.1. Location and Extent

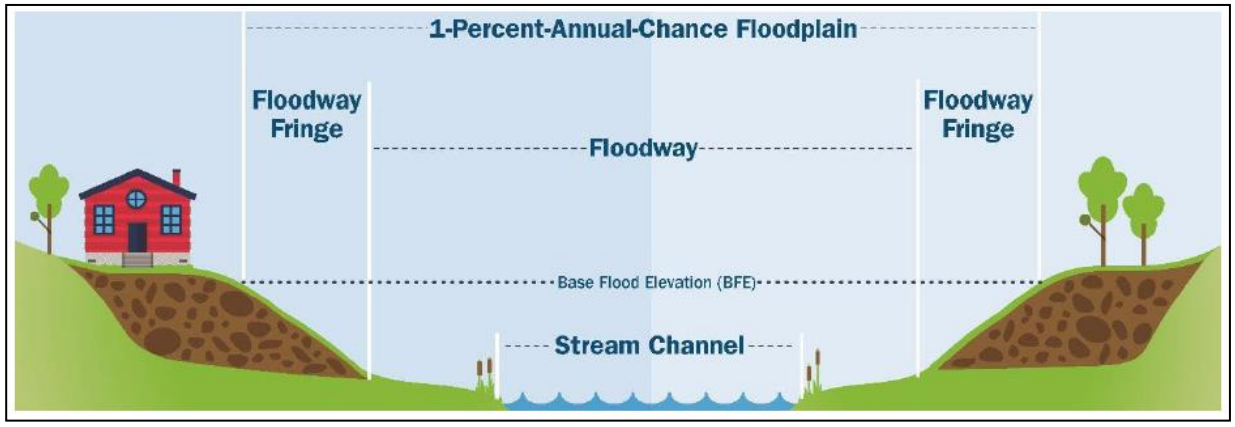
Flood sources within Berkeley and Morgan County include rivers and streams. For inland areas like the Eastern Panhandle, excess water from snowmelt or rainfall accumulates and overflows onto stream banks and adjacent floodplains. Berkeley and Morgan County lie within the drainage basin of the Potomac River, which drains directly into the Chesapeake Bay. Most of the region's population is in Potomac Direct Drains Watershed, but the western portion of Morgan County lies in the Cacapon Watershed.

The various tributary streams and creeks generally flow towards the northern region of Berkeley and Morgan County, towards the Potomac River. Large tributaries in the region include Opequon Creek, Back Creek, Sleepy Creek, and Cacapon River.

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. However, in assessing the potential spatial extent of flooding it is important to know that a floodplain associated with a 10-percent-annual chance of occurring in a given year is smaller than the floodplain associated with a flood that has a 0.2-percent-annual chance of occurring. The National Flood Insurance Program (NFIP), for which Flood Insurance Rate Maps (FIRM) are published, identifies the risk associated with the 1-percent-annual chance flood. This 1-percent-annual chance flood event is used to delineate the Special Flood Hazard Area (SFHA) and to identify Base Flood Elevations (BFE). Figure 4.3.4-1 illustrates these terms. The SFHA serves as the primary regulatory boundary used by FEMA, and the State of

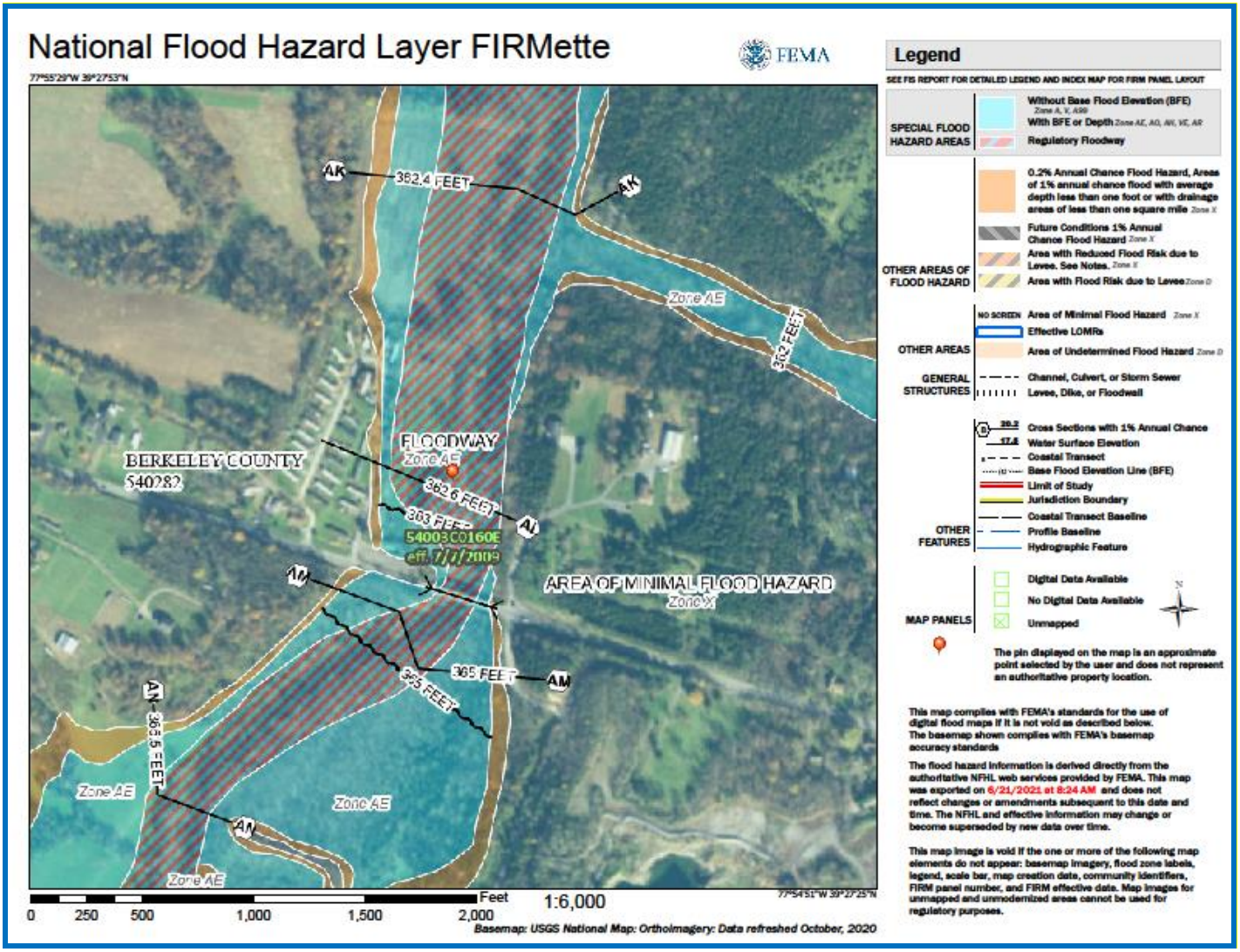
West Virginia, when determining risk associated with flooding.

Figure 4.3.4-1: Diagram Identifying Special Flood Hazard Area and 100-Year Floodplain



The current countywide FIRM and Flood Insurance Study (FIS) report was published for Berkeley County on August 7, 2009, and Morgan County on November 25, 2009 (FEMA, 2021c). This best available flood hazard data, which was used to update this flood hazard profile, included current effective FIRM data and incorporated Letters of Map Revision (LOMRs). Figure 4.3.4-2 displays an example of a FIRM, found along Opequon Creek. The FIRM and FIS for both counties can be obtained from the FEMA Map Service Center (http://www.msc.fema.gov) and can be used to identify the expected spatial extent and elevation of flooding from a 1-percent and 0.2-percent-annual chance event.

Figure 4.3.4-2: FIRM Panel 54003C0160E Showing Flood Hazard Areas along Opequon Creek in Berkeley County (FEMA, 2021c)



According to Figure 4.3.4-3 and Figure 4.3.4-4, Berkeley and Morgan County both face flooding countywide. Berkeley County is most threatened by flooding resulting from Opequon Creek, Back Creek, and their tributaries. Morgan County's greatest flooding risk results from Sleepy Creek, Cacapon River, and their corresponding tributaries. Both counties also face some risk of flooding from the Potomac River. In these figures, Zone A represents areas with a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Zone AE represents the base floodplain where base

flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones. Zone X represents area of moderate flood hazard, usually the area between the limits of the 100- year and 500-year floods (FEMA, 2021c).

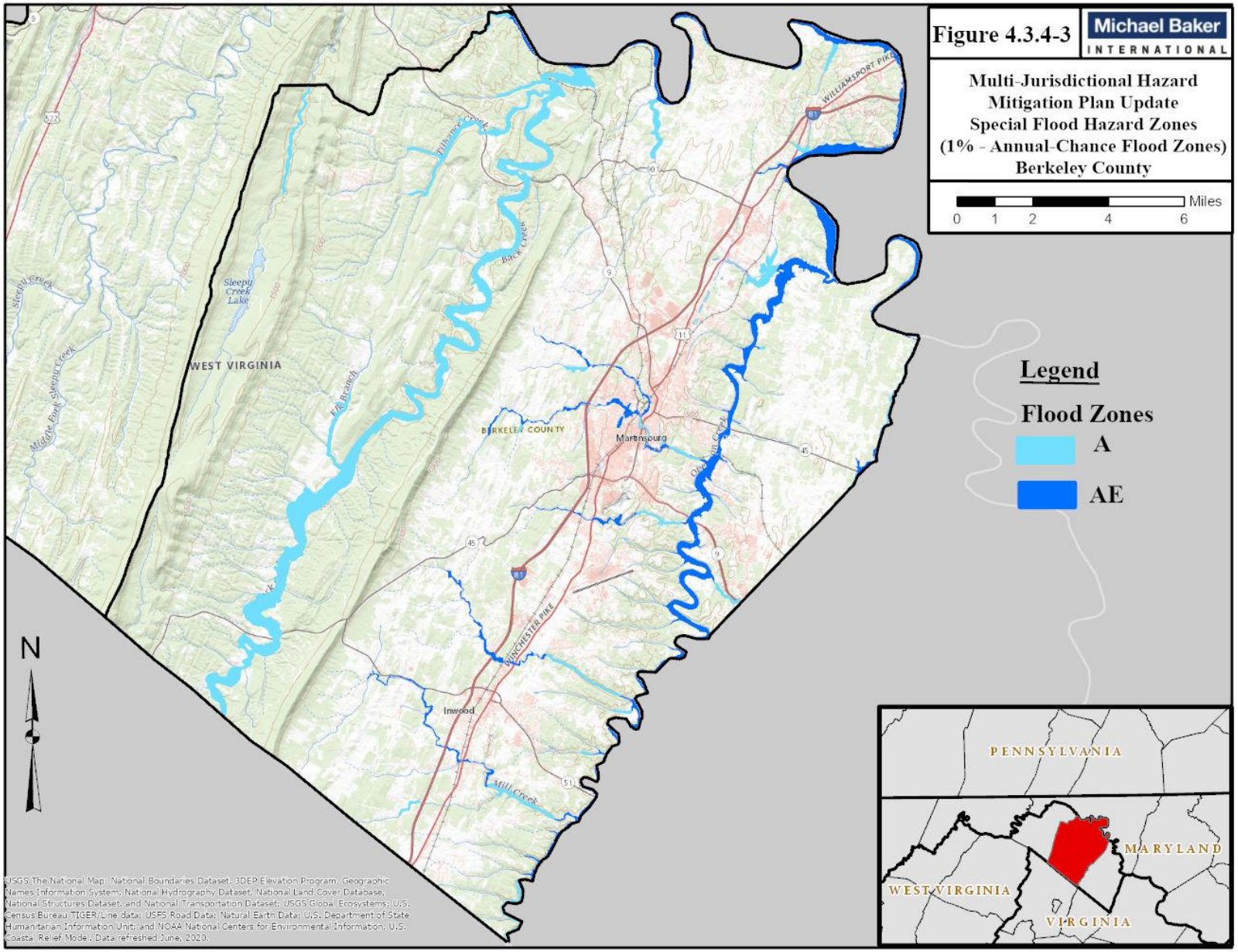
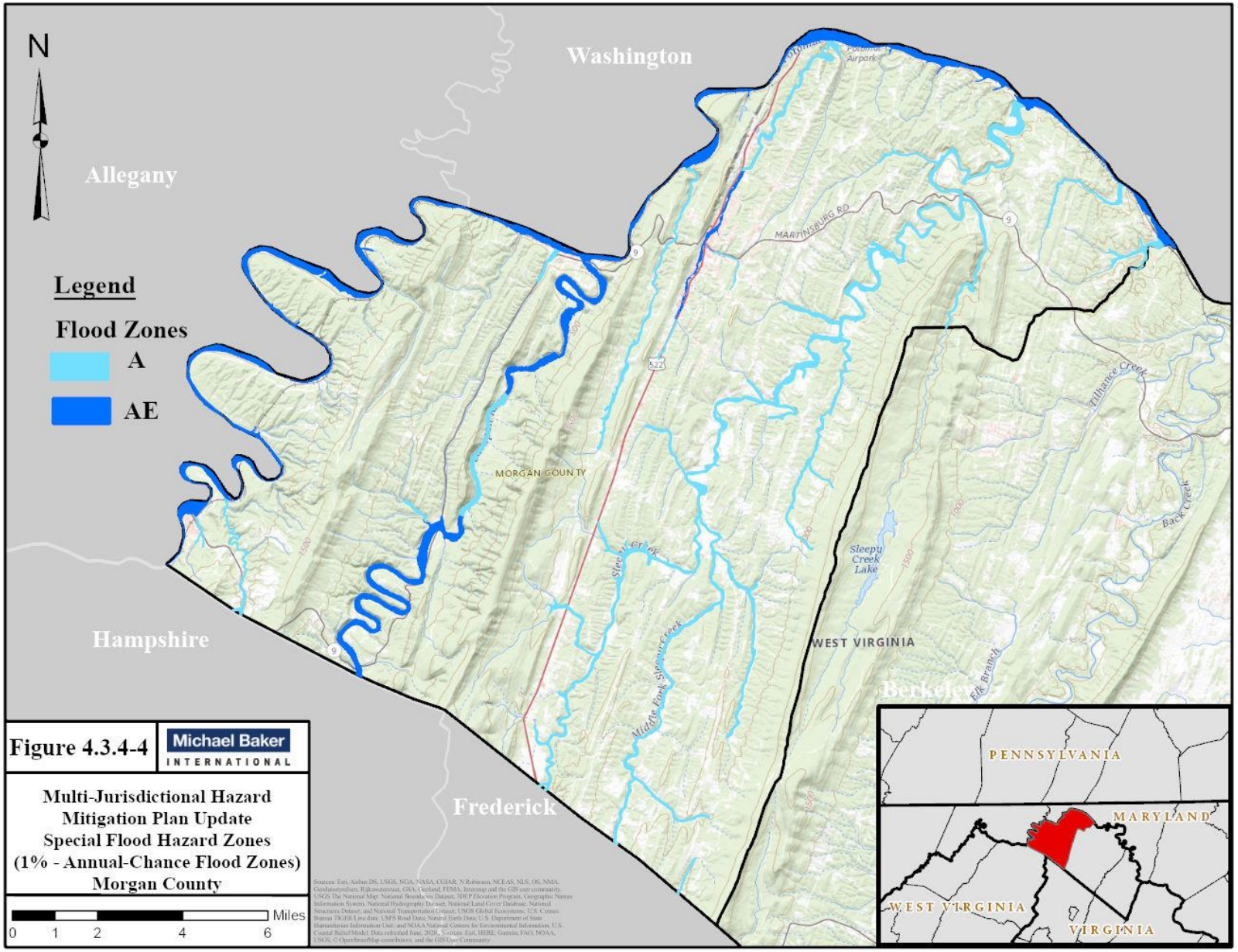


Figure 4.3.4-3
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Special Flood Hazard Zones
(1% - Annual-Chance Flood Zones)
Berkeley County
Miles
0 1 2 4 6
Legend
Flood Zones
A
AE
WEST VIRGINIA
BERKELEY COUNTY
Martinsburg
Inwood
Sleepy Creek Lake
Back Creek
Tuscarora Creek
Mill Creek
WILLIAMSPORT PIKE
WINCHESTER PIKE
N
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA
USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed June, 2020.


N
Washington
Allegany
Hampshire
Frederick
Berkeley
MORGAN COUNTY
WEST VIRGINIA
MARTINSBURG RD
Tuthaire Creek
Back Creek
Sleepy Creek Lake
Middle Fork Sleepy Creek
Elk Branch
Legend
Flood Zones
A
AE
Figure 4.3.4-4
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Special Flood Hazard Zones
(1% - Annual-Chance Flood Zones)
Morgan County
Miles
0 1 2 4 6
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA

4.3.4.2. Range of Magnitude

Floods are considered hazards when people and property are affected. Injuries and deaths can occur when people are swept away by flood currents or bacteria and disease are spread by moving or stagnant floodwaters. Most property damage results from inundation by sediment-filled water. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can result in floods in locations where the soil is frozen or saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, or other impervious developed areas.

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 or no vegetative ground cover. Berkeley and Morgan County have significant amounts of sloping and mountainous terrain, which can contribute to more severe floods as runoff reaches receiving water bodies more rapidly over steep terrain. Also, urbanization typically results in the replacement of vegetative ground cover with asphalt and concrete, increasing the volume of surface runoff and stormwater, particularly in areas with poorly planned stormwater drainage systems.

In much of the northeastern United States, including Berkeley and Morgan County, there are seasonal differences in how floods are caused. In the winter and early spring (February to April), major flooding has occurred as a result of heavy rainfall on dense snowpack throughout contributing watersheds, although the snowpack is generally moderate during most winters. Summer floods have occurred from intense rainfall on previously saturated soils. Summer thunderstorms deposit large quantities of rainfall over a short period of time that can result in flash flood events. In addition, as detailed in Section 4.3.6, Berkeley and Morgan County occasionally experience intense rainfall associated with tropical storms or hurricanes in late summer and early fall.

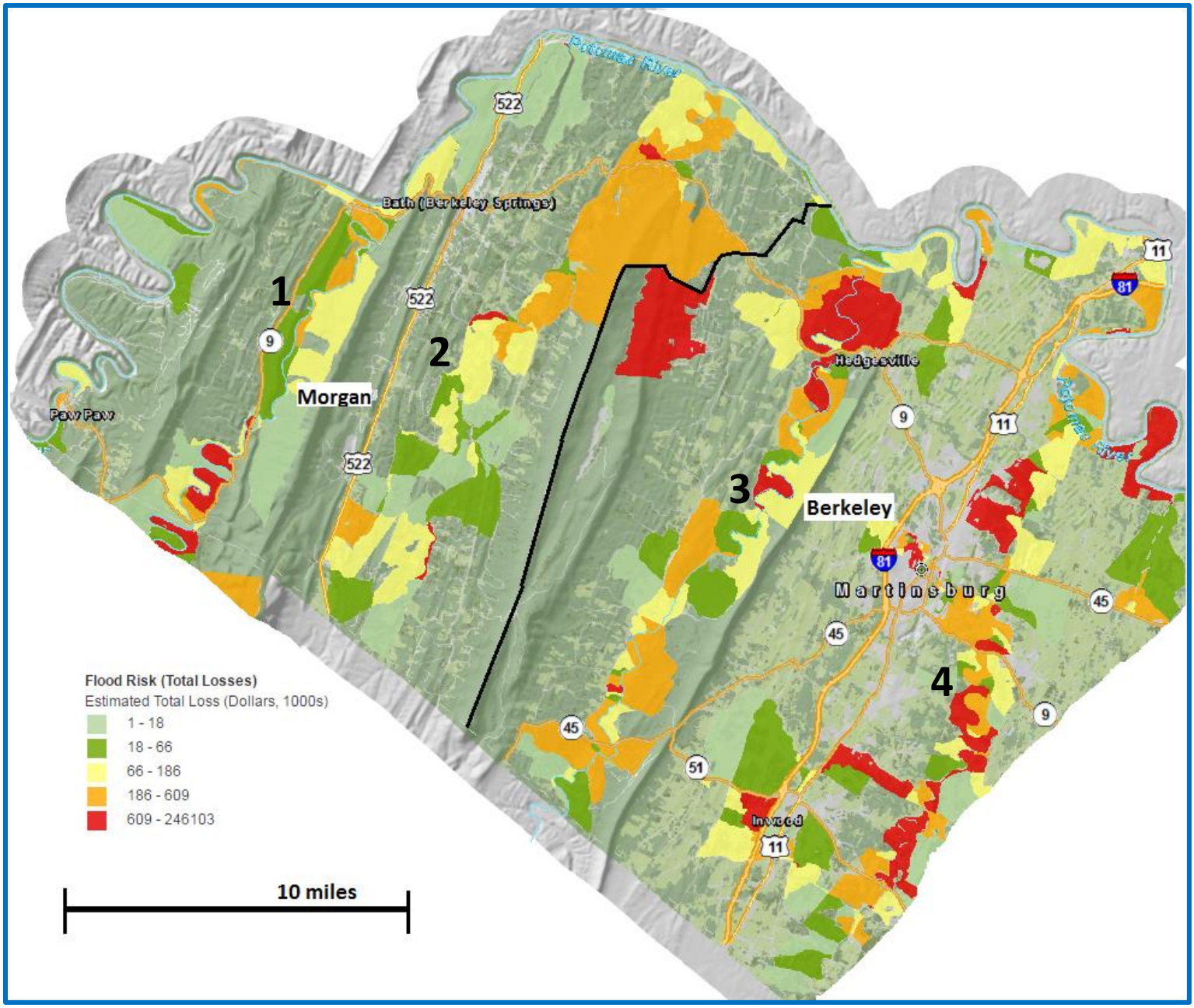
Flood effects can be volume or force related. Major floods along larger streams having wide floodplains tend to result in large-scale inundations. This causes widespread damage through soaking and silt deposits in homes, businesses, and industrial plants. In hilly regions where runoff paths are steep, flash floods may be prevalent. Flash floods are short in duration and usually occur in a somewhat localized area. In these floods, the velocity rather than the volume of water causes flood damages. Torrents of water can rush down minor hillside gullies at 30-50 miles per hour, carrying trees, debris, and rocks. These floods are often unpredictable and, particularly if they occur at night, can cause major panic and loss of life. Frozen surfaces can more than double normal runoff velocities, particularly in small drainage areas. This causes flash floods which can be compounded by ice and debris jams in channels and culverts. Also, obstructions within the floodplain such as bridges and undersized culverts can also increase flooding.

Although floods can cause damage to property and loss of life, floods 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 improving soil fertility. However, the destruction of riparian buffers, changes to land use and land cover throughout a watershed, and the introduction of chemical or biological contaminants which often accompany human presence cause environmental harm when floods occur. Hazardous material facilities are potential sources of contamination during flood events. Other negative environmental impacts of flooding include water-borne diseases, heavy siltation, damage or loss of crops, and drowning of both humans and animals.

According to Figure 4.3.4-5, generally, there are four areas within Berkeley and Morgan County that face the highest risk of flooding, two in each county. These areas stretch across the region in southwest to northeast direction and correspond with four major waterbodies. The watershed labeled "1" in the figure is in Morgan County and is connected with the Cacapon River. The area around this watershed that faces the most significant losses from a flood is at the southern edge of the county, around Largent, which faces potential losses of more than $600,000 per census block. In the figure, "2" is the watershed connected with Sleepy Creek and its tributaries, which poses the greatest threat to northeastern Morgan County and northwestern Berkeley County. The watershed labelled "3" in Figure 4.3.5-5 feeds into Back Creek and poses a clear threat to all of the communities near the creek. However, the area north of Hedgesville could experience the most serious losses. Additionally, "4" represents the flooding threat of Opequon Creek which poses a threat in the highest loss category to some areas across its length. Lastly, both counties have flooding risks along their northern edge due to the Potomac River (WV Flood Tool, 2021). It is important to note that no matter how slight the potential for loss, communities that face a possibility of flooding must be prepared.

Figure 4.3.4-5 Flood Risk in Berkeley and Morgan County (WV Flood Tool, 2021)



4.3.4.3. Past Occurrence

Berkeley and Morgan County have a long history of flooding events. Some small, localized flooding events occur annually with minimal property damage. However, occasionally larger floods can occur, seriously impacting communities and destroying property. Significant flooding events are listed in Table 4.3.4-1. These are the oldest floods for which data is available from the NCDC. Reported property damages are estimates reported to the NCDC and displayed in the Storm Events database today. Please note a zero-dollar entry may indicate minimal property damage, or that damage costs were not reported. From the table, the May 12, 2008 flood is highlighted as being fairly representative of the usual type of flooding that occurs within the region. A late spring storm hammered the tri-state region with heavy rain over a two-day period. Paw Paw received about 2.38 inches of rain, rainfall in Berkeley Springs measured 1.97 inches, and Martinsburg received 2.75 inches of rain. Water levels for rivers and creeks grew quickly, with Opequon Creek cresting at almost 3 feet above the 10-foot flood stage. Some roads and basements filled with water, but damage was not severe (Keels, 2008).

Table 4.3.4-1 Flood and Flash Flood Events Impacting Berkeley and Morgan County, 1996-June 2021 (NCEI NOAA, 2021b)

County	Starting Location	Date	Type	Property Damage ($)
Berkeley	Not Provided (NP)	1/19/1996	Flood	0
Berkeley	All	1/19/1996	Flash Flood	0
Morgan	NP	1/19/1996	Flood	0
Morgan	All	1/19/1996	Flash Flood	500,000
Berkeley	Martinsburg	7/30/1996	Flash Flood	20,000
Berkeley	Southern Portion	8/2/1996	Flash Flood	20,000
Berkeley	Countywide	9/6/1996	Flash Flood	150,000
Morgan	Countywide	9/6/1996	Flash Flood	250,000
Berkeley	Countywide	11/7/1997	Flash Flood	0
Morgan	Countywide	11/7/1997	Flash Flood	0
Berkeley	Countywide	2/4/1998	Flash Flood	5,000
Berkeley	Countywide	3/20/1998	Flash Flood	2,500
Morgan	Countywide	6/16/2000	Flash Flood	6,000
Berkeley	NP	3/22/2001	Flood	0
Berkeley	NP	1/2/2003	Flood	0
Berkeley	NP	2/22/2003	Flood	0
Morgan	NP	2/22/2003	Flood	0
Berkeley	NP	2/23/2003	Flood	0
Morgan	NP	3/20/2003	Flood	0
Berkeley	NP	3/21/2003	Flood	0
Berkeley	NP	5/16/2003	Flood	0
Berkeley	NP	5/16/2003	Flood	0

Table 4.3.4-1 Flood and Flash Flood Events Impacting Berkeley and Morgan County, 1996-June 2021 (NCEI NOAA, 2021b)				
County	**Starting Location**	**Date**	**Type**	**Property Damage ($)**
Morgan	Countywide	5/31/2003	Flash Flood	0
Berkeley	Countywide	6/13/2003	Flash Flood	0
Berkeley	NP	6/21/2003	Flood	0
Morgan	Countywide	8/22/2003	Flash Flood	0
Berkeley	Northern Portion	9/3/2003	Flash Flood	50,000
Berkeley	NP	9/18/2003	Flood	5,000
Morgan	NP	9/19/2003	Flood	100,000
Berkeley	NP	11/19/2003	Flood	0
Berkeley	NP	12/11/2003	Flood	0
Morgan	NP	12/11/2003	Flood	0
Berkeley	NP	2/6/2004	Flood	0
Morgan	NP	2/6/2004	Flood	0
Berkeley	Martinsburg	5/14/2004	Flash Flood	0
Morgan	Berkeley Springs	9/8/2004	Flash Flood	0
Berkeley	NP	9/17/2004	Flood	0
Berkeley	Martinsburg	9/17/2004	Flash Flood	0
Morgan	NP	9/17/2004	Flood	0
Morgan	Berkeley Springs	9/17/2004	Flash Flood	0
Berkeley	Inwood	9/28/2004	Flash Flood	0
Morgan	Berkeley Springs	9/28/2004	Flash Flood	0
Berkeley	Martinsburg	11/29/2005	Flash Flood	0
Morgan	NP	11/29/2005	Flood	50,000
Berkeley	Inwood	6/27/2006	Flash Flood	12,000
Morgan	Countywide	6/27/2006	Flash Flood	8,000
Morgan	Berkeley Springs	7/18/2006	Flash Flood	125,000
Morgan	Berkeley Springs	4/15/2007	Flood	0
Berkeley	Martinsburg	4/21/2008	Flood	0
Morgan	Berkeley Springs	4/21/2008	Flood	5,000
Berkeley	Arden	5/12/2008	Flood	0
Morgan	Johnsons Mill	5/12/2008	Flood	0
Berkeley	Martinsburg	7/23/2008	Flood	0
Morgan	Largent	9/27/2008	Flash Flood	0
Berkeley	Inwood	12/1/2010	Flash Flood	0
Berkeley	Eastern WV Regional Airport	4/16/2011	Flood	0
Berkeley	Union Corner	4/16/2011	Flood	0

Table 4.3.4-1 Flood and Flash Flood Events Impacting Berkeley and Morgan County, 1996-June 2021 (NCEI NOAA, 2021b)				
County	**Starting Location**	**Date**	**Type**	**Property Damage ($)**
Morgan	Ridge	4/16/2011	Flood	0
Morgan	Berkeley Springs	4/28/2011	Flash Flood	0
Berkeley	Bedington	5/17/2011	Flood	0
Berkeley	Martinsburg	5/17/2011	Flash Flood	0
Berkeley	Martinsburg	8/13/2011	Flash Flood	0
Berkeley	Vanclevesville	5/29/2012	Flash Flood	0
Morgan	Omps	8/9/2012	Flash Flood	0
Morgan	Berkeley Springs	9/1/2012	Flash Flood	0
Berkeley	Martinsburg	10/29/2012	Flash Flood	0
Berkeley	Martinsburg	9/1/2013	Flash Flood	0
Berkeley	Bunker Hill	5/16/2014	Flood	0
Berkeley	Tomahawk	5/16/2014	Flood	0
Berkeley	Ganotown	5/16/2014	Flood	0
Morgan	Great Cacapon	2/2/2016	Flood	0
Berkeley	Vanclevesville	2/4/2016	Flood	0
Morgan	Great Cacapon	2/4/2016	Flood	0
Morgan	Johnsons Mill	7/28/2016	Flood	0
Berkeley	Vanclevesville	9/29/2016	Flood	0
Berkeley	Eastern WV Regional Airport	1/24/2017	Flood	0
Berkeley	Tomahawk	1/24/2017	Flood	0
Berkeley	Bunker Hill	5/5/2017	Flood	0
Berkeley	Bunker Hill	5/5/2017	Flood	0
Berkeley	Eastern WV Regional Airport	5/5/2017	Flood	0
Berkeley	Tomahawk	5/5/2017	Flood	0
Morgan	Great Cacapon	5/5/2017	Flood	0
Morgan	Paw Paw	6/16/2017	Flood	0
Berkeley	Martinsburg	7/28/2017	Flash Flood	0
Berkeley	Bunker Hill	7/29/2017	Flood	0
Berkeley	Blairton	7/29/2017	Flood	0
Berkeley	Eastern WV Regional Airport	4/16/2018	Flood	0
Morgan	Doe Gully	4/17/2018	Flood	0
Berkeley	Ridgeway	5/17/2018	Flood	0
Morgan	Largent	5/17/2018	Flood	0
Berkeley	Ridgeway	5/19/2018	Flood	0

Table 4.3.4-1 Flood and Flash Flood Events Impacting Berkeley and Morgan County, 1996-June 2021 (NCEI NOAA, 2021b)				
County	**Starting Location**	**Date**	**Type**	**Property Damage ($)**
Berkeley	Tomahawk	5/19/2018	Flood	0
Berkeley	Martinsburg	5/31/2018	Flood	0
Berkeley	Martinsburg	6/1/2018	Flood	0
Berkeley	Bedington	6/1/2018	Flood	0
Berkeley	Berkeley	6/1/2018	Flood	0
Morgan	Paw Paw	6/1/2018	Flood	0
Morgan	Omps	6/1/2018	Flood	0
Berkeley	Hainesville	6/1/2018	Flood	0
Berkeley	Tomahawk	6/2/2018	Flood	0
Morgan	Stotlers Xds	6/2/2018	Flood	0
Morgan	Largent	6/2/2018	Flood	0
Berkeley	Johnstown	6/2/2018	Flood	0
Berkeley	Johnstown	6/2/2018	Flood	0
Morgan	Paw Paw	6/3/2018	Flood	0
Morgan	Paw Paw	6/3/2018	Flood	0
Morgan	Berkeley Springs	6/3/2018	Flood	0
Morgan	Great Cacapon	6/3/2018	Flood	0
Berkeley	Ridgeway	6/3/2018	Flood	0
Morgan	Woodmont	6/3/2018	Flood	0
Morgan	Paw Paw	6/3/2018	Flood	0
Berkeley	Glengary	6/3/2018	Flood	0
Morgan	Great Cacapon	6/22/2018	Flood	0
Berkeley	Vanclevesville	6/23/2018	Flood	0
Berkeley	Blairton	8/4/2018	Flood	0
Morgan	Berkeley Springs	8/21/2018	Flash Flood	0
Morgan	Greenwood	8/21/2018	Flood	0
Morgan	Berkeley Springs	8/21/2018	Flood	0
Morgan	Berkeley Springs	8/21/2018	Flood	0
Berkeley	Martinsburg	8/21/2018	Flash Flood	0
Berkeley	Martinsburg	8/21/2018	Flood	0
Berkeley	Martinsburg	8/21/2018	Flood	0
Berkeley	Martinsburg	8/21/2018	Flood	0
Berkeley	Inwood	8/21/2018	Flood	0
Berkeley	Vanclevesville	8/22/2018	Flood	0
Berkeley	Blairton	8/22/2018	Flood	0
Berkeley	Berkeley	8/31/2018	Flood	0

Table 4.3.4-1 Flood and Flash Flood Events Impacting Berkeley and Morgan County, 1996-June 2021 (NCEI NOAA, 2021b)				
County	**Starting Location**	**Date**	**Type**	**Property Damage ($)**
Berkeley	Martinsburg	8/31/2018	Flood	0
Morgan	Oakland	9/9/2018	Flood	0
Morgan	Holton	9/9/2018	Flood	0
Berkeley	Martinsburg	9/9/2018	Flood	0
Morgan	Berkeley Springs	9/9/2018	Flood	0
Berkeley	Ridgeway	9/9/2018	Flood	0
Morgan	Patterson Creek	9/9/2018	Flood	0
Morgan	Rock gap	9/10/2018	Flood	0
Berkeley	Ridgeway	9/10/2018	Flood	0
Berkeley	Johnstown	9/10/2018	Flood	0
Berkeley	Spring Mills	9/10/2018	Flood	0
Berkeley	Bedington	9/10/2018	Flood	0
Berkeley	Berkeley	9/10/2018	Flood	0
Berkeley	Martinsburg	9/10/2018	Flood	0
Berkeley	Vanclevesville	9/10/2018	Flood	0
Berkeley	Inwood	9/10/2018	Flood	0
Berkeley	Blairton	9/28/2018	Flood	0
Berkeley	Berkeley	9/28/2018	Flood	0
Morgan	Rock gap	9/28/2018	Flood	0
Morgan	Holton	9/28/2018	Flood	0
Berkeley	Vanclevesville	11/25/2018	Flood	0
Berkeley	Inwood	12/15/2018	Flood	0
Berkeley	Martinsburg	12/15/2018	Flood	0
Morgan	Largent	12/15/2018	Flood	0
Berkeley	Tomahawk	12/16/2018	Flood	0
Berkeley	Inwood	12/16/2018	Flood	0
Berkeley	Bedington	12/16/2018	Flood	0
Morgan	Great cacapon	12/22/2018	Flood	0
Berkeley	Blairton	1/20/2019	Flood	0
Berkeley	Vanclevesville	2/13/2019	Flood	0
Berkeley	Blairton	3/22/2019	Flood	0
Berkeley	Inwood	4/20/2019	Flood	0
Berkeley	Eastern WV Regional Airport	4/20/2019	Flood	0
Berkeley	Inwood	5/5/2019	Flood	0
Berkeley	Inwood	5/5/2019	Flood	0

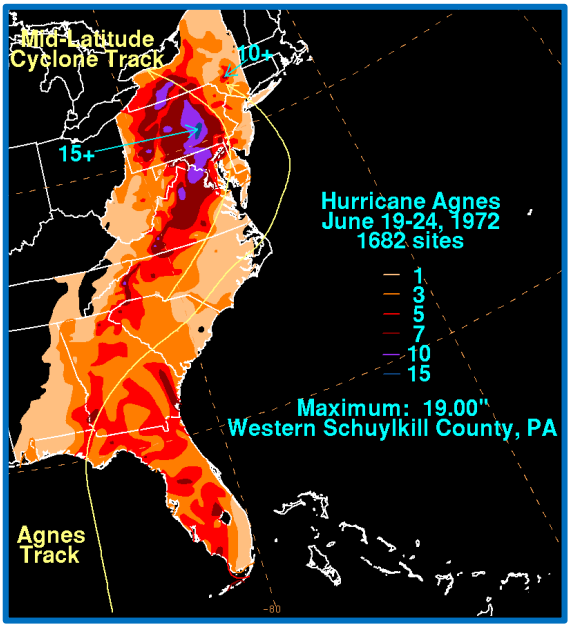
Table 4.3.4-1 Flood and Flash Flood Events Impacting Berkeley and Morgan County, 1996-June 2021 (NCEI NOAA, 2021b)				
County	**Starting Location**	**Date**	**Type**	**Property Damage ($)**
Berkeley	Blairton	5/5/2019	Flood	0
Berkeley	Blairton	5/5/2019	Flood	0
Berkeley	Eastern WV Regional Airport	5/5/2019	Flood	0
Berkeley	Tomahawk	5/5/2019	Flood	0
Morgan	Great Cacapon	5/1/2020	Flood	0
Morgan	Largent	3/1/2021	Flood	0

Figure 4.3.4-6: Town of Berkeley Springs, Morgan County during June 2018 flood event (Madison, 2018)

2018 was a particularly heavy year for flooding in the region. West Virginia Governor Jim Justice declared a State of Emergency in eight counties for flooding from heavy rain, including Berkeley and Morgan County in June 2018. According to the National Weather Service (NWS) the Cacapon River near Great Cacapon, Opequon Creek near Martinsburg and the Shenandoah River at Millville all reached moderate flood stage (Floodlist, 2018). Morgan and Hampshire County were hit the hardest, seeing six to eight inches of rain. More than 30 roads were closed in Morgan County, and several sections of road were damaged or washed out. Approximately 10 roads were closed in Berkeley County due to high water (Welch, 2018). Figure 4.3.4-6 shows flooded roads in Berkeley Springs, Morgan County in June 2018.

A few events representative of the most severe flooding events Berkeley and Morgan County could face involve June 1972 flooding due to Hurricane Agnes and January 1996 flooding because of heavy rain and snowmelt. Hurricane Agnes was one of the largest June hurricanes on record, but quickly weakened before landfall in Florida. However, a second low pressure developed west of Agnes, moving in tandem with the storm system and dramatically increasing rainfall across the east coast. Rainfall amounts on the east coast can be seen in Figure 4.3.5-7. Note that Berkeley and Morgan County lie within the five and seven inches of rainfall categories (WPC NOAA, 2013). This intense rain caused waterbodies to flood over their banks, completely flooding low lying communities and carrying away bridges. The Cacapon River crested at 22 feet near Great Cacapon, 13 feet above its flood stage. No other flood event has led to a crest of this magnitude in the Cacapon River since then (NWS, 2021). Flooding destroyed over 100 homes and damaged more than 1,500 others in West Virginia. Losses in West Virginia related to Hurricane Agnes totaled more than $7,750,000 in 1972 dollars, equivalent to more than $50,000,000 today (NHC NOAA, 2009).

Figure 4.3.5-7 Hurricane Agnes Rainfall in Inches (WPC NOAA, 2013)



The January 19, 1996 flooding resulted from an unprecedented combination of unseasonably warm air, rainfall totals between 3 to 5 inches, and an existing dense snowpack between 12 to 18 inches that melted within a 12-hour period. This influx of rain and snowmelt produced catastrophic flooding across the region, damaging homes and businesses, and triggering mudslides. A 51-year-old woman was killed in Morgan County after she exited her stalled vehicle and was swept up in flood currents. Property damage in Morgan County was estimated at roughly $500,000 (NWS, 1996). Opequon Creek, near Martinsburg, crested at its highest recorded level, 18.76 feet, almost nine feet above its designated flood stage (NWS, 2021).

In addition to past flood events, the NFIP identifies properties that experience frequent flooding and can be used to determine areas of higher risk. These properties are identified through the NFIP when they receive more than one payment for flood damages. The NFIP defines a **Repetitive Loss (RL)** property as "any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978." The RL data provided in Table 4.3.4-2 and throughout the plan represents the NFIP's definition of RL.

Under FEMA's Hazard Mitigation Assistance (HMA), regarding mitigation grant funding, RL is defined as a structure that:

a) Is covered by a contract for flood insurance made available under the NFIP; and

b) Has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and

c) At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage (ICC). (Note: Homes are eligible for ICC coverage after the first loss, however the cost for ICC is part of all policies.)

A **Severe Repetitive Loss** property is a structure that:

a) Is covered under a contract for flood insurance made available under the NFIP; and

b) Has incurred flood related damage (i) For which four or more separate claims payments have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or (ii) For which at least two separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Using data provided by FEMA in 2021, table 4.3.4-2 displays repetitive loss properties by jurisdiction and type in Berkeley and Morgan County. Berkeley County has 64 repetitive loss properties, and Morgan County has 41 repetitive loss properties. Of the 64 and 41 repetitive loss structures in Berkeley County and Morgan County, the most are single family homes, 58 and 39 respectively.

Table 4.3.3-2 Summary of the number and type of Repetitive Loss properties by municipality (FEMA, 2021)

Jurisdiction	Type			Sum of Repetitive Loss Properties
	2-4 Family	Other Non-Residential	Single Family	
Berkeley County	1	1	56	58
Martinsburg	3	1	2	6
Hedgesville	0	0	0	0

Table 4.3.3-2 Summary of the number and type of Repetitive Loss properties by municipality (FEMA, 2021)				
Jurisdiction	Type			Sum of Repetitive Loss Properties
	2-4 Family	Other Non-Residential	Single Family	
Morgan County	0	1	38	39
Bath	1	1	1	3
Paw Paw	0	0	0	0
Berkeley and Morgan County Total	**5**	**4**	**97**	**105**

Floods are the most common and costly natural catastrophe in the United States. In terms of economic disruption, property damage, and loss of life, floods are "nature's number-one disaster" (CRS, 2021). For that reason, flood insurance is a critical way for citizens to protect their property against flood loss. Home and business owners can purchase flood insurance through private insurers or through the NFIP.

Congress established the NFIP in 1968 to help control the growing cost of federal disaster relief (CRS, 2021). The NFIP, administrated through FEMA, offers federally backed flood insurance at discounted rates when communities adopt and enforce effective floodplain management ordinances to reduce future flood losses based on flood maps. The NFIP is based on voluntary participation of communities but is required for communities to receive federal disaster relief funding.

Table 4.3.4-3 lists the Berkeley and Morgan County municipalities participating in the NFIP.

The minimum floodplain management requirements to be a community in good standing in the NFIP include:

- Review and permit all development in the Special Flood Hazard Area (SFHA);
- Elevate new and substantially improved residential structures above the Base Flood Elevation;
- Elevate or dry floodproof new and substantially improved non-residential structures;
- Limit development in floodways;
- Locate or construct all public utilities and facilities to minimize or eliminate flood damage; and
- Anchor foundation or structure to resist floatation, collapse, or lateral movement.

Table 4.3.4-3 Berkeley and Morgan County NFIP Policies and Claim Information					
Community	**Policies in Force**	**Total Coverage**	**Prior Claims**	**Total Amount of Paid Claims**	**A-Zone**
Berkeley County	165	$34,220,300	377	$5,517,937	79
Martinsburg	23	$4,818,600	34	$680,792	14
Hedgesville	Does not participate in NFIP				
Morgan County	116	$26,421,300	199	$2,864,757	71
Bath	19	$3,240,500	24	$397,983	14
Paw Paw	6	$768,500	6	$79,550	6
Total	**329**	**$69,469,200**	**640**	**$9,541,019**	**184**

4.3.4.4. Future Occurrence

The NFIP recognizes the 1 percent-annual-chance flood, also known as the base flood, as the standard for identifying properties subject to federal flood insurance purchase requirements. A 1 percent-annual-chance flood is a flood which has a 1 percent chance of occurring over a given year. The FIRMs published in 2009 can be used to identify areas subject to the 1 percent- and 0.2 percent-annual-chance flooding. Areas subject to 2 percent- and 10 percent-annual-chance events are not shown on maps; however, water surface elevations associated with these events are included in the flood source profiles contained in the Flood Insurance Study Report. In this plan, the term "Special Flood Hazard Area" is used rather than floodplain to clarify that the area under consideration is identified on the FIRM as having at least a 1 percent chance of flooding in any given year. Historically, the area with a 1-percent chance of flooding in any given year has been called the "100-year floodplain" or the "base flood" and the area with a 0.2 percent chance of flooding in any given year has been called the "500-year floodplain." As these terms can be misleading by suggesting that there will be a flood only every 100 or 500 years respectively, they are not used in this plan.

In Berkeley and Morgan County, flooding occurs commonly and can take place during any season of the year. However, the possibility of flooding is greatly reduced during the winter months. Although most severe floods are attributable to rainfall alone, the spring floods can be compounded by snowmelt and moving ice. The major floods in the late summer and fall are often associated with tropical storms moving up the Atlantic coastline. Every two to three years, serious flooding occurs along one or more of the area's major rivers or streams and it is not unusual for such events to happen several years in succession. Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and related probability of occurrence. Historical records are used to determine the probability of occurrence (percent chance) for a flood of specific extent to occur. Overall, the probability of future flooding in Berkeley and Morgan County can be considered *likely* according to the Risk Factor Methodology (see Table 4.4.1-1).

The Town of Bath outlined several concept plans that propose stormwater management practices throughout the area. The locations were selected based on the criteria of existing land use, amount of impervious surface, proximity to the run or point of high-water flow, and feasibility based on opportunity to incorporate with already planned projects. The study utilizes a retrofit philosophy that if a project is being planned then what is being done or can be done to incorporate green infrastructure in a way that it does not impact the goal of construction and is cost effective to the owner. The main point of these concept plans is to designate opportunities within the watershed where green infrastructure could be most effective. Preventing stormwater runoff in areas with a high percentage of impervious surface land cover, can aid in reducing the effects of future heavy rain and melt events that cause damaging floods. By 2018, with the help of local and regional partnerships, Berkeley Springs had added new green infrastructure elements into already scheduled development projects—a cost-effective solution for the small town. The new elements included permeable pavers, tree boxes with bioretention cells and a rain garden at the bottom of a historic cemetery. Since the completion of these green infrastructure projects, residents in the town have noticed improved stormwater management in the area near the restoration project and plan to implement similar projects in other parts of the town that still suffer from floods.

4.3.4.5. Vulnerability Assessment

Flooding can lead to property loss as well as to loss of life. Flooding damages structures, including homes and businesses, vehicles, and infrastructure, including roadways. People who are surrounded by flood waters may at some point require evacuation, placing their lives and the lives of rescuers in danger. Flooding can disrupt the operation of businesses and schools. Recovery from flood damages can be time consuming and costly.

Flood vulnerability is described in terms of what community assets, structures, and infrastructure are situated in locations where flooding is anticipated. For purposes of assessing vulnerability, this plan focuses on those that are located within the SFHA. Please note that while other floods are possible, information about the extent and depths for the flood frequencies likely to be seen in this floodplain are available for all municipalities countywide, thus providing a consistent basis for analysis. Flood vulnerability maps for each county, showing the SFHA, critical facilities, and transportation routes within it, are included in **Appendix D**. These maps were created using FEMA countywide data from each county's current effective FIRM.

The best way for communities to strengthen floodplain management is by reviewing current codes and ordinances and by strongly enforcing their floodplain codes on new development to avoid aggravating further flooding. Significant residential growth in the outlying rural townships can increase opportunities for flash flooding if floodplain development and stormwater management are not properly regulated. Numerous times since the January 1996 floods, localized rainstorms that went undetected by the National Weather Service created surface flooding, which forced evacuations in

several floodplain communities.

Table 4.3.4-4 displays the number of addressable structures and critical facilities intersecting the SFHA in each county.

The number of vulnerable structures and critical facilities were calculated by overlaying the building footprints with the SFHA as shown in the FIRM data. Overall, 2.57 percent of the building footprints in Berkeley County and 4.77 percent of building footprints in Morgan County are within the SFHA. Of the 125 critical facilities located within Berkeley County, only four are within the SFHA, both the Kilmer Springs and Big Sprints Water Treatment Plants, Roach Energy, and the Martinsburg Recycling Center. Of the 36 critical facilities located within Morgan County, 11 are within the SFHA.

Table 4.3.4-4 Community Flood Vulnerability for Berkeley and Morgan County

County	Total Structures	Total Structures in SFHA	Percent of Structures in SFHA	Total Critical Facilities	Critical Facilities in SFHA	Percent of Critical Facilities in SFHA
Berkeley	71,289	1,836	2.57%	125	4	3.2%
Morgan	11,340	547	4.77%	36	11	30.6%
Total	82,629	2,383	7.34%	159	14	3.38%

The WV GIS Technical Center has also performed in depth analysis of critical infrastructure, flood depth, building-level risk, and much more on the WV Flood Tool, located at: https://www.mapwv.gov/flood/map/. Hazus reports found in Appendix G provides links directly to different aspects of the flood tool.

FEMA and the WVEMD have partnered to identify buyouts of repetitive flood properties during the past two decades, since the inception of the FEMA Hazard Mitigation Assistance grant programs. Some landowners have taken flood mitigation into their own hands, without the use of state or federal mitigation funding. For example, in 2006, the historic Morgan County Courthouse in Berkeley Springs was destroyed by a fire. This prompted the county to not just rebuild the courthouse, but also to move the courthouse out of a designated floodway. This type of community hazard mitigation action and awareness is important for long term progress in reducing the impacts of flooding.

Figure 4.3.4-9: Rebuilt Morgan County Courthouse (Silling Architects, 2017)

Additional information on flood vulnerability and losses in the region, including the 1 percent-annual-chance flood event results from Hazus, FEMA's loss estimation software, is provided in Section 4.4.3: Potential Loss Estimates.

4.3.5. Hailstorm

Hail is a form of precipitation that occurs when updrafts in thunderstorms move raindrops up into incredibly cold areas of the atmosphere freezing them into balls of ice. Thunderstorms that have a very strong updraft repeatedly lift hailstones up into the top of the cloud where they encounter supercooled water drops. These water drops will freeze on contact with the hail, increasing its size. The hail falls when the updraft can no longer sustain the weight of the hailstones (NSSL NOAA, 2021).

4.3.5.1. Location and Extent

Hail is a relatively minor natural hazard in all parts of the region, but it occurs with some frequency. Even with these frequent occurrences, losses tend to be minor, especially to critical facilities and other infrastructure. Much like minor thunderstorms, hailstorms rarely slow down the daily lives of the residents in the region. If their vehicles or homes are damaged, they usually claim those damages on

their insurance policies or repair the damage themselves.

When hail occurs, it can cause damage by battering crops, structures, automobiles, and transportation systems. When hailstorms are large, especially when combined with high winds, damage can be somewhat extensive. Hail is also much more common along mountain ranges because mountains force horizontal winds upwards thereby intensifying the updrafts within thunderstorms, where hail is formed, and making hail more likely. In mountainous areas, the falling hail has less time to melt before touching the ground (NSSL NOAA, 2021).

4.3.5.2. Range of Magnitude

Hail can vary significantly in its size and impact, but to be considered hail frozen precipitation must be greater than 0.2 inches in diameter. Table 4.3.5-1 demonstrates the range of reported hail sizes, with severe hail identified as being 1 inch or greater in diameter. The most severe hail experienced by Berkeley and Morgan County is between 1.5-2.5 inches in diameter (NSSL NOAA, 2021).

Hailstorms can cause significant damage to crops, livestock, and property. Damage is dependent on the size, duration, and intensity of hail precipitation. Automobiles and aircraft are particularly susceptible to damage. Also, people are at risk for serious injury if they do not seek immediate shelter. Since hail precipitation usually occurs during thunderstorm events, the impacts of other hazards associated with thunderstorms (i.e. strong winds, intense precipitation, etc.) often occur simultaneously (NOAA NSSL, 2021).

A potential worst-case scenario of a hailstorm would be if a storm carrying hail of over two inches were to occur over a prolonged period in a predominantly agricultural area. Because hail can cause significant crop damage, a storm of this magnitude would potentially destroy agricultural yields and result in significant lost revenue, as well as property damage and injuries.

Table 4.3.5-1 Reference Object Used to Estimate Hail Size and Corresponding Scale of Hail Diameters (NSSL NOAA, 2020)

Hailstone Size	Measurement (Inches)	Updraft Speed (mph)
BB	< 0.25	< 24
Pea	0.25	24
Marble	0.50	35
Dime	0.70	38
Penny	0.75	40
Nickel	0.88	46
Quarter	1.00	49
Half Dollar	1.25	54
Walnut	1.50	60
Golf Ball	1.75	64

Hailstone Size	Measurement (Inches)	Updraft Speed (mph)
Hen Egg	2.00	69
Tennis Ball	2.50	77
Baseball	2.75	81
Teacup	3.00	84
Grapefruit	4.00	98
Softball	4.50	103

4.3.5.3. Past Occurrence

There have been several hazardous hailstorms reported in the region. According to NCDC Event Records, 80 hail events of 0.5 inch or greater have been reported in Berkeley County, and 19 events have been reported in Morgan County since 1968. The largest reported hail in the area occurred during a hailstorm in Morgan County on July 18, 2006. It produced hail the size of a baseball, 2.75 inches in diameter (NCDC, 2021). Hail events from both 1968 to present for both counties can be viewed in Table 4.3.5-2. Damages from these events totaled $814,500.00.

Table 4.3.5-2 Berkeley and Morgan County Hail Events 1956-2021 (NCDC, 2021)

Location	Date	Size (in)	Property and Crop Losses
Berkeley County	6/3/1968	1.75	$0.00
Berkeley County	7/2/1968	1.5	$0.00
Berkeley County	6/8/1969	1	$0.00
Berkeley County	5/16/1988	1.75	$0.00
Berkeley County	9/18/1991	1	$0.00
Berkeley County	9/18/1991	1.75	$0.00
Berkeley County	9/18/1991	0.75	$0.00
Morgan County	4/16/1993	0.75	$0.00
Berkeley Springs	9/2/1993	1	$500
Berkeley county	9/21/1993	1.75	$500
Martinsburg	6/29/1994	0.5	$0.00
Berkeley County	5/25/1995	0.75	$2,000
Martinsburg	6/11/1995	0.75	$0.00
Morgan County	7/6/1995	0.75	$0.00
Martinsburg	7/10/1995	0.75	$0.00
Morgan County	7/10/1995	1	$5,000
Hedgesville	3/29/1997	0.88	$0.00
Bunker Hill	7/30/1998	1.75	$0.00
Martinsburg	5/12/1999	1	$0.00

Table 4.3.5-2 Berkeley and Morgan County Hail Events 1956-2021 (NCDC, 2021)			
Location	**Date**	**Size (in)**	**Property and Crop Losses**
Falling Waters	7/24/1999	0.75	$0.00
Martinsburg	7/24/1999	0.88	$0.00
Falling Waters	7/25/1999	0.75	$0.00
Martinsburg	11/2/1999	1	$0.00
Berkeley	11/2/1999	1	$0.00
Martinsburg Airport	5/10/2000	0.75	$0.00
Inwood	5/10/2000	0.88	$0.00
Falling WWaters	5/10/2000	0.75	$0.00
Hedgesville	7/14/2000	1	$0.00
Hedgesville	7/28/2000	1	$0.00
Berkeley Springs	6/12/2001	0.75	$0.00
Bunker hill	5/26/2002	0.88	$0.00
Martinsburg	5/26/2002	1.75	$0.00
Berkeley Springs	5/26/2002	1	$0.00
Berkeley Springs	5/26/2002	1.75	$0.00
Arden	6/4/2002	0.75	$0.00
Inwood	8/16/2003	1	$0.00
Martinsburg	5/14/2004	0.88	$5,000
Martinsburg Airport	5/25/2004	0.88	$0.00
Martinsburg	6/22/2005	0.88	$0.00
Martinsburg	7/9/2006	0.88	$0.00
Berkeley Springs	7/18/2006	1	$0.00
Berkeley Springs	7/18/2006	2.5	$750,000
Berkeley Springs	7/18/2006	1	$0.00
Omps	6/19/2007	1.75	$0.00
Martinsburg	9/26/2007	0.88	$0.00
Eastern WV Regional Airport	6/16/2008	0.75	$0.00
Gerrardstown	6/16/2008	0.75	$0.00
Hedgesville	8/14/2008	0.75	$0.00
Eastern WV Regional Airport	6/9/2009	1	$0.00
Great Cacapon	6/9/2009	0.75	$0.00
Marlowe	7/11/2009	1	$0.00
Tarico Heights	4/25/2010	1	$0.00
Tablers	5/26/2011	1	$0.00

Table 4.3.5-2 Berkeley and Morgan County Hail Events 1956-2021 (NCDC, 2021)			
Location	**Date**	**Size (in)**	**Property and Crop Losses**
Tablers	5/26/2011	1.25	$0.00
Blairton	6/21/2011	1	$0.00
Spring Mills	6/21/2011	1.25	$0.00
Marlowe	8/18/2011	1	$0.00
Marlowe	8/18/2011	1	$0.00
Gerrardstown	9/14/2011	1	$0.00
Union Corner	9/14/2011	1	$0.00
Shanghai	9/14/2011	1	$0.00
Shanghai	9/14/2011	1.5	$0.00
Ganotown	9/14/2011	1	$0.00
Johnstown	9/14/2011	1.75	$5,000
Johnstown	9/14/2011	1	$0.00
Arden	9/14/2011	1	$0.00
Jones Springs	9/14/2011	1.75	$0.00
North Mountain	5/3/2012	1	$0.00
North Mountain	5/3/2012	1	$0.00
Union Corner	5/3/2012	1	$0.00
Union Corner	5/3/2012	1.75	$0.00
Vanclevesville	5/29/2012	1	$0.00
Glengary	8/1/2012	1	$0.00
Stotlers Xrds	8/9/2012	1.25	$0.00
Hansrote	8/14/2012	1	$0.00
New hope	9/1/2012	1	$0.00
Fair view	5/22/2013	1	$0.00
Berkeley Springs	5/22/2013	1	$0.00
Gerrardstown	5/13/2014	1	$0.00
Spring Mills	6/11/2014	1	$0.00
Berkeley	6/11/2014	1	$0.00
Glengary	6/18/2014	1	$0.00
Great Cacapon	4/20/2015	1	$0.00
Berkeley Springs	6/16/2016	1.75	$0.00
Blairton	6/21/2016	1	$0.00
Nollville	6/21/2016	1	$0.00
Oakland	8/15/2016	1	$0.00
Johnstown	8/12/2017	1	$0.00
Berkeley Springs	8/12/2017	1	$0.00

Table 4.3.5-2 Berkeley and Morgan County Hail Events 1956-2021 (NCDC, 2021)			
Location	**Date**	**Size (in)**	**Property and Crop Losses**
Omps	9/5/2017	1	$0.00
Holton	5/13/2018	1	$0.00
Inwood	5/14/2018	1	$0.00
Martinsburg	5/14/2018	1.5	$0.00
Vanclevesville	5/3/2019	0.75	$0.00
Vanclevesville	5/3/2019	0.75	$0.00
Eastern WV Regional Airport	5/3/2019	1	$0.00
Darkesville	5/3/2019	1	$0.00
Eastern WV Regional Airport	6/2/2019	0.75	$0.00
Blairton	6/2/2019	1	$0.00
Martinsburg	6/2/2019	0.75	$0.00
Eastern WV Regional Airport	6/2/2019	0.75	$0.00
Blairton	6/2/2019	1	$0.00
Martinsburg	6/2/2019	0.75	$0.00
Inwood	6/23/2020	1	$15,500
Inwood	6/23/2020	1	$15,500
Inwood	6/23/2020	1.00	$15,500
Eastern WV Regional Airport	6/2/2019	0.75	$0.00
Blairton	6/2/2019	1.00	$0.00
Martinsburg	6/2/2019	0.75	$0.00
Vanclevesville	5/3/2019	0.75	$0.00
Inwood	6/23/2020	1.00	$15,500

The most recent occurrence of sizeable hail was reported in Martinsburg on May 14, 2018, with hail up to 1.5 inches in diameter. No damages were claimed. More recently, a hail occurrence in Inwood on June 23, 2020, resulted in $15,500 in property damage claims.

4.3.5.4. Future Occurrence

The future occurrence of hailstorm activity in Berkeley and Morgan County is expected, and the susceptibility to damage from hail will remain unchanged. The past occurrences in the region indicate that this event is one that can happen several times in any given year, most likely during the late spring

and summer months. However, the probability of hailstorm events resulting in multiple casualties and extensive structural damage can be considered *unlikely,* while the probability of nondamaging hail can be considered *possible,* according to the Risk Factor Methodology (see Table 4.4.1-1).

4.3.5.4. Vulnerability Assessment

All of Berkeley and Morgan County, including all critical infrastructure, is vulnerable to the effects of hail, as the storm cells that produce this hazard are spread over a large (multi-county) area. The area of damage due to these storms is relatively small, in that a single storm does not cause widespread devastation but may cause damage in a focused area of the storm. However, stakeholders have reported that hail damage can be especially damaging to tree orchards and other crops. According to the USDA Risk Management Agency (RMA) Federal Crop Insurance Corporation, which provides crop insurance to American farmers, $482,269 has been issued to farmers in Berkeley County in response to hail damage from 1996 to 2021. In Morgan County, $402,528 has been issued to farmers from 1996 to 2021 (USAD RMA, 2021). Even though not all crops are insured through RMA, these records provide some insight into how damaging hail can be. Morgan County farmers appear to be the most threatened by hail.

However, the National Weather Service and other meteorological forecasters can predict severe hail and warn residents and farmers. Vulnerability will vary by community, and people who are outdoors and property that is not protected by a strong roof will be most vulnerable.

4.3.6. Hurricane and Tropical Storm

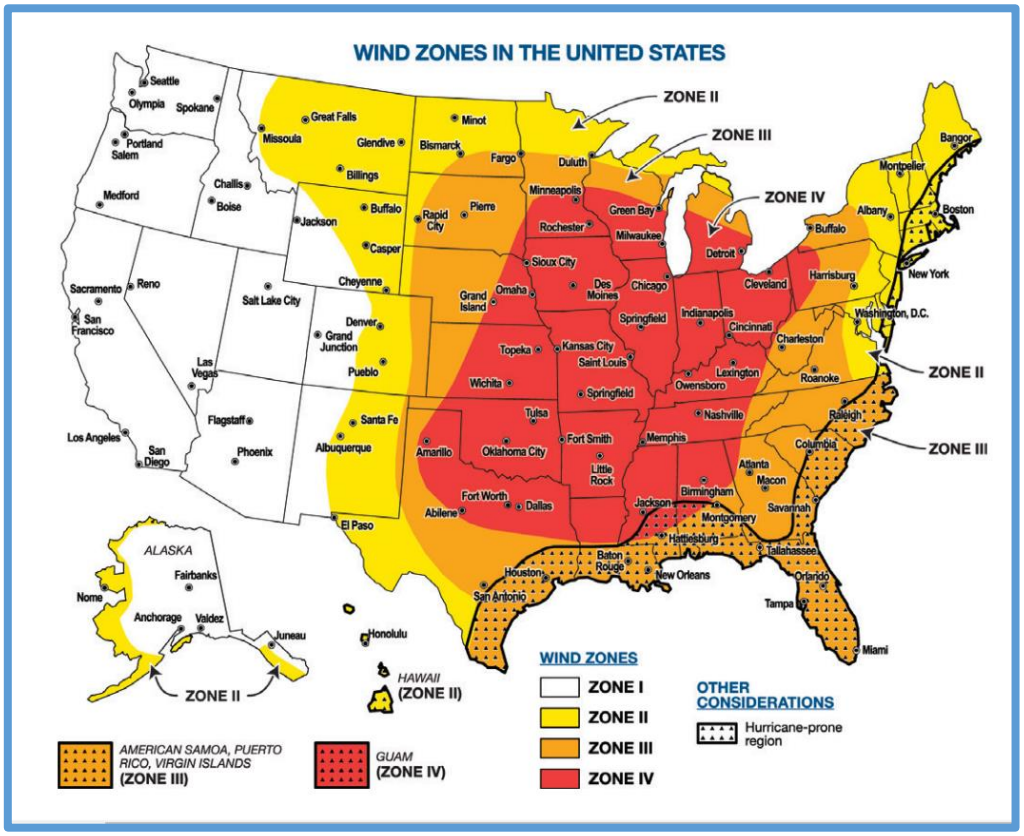
4.3.6.1. Location and Extent

Tropical storms impacting Berkeley and Morgan County develop in tropical or sub-tropical waters found in the Atlantic Ocean, Gulf of Mexico, or Caribbean Sea. Cyclones with maximum sustained winds of less than 39 miles per hour (mph) are called tropical depressions. A tropical storm is a cyclone with maximum sustained winds between 39-74 mph. These storms sometimes develop into hurricanes with wind speeds more than 74 mph. While the region is located over 100 miles from the Atlantic Coast, tropical storms can track inland causing heavy rainfall and winds.. Therefore, all communities within both counties are equally subject to the impacts of hurricanes and tropical storms. Areas subject to flooding, wind, and winter storm damage are particularly vulnerable.

Figure 4.3.6.1 shows wind speed zones developed by the American Society of Civil Engineers based on information including 40 years of tornado history and over 100 years of hurricane history. It identifies wind speeds that could occur across the United States to be used as the basis for design and evaluation of the structural integrity of shelters and critical facilities. Berkeley and Morgan County fall within Zone III, meaning shelters and critical facilities should be able to withstand a 3-second gust of

up to 200 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm event. More detail on tornados and windstorms is discussed in Section 4.3.13.

Figure 4.3.6-1: Wind Zones of the United States (IBEC, 2019)



4.3.6.2. Range of Magnitude

The impacts associated with hurricanes and tropical storms are primarily wind damage and flooding. It is not uncommon for tornadoes to develop during these events. Historical tropical storm and hurricane events have brought intense rainfall, sometimes leading to damaging floods, northeast winds, which, combined with waterlogged soils, caused trees and utility poles to fall.

The impact tropical storm or hurricane events have on an area is typically measured in terms of wind speed. Expected damage from hurricane force winds is measured using the Saffir-Simpson Scale. The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure and storm surge potential (characteristic of tropical storms and hurricanes, but not a threat to Berkeley and Morgan County), which are combined to estimate potential damage. Table 4.3.6-1 lists Saffir-Simpson Scale categories with associate wind speeds and expected damages. Categories 3, 4 and 5 are classified as “major” hurricanes. While major hurricanes comprise only 20

percent of all tropical cyclones making landfall, they account for over 70 percent of the damage in the United States.

Table 4.3.6-1 Saffir-Simpson Scale Categories with Associated Wind Speeds and Damages (NHC, 2009)

Storm Category	Wind Speed (mph)	Description
1	74-95	**MINIMAL:** Damage is limited primarily to shrubbery and trees, unanchored mobile homes and signs. No significant structural damage.
2	96-110	**MODERATE:** Some trees are toppled, some roof coverings are damaged, and major damage occurs to mobile homes. Some roofing material, door and window damage.
3	111-130	**EXTENSIVE:** Some structural damage to small residences and utility buildings, with a minor amount of Curtin wall failures. Mobile homes are destroyed. Large trees are toppled. Terrain may be flooded well inland.
4	131-155	**EXTREME:** Extensive damage to roofs, windows, and doors; roof systems on small buildings completely fail. More extensive Curtin wall failures. Terrain may be flooded well inland.
5	>155	**CATASTROPHIC:** Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Massive evacuation of residential areas may be required.

It is important to recognize the potential for flooding during hurricane, and tropical storm events; the risk assessment for these events is included Section 4.3.4. Environmental impacts associated with hurricanes and tropical storms are consistent with the impacts described for flooding in Section 4.3.4 and tornadoes and windstorms in Section 4.3.13.

4.3.6.3. Past Occurrence

Berkeley and Morgan County and the State of West Virginia have a history of hurricane related disasters despite their distance from the coast. Federally declared hurricane related events that have occurred in West Virginia are included in Table 4.3.6-2.

Figure 4.3.6-2 shows historic coastal storms which have passed through the State of West Virginia, as found in the State of West Virginia 2018 Hazard Mitigation Plan.

Table 4.3.6-2 Previous Tropical Storm Events Affecting Berkeley and Morgan County (FEMA, 2021a)

Year	Event	Description of Damages
1972	Hurricane Agnes (DR 344)	Caused $7.8 million in damages in West Virginia

Table 4.3.6-2 Previous Tropical Storm Events Affecting Berkeley and Morgan County (FEMA, 2021a)		
Year	**Event**	**Description of Damages**
1996	Hurricane Fran (DR 1137)	Heavy rain across the state, 2 to 6 inches of rainfall in Morgan and Berkeley County
2003	Hurricane Isabel (DR 1496)	2 to 6 inches of rainfall across eastern West Virginia
2004	Hurricane Ivan (DR 1558)	Spawned 3 tornadoes in the Eastern Panhandle (discussed further in Section 4.3.13)
2005	Hurricane Katrina (Emergency Declaration 3221)	Heavy rainfall in western part of West Virginia
2012	Hurricane Sandy (Emergency Declaration 3558)	Heavy snowfall in the middle of the state, heavy winds across the state. A photo of the Martinsburg city cleanup efforts that took place after Hurricane Sandy winds can be seen in Figure 4.3.13-2.

4.3.6.4. Future Occurrence

The likelihood of Berkeley or Morgan County being impacted by a tropical storm or hurricane is low, but still possible in any given year. FEMA produces an online mapping application that identifies communities most at risk to natural hazards, called the National Risk Index. A summary of the risk index for hurricanes can be seen in table 4.3.6-3 and 4.3.6-4. Berkeley and Morgan County have a probability of a hurricane event happening per year at 6 percent and 5 percent, respectively. Both County also have very low expected annual loss, historic loss, and overall risk ratings (FEMA NRI, 2021). Overall, the probability of future Hurricane or Tropical Storms impacting the region can be considered *possible* according to the Risk Factor Methodology (see Table 4.4.1-1).

Figure 4.3.6-2: Historical Tropical Storms in West Virginia (State of West Virginia, 2018)

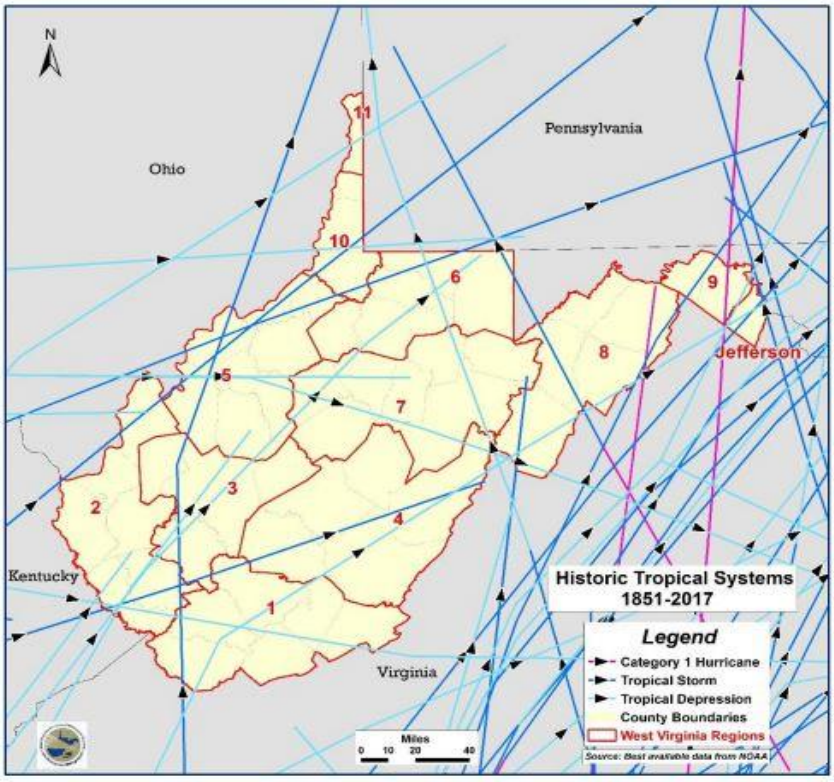


Table 4.3.6-3 National Risk Index Hurricane Summary for Berkeley County (FEMA NRI, 2021)	
Number of Events	9
Number of Events 1970-2021	9
Annualized Frequency	0.06%
Expected Annual Loss Rating	Very Low
Historic Loss Rating – Overall Rating	Very Low
Risk Rating	Very Low

Table 4.3.6-4 National Risk Index Hurricane Summary for Morgan County (FEMA NRI, 2021)	
Number of Events 1970-2021	6
Annualized Frequency	0.05%
Expected Annual Loss	Very Low
Historic Loss Rating – Overall Rating	Very Low
Risk Rating	Very Low

There has been an increase in North Atlantic hurricane activity since the 1970s with locations of peak intensity tropical cyclones migrating poleward coinciding with tropics expansion (Kossin et al. 2020). It is likely that precipitation rates and maximum sustainable winds associated with tropical cyclones will increase globally, however, regional projections are more uncertain due to differences in circulation patterns and sea surface temperature increases. For the Atlantic, the frequency of intense (stronger and with heavier rainfall) tropical storms is likely to increase (Kossin et al. 2020).

4.3.6.5. Vulnerability Assessment

A vulnerability assessment for hurricanes and tropical storms focuses on the impacts of flooding and severe wind. Berkeley and Morgan County are vulnerable to the impact of flooding and severe wind caused by hurricanes and tropical storms. Historic data indicates that while storm tracks do not typically track over this region, impacts from associated rain can be felt in low-lying communities that face similar vulnerability from flooding events. A detailed assessment of Berkeley and Morgan County's flood-related vulnerability is addressed in Section 4.3.4, while its vulnerability to wind damage is addressed in Section 4.3.13.

4.3.7. Invasive Species

In the 2022 Plan Update, this hazard name was changed from Infestation to Invasive Species to better match the PA SOG which was consulted for this Update. The PA SOG was consulted because no SOG exists for West Virginia. The 2017 definition for Infestation closely matches the definition for Invasive Species, so this was a suitable change for the region.

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.

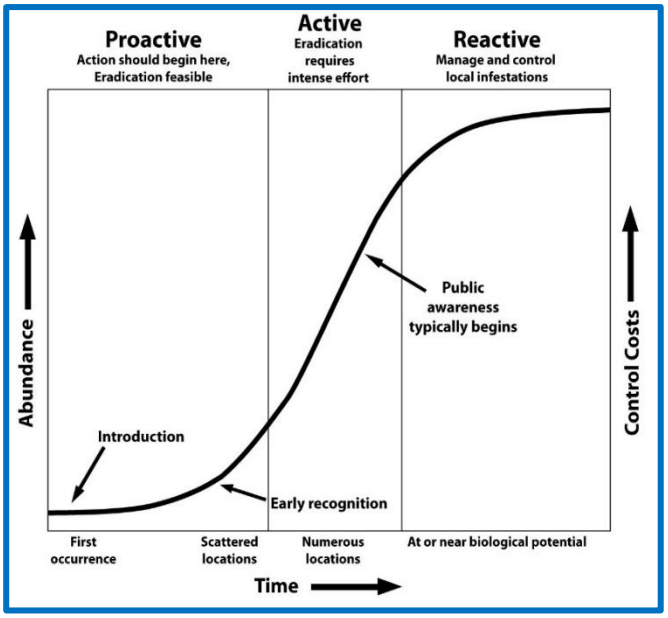
4.3.7.1. Location and Extent

The effects of an infestation to this region could be quite damaging due to the thousands of acres of agriculture and forested land in the region. Both Berkeley and Morgan County have similar native forests, agricultural species, and climate. Therefore, they both have essentially the same risk of infestation. Infestations often spread regionally, as invasive species are often adept at gaining footholds and outcompeting native species in entire biomes.

4.3.7.2. Range of Magnitude

The magnitude of an infestation varies as widely as the species that can cause them. Invasive species can have severe impacts to agriculture, wipe out tree species, and out compete native organisms. Infestations can be caused by plants, animals, insects, or pathogens, and there are over 1,000 invasive species in West Virginia. The complete scope of magnitude of these organisms is outside the scope of this document. However, as seen in Figure 4.3.7-1, infestations do not often occur overnight, and invasive populations grow along a logistic curve. The earlier along this curve control and eradication actions are taken against an infestation, the more effective they will be. Once populations reach their peak level, they are very difficult to eradicate, and communities are forced to rely on careful management and control of invasive populations (WV DNR,

Figure 4.3.7-1: Phases of Invasive Species Infestation and Control



2014). Education and public awareness become extremely important as invasive species spread.

4.3.7.3. Past Occurrence

Species that impact trees that have been of specific concern to Berkeley and Morgan County in recent years include the emerald ash borer, the gypsy moth, hemlock woolly adelgid, and spotted lanternfly. The emerald ash borer eats the cambium (cellular plant tissue) of ash trees, killing the tree within 2 or 3 years of infestation. The emerald ash borer was first sighted in 2009 in Morgan County and in 2010 in Berkeley County, and ash trees are now extremely scarce in the Eastern Panhandle (WV DNR, 2014; USDA, 2016).

Figure 4.3.7-2: A WVDA employee conducts a Gypsy Moth Survey (WV Division of Forestry, 2020).

Gypsy moths have been a widespread issue in West Virginia after they first arrived in the state in the early 1970s. According to The West Virginia Division of Forestry, the gypsy moth is considered the most serious insect pest ever to invade West Virginia (WV Division of Forestry, 2020). The moths eat the leaves of many hardwoods, which can kill trees and damage the health and appearance of forests. Exposure to the caterpillars of these moths can also cause minor health problems, such as irritation to the eyes or respiratory tract and rashes. Bans on the transport of certain trees and tree products, mobile homes, and outdoor household articles have been put in place in 44 West Virginia counties, including Berkeley County, to try to stop the spread of gypsy moths (WV DNR, 2014; USDA, 2016).

The hemlock woolly adelgid feeds off the sap of and is deadly to hemlock trees. It was reported in Morgan County in 1993 and in Berkeley County in 1997, and it has continued to spread across the state. The loss of hemlock trees contributes to dramatic changes in the composition of forests, habitat loss for birds, and the reduction of shade and increased sedimentation for cold water trout streams (WV DNR, 2014).

The spotted lanternfly has the potential to infest over 70 species of trees and vines. Its primarily known to infest the exotic and equally invasive tree-of-heaven (scientific name Ailanthus altissima) but has been detected on many of West Virginia's native tree hosts where it has the potential to cause severe economic and ecological damage. As of October 2020, Berkeley and Mineral County were the only counties in West Virginia with records of spotted lanternfly (West Virginia Department of Agriculture, 2021).

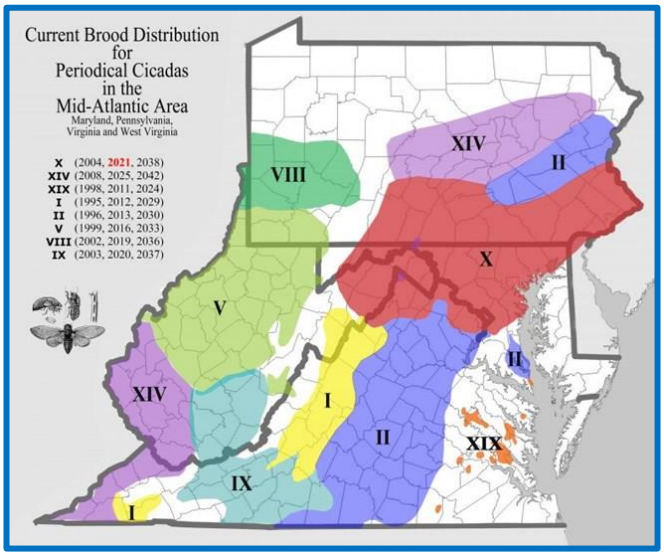
Figure 4.3.7-3: Spotted Lanternfly tree infestation (WV Division of Forestry, 2020)

Other infestations include a European fungus that causes white-nose syndrome and the death of bats, chestnut blight which eradicated chestnuts trees across their entire habitable entire range by 1940, and the brown marmorated stink bug which feeds on over 170 kinds of plants and crops (WV DNR, 2014). Feral cats are listed by the Global Invasive Species Database as one of the top 100 worst invasive species globally because of their impact on bird species and competition with other native species such as raccoons, foxes, and skunks. Over 270 invasive plants have been well documented in West Virginia, and more than a third of these are classified as posing moderate to high threats. These non-native species infest areas and out compete native plants and include Japanese knotweed, tree-of-heaven, and purple loosestrife (WV DNR, 2014).

4.3.7.4. Future Occurrence

It is impossible to predict what infestations may emerge as a hazard, as new species can be introduced to the area without warning and existing pathogens can evolve to become a greater threat. However invasive species that already exist in West Virginia and may be of some concern for Berkeley and Morgan County in the future include beech scale, yellow poplar weevil, and the *Matsucoccus* scale/*Caliciopsis* canker complex. These all threaten specific tree species and could fundamentally change the composition of forests in the Eastern Panhandle. Beech scale is a disease that exposes beech bark to attack by fungi,

Figure 4.3.7-4: Brood Distribution for Periodical Cicadas (National Park Service, 2021).



killing the tree, and is spreading north from the east central portion of West Virginia. It is has already reached Hardy and Mineral County. Yellow poplar weevils attack and eat the leaves of yellow poplar trees and has already begun to infest Berkeley County. It may spread to Morgan County in the coming years. *Matsucoccus* scale is a bug that attacks cankers caused by *Caliciopsis pinea*, which is thought to be a fungus. The combination of these two conditions can kill white pines, but it has not spread to the Eastern Panhandle and so far is limited only to West Virginia counties that are further south (USDA, 2016).

In addition to the possible future infestations disused in the 2017 update, Berkeley and Morgan County stakeholders are particularly concerned about Brood X periodical cicadas and spotted lanternfly infestations. Brood X is the largest brood of 17-year cicadas and will be in areas centering around Pennsylvania and northern Virginia, Indiana, and eastern Tennessee, during the summer of 2021. Their locations can be seen in Figure 4.3.7-4. The massive number of periodical cicadas emerging can harm young trees because the females lay their eggs in young tree branches, making Spring 2021 not a good time to plant small trees (National Park Service, 2021).

As seen in Pennsylvania over the past several years, where the spotted lanternfly population exceeds that of West Virginia, spotted lanternflies can spread rapidly when introduced to new areas, especially if major highways, railways, or rivers are in proximity of the introduction site. The key to controlling the spread of this invasive pest throughout West Virginia will be early detection and prompt eradication efforts. Within the Eastern Panhandle, there is a profitable orchard industry which could be affected by an increased spotted lanternfly population. The West Virginia Department of Agriculture is diligently working to prevent the continued spread of spotted lanternfly with joint efforts including the USDA APHIS and other professional agricultural agencies (West Virginia Department of Agriculture, 2021). The probability of future invasive species impacting the region can be considered *possible* according to the Risk Factor Methodology (see Table 4.4.1-1).

4.3.7.5. Vulnerability Assessment

With similar ecosystems and environment, Berkeley and Morgan County are likely to be threatened by the same pests. However, with a greater population and economy, Berkeley County may be more threatened by invasive species that can be transported by people or goods. For example, the emerald ash borer and gypsy moth can be transported through firewood or other tree products. Spotted lanternflies can be spread long distances by people who move infested materials or items containing eggs. Farmers or individuals involved in timber sales may be more vulnerable to the impacts of infestation due to the potential for pests to damage crops or trees; farmers in both counties have millions of dollars in crops that could be affected.

Based on historical documentation, and increased incidences of infestation throughout the State of West Virginia, it is estimated that Berkeley and Morgan County will continue to experience infestation that may induce secondary hazards and health threats to the region's population, if infestations are

not prevented, controlled, or eradicated efficiently.

4.3.8. Landslides and Land Subsidence

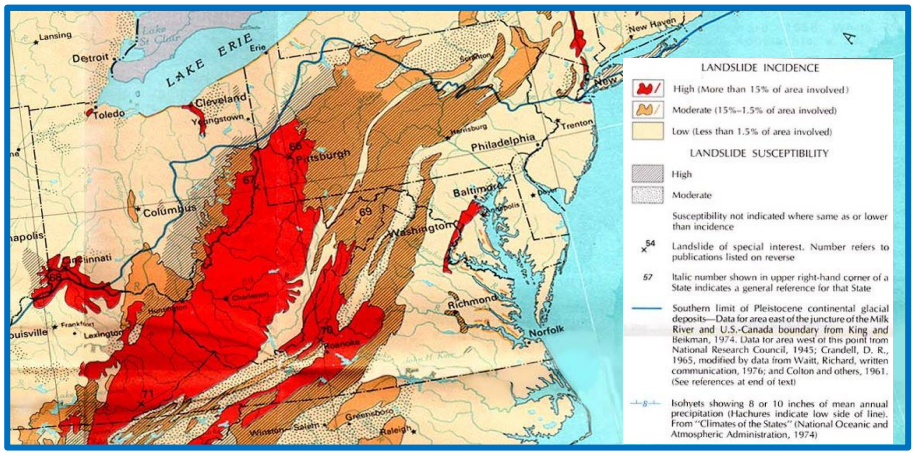
A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation reacting to the force of gravity. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening slopes due to construction, erosion, earthquakes, and changes in groundwater levels. Mudflows, mudslides, rockfalls, rockslides, and rock topples are all forms of a landslide.

Land subsidence is defined as a gradual settling or abrupt sinking of the Earth's surface as a result of subsurface movement of earthen material. The principal causes of subsidence are aquifer depletion and compaction, underground mining, natural compaction, sinkholes, drainage of organic soils, and hydrocompaction (USGS, 2013).

4.3.8.1. Location and Extent

The Eastern Panhandle faces some risk of minor landslides, in large part due to its mountainous terrain, including North Mountain and Cacapon Mountain. Berkeley and Morgan County encompass a variety of susceptibility, but at the local level only minor landslides in the form of falling rock and/or mud slides have occurred to date. No serious injury, death or property damage attributed to landslides has been identified in the region. Most of these landslides occur along road and highway cuts through the mountains. Figure 4.3.8-1 shows general landslide susceptibility and incidence rate throughout the region. According to this figure, generally, the eastern half of Berkeley County faces a low, less than 1.5 percent of area involved landslides incidence while the rest of Berkeley County and Morgan County have a high susceptibility to landslides and a moderate (15-1.5 percent of area involved) landslide incidence. (USGS, 2016). Figure 4.3.8-1 identifies landslide hazard areas throughout the region.

Figure 4.3.8-1: Landslide Incidence and Susceptibility near the Eastern Panhandle Region (USGS 2016)



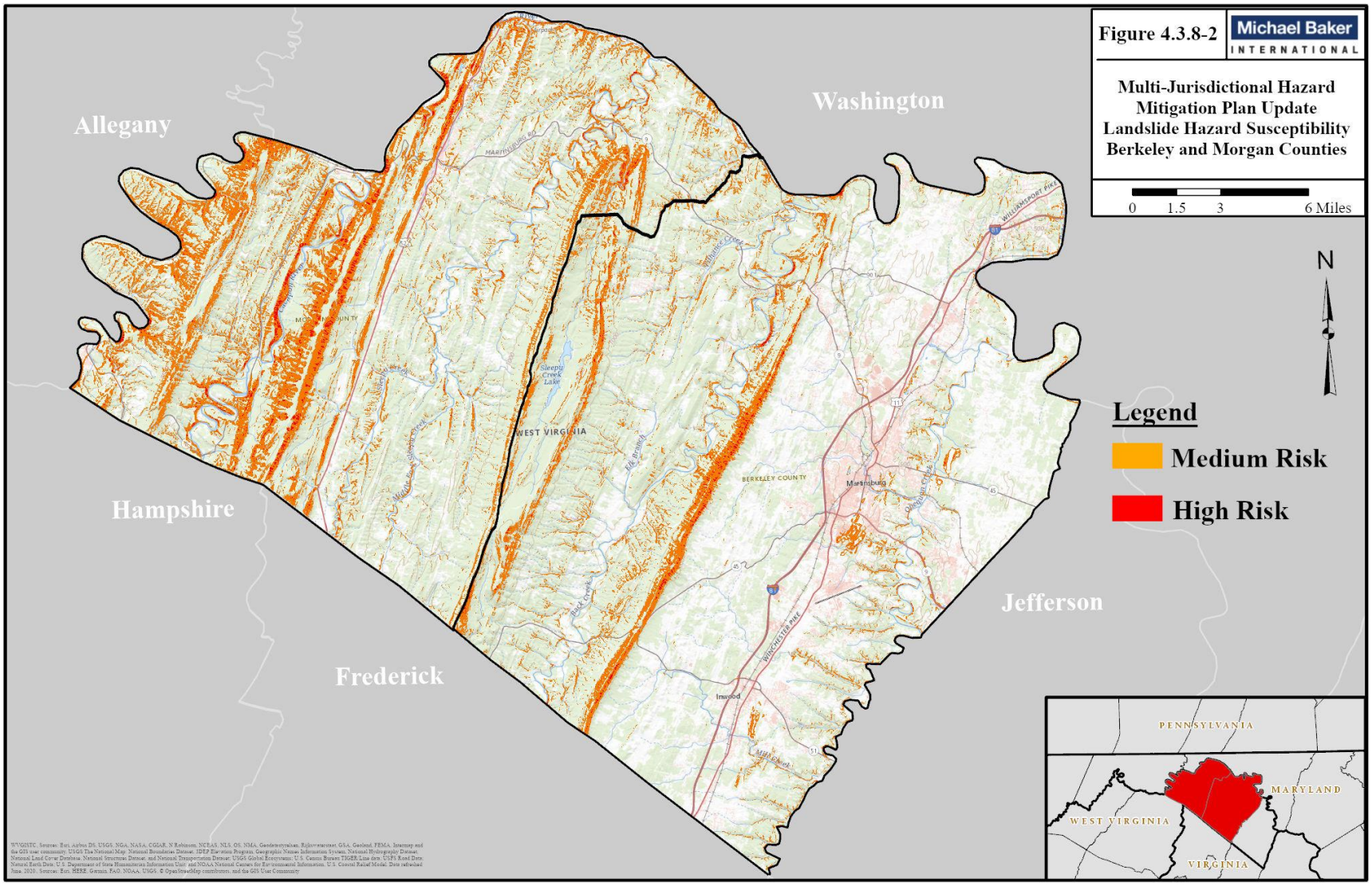
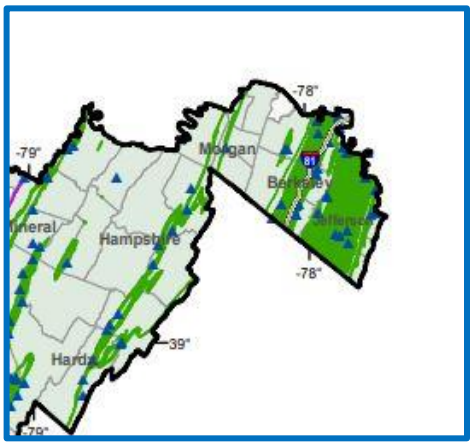


Figure 4.3.8-2
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Landslide Hazard Susceptibility
Berkeley and Morgan Counties
0 1.5 3 6 Miles
N
Legend
Medium Risk
High Risk
Allegany
Washington
Hampshire
Frederick
Jefferson
WEST VIRGINIA
BERKELEY COUNTY
Martinsburg
Inwood
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA

Land subsidence occurs in areas of abandoned mines and karst area underlain by carbonate rock. These formations often contain several underground caves that could collapse, causing subsidence on top of the ground. Additionally, some portions of the region have also been undermined which could result in subsidence as well. As a result, the entire region appears susceptible to subsidence, but it should be noted that the type of subsidence could vary. The West Virginia Statewide Standard Hazard Mitigation Plan (2018) discusses karst formations throughout West Virginia. According to that document, rapid subsidence can also occur in developed areas because of subsurface erosion caused by leaking water lines, or changes in groundwater flow caused by pumping associated with dewatering excavations, especially in karst areas. Slow subsidence is typically caused by consolidation in areas in which the soil stresses increase materially. Slow developing regional subsidence is often the result of excessive removal of groundwater, or petroleum that increases the effective stresses in subsurface soils. Slow developing, site-specific subsidence is often the result of construction structures or facilities over uncontrolled fills, including soils dumped loosely at convenient dumping locations, leveled deposits of mine spoil, highway construction spoil, head-of-hollow fills, covered sanitary landfills, etc. (State of West Virginia, 2018). Figure 4.3.8-3 depicts these areas, with the green representing carbonate rocks outcrops.

Figure 4.3.8-3: Karst Formations (West Virginia Geological and Economic Survey, 2016)



4.3.8.2. Range of Magnitude

Landslide velocity can vary from rapid to slow, and the amount of material moving in a landslide can range from a relatively small amount to a large amount. Landslides can include falling, sliding, or flowing of rocks and soil or a combination of these different types of motion.

The impact of landslides on the environment depends on the size and specific location of the event. In general, impacts include:

- Changes to topography
- Damage or destruction of vegetation
- Potential diversion or blockage of water in the vicinity of streams, rivers, etc.
- Increased sediment runoff both during and after event

Landslides can have potentially devastating consequences in localized areas. Landslides cause damage to transportation routes, utilities, and buildings and create travel delays and other side effects. Structures or infrastructure built on susceptible land will likely collapse as their footings slide downhill. Structures below the landslide can be crushed. Landslides next to roads and highways have the

potential to fall on and damage vehicles or cause crashes. Most West Virginia landslides are moderate to slow moving and damage things rather than people.

No two subsidence areas or sinkholes are exactly alike. Variations in size and shape, time period under which they occur (i.e., gradually or abruptly), and their proximity to development ultimately determines the magnitude of damage incurred. Potential damage due to landslides or subsidence in the region is mostly limited to roadway closures and/or the possibility of highway accidents due to debris deposited on the roadway. The threat of landslides is greatest along high-volume traffic areas, especially where the road travels through a cut in the topography. Other problems related to subsidence include the disruption of utility services and damages to private and public property including buildings, and underground infrastructure. If long-term subsidence or sinkhole formation is not recognized and mitigation measures are not implemented, fractures or complete collapse of building foundations and roadways may result. If mitigation measures are not taken, the cost to fill in and stabilize sinkholes can be significant although sinkholes are limited in extent. A worst-case scenario event for planning purposes would likely involve a U.S. Route traversing a higher risk area. Crushed vehicles, stranded motorists, economic impacts due to disruptions in freight movement, as well as the cost to clear debris would result from this scenario.

4.3.8.3. Past Occurrence

Fortunately, neither county in the region has reported significant numbers of historical landslides or land subsidence occurrences. NCEI is known to have spotty recording of geological hazards (i.e., earthquake, landslide, karst), primarily because these events are not always seen. Beyond debris avalanches associated with significant rain and flooding activity, only minor landslides in the form of falling rock and/or mud slides have occurred in Berkeley and Morgan County to date. One such landslide can be seen in Figure 4.3.8-4. A collapsed road caused by overflowing small streams and creeks in Morgan County can be seen in Figure 4.3.8-5.

Figure 4.3.8-4: Mudslide in Morgan County Caused by Heavy Rain in January 2012

Since landslides often occur during periods of heavy rain or snowmelt, it is possible to examine past occurrences of these events. At least 34 events of heavy rain or snow in Berkeley or Morgan County have been recorded by NCEI since 1990 (NOAA NCEI, 2021). No heavy snow events have occurred since 2007.

Figure 4.3.8-5: Collapsed Road in Paw Paw (The Morgan Messenger, 2018)

Figure 4.3.8-6: Emergency Management crews respond to a collapsed portion of Bowers Lane in Morgan County (Morgan County EM)

4.3.8.4. Future Occurrence

Since the exact number of previous landslides over a definite time interval is not known, it is not possible to determine a quantitative probability of future occurrence for landslides in the region. Historical evidence indicates significant landslide and subsidence events are unlikely to occur in the region. However, mismanaged intense development in steeply sloped areas could increase their frequency of landslide occurrence. Building and road construction are contributing development factors to landslides as they can often undermine or steep otherwise stable soil. The West Virginia Statewide Standard Hazard Mitigation Plan (2018) recommends that the WV Department of Transportation (WVDOT) be involved in determining areas where roads experience sinkholes to

improve on incidence reporting. Additionally, as noted in Section 4.3.4, the region anticipates an increase in the frequency and magnitude of flood events as a result of increasing amounts and intensity of precipitation. Increased rainfall has also been shown to increase occurrences of landslide and land subsidence events. The probability of future landslide events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4.1-1).

4.3.8.5. Vulnerability Assessment

Landslides can result in the disruption of roads, water, sewer, gas, electric and phone lines, as well as serious damage to public and private property. The loss of life likely to happen in such an occurrence would be a major concern, particularly for those areas where multi-family construction has taken place. While most of the development in the Eastern Panhandle is not particularly vulnerable to landslides, any landslide events that do occur in the region would take place in steeply sloped areas. In addition, conditions that may exacerbate or mitigate the severity and effects of landslides include erosion, unstable slopes, earthquakes, increase of weight of slopes, hydrologic factors, and human activity. Human activities are responsible for initiating or intensifying certain conditions where otherwise there would have been little or no risk. Activities that increase vulnerability by triggering landslides include:

- Excavations and developments in unstable slope materials
- Haphazard construction or improper use of pipelines
- Disruption of surface or subsurface drainage (streams and springs) e.g. by filling
- Overuse of fill materials on slopes, particularly at the heads of existing slide masses
- Removal of materials at the bases of slopes
- Vibrations from heavy traffic, blasting, and driving piles near unstable slopes

Additionally, increased deforestation and soil disturbances caused by development on sloped areas may further increase these risks. As timbering and development of sloped land continue, the risk of significant landslides increases.

The WVU GIS Technical Center released a landslide risk assessment in 2021 for Region 9 profiling high and medium risk road segments and structure/parcels. The landslide risk assessment is designed to be updated as characteristics of the area, roads and structures change, and updates and further mapping can be found on the WV Landslide Tool.

Table 4.3.8-1 shows the total miles of roads that are prone to high/medium slope failure risk, as well as the rank of landslide susceptibility within the state. Morgan County has about 21.5 miles of roads susceptible to landslides and Berkeley County has about 16.4 miles of roads susceptible to landslides.

Table 4.3.8-1 Road Length Susceptible to High/Medium Risk Landslide (WVGIST, 2021).				
Community Name	County	Roads Total (miles)	Roads Total (miles) – High/Medium Risk	Rank
Morgan County	Morgan	423.9	21.1	49
Bath	Morgan	4.5	0	182
Paw Paw	Morgan	2.7	0.3	96
	Morgan	431.1	21.5	51
Berkeley County	Berkeley	701.6	15.9	53
Hedgesville	Berkeley	0.9	9	182
Martinsburg	Berkeley	30.6	0.3	96
	Berkeley	733.1	16.4	54

The study also examined land use risk analysis for structures/parcels in Region 9. Table 4.3.8-2 shows the total count of primary structures in high/medium landslide susceptibility areas. Morgan County has a total of 356 primary structures with a total appraisal value of $31,940,422 that are in high/medium susceptibility areas and Berkeley County has 516 primary structures with total appraisal value of $57,360,557 in high/medium susceptibility areas.

Table 4.3.8-2 Structures Susceptible to High/Medium Risk Landslide (WVGIST, 2021).					
Community Name	County	Total Count	Total Value	Ranking (Count)	Ranking (Value)
Morgan County	Morgan	337	$30,207,387	18	10
Bath	Morgan	19	$1,733,036	57	34
Paw Paw	Morgan	0	$0	187	183
	Morgan	356	$31,940,422	25	13
Berkeley County	Berkeley	496	$54,441,856	9	5
Hedgesville	Berkeley	18	$2,804,600	62	23

Martinsburg	Berkeley	2	$114,100	158	130
	Berkeley	516	$57,360,557	15	7

The study also provides a detailed risk of slope failure based on different occupancy classes. Findings indicate that:

Morgan County has a total of 298 structures in Residential occupancy class with replacement costs of $30,903,625 followed by 49 Other occupancy class structures and 9 Commercial structures with replacement costs of $712,158. The unincorporated areas of Morgan County have the highest structure count and corresponding replacement values, whereas Paw Paw has no structure or related replacement costs in high and medium-risk susceptibility areas.

Berkeley County has a total of 456 structures in the Residential occupancy class with replacement costs of $53,183,807 followed by 52 Other structures and finally 8 commercial structures with replacement costs of $2,575,300. The unincorporated areas of Berkeley County have the highest structure count and corresponding replacement values whereas Hedgesville has the lowest structure count and related replacement costs in high and medium risk susceptibility areas.

4.3.9. Pandemic and Infectious Disease

4.3.9.1. Location and Extent

In the 2022 Plan Update, the Epidemic profile was changed to Pandemic and Infectious Disease in accordance with the PA SOG and to better reflect the current state of disease transmission.

Pandemic is defined as a disease affecting or attacking the population of an extensive region, including several countries, and/or continent(s). It is further described as extensively epidemic. Generally, pandemic diseases cause sudden, pervasive illness in all age groups on a global scale. Infectious diseases are also highly virulent and can be spread person-to-person.

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

The region is primarily concerned with the possibility of a pandemic flu outbreak. Influenza, also known as "the flu," is a contagious disease that is caused by the influenza virus and most commonly attacks the respiratory tract in humans. Influenza is considered to have pandemic potential if it is novel, meaning that people have no immunity to it, virulent, meaning that is causes deaths in normally healthy individuals, and easily transmittable from person-to-person.

Different strands of influenza mutate over time and replace older strands of the virus and thus have drastically different effects. The H1N1 virus, colloquially known as swine flu, is of particular concern. This virus was first detected in people in the United States in April 2009. On June 11, 2009, the World Health Organization signaled that a pandemic of 2009 H1N1 flu was underway (CDC, 2009). Avian influenza, also known as bird flu, infects birds. A recent strain, H5N1, has caused concern due to its ability to pass from wild birds to poultry then on to people. This virus has killed more than half of the people infected with it, although the avian flu is less likely to infect humans.

Prior to the beginning and during the 2022 Hazard Mitigation Plan Update process, a novel coronavirus spread into a worldwide pandemic. Named COVID-19, this type of coronavirus is a new virus that causes respiratory illness, is extremely contagious even prior to exhibiting symptoms or if the infected person is asymptomatic and can be fatal. Flu-like in nature, symptoms of the virus include fever, cough, shortness of breath, and diarrhea.

This virus became a great concern due to its high rates of transmission, and high incidence of mortality in addition to so little being known about it. Severe reactions that require immediate medical care include trouble breathing, persistent pain or pressure in the chest, new confusion, inability to wake or stay awake, and discolored skin, lips or nail beds (CDC, 2021a). In extreme COVID-19 cases that require hospitalization, patients require ventilators to support breathing and may pass away from COVID-19 or COVID-19 related reasons. Governor Jim Justice issued the first stay-at-home order on March 24, 2021 for all West Virginians. Schools were moved to virtual settings, non-essential businesses were closed, and all essential state services were continued operation (WVDHHR, 2020). The region adopted all state-level restrictions and guidelines to slow the spread of the virus. People were advised to practice social distancing; only leaving the house for essentials like grocery shopping, and to avoid gathering even in small groups. Even when going on walks, people should remain six feet apart to slow the spread of transmission. At least three new variants of the virus have been detected globally, each reaching the United States by January 2021, with the possibility of more occurring (CDC, 2021a). On March 5, 2021, Governor Justice announced that, after continued discussions with members of the West Virginia pandemic response leadership team regarding the decreasing number of COVID-19 cases and the increasing number of vaccinated West Virginians, he was lifting capacity restrictions on several types of West Virginia businesses, increasing the social gathering limit, and permitting more youth travel sports to take place.

Starting January 2021, vaccines were being distributed in phases based off of vulnerable populations as well as those who are frequently exposed:

- Phase 1A: includes hospital, long-term care facility and staff, and pharmacies
- Phase 1B: includes community infrastructure and emergency response, public health officials, and first responders
- Phase 1: includes other healthcare workers, like home health providers
- Phase 1D: includes teachers and education staff in higher education and K-12 and other sectors for critical services for our state, such as utility and transportation workers
- Phase 2: General public (Office of the Governor, 2020)

The three vaccines that received emergency approval by the U.S. Food and Drug Administration (FDA) include the Pfizer-BioNTech vaccine, the Johnson & Johnson-Janssen vaccine, and the Moderna vaccine. Each recipient requires a 15–30-minute on-site observation period after receiving the vaccine. The Pfizer-BioNTech and Moderna vaccine requires two shots for immunity; the Johnson & Johnson-Janssen vaccine is a one-shot vaccine. All three vaccines take two weeks after the final shot to be considered fully vaccinated against COVID-19 (CDC, 2021b). As Berkeley and Morgan County, and the rest of the nation, continue to get vaccinated during the pandemic, there have been issues with some of those who chose to receive the two-step vaccines with not returning to receive the second dose for full inoculation. There is a growing concern about a potential additional peak of COVID-19 infections and deaths in the unvaccinated population.

4.3.9.2. Range of Magnitude

The magnitude of a pandemic or infectious disease threat in Berkeley and Morgan County will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemic influenza is easily transmitted from person-to-person, but advances in medical technologies have greatly reduced the number of deaths caused by influenza over time. The magnitude of a pandemic may be exacerbated by the fact than an influenza pandemic will cause outbreaks across the United States, limiting the ability to transfer assistance from one jurisdiction to another. Additionally, effective preventive and therapeutic measures, including vaccines and other medications, will likely be in short supply or will not be available.

In terms of lives lost, the impact various pandemic influenza outbreaks have had globally over the last century has declined. The severity of illness from the 2009 H1N1 influenza flu virus varied, with the gravest cases occurring mainly among those considered to be high risk. High risk populations are considered to be more vulnerable and include children, the elderly, pregnant women, and chronic disease patients with reduced immune system capacity. Most people infected with swine flu in 2009 recovered without needing medical treatment. Unlike a regular flu season, according to the Centers for Disease Control and Prevention (CDC) the majority of people who died, as many as 77 percent, were 18-64 years old with up to 11 percent of the deaths estimated in those 17 years old or younger

(CDC, 2009).

The 1918 Spanish flu pandemic was the worst-case pandemic event in the 20th century for both West Virginia and worldwide. County data is unavailable, and mortality figures were probably under-reported. It is recorded that over 71,000 West Virginians died from the flu or its complications in this pandemic (Kercheval, 2020). Infection rates were much worse in denser cities, which should be a higher priority for response actions in future flu events.

In 2020 COVID-19, another worst-case pandemic began having worldwide impacts. As of June 2021, we are still facing impacts of the pandemic. Berkeley and Morgan County have faced varying impacts of the COVID-19 pandemic. It is believed that the virus originated in an open-air market in the Wuhan province of China in November 2019. Shortly afterwards, the virus began to spread to nearby countries including Japan and South Korea. By March 2020, the virus had reached almost every country worldwide, with the most cases in the United States. At first, concern was focused on people who might be infected due to recent travel. However, community infections soon began to crop up in many cities and towns. This led to a statewide shutdown of schools and businesses and the cancellation of large events for the remainder of 2020. Only life sustaining services were permitted to remain open, including medical facilities, pharmacies, and grocery stores. People were advised to remain home as much as possible in an attempt to slow the transmission of COVID-19. State health officials note that the virus has infected all age ranges at about the same rate, and that no age group can be considered more or less vulnerable to infection. However, people with underlying health conditions and the elderly population are more vulnerable to the virus having a serious, or even deadly, symptoms. New variants of the virus reached the United States in January 2021. The CDC notes that these variants spread more easily and quickly than other variants, which may lead to a rapid increase in COVID cases (CDC, 2021a). It is currently unknown how new variants will interact with existing vaccines.

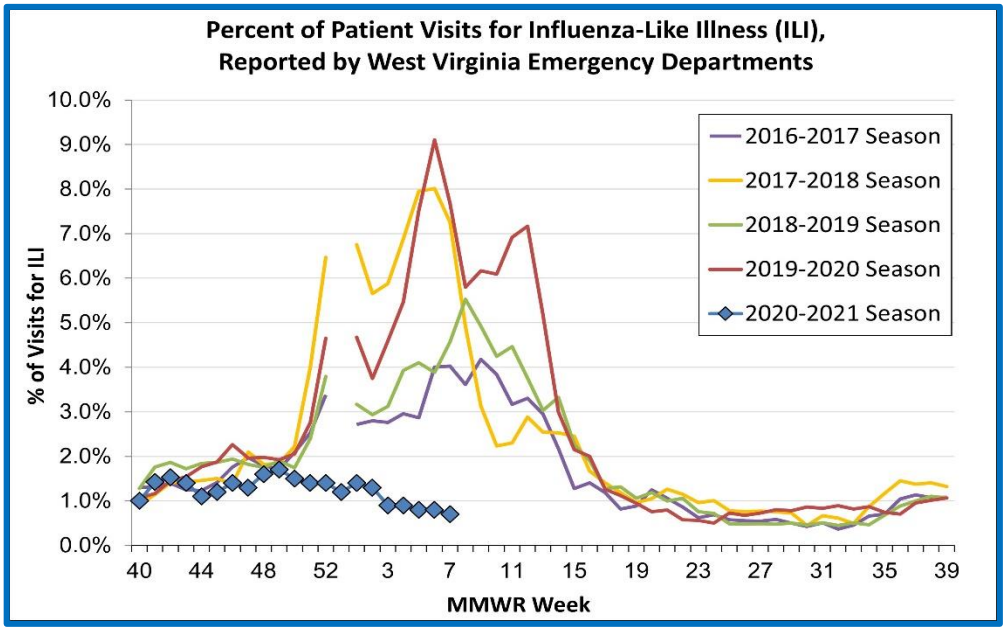
4.3.9.3. Past Occurrence

The United States Department of Health and Human Services estimates that influenza pandemics have occurred for at least 300 years at unpredictable intervals. There have been several pandemic influenza outbreaks over the past 100 years. A list of events and worldwide deaths are shown in Table 4.3.9-1 below.

Table 3.3.9-1 List of previous significant outbreaks of influenza over the past century (Global Security, 2009; WHO, 2009)		
Date	**Pandemic**	**Worldwide Deaths (approximate)**
1918-1920	Spanish Flu / H1N1	50 million
1957-1958	Asian Flu / H2N2	1.5-2 million
1968-1969	Hong Kong Flu / H3N2	1 million
2009 - 2010	Swine Flu / A/H1N1	12,000
2020-Continuing	COVID-19	3.76 million +

The CDC marked the 2014-2015 flu season as severe, with approximately 590,000 hospitalizations. The 2017-2018 flu season was another severe season, with approximately 810,000 hospitalizations nation-wide. Figure 3.3.9-1 below displays the percentage of emergency visits that were for influenza-like illness and that were reported during the current influenza season and the four preceding seasons (2015-2016, 2016-2017, 2017-2018, 2018-2019, and 2019-2020) in West Virginia. As demonstrated in that figure, influenza seasons vary in severity and duration. When peak influenza activity will occur and how severe it will be cannot be predicted. "MMWR Week" refers to the number assigned to each week of the year by the CDC, with January 1st falling either in Week 1 or Week 52/53. MMWR Week 40 is usually the first week of October. Flu cases were remarkably down in the 2020-2021 season, likely due to masking, social distancing, and stay-at-home mandates due to the COVID-19 pandemic.

Figure 3.3.9-1: Percentage of Emergency Visits for influenza-like symptoms, 2016-2021 (WVDHHR, 2021a)



The COVID-19 outbreak began in China in November 2019. According to a report published by the CDC on June 5, 2020, the first case of COVID-19 in the United States occurred on January 15, 2020 when a person traveled from Wuhan, China to Seattle and fell ill four days later. Small community spreading of the virus occurred during the second half of January and early February, prior to the more widespread outbreak of the virus in late February of 2020 (Jorden MA, Rudman SL, et al, 2020). The virus became more widespread the US in late February 2020, and most counties in West Virginia were affected by March 2020. As of June 2021, there were more than 163,000 confirmed cases and more than 2,860 deaths in West Virginia, with 12,796 cases and 130 deaths reported in Berkeley County and 1,224 cases and 23 deaths in Morgan County (WVDHHR, 2021b). In January 2021, a vaccine became available, and is readily available at the time of this writing. In spring 2021, many states, including West Virginia began to lift masking and stay at home mandates. As more people receive the vaccine it is expected that case numbers will decrease, though there is a growing concern about a potential additional peak of COVID-19 infections and deaths in the intentionally unvaccinated population. Several vaccination sites opened throughout the region, in various pharmacies, community centers, and vaccination clinics.

4.3.9.4. Future Occurrence

Future occurrences of pandemics and infectious diseases are unclear. The precise timing of pandemic influenza is uncertain, but occurrences are most likely when the Influenza Type A virus makes a dramatic change, or antigenic shift, that results in a new or "novel" virus to which the population has no immunity. This emergence of a novel virus is the first step toward a pandemic. Future pandemics may also emerge from other diseases, especially invasive pathogens that West Virginian's do not have natural immunity to. While it is unlikely that pandemics and infectious diseases will affect the region, this hazard occurred recently in Spring 2020 and is ongoing through the HMP update period. It is impossible to predict this type of hazard. The best form of county response is to expect that these events can occur at any time and to constantly evaluate resources and update emergency response plans.

Looking at the number of historical incidences of pandemic-potential diseases, the probability of future pandemic events can be considered *possible* according to the Risk Factor Methodology (see Table 4.4.1-1).

4.3.9.5. Vulnerability Assessment

Certain population groups are at higher risk of pandemic flu infection. This population group includes people 65 years and older, children younger than 5 years old, pregnant women, and people of any age with certain chronic medical conditions. Such conditions include but are not limited to diabetes, heart disease, asthma, and kidney disease (CDC, 2015). Schools, colleges, convalescent centers, and other institutions serving those younger than 5 years old and older than 65 years old, are locations conducive to faster transmission of pandemic influenza since population identified as being at high

risk are concentrated at these facilities or because of a large number of people living in close quarters. In general, jurisdictions that are more densely population are more vulnerable to disease threats when the disease is directly spread from human to human, but every jurisdiction in the state has some vulnerability to pandemic and infectious disease threats.

Local health departments have taken steps to ensure a base level of preparedness for pandemics and other infectious diseases. National and state efforts to encourage vaccinations have also been relatively successful. According to COVIDActNow.org, 34.4 percent of Berkeley County and 27.9 percent of Morgan County are vaccinated with the latest COVID-19 vaccine at the time of the drafting of this plan (COVIDActNow, 2021). Vaccinations help protect even non-vaccinated individuals due to herd immunity, meaning that a pathogen has a more difficult time spreading due to higher immunity rates.

There are some occupation-specific risks that may make some employees more vulnerable. For example, those working in direct patient care situations are more likely to be exposed to a pandemic disease.

The environmental impacts of pandemics and infectious disease threats are still being determined. Many countries noted environmental benefits to everyone sheltering-in-place due to reduced commuting pollution and overall an increase in air quality. Some areas have also identified “mask trash” from discarded face masks as a new form of litter that may have impacts on storm drains and otherwise still being determined. There will be significant economic and social costs beyond the possibility of disease-related deaths. Widespread illness may increase the likelihood of shortages of personnel to perform essential community services. In addition, high rates of illness and worker absenteeism occur within the business community, and these contribute to social and economic disruption. Social and economic disruptions could be temporary but may be amplified in today’s closely interrelated and interdependent systems of trade and commerce. Social disruption may be greatest when rates of absenteeism impair essential services, such as power, transportation, and communications. Research of COVID-19 suggests that public transportation has greatly increased the transmission of this and other past viruses, bringing this vulnerability to light.

Jurisdictional losses in a pandemic or infectious disease outbreak stem from lost wages and productivity, not losses to buildings or land. Losses are difficult to estimate because the exact rates of absenteeism and cost of treating a widespread disease will depend on the virus or bacterium in question, the availability of vaccination or treatment, and the severity of symptoms. The World Bank estimates that a severe flu pandemic could kill as many as 71 million people worldwide and cause a $3 trillion recession (CIDRAP, 2008).

The COVID-19 pandemic has also spurred conversations around creating safe public spaces and work environments regarding pandemic and infectious disease. The International Code Council (ICC) published an overview of code compliance that helps facilitate response to pandemic instances. For

example, properly designed, installed, and maintained ventilation systems can help in mitigating the spread of pathogens (ICC, 2020). Many buildings have chosen to inspect and upgrade these systems during shelter in place orders. This is essential towards stopping the spread of pathogens in high density residential buildings and ensures workers will return to a safe environment when it is safe to work in offices again.

4.3.10. Radon Exposure

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. In 1984, routine monitoring of employees leaving the Limerick nuclear power plant near Reading, PA while it was still under construction and not yet functional, showed that readings on a construction worker at the plant frequently exceeded expected radiation levels. However, only natural, nonfission-product radioactivity was detected on him. Subsequent testing of the employee's home in the Reading Prong section of Pennsylvania showed extremely high radon levels around 2,500 pCi/L (pico Curies per Liter). To put this amount in perspective, the Environmental Protection Agency (EPA) guidelines state that actions should be taken if radon levels exceed 4 pCi/L in a home, and uranium miners have a maximum exposure of 67 pCi/L. As a result of this event, the Reading Prong became the focus of the first large-scale radon scare in the world. Studies have tied high radon levels to a few different geologic units, including the type of carbonate bedrock found in both Reading, PA and West Virginia's Eastern Panhandle Region (USGS, 2013).

Radon is a gas that cannot be seen or smelled. It is a noble gas that originates by the natural radioactive decay of uranium and thorium. Like other noble gases (e.g., helium, neon, and argon), radon forms essentially no chemical compounds and tends to exist as a gas or as a dissolved atomic constituent in groundwater. Two isotopes of radon are significant in nature, 222Rn and 220Rn, formed in the radioactive decay series of 238U and 232Th, respectively. The isotope thoron (i.e. 220Rn) has a half-life (time for decay of half of a given group of atoms) of 55 seconds, barely long enough for it to migrate from its source to the air inside a house and pose a health risk. However, radon (i.e., 222Rn), which has a half-life of 3.8 days, is a widespread hazard.

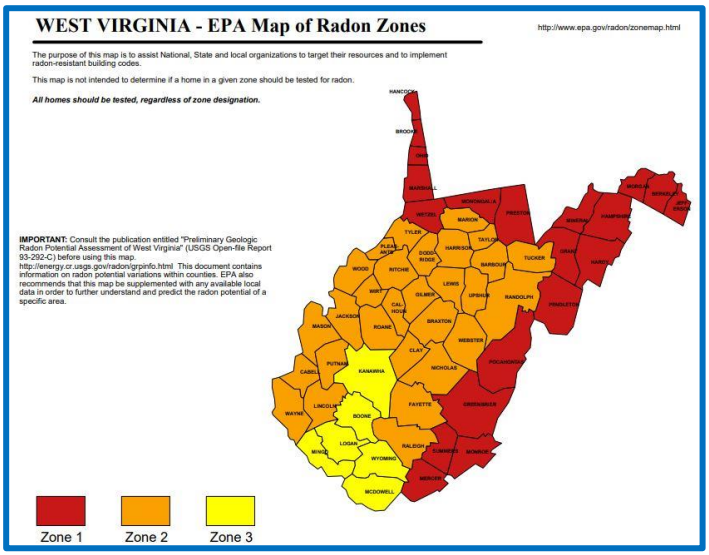
4.3.10.1. Location and Extent

Radon is frequently a hazard to West Virginia residents, but can often go unnoticed. As seen in Figure 4.3.10-1, Berkeley and Morgan County lie in the zone with the highest potential for radon. Homeowners and building managers need to be aware of the danger radon can cause. Three sources of radon in houses are now recognized (shown in Figure 4.3.10-2):

- Radon in soil air that flows into the house;

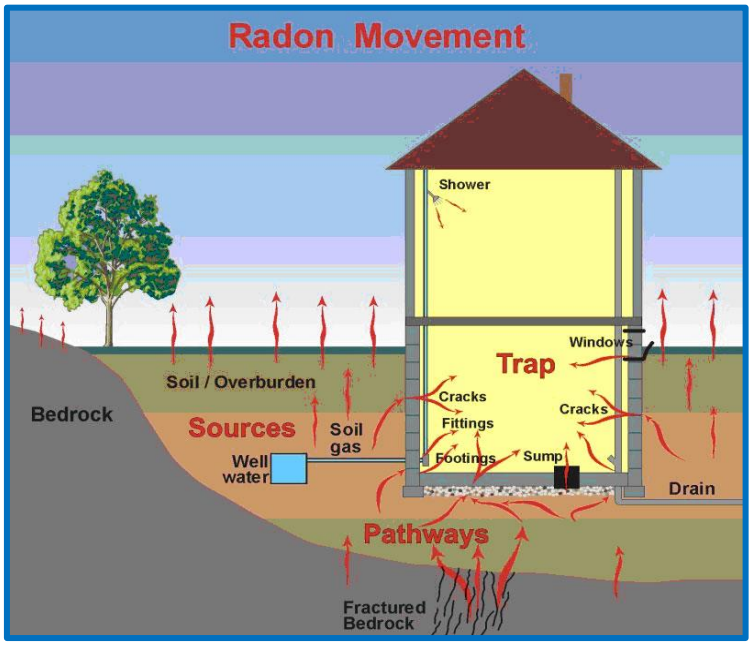
- Radon dissolved in water from private wells and exsolved during water usage; this is rarely a problem in region; and
- Radon emanating from uranium-rich building materials (e.g. concrete blocks or gypsum wallboard); this is not known to be a problem in West Virginia

Figure 4.3.10-1: West Virginia Radon Program Hazard Zones (EPA, n.d.)



High radon levels were initially thought to be exacerbated in houses that are tightly sealed, but it is now recognized that rates of air flow 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 (radon concentration generally <0.1 pCi/L), then an appreciable fraction of the air may be drawn in from the soil or fractured bedrock through the foundation and slab beneath the house, or through cracks and openings for pipes, sumps, and similar features. Soil gas typically contains from a few hundred to a few thousand pCi/L of radon; therefore, even a small rate of soil gas inflow can lead to elevated radon concentrations in a house.

Figure 4.3.10-2: Sketch of Radon Entry Points into a House (Arizona Geological Survey, 2006).



The radon concentration of soil gas depends upon a number of soil properties, the importance of which is still being evaluated. In general, ten to fifty percent 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 air flow, 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.

Areas where houses have high levels of radon can be divided into three groups in terms of uranium content in rock and soil:

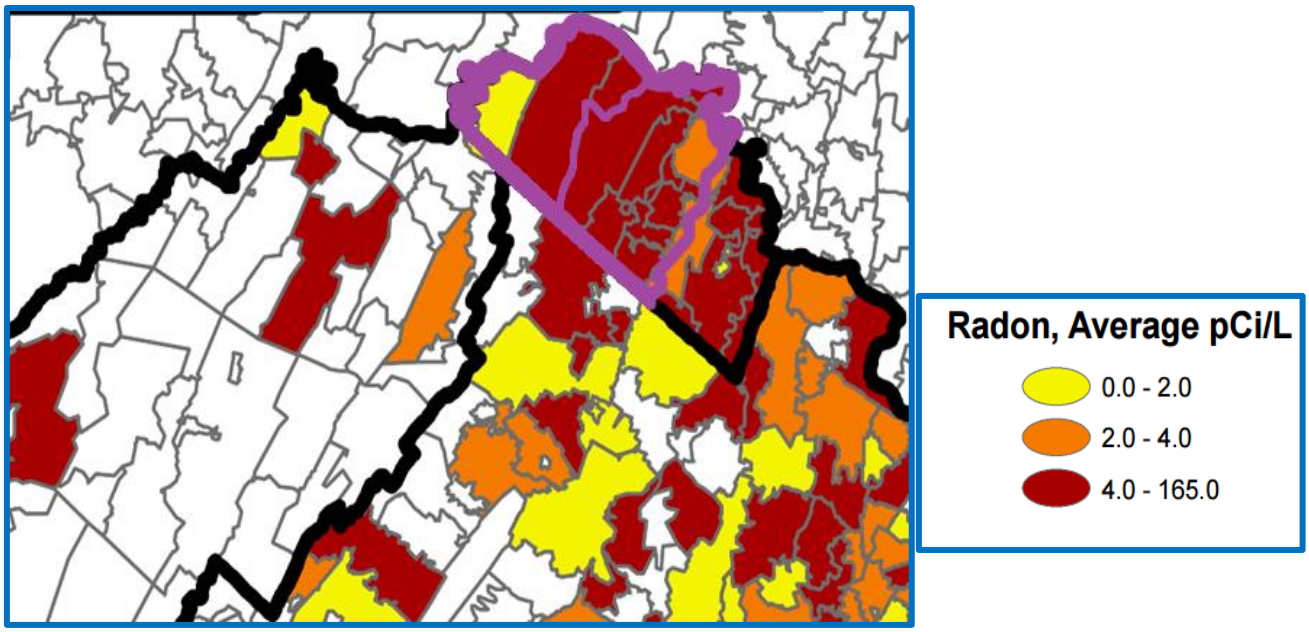
- Areas of very elevated uranium content (>50 ppm) around uranium deposits and prospects. Although very high levels of radon can occur in such areas, the hazard normally is restricted to within a few hundred feet of the deposit. In West Virginia, such localities occupy an insignificant area.

- Areas of common rocks having higher than average uranium content (5 to 50 ppm). In West Virginia, such rock types include granitic and felsic alkali igneous rocks and black shales. In the Reading Prong, high uranium values in rock or soil and high radon levels in houses are associated with Precambrian granitic gneisses commonly containing 10 to 20 ppm uranium, but locally containing more than 500 ppm uranium. In West Virginia, elevated uranium occurs in black shales of the Devonian Marcellus Formation and possibly the Ordovician Martinsburg Formation. High radon values are locally present in areas underlain by these formations.

- Areas of soil or bedrock that have normal uranium content but properties that promote high radon levels in houses. This group is incompletely understood at present. Relatively high soil permeability can lead to high radon, the clearest example being houses built on glacial eskers. Limestone-dolomite soils also appear to be predisposed for high radon levels in houses, perhaps because of the deep clay-rich residuum in which radium is concentrated by weathering on iron oxide or clay surfaces, coupled with moderate porosity and permeability.

The second factor listed above is most likely the cause of radon levels in the Eastern Panhandle, although high test results may be a result of multiple factors. Figures 4.3.10-3 shows the radon test data available for Berkeley and Morgan County by zip code. As shown in Figure 4.3.10-3, most communities have average basement radon readings of over the threshold of action of 4 pCi/L, and many communities likely have maximum basement readings much greater than that.

Figure 4.3.10-3: EPA Region III 2007 Average Radon Measurements By Zip Code (WV DHHR, 2015)



4.3.10.2. Range of Magnitude

Exposure to radon is the second leading cause of lung cancer after smoking. It is the number one cause of lung cancer among non-smokers. Radon is responsible for about 21,000 lung cancer deaths every year; approximately 2,900 of which occur among people who have never smoked. Lung cancer is the only known effect on human health from exposure to radon in air and thus far, there is no evidence that children are at greater risk of lung cancer than are adults (EPA, 2021a). The main hazard is from the radon daughter products (218Po, 214Pb, 214Bi), which may become attached to lung tissue and induce lung cancer by their radioactive decay.

According to the EPA, the average radon concentration in the indoor air of homes nationwide is about 1.3 pCi/L. The EPA recommends homes be fixed if the radon level is 4 pCi/L or more. However, because there is no known safe level of exposure to radon, the EPA also recommends that Americans consider fixing their home for radon levels between 2 pCi/L and 4 pCi/L. Table 4.3.10-1 shows the relationship between various radon levels, probability of lung cancer, comparable risks from other hazards, and action thresholds. As is shown in Table 4.3.10-1, a smoker exposed to radon has a much higher risk of lung cancer.

The worst-case scenario for radon exposure would be that a large area of tightly sealed homes provided residents high levels of exposure over a prolonged period of time without the residents being aware. This worst-case scenario exposure then could lead to a large number of people with cancer attributed to the radon exposure.

Table 4.3.10-1 Radon risk for smokers and non-smokers (EPA, 2021b)			
Radon Level (cci/l)	**If 1,000 people were exposed to this level over a lifetime…***	**Risk of cancer from radon exposure compares to…****	**Action Threshold**
Smokers			
20	About 260 people could get lung cancer	250 times the risk of drowning	Fix Structure
10	About 150 people could get lung cancer	200 times the risk of dying in a home fire	
8	About 120 people could get lung cancer	30 times the risk of dying in a fall	
4	About 62 people could get lung cancer	5 times the risk of dying in a car crash	
2	About 32 people could get lung cancer	6 times the risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 20 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	About 3 people could get lung cancer	(Average outdoor radon level)	
Non-Smokers			
20	About 36 people could get lung cancer	35 times the risk of drowning	Fix Structure
10	About 18 people could get lung cancer	20 times the risk of dying in a home fire	
8	About 15 people could get lung cancer	4 times the risk of dying in a fall	
4	About 7 people could get lung cancer	The risk of dying in a car crash	
2	About 4 people could get lung cancer	The risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 2 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	-	(Average outdoor radon level)	

NOTE: Risk may be lower for former smokers.

** Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).*

*** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.*

4.3.10.3. Past Occurrence

Current data on abundance and distribution of radon as it affects individual houses in the State of West Virginia in general is considered incomplete and potentially biased due to under reporting in some areas, and Berkeley and Morgan County are no exception. The EPA 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 is much higher than that for the Eastern Panhandle.

4.3.10.4. Future Occurrence

Radon exposure in Berkeley and Morgan County remains a probability given present soil, geologic, and geomorphic factors. Future occurrence of high radon level hazards can be considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

Development in areas where previous radon levels have been significantly high will continue to be more susceptible to exposure. However, new incidents of concentrated exposure may occur with future development or deterioration of older structures. Exposure can be limited with proper testing for both past and future development and appropriate mitigation measures.

4.3.10.5. Vulnerability Assessment

Structures in Morgan and Berkeley County, particularly in high vulnerability areas as shown in Figure 4.3.10-3, could be susceptible to moderate levels of radon. Smokers can be up to ten times more vulnerable to lung cancer from high levels of radon depending on the level of radon they are exposed to. Older houses that have crawl spaces or unfinished basements are more vulnerable as well because of the increased exposure to soils which could be releasing higher levels of radon gas. Additionally, houses that rely on wells for their water may face an additional risk, although this type of exposure is low and rare in the region.

Proper testing for radon levels should be completed through the Eastern Panhandle, especially in the areas of higher incidence levels and for vulnerable populations that face the contributing risks described above. This testing will determine the level of vulnerability that residents face in their homes, as well as in their businesses and schools. The WV DHHR Office of Environmental Health Services will provide free radon test kits to residents upon request (WV DHHR, 2021). These can be used to evaluate the radon hazard within a building. A Berkeley County sanitarian demonstrating the use of a radon detection kit can be seen in Figure 4.3.10-4. Based on these results, a licensed radon contractor may need to be contacted to enact a mitigation solution. A radon mitigation fan, installed by a radon mitigation contractor, can be seen in Figure 4.3.10-5. This radon mitigation fan extracts radon from the basement of the building. As seen in Figure 4.3.10-3, areas with the highest level of reported tests were located across much of both counties.

Berkeley County has adopted the 2015 International Building Code (IBC) and 2015 International Residential Code (IRC), which is now part of the building approval process in Berkeley County. An appendix to the IRC includes standards for radon mitigation and Berkeley County has been enforcing these standards for roughly a decade. Additionally, the West Virginia Fire Commission has adopted the IBC and IRC statewide for any jurisdiction that chooses to enforce codes. This includes Morgan County, but the county lacks the administrative and enforcement capacities to implement the IBC and IRC.

Figure 4.3.10-4: Berkeley County Health Department Sanitarian Demonstrates Use of a Radon Detection Kit (Vincent, 2011)

Figure 4.3.10-5: Radon Mitigation Fan Installed on Commercial Building in Martinsburg (SWAT Environmental, 2015)

4.3.11. Thunderstorm, Lightning Strike

The wind gusts associated with thunderstorms pose a threat to life and/or property. Severe thunderstorms also have the potential of producing a tornado with little or no advanced tornado warning. Thunderstorms can also produce hail or heavy downpours that can lead to localized flooding. Thunderstorms are often characterized by frequent cloud-to-ground lightning as well.

Lightning is a rapid discharge of electrical energy in the atmosphere. When the charge difference between the ground and the cloud becomes too large, a conductive channel of air develops between the cloud and the ground, and a small amount of charge (step leader) starts moving toward the ground. When it nears the ground, an upward leader of opposite charge connects with the step leader. At the instant this connection is made; a powerful discharge occurs between the cloud and the ground. This discharge is seen as a bright visible flash of lightning.

4.3.11.1. Location and Extent

Thunderstorms are one of the most frequently occurring hazards throughout the region (second only to winter storms). NCEI records reflect the most severe of thunderstorms. Storms, however, are common throughout the spring and summer months (although a thunderstorm can occur in any season) that cause downed trees and power lines. Residents and businesses are likely to incur more damage because of these "smaller" storms as individual houses and vehicles are damaged by fallen limbs and businesses are forced to close due to a lack of electricity.

More than 100,000 thunderstorms occur in the U.S. each year, with lightning striking more than 30 million points on the ground during that same period. This causes an average of between 55-60 fatalities and 300 injuries each year. Lightning can occur with all thunderstorms, of which the entire region is susceptible. Lightning fatalities are also most common during the summer and during the afternoon and evening.

4.3.11.2. Range of Magnitude

Because lightning damage is largely unreported, statistics vary considerably. The insurance industry, however, estimates 6.5 percent of all property/casualty claims are related to lightning strikes (Credit Union National Association, 2015). While it is difficult to quantify lightning losses, it is estimated that $4-5 billion damage occurs each year. Likewise, the cost of lightning protection to safeguard critical equipment and facilities from lightning strikes during severe weather is enormous. In statistics kept from 1997-2012, West Virginia was reported as having an average of 210,169 cloud-to-ground flashes per year (NWS, 2016). The worst-case scenario for casualties from a lightning strike is envisioned to occur during a capacity sports game, crowded outdoor festival, or another outdoor event with a dense crowd. While to date there have been few casualties in the United States from direct lightning strikes

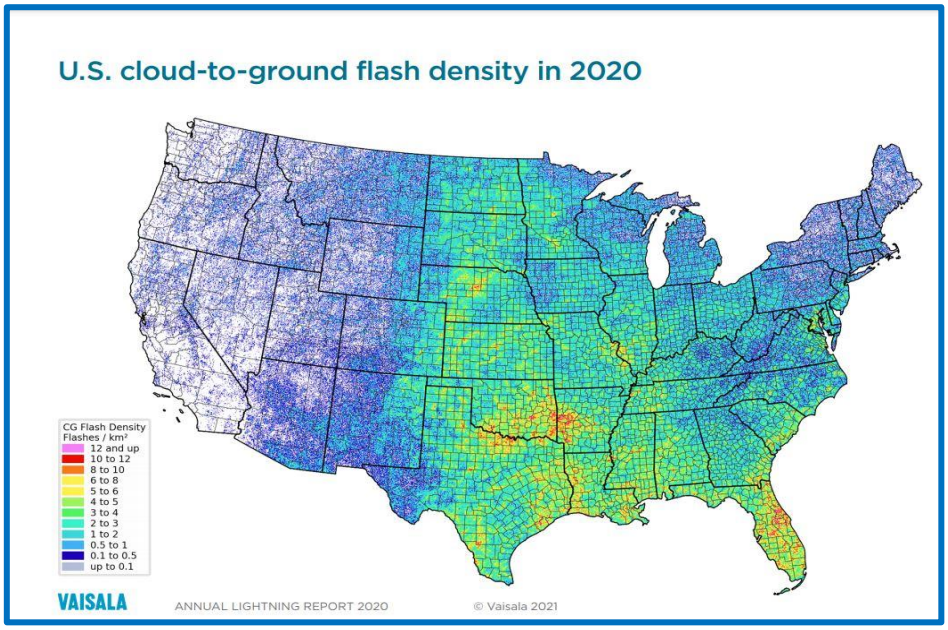
to dense groups of people or from the mass movement of panicked individuals when lightning threatens, it is important to recognize this potential, albeit extremely low risk, event. Other worst-case scenarios could involve thunderstorms leading to car crashes, downed trees, and mass power outages.

The magnitude and impacts of other hazards associated with thunderstorms, such as flooding (Section 4.3.4), hail (Section 4.3.5), wildfires (Section 4.3.12), and wind (Section 4.3.13) are addressed in other sections of this document.

4.3.11.3. Past Occurrence

Even though lightning strike deaths and injuries are rare, they do happen. Between 1959 and 2017, 26 individuals have been killed by lightning in the State of West Virginia, an average of one person every other year (Vaisala, 2017). This puts West Virginia's risk in the bottom half of all states. Furthermore, West Virginia and the Eastern Panhandle have a moderate lightning flash density per year compared to other states. As seen in Figure 4.3.11-1, the density of lightning strikes the Eastern Panhandle experiences each year is 0.1 to 4 per square kilometer, compared to over 12 flashes per square kilometer in some parts of Florida (Vaisala, 2021).

Figure 4.3.11-1: U.S. Cloud-to-Ground Flash Density 2020 (Vaisala, 2021)



Records from the NCEI show that there were 89 lightning events in the 55 counties across West Virginia between 1950 and 2021. A lightning "event" is defined as a lightning strike that results in fatality, injury, and/or property or crop damage (NOAA NWS, 2021).

Thunderstorms with heavy downpours can create slick driving conditions and obscure visibility, and in combination with reckless drivers this can lead to fatalities on the road. On June 16, 2016, a reckless driver caused a 15-vehicle crash during a severe thunderstorm on Interstate 81 between Martinsburg and Spring Mills, as seen in Figure 4.3.11-2. The crash killed one person and injured 10 others. The same storm also contributed to a power outage for thousands, dozens of downed trees, and contributed to a couple of other fatal traffic incidents in northern and eastern West Virginia (Jenkins, 2016).

Figure 4.3.11-2: 15-Vehicle Crash on Interstate 81 on June 16, 2016 (Jenkins, 2016)

4.3.11.4. Future Occurrence

Lightning strikes the earth about 100 times every second. Each year in the United States, approximately 400 people are struck (about one for every 86,000 lightning flashes in the U.S.), and 17,400 fires are caused by lightning. July is the peak month for lightning strikes in the United States. The probability of a lightning strike on a given building is a function of the object's lightning-attractive area (e.g., a tall metal pole is more likely to be struck by lightning than a shorter non-conductive objects).

The future occurrence of lightning and thunderstorm activity in Berkeley and Morgan County is anticipated, and the susceptibility to damage from these severe storms will remain unchanged. The number of lightning events is influenced by the frequency of a severe thunderstorm occurrence. Therefore, potential future changes in climate and weather conditions may impact the future occurrences of lightning strike. The probability of thunderstorms and lightning strike events in the region is considered *likely* according to the Risk Factor Methodology (see Table 4.4-1).

4.3.11.5. Vulnerability Assessment

Thunderstorm is another hazard that can be said to affect the entire region equally (i.e., all structures in the region are at risk). In many ways, the cascading effects of thunderstorms are more damaging than the storm itself. For example, as mentioned above, lightning strikes may cause power surges that result in damage. Thunderstorm winds may down trees that fall onto personal property. Tracking

these types of damages is difficult as many people may not turn such claims into their insurance. Outdoor activities and events are particularly vulnerable to thunderstorms, but when lightning threatens a large outdoor venue, the game or event itself is usually postponed. The environmental impacts most often associated with lightning strikes include damage to or death of trees and ignition of wildfires. During the years of 2000 – 2020, the NOAA NCEI Storm Events Database reported 64 lightning events in the state which caused two deaths, 17 injuries, property damage of $3,447,000 and $0 in crop damage (NOAA NCEI, 2021).

Losses due to lightning can be lessened by installing surge protection on critical electronic, lightning, or information technology systems. Lightning protection devices and methods, such as lightning rods and grounding, can be installed on a community's communications infrastructure and other critical facilities to reduce losses.

4.3.12. Wildfire

4.3.12.1. Location and Extent

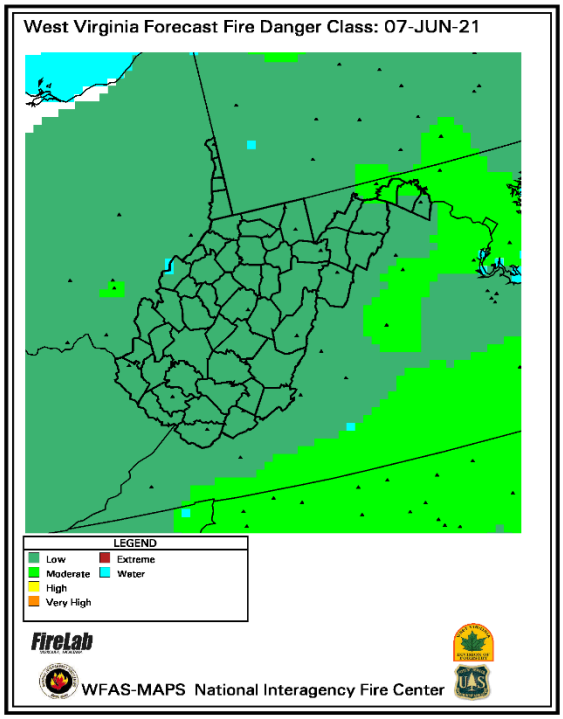
A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. Wildfires often begin unnoticed and can spread quickly, creating dense smoke clouds. A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar facilities. An urban-wildland interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

Wildland fires are most common in the spring (March to May) and fall (October to November) months. During spring months, the lack of leaves on the trees allows the sunlight to heat the existing leaves on the ground from the previous fall. The same theory applies for the fall; however, the dryer conditions are a more crucial factor.

Wildfire events can occur at any time of the year but are most likely to occur in the region during a drought. Wildland fires in West Virginia can occur in fields, grass, and brush as well as in the forest itself. Under dry conditions or drought, wildfires have the potential to burn forests as well as croplands. Any small fire in a wooded area, if not quickly detected and suppressed, can get out of control. Most wildland fires are caused by human carelessness, negligence, and ignorance. They are usually signaled by dense smoke that fills the area for miles around. The size of a wildfire is contingent on the amount of fuel available, weather conditions, and wind speed and direction. The West Virginia Division of Forestry tracks and maps fire hazard daily with their Wildland Fire Assessment System, as seen for a day in June 2021 in Figure 4.3.12-1.

Morgan County is generally more rural in nature than Berkeley County, consisting of large tracts of agricultural, undeveloped, and forested lands. Therefore, a wildfire could develop in any portion of the county and is more likely to than in more developed Berkeley County. The most high-risk areas of the counties are at the forest-urban interface, where the potential for wildfire to spread to structures is greatest.

Figure 4.3.12-1: West Virginia Forecasted Fire Danger (WV Division of Forestry, 2021a)



4.3.12.2. Range of Magnitude

Wildfire events can range from small fires that can be managed by local firefighters to large fires impacting many acres of land. Large events may require evacuation from one or more communities and necessitate regional or national firefighting support. The impact of a severe wildfire can be devastating. While some fires are not human-caused and are part of natural succession processes, a wildfire can kill people, livestock, fish, and wildlife. They often destroy property, valuable timber, forage, and recreational and scenic values.

Vegetation loss is often an environmental concern with wildfires, but it typically is not a serious impact since natural re-growth occurs with time. The most significant environmental impact is the potential for severe erosion, silting of stream beds and reservoirs, and flooding due to ground-cover loss following a fire event.

Wildfires also have a positive environmental impact in that they burn dead trees, leaves, and grasses to allow more open spaces for new and different types of vegetation to grow and receive sunlight. Another positive effect of a wildfire is that it stimulates the growth of new shoots on trees and shrubs, and a fire's heat can open pinecones and other seed pods.

In addition to the risk wildfires post to the public and property owners, the safety of firefighters is also a concern. Although loss of life among firefighters does not occur often in West Virginia, it is always a risk. More common firefighting injuries include falls, sprains, abrasions, or heat-related injuries such as dehydration. Response to wildfires also exposes emergency responders to the risk of motor vehicle incidents and can place them in remote acres away from the communities that they are chartered to protect.

One of the largest wildfires in West Virginia during the last 40 years occurred in the fall of 1987. A 19,560-acre wildfire blazed through Raleigh County, while another forest fire burned 15,192 acres in Boone County. The 1987 fire season proved to be the state's second worst year on record for forest fires, with more than 416,687 acres damaged (Steelhammer, 2013).

4.3.12.3. Past Occurrence

The U.S. Fire Administration (USFA) collects data from a variety of sources to provide a statistical analysis of fire incidents nationwide. According to the USFA, the number of fires and fire related injuries has continued to decline over the last several years. However, the number of fire related casualties and the economic losses from wildfire events have both begun to increase again. From 2008 to 2017, fires per million population declined 12.3 percent and injuries per million population declined 21.2 percent. However, in this same time frame, deaths per million population increased 2.4 percent and dollar loss per capita increased 11.9 percent (USFA, 2019).

A 2019 study by the USFA showed the largest number of fires were classified as "outside/other" and accounted for 45 percent of all fires, while residential fires resulted in the highest percentage of fire deaths (80 percent), fire injuries (84 percent), and dollar loss (83 percent). Nonresidential properties, such as industrial and commercial establishments, institutions, and educational facilities, accounted for only 9 percent of all fires, but 29 percent of total dollar loss (NFPA, 2020).

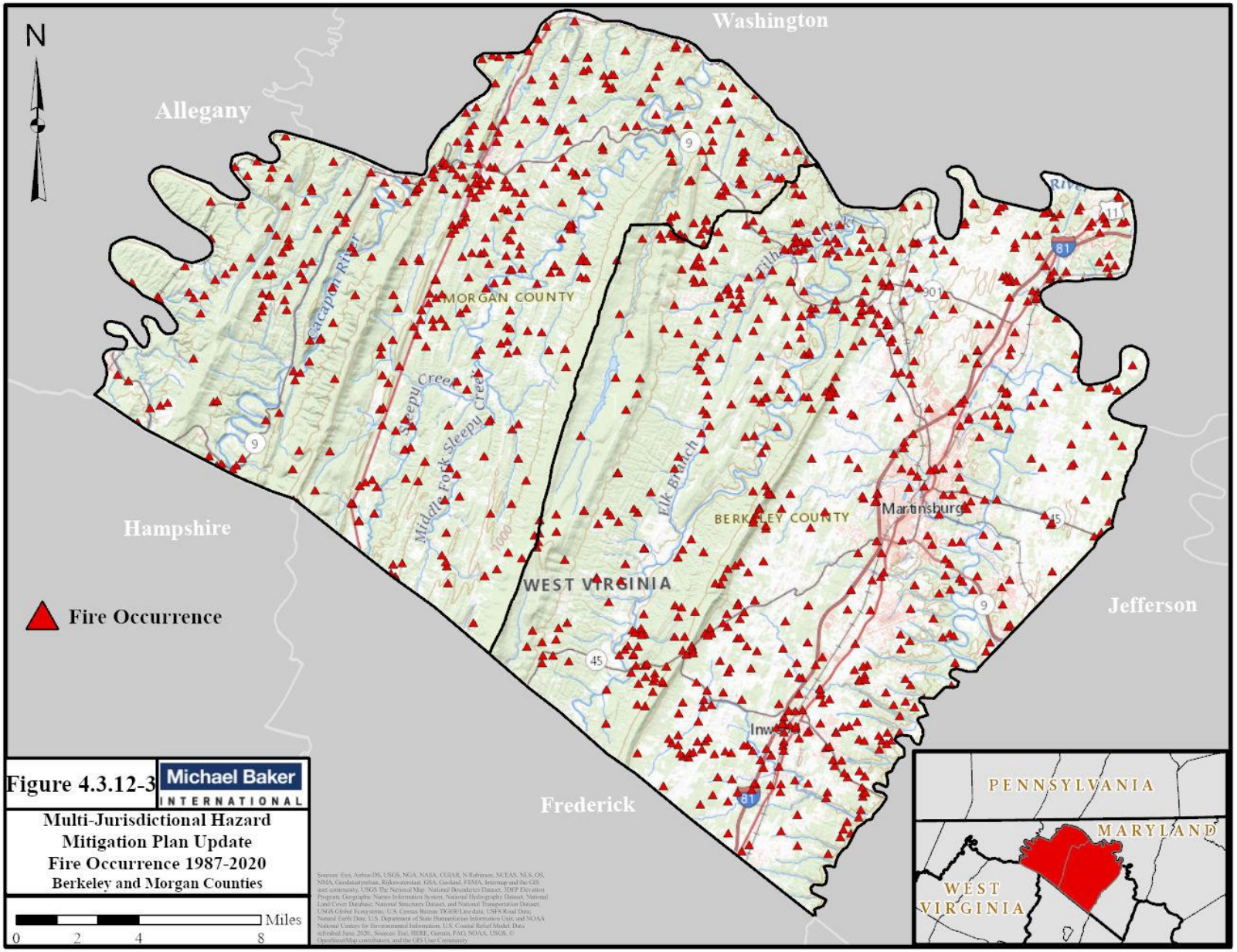
Figure 4.3.12-2: Area firefighters battled several brush fires including this one on Roberts Road in Great Cacapon. (The Morgan Messenger, 2020)

No major wildfires have been identified in the Eastern Panhandle, but this does not mean that vegetation fires do not occur frequently. Representatives from local fire departments throughout the region confirm that brush fires, ranging in size from a single acre to hundreds of acres occur each year. Many of these fires are extinguished before becoming a major problem. Additionally, most of these events occur in rural areas rather than in areas of urban-wildland interface.

Between January 1, 2021 and March 25, 2021, the West Virginia Division of Forestry reported 312 fires and nearly 3,000 acres burned. During the same period in 2020, the state counted 158 fires and 632 acres burned. Debris burning accounts for more than 35 percent of all wildfire occurrence over the past 10 years. (WV Division of Forestry, 2021b). Figure 4.3.12-3 displays fire occurrences in both counties between the years 1987-2020, as supplied by West Virginia Division of Forestry Mont Chateau Research Center. The WVDOF tracks fire locations, cause of fire, and total acres burned.

There have been recent wildfires and brush fires in Berkeley and Morgan County that have been significant enough to cause damage to acres of fields and forests. In February 2020, firefighters responded to multiple large brush fires that occurred in Berkeley Springs and Great Cacapon. Units that responded to the River Road brush fires were Berkeley Springs, Great Cacapon, South Morgan, Hancock, Hedgesville, Orleans and Reynolds Store Volunteer Fire Companies and Washington County Emergency Rehab Unit 255. Also responding were the West Virginia State Police, the Morgan County Sheriff's Department, the West Virginia Division of Highways, the West Virginia Division of Forestry, and the West Virginia Division of Natural Resources Police (Evans, 2020). A photo of the incident can be seen in Figure 4.3.12-2. More recently, on March 8, 2021. A large brush fire broke out in the area

of Featherbed Lane in Morgan County. The fire spread about eight acres before firefighters were able to tame the flames. No people, animals, or structures were harmed by the fire (Davis, 2021). Figure 4.3.12-3 depicts fire occurrences across West Virginia for the years 1987-2020 as recorded by the West Virginia Division of Forestry.


N
Washington
Allegany
Hampshire
Frederick
Jefferson
MORGAN COUNTY
BERKELEY COUNTY
WEST VIRGINIA
Martinsburg
Cacapon River
Sleepy Creek
Middle Fork Sleepy Creek
Elk Branch
Fire Occurrence
Figure 4.3.12-3
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Fire Occurrence 1987-2020
Berkeley and Morgan Counties
Miles
0 2 4 8
PENNSYLVANIA
MARYLAND
WEST VIRGINIA

4.3.12.4. Future Occurrence

Previous events indicate that annual wildfire occurrences in the region are expected. In some cases, an increase in wildfires or acreage burned follows significant drought. Droughts in 1987, 1991 and 1999 had that effect. There were effects of drought visible during the 2001 fire season when 94,233 acres burned, the largest number of acres consumed since 2000. Many wildfires in Berkeley and Morgan County are also the result of human-caused ignitions. Any fire, without the quick response or attention of fire-fighters, forestry personnel, and/or the public, has the potential to become a wildfire. Morgan County will likely face more wildfires as a result of the its rural nature. Therefore, the probability of a wildfire occurring in Berkeley and Morgan County is considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

4.3.12.5. Vulnerability Assessment

Based on the wildfire history of the area, Berkeley and Morgan County appear to have a low vulnerability to severe wildfire. The wildfire hazard was defined based on conditions that affect wildfire ignition and/or behavior such as fuel, topography, and local weather. These conditions are constantly changing, so the region's vulnerability will fluctuate over time.

The WV Statewide 2018 HMP analysis for wildfire found that historic wildfire property damage in Berkeley County to be between $10,000 - $50,000, and Morgan County to be $150,000+. Morgan County is included in the counties with highest historical property damages (WV Statewide HMP, 2018).

In locations where homes are at risk for wildfires, the BOF's Wildland/Urban Interface Guidance Document is available to assist homeowners, community associations, local government, and developers to assess and mitigate the potential dangers of a wildfire. The guidance also provides information for developing an action plan in coordination with local emergency managers. Communities at risk for wildfires can adopt by local ordinance the "International Wildland-Urban Interface Code" of the Uniform Construction Code.

For the purpose of this document, the parcels and critical facilities most vulnerable to wildfire hazard is defined as in or within 2 miles of state forests, state parks, and state game lands, as they are the largest continuous tracks of wooded land in the region. Table 4.3.12-1 shows the number of structures and critical facilities in wooded areas of the region.

Table 4.3.12-1 Structures and Critical Facilities located in and near State Parks and Wildlife Management Areas defined as in or within 2 miles						
County	**Total Structures**	**Total Structures In/Near State Recreation Areas**	**Percent Structures In/Near State Recreation Areas**	**Total Critical Facilities**	**Critical Facilities In/Near State Recreation Areas**	**Percent Critical Facilities In/Near State Recreation Areas**
Berkeley	71,289	5,150	7%	125	1	0.8%
Morgan	11,340	7,694	68%	36	21	58.3%

4.3.13. Windstorm, Tornado

4.3.13.1. Location and Extent

Both tornado and windstorm events can occur throughout Berkeley and Morgan County. Tornado events are usually localized. However, severe thunderstorms may result in conditions favorable to the formation of numerous or long-lived tornadoes. 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 August. Tornado movement is characterized in two ways: direction and speed of spinning winds and forward movement of the tornado, also known as the storm track. Rotational wind speeds of the vortex can range from 100 mph to more than 250 mph. In addition, the speed of forward motion can be zero to 45 or 50 mph. Therefore, some estimates place the maximum velocity (combination of ground speed, wind speed, and upper winds) of tornadoes at about 300 mph.

Straight-line winds and windstorms are experienced on a more region-wide scale. Straight-line winds often accompany tornados and are caused by the movement of air from areas of higher pressure to areas of lower pressure – the greater the difference in pressure, the stronger the winds. Windstorms are generally defined as sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration.

Figure 4.3.13-1: Wind Zones of the United States (FEMA, 2014)

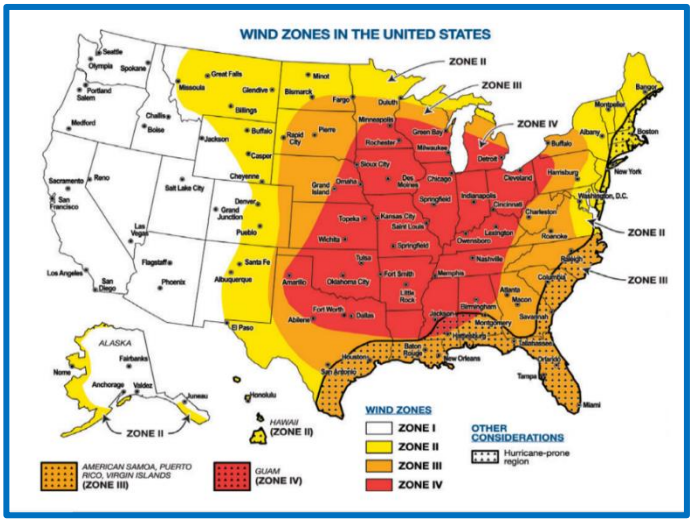


Figure 4.3.13-1 shows the wind speed zones developed by the American Society of Civil Engineers based on tornado and hurricane historical events. These wind speed zones are intended to guide the design and evaluation of the structural integrity of shelters and critical facilities. The whole of the Eastern Panhandle falls within Zone III, meaning the region is susceptible to winds up to 200 miles per hour. The hurricane susceptibility shown in the map is discussed in Section 4.3.6.

4.3.13.2. Range of Magnitude

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light construction such as mobile homes. The impact of tornado hazards is ultimately dependent on the population or amount of property present in the area in which the tornado occurs. Tornado events are often so severe that property loss or human fatality is typically inevitable if evacuation or proper construction standards are not implemented.

Since 2007, enhanced Fujita Tornado Scale (or the -EF-Scale) has been used in the United States to describe the magnitude of tornadoes. Prior to 2007, the Fujita Scale (F-Scale) was commonly used to describe magnitude. This scale is based on new information about the relationship between wind speed given in miles per hour (mph) and corresponding damages. The EF Scale categorized tornadoes from EF0 to EF5 with EF0 being the most commonly occurring type of tornado. Table 4.3.13-1 shows the enhanced Fujita Tornado Scale and associated damages.

Table 4.3.13-1 Enhanced Fujita Scale (EF-Scale) Categories with Associated Wind Speeds and Expected Damage

Ef-Scale Number	Wind Speed (mph)	F-Scale Number	Type of Damage Possible
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 missiles generated.
EF5	>200	F3-F6	**Extreme damage**: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (300 ft.); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation.

As noted above, Figure 4.3.13-1 shows the wind speed zones based on tornado and hurricane historical events. The whole Eastern Panhandle falls within Zone III, meaning that shelters and critical facilities should be able to withstand a 3-second gust of up to 200 mph, regardless of whether the gust is the result of a tornado, coastal storm, or windstorm event. Therefore, these structures should be able to withstand the wind speeds experienced in an F3 tornado event.

Since tornado and windstorm events are typically localized, environmental impacts are rarely widespread. However, where these events occur, severe damage to buildings and plant species is likely. This includes loss of trees and an increased threat of wildfire in areas where dead trees are not removed. Hazardous material facilities should meet design requirements to withstand a 3-second gust of up to 160 mph in order to prevent release of hazardous materials into the environment.

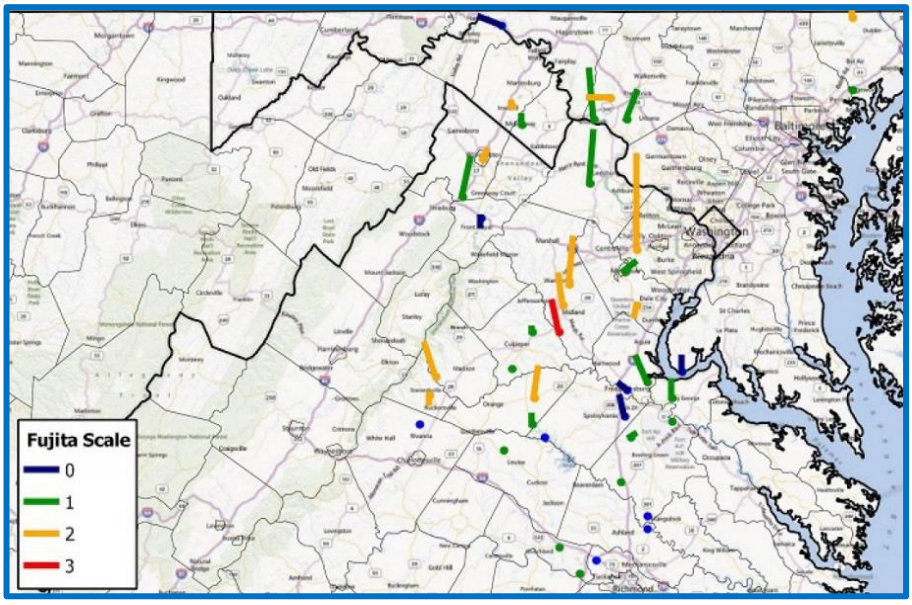
The worst-case scenario for windstorm and tornado events in Berkeley and Morgan County would be an EF5 tornado that strikes the Martinsburg area in Berkeley County. This is the most densely

developed and populated area in both counties and a severe tornado here could cause maximum property damage and casualties. Most tornadoes only remain on the ground for around 5 minutes and travel a few miles, but some have tornadoes have remained grounded for over an hour and traveled 70 miles. An EF5 tornado can level houses, throw cars, and deform reinforced or high-rise buildings. An event of this severity is exceptionally unlikely to occur and represents an extreme scenario only, but the possibility should be considered. More typical wind hazard events in Berkeley and Morgan County involve tree and limb damage, with fallen trees and limbs possibly resulting in damage to nearby vehicles or structures.

4.3.13.3. Past Occurrence

There have been ten tornado events in Berkeley and Morgan County since 1990, as seen in Table 4.3.13-2. They have all occurred between the months of May and September, and eight out of the 10 tornadoes have been in Berkeley County. The only tornado to inflict any casualties was a tornado that touched down in Darkesville, spawned by the Hurricane Ivan weather system on September 17, 2004, that injured at least six. This is the most severe documented tornado occurrence in the area was an F2 magnitude. The damage it caused was described in the 2013 WV Statewide HMP, stating that the tornado caused extensive damage to houses and businesses and overturned vehicles on I-81. The path of this tornado can be seen in Figure 4.3.13-2 alongside other tornadoes in the region formed during Hurricane Ivan.

Figure 4.3.13-2: Tornado Tracks of Hurricane Ivan (Prociv, 2004)



Hurricane Ivan resulted in the most recent severe tornadoes identified in the region. However, a recent severe windstorm did occur on May 3, 2021. Severe winds swept through the Eastern Panhandle, displacing several families. The National Weather Service confirmed a tornado hit Ranson, WV with peak winds at 90 mph. Emergency Officials reported severe damage in the Ranson area as well as the areas of Bunker Hill and Inwood in neighboring Berkeley County. In Berkeley County, two families were displaced due to damage to mobile homes (McMillion & Greene, 2021). A list of other

hazardous windstorms from 2000 to May 2021 can be seen in Table 4.3.13-3.

On June 29, 2012, a type of violent wind storm system, called a derecho, moved eastward impacting Indiana, Ohio, West Virginia, Virginia, Washington DC, Maryland, and part of New Jersey, as seen in Figure 4.3.13-3. The storm carried thunder and wind gusts ranging between 60 and 100 mph. Thirteen people were killed, three in West Virginia, and widespread power outages across the impacted area left 1.6 million people without power. Damages from the storm were reported in the Eastern Panhandle. Meteorologists theorize that the derecho event occurred in part thanks to the above average temperatures being experienced across the impacted region, which helped to fuel the storm (Daniel, 2012).

Figure 4.3.13-3: 6/29/12 Derecho Wind Storm

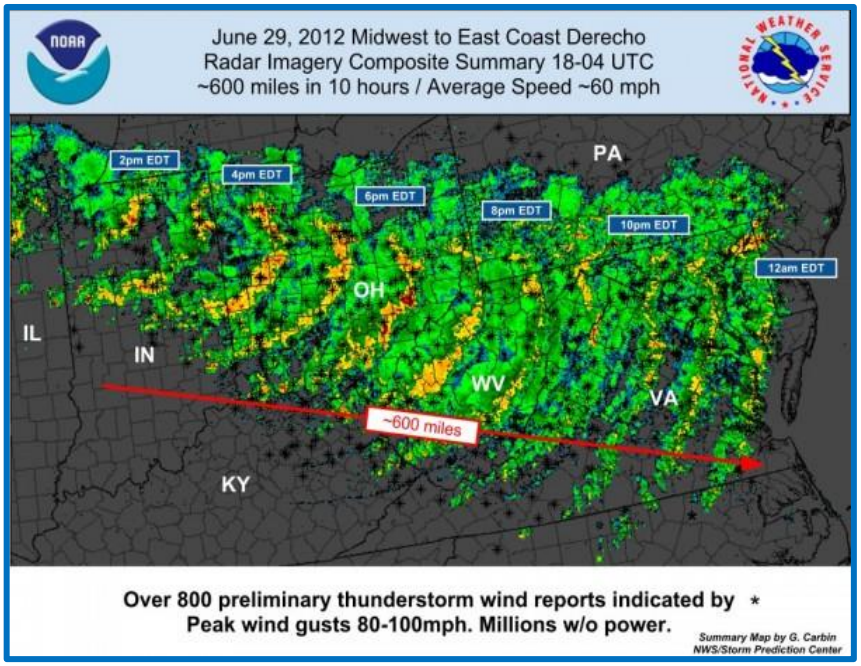


Table 4.3.13-2 Tornado Events in Berkeley and Morgan County, 1990 – May 2021, (NCEI NOAA, 2021)

County	Location	Date	Magnitude	Property Damage ($)	Crop Damage ($)	Injuries
Berkeley	-	8/17/1994	F1	500000	0	0
Morgan	Paw Paw	8/17/1994	F0	500	0	0
Berkeley	Ridgeway	6/16/1998	F0	50000	0	0
Berkeley	Martinsburg	6/16/1998	F1	100000	0	0
Berkeley	Bunker Hill	7/30/1998	F1	80000	10000	0
Berkeley	Arden	5/21/2004	F0	0	0	0
Berkeley	Darkesville	9/17/2004	F2	25000	0	6
Morgan	Sleepy Creek	9/17/2004	F0	25000	0	0
Berkeley	Martinsburg	6/8/2014	EF1	20000	10000	0
Berkeley	Glengary	7/13/2014	EF0	0	5000	0

Table 4.3.13-3 Hazardous Wind Events in Berkeley and Morgan County, 1990 – May 2021 (NCEI NOAA, 2021)

County	Date	Type	Wind Speed (Knots)	Property Damage ($)	County	Date	Type	Wind Speed (Knots)	Property Damage ($)
Berkeley	1/11/2000	High Wind	50	5000	**Morgan**	9/1/2012	T-Storm Wind	50	500
Berkeley	1/11/2000	High Wind	-	20000	**Morgan**	9/1/2012	T-Storm Wind	50	500
Morgan	1/16/2000	High Wind	-	20000	**Berkeley**	9/8/2012	T-Storm Wind	50	500
Morgan	4/8/2000	T-Storm Wind	-	100000	**Berkeley**	10/29/2012	High Wind	52	0
Berkeley	5/10/2000	High Wind	-	2000	**Morgan**	10/29/2012	High Wind	60	0
Berkeley	7/28/2000	T-Storm Wind	-	1000	**Morgan**	4/24/2013	T-Storm Wind	56	0
Morgan	7/28/2000	T-Storm Wind	-	1000	**Berkeley**	5/22/2013	T-Storm Wind	52	0
Berkeley	11/10/2000	T-Storm Wind	-	2000	**Morgan**	5/23/2013	T-Storm Wind	52	0
Berkeley	12/12/2000	High Wind	57	0	**Berkeley**	6/25/2013	T-Storm Wind	52	0
Morgan	12/12/2000	Strong Wind	-	0	**Berkeley**	6/25/2013	T-Storm Wind	52	1000
Berkeley	12/17/2000	Strong Wind	-	0	**Berkeley**	6/25/2013	T-Storm Wind	52	1000
Morgan	12/17/2000	Strong Wind	-	0	**Morgan**	7/7/2013	T-Storm Wind	52	0
Berkeley	1/27/2001	Strong Wind	-	0	**Morgan**	7/7/2013	T-Storm Wind	52	0
Morgan	1/27/2001	Strong Wind	-	0	**Morgan**	7/7/2013	T-Storm Wind	52	0
Berkeley	2/9/2001	High Wind	50	0	**Morgan**	11/1/2013	T-Storm Wind	52	0
Morgan	2/9/2001	Strong Wind	-	0	**Morgan**	11/1/2013	T-Storm Wind	52	0
Berkeley	3/6/2001	Strong Wind	-	0	**Berkeley**	3/12/2014	High Wind	53	0
Morgan	3/6/2001	Strong Wind	-	0	**Berkeley**	5/22/2014	T-Storm Wind	52	0
Berkeley	3/13/2001	T-Storm Wind	56	0	**Berkeley**	6/8/2014	T-Storm Wind	52	0
Berkeley	3/13/2001	T-Storm Wind	-	2000	**Berkeley**	6/8/2014	T-Storm Wind	52	0
Berkeley	3/13/2001	T-Storm Wind	72	0	**Morgan**	6/8/2014	T-Storm Wind	52	0
Berkeley	3/21/2001	Strong Wind	-	50000	**Morgan**	6/8/2014	T-Storm Wind	52	0
Berkeley	4/9/2001	T-Storm Wind	-	1000	**Berkeley**	6/11/2014	T-Storm Wind	52	0
Morgan	4/9/2001	T-Storm Wind	-	1000	**Berkeley**	6/25/2014	T-Storm Wind	52	3000
Berkeley	6/20/2001	T-Storm Wind	-	25000	**Berkeley**	6/25/2014	T-Storm Wind	52	1000
Berkeley	2/1/2002	Strong Wind	-	0	**Morgan**	6/25/2014	T-Storm Wind	52	0

Table 4.3.13-3 Hazardous Wind Events in Berkeley and Morgan County, 1990 – May 2021 (NCEI NOAA, 2021)

County	Date	Type	Wind Speed (Knots)	Property Damage ($)	County	Date	Type	Wind Speed (Knots)	Property Damage ($)
Morgan	2/1/2002	Strong Wind	-	0	Berkeley	7/2/2014	T-Storm Wind	52	0
Berkeley	3/9/2002	Strong Wind	-	0	Berkeley	7/2/2014	T-Storm Wind	52	1000
Morgan	3/9/2002	Strong Wind	-	0	Berkeley	7/2/2014	T-Storm Wind	52	0
Berkeley	3/21/2002	Strong Wind	-	0	Berkeley	7/2/2014	T-Storm Wind	52	0
Morgan	3/21/2002	Strong Wind	-	0	Berkeley	7/8/2014	T-Storm Wind	52	5000
Berkeley	4/28/2002	T-Storm Wind	-	500	Morgan	7/8/2014	T-Storm Wind	52	0
Berkeley	4/28/2002	T-Storm Wind	-	1000	Morgan	7/8/2014	T-Storm Wind	52	2000
Morgan	4/28/2002	T-Storm Wind	-	500	Morgan	7/8/2014	T-Storm Wind	52	2000
Berkeley	5/13/2002	T-Storm Wind	-	1000	Morgan	7/8/2014	T-Storm Wind	52	0
Berkeley	5/13/2002	T-Storm Wind	-	5000	Morgan	7/8/2014	T-Storm Wind	52	1000
Morgan	5/13/2002	T-Storm Wind	-	500	Morgan	7/8/2014	T-Storm Wind	51	0
Berkeley	5/14/2002	T-Storm Wind	-	5000	Morgan	7/8/2014	T-Storm Wind	52	0
Berkeley	5/14/2002	T-Storm Wind	54	0	Morgan	7/8/2014	T-Storm Wind	52	0
Morgan	5/14/2002	T-Storm Wind	-	20000	Berkeley	7/13/2014	T-Storm Wind	52	0
Berkeley	6/4/2002	T-Storm Wind	-	100	Berkeley	7/13/2014	T-Storm Wind	52	0
Berkeley	6/5/2002	T-Storm Wind	-	15500	Berkeley	7/13/2014	T-Storm Wind	52	0
Berkeley	6/6/2002	T-Storm Wind	-	7000	Berkeley	7/13/2014	T-Storm Wind	52	2000
Morgan	7/9/2002	T-Storm Wind	-	1000	Berkeley	7/13/2014	T-Storm Wind	52	0
Berkeley	9/27/2002	T-Storm Wind	50	2000	Berkeley	7/13/2014	T-Storm Wind	52	0
Berkeley	1/8/2003	High Wind	35	0	Berkeley	7/13/2014	T-Storm Wind	52	0
Morgan	1/8/2003	High Wind	35	0	Berkeley	7/13/2014	T-Storm Wind	50	0
Berkeley	2/23/2003	Strong Wind	30	100	Berkeley	7/13/2014	T-Storm Wind	52	2000
Morgan	2/23/2003	Strong Wind	30	100	Berkeley	7/13/2014	T-Storm Wind	52	0
Berkeley	6/1/2003	Strong Wind	40	1000	Berkeley	7/13/2014	T-Storm Wind	52	5000
Berkeley	6/30/2003	T-Storm Wind	50	2000	Berkeley	7/13/2014	T-Storm Wind	52	5000

Table 4.3.13-3 Hazardous Wind Events in Berkeley and Morgan County, 1990 – May 2021 (NCEI NOAA, 2021)

County	Date	Type	Wind Speed (Knots)	Property Damage ($)	County	Date	Type	Wind Speed (Knots)	Property Damage ($)
Berkeley	8/26/2003	T-Storm Wind	55	5000	Berkeley	7/14/2014	T-Storm Wind	52	2000
Morgan	8/26/2003	T-Storm Wind	50	2000	Morgan	9/2/2014	T-Storm Wind	52	0
Berkeley	9/18/2003	High Wind	50	100000	Morgan	9/2/2014	T-Storm Wind	52	1000
Morgan	9/18/2003	High Wind	50	70000	Morgan	9/2/2014	T-Storm Wind	52	1000
Berkeley	10/15/2003	Strong Wind	41	2000	Morgan	9/2/2014	T-Storm Wind	52	0
Morgan	10/15/2003	Strong Wind	44	2000	Morgan	9/2/2014	T-Storm Wind	52	0
Berkeley	11/13/2003	Strong Wind	43	5000	Morgan	9/2/2014	T-Storm Wind	52	0
Morgan	11/13/2003	Strong Wind	43	5000	Morgan	9/2/2014	T-Storm Wind	52	0
Berkeley	11/19/2003	T-Storm Wind	50	500	Morgan	9/2/2014	T-Storm Wind	52	0
Berkeley	5/14/2004	T-Storm Wind	55	5000	Morgan	4/20/2015	T-Storm Wind	50	0
Berkeley	5/15/2004	T-Storm Wind	57	5000	Berkeley	5/31/2015	T-Storm Wind	50	1000
Berkeley	5/18/2004	T-Storm Wind	50	2000	Berkeley	1/12/2016	High Wind	55	0
Morgan	5/18/2004	T-Storm Wind	50	1500	Berkeley	4/2/2016	High Wind	53	0
Berkeley	5/21/2004	T-Storm Wind	55	2000	Berkeley	4/2/2016	High Wind	50	0
Morgan	5/21/2004	T-Storm Wind	55	3000	Berkeley	6/5/2016	T-Storm Wind	50	0
Berkeley	5/25/2004	T-Storm Wind	60	5000	Morgan	6/16/2016	T-Storm Wind	50	0
Berkeley	6/1/2004	T-Storm Wind	55	2000	Morgan	6/16/2016	T-Storm Wind	50	0
Morgan	6/1/2004	T-Storm Wind	55	0	Morgan	6/21/2016	T-Storm Wind	50	0
Morgan	8/4/2004	T-Storm Wind	50	0	Morgan	6/21/2016	T-Storm Wind	50	0
Berkeley	12/1/2004	High Wind	50	0	Morgan	6/21/2016	T-Storm Wind	50	0
Morgan	12/1/2004	High Wind	50	0	Berkeley	6/21/2016	T-Storm Wind	50	0
Morgan	4/3/2005	High Wind	50	0	Berkeley	6/28/2016	T-Storm Wind	50	0
Berkeley	6/22/2005	T-Storm Wind	50	0	Morgan	7/18/2016	T-Storm Wind	50	0
Berkeley	7/27/2005	T-Storm Wind	50	0	Berkeley	7/18/2016	T-Storm Wind	50	0
Berkeley	8/7/2005	T-Storm Wind	50	3000	Morgan	8/13/2016	T-Storm Wind	50	0
Berkeley	1/14/2006	High Wind	50	100000	Morgan	8/16/2016	T-Storm Wind	50	0

Table 4.3.13-3 Hazardous Wind Events in Berkeley and Morgan County, 1990 – May 2021 (NCEI NOAA, 2021)

County	Date	Type	Wind Speed (Knots)	Property Damage ($)	County	Date	Type	Wind Speed (Knots)	Property Damage ($)
Morgan	1/14/2006	High Wind	50	80000	Morgan	8/16/2016	T-Storm Wind	50	0
Berkeley	7/18/2006	T-Storm Wind	50	10000	Morgan	9/7/2016	T-Storm Wind	50	0
Morgan	7/18/2006	T-Storm Wind	50	13000	Berkeley	11/20/2016	High Wind	54	0
Berkeley	7/20/2006	T-Storm Wind	55	75000	Morgan	2/12/2017	High Wind	52	0
Berkeley	7/27/2006	T-Storm Wind	50	70000	Berkeley	2/12/2017	High Wind	52	0
Berkeley	8/26/2006	T-Storm Wind	50	15000	Berkeley	7/22/2017	T-Storm Wind	50	0
Morgan	9/28/2006	T-Storm Wind	60	85000	Morgan	8/4/2017	T-Storm Wind	50	0
Berkeley	10/28/2006	Strong Wind	42	20000	Berkeley	8/4/2017	T-Storm Wind	50	0
Berkeley	2/22/2007	Strong Wind	45	5000	Morgan	8/12/2017	T-Storm Wind	50	0
Morgan	2/22/2007	Strong Wind	45	2000	Morgan	8/12/2017	T-Storm Wind	50	0
Morgan	6/1/2007	T-Storm Wind	50	2000	Morgan	8/12/2017	T-Storm Wind	50	0
Morgan	6/12/2007	T-Storm Wind	50	0	Morgan	8/12/2017	T-Storm Wind	50	0
Berkeley	6/13/2007	T-Storm Wind	50	5000	Morgan	8/12/2017	T-Storm Wind	50	0
Morgan	6/13/2007	T-Storm Wind	50	1000	Morgan	8/12/2017	T-Storm Wind	50	0
Morgan	6/21/2007	T-Storm Wind	50	1000	Morgan	8/12/2017	T-Storm Wind	50	0
Berkeley	8/16/2007	T-Storm Wind	50	0	Morgan	9/5/2017	T-Storm Wind	50	0
Berkeley	9/26/2007	T-Storm Wind	50	1000	Morgan	9/5/2017	T-Storm Wind	50	0
Berkeley	9/27/2007	T-Storm Wind	50	2000	Morgan	9/5/2017	T-Storm Wind	50	0
Berkeley	9/27/2007	T-Storm Wind	50	0	Morgan	9/5/2017	T-Storm Wind	50	0
Berkeley	9/27/2007	T-Storm Wind	50	2000	Morgan	9/5/2017	T-Storm Wind	50	0
Morgan	9/27/2007	T-Storm Wind	50	5000	Berkeley	9/5/2017	T-Storm Wind	50	0
Berkeley	12/16/2007	High Wind	51	0	Berkeley	9/5/2017	T-Storm Wind	50	0
Morgan	12/16/2007	High Wind	50	5000	Berkeley	9/5/2017	T-Storm Wind	50	0
Berkeley	1/30/2008	High Wind	50	0	Berkeley	9/5/2017	T-Storm Wind	50	0
Berkeley	2/6/2008	T-Storm Wind	50	1000	Berkeley	9/5/2017	T-Storm Wind	50	0
Berkeley	2/10/2008	High Wind	50	0	Berkeley	9/5/2017	T-Storm Wind	58	0

Table 4.3.13-3 Hazardous Wind Events in Berkeley and Morgan County, 1990 – May 2021 (NCEI NOAA, 2021)

County	Date	Type	Wind Speed (Knots)	Property Damage ($)	County	Date	Type	Wind Speed (Knots)	Property Damage ($)
Morgan	2/10/2008	High Wind	50	10000	Berkeley	3/2/2018	High Wind	50	0
Berkeley	6/4/2008	T-Storm Wind	60	5000	Morgan	3/2/2018	High Wind	55	0
Berkeley	6/4/2008	T-Storm Wind	50	6000	Morgan	5/14/2018	T-Storm Wind	50	0
Berkeley	6/4/2008	T-Storm Wind	50	25000	Berkeley	5/31/2018	T-Storm Wind	52	0
Berkeley	6/4/2008	T-Storm Wind	50	10000	Berkeley	5/31/2018	T-Storm Wind	50	0
Berkeley	6/28/2008	T-Storm Wind	59	0	Morgan	6/20/2018	T-Storm Wind	50	0
Berkeley	6/28/2008	T-Storm Wind	56	0	Berkeley	6/20/2018	T-Storm Wind	50	0
Berkeley	6/28/2008	T-Storm Wind	50	5000	Berkeley	6/20/2018	T-Storm Wind	50	0
Berkeley	6/28/2008	T-Storm Wind	50	15000	Berkeley	6/20/2018	T-Storm Wind	50	0
Morgan	2/12/2009	High Wind	56	0	Morgan	7/2/2018	T-Storm Wind	50	0
Morgan	2/12/2009	High Wind	62	0	Berkeley	8/17/2018	T-Storm Wind	54	0
Berkeley	8/2/2009	T-Storm Wind	61	0	Berkeley	8/17/2018	T-Storm Wind	54	0
Berkeley	2/26/2010	High Wind	50	0	Morgan	8/21/2018	T-Storm Wind	50	0
Morgan	2/26/2010	High Wind	50	2000	Morgan	8/21/2018	T-Storm Wind	50	0
Berkeley	4/8/2010	T-Storm Wind	45	4000	Berkeley	8/21/2018	T-Storm Wind	50	0
Berkeley	2/25/2011	High Wind	50	0	Berkeley	2/24/2019	High Wind	57	0
Berkeley	4/16/2011	T-Storm Wind	52	1000	Morgan	2/24/2019	High Wind	52	0
Berkeley	5/26/2011	T-Storm Wind	52	1000	Berkeley	6/27/2019	T-Storm Wind	53	0
Berkeley	5/26/2011	T-Storm Wind	52	500	Berkeley	6/27/2019	T-Storm Wind	50	0
Morgan	5/26/2011	T-Storm Wind	56	1000	Morgan	6/29/2019	T-Storm Wind	50	0
Morgan	6/12/2011	T-Storm Wind	52	2000	Berkeley	6/29/2019	T-Storm Wind	50	0
Morgan	6/12/2011	T-Storm Wind	50	1000	Berkeley	6/29/2019	T-Storm Wind	50	0
Berkeley	7/3/2011	T-Storm Wind	50	1000	Berkeley	8/18/2019	T-Storm Wind	61	0
Morgan	7/3/2011	T-Storm Wind	52	1000	Morgan	10/31/2019	T-Storm Wind	52	0
Berkeley	7/7/2011	T-Storm Wind	50	1000	Berkeley	11/27/2019	High Wind	50	0
Berkeley	7/22/2011	T-Storm Wind	56	2000	Morgan	11/27/2019	High Wind	52	0
Berkeley	7/22/2011	T-Storm Wind	56	2000	Morgan	3/3/2020	T-Storm Wind	52	0

Table 4.3.13-3 Hazardous Wind Events in Berkeley and Morgan County, 1990 – May 2021 (NCEI NOAA, 2021)

County	Date	Type	Wind Speed (Knots)	Property Damage ($)
Berkeley	7/22/2011	T-Storm Wind	50	3000
Berkeley	7/22/2011	T-Storm Wind	52	3000
Morgan	7/22/2011	T-Storm Wind	52	5000
Morgan	7/22/2011	T-Storm Wind	52	4000
Berkeley	7/29/2011	T-Storm Wind	50	3000
Berkeley	8/1/2011	T-Storm Wind	59	0
Berkeley	8/1/2011	T-Storm Wind	52	0
Berkeley	8/1/2011	T-Storm Wind	56	10000
Berkeley	8/13/2011	T-Storm Wind	52	5000
Morgan	8/19/2011	T-Storm Wind	56	1000
Morgan	8/19/2011	T-Storm Wind	56	0
Berkeley	9/14/2011	T-Storm Wind	56	1000
Berkeley	9/14/2011	T-Storm Wind	52	1000
Berkeley	5/29/2012	T-Storm Wind	52	1000
Morgan	5/29/2012	T-Storm Wind	52	1000
Berkeley	6/22/2012	T-Storm Wind	61	2000
Berkeley	6/22/2012	T-Storm Wind	57	500
Berkeley	6/29/2012	T-Storm Wind	66	5000
Berkeley	6/29/2012	T-Storm Wind	50	0
Berkeley	6/29/2012	T-Storm Wind	52	2000
Berkeley	6/29/2012	T-Storm Wind	66	5000
Berkeley	6/29/2012	T-Storm Wind	70	5000
Berkeley	6/29/2012	T-Storm Wind	57	2000
Berkeley	6/29/2012	T-Storm Wind	52	0
Morgan	6/29/2012	T-Storm Wind	57	5000
Berkeley	7/8/2012	T-Storm Wind	56	0
Morgan	3/3/2020	T-Storm Wind	52	0
Berkeley	3/3/2020	T-Storm Wind	52	0
Morgan	4/7/2020	T-Storm Wind	54	0
Berkeley	4/13/2020	T-Storm Wind	50	0
Berkeley	4/13/2020	T-Storm Wind	50	0
Berkeley	4/13/2020	T-Storm Wind	55	0
Berkeley	4/13/2020	T-Storm Wind	50	0
Morgan	6/4/2020	T-Storm Wind	50	0
Morgan	6/4/2020	T-Storm Wind	50	0
Berkeley	6/4/2020	T-Storm Wind	50	0
Morgan	6/10/2020	T-Storm Wind	50	0
Morgan	6/22/2020	T-Storm Wind	50	0
Berkeley	6/23/2020	T-Storm Wind	50	0
Berkeley	6/25/2020	T-Storm Wind	50	0
Morgan	7/21/2020	T-Storm Wind	50	0
Morgan	8/1/2020	T-Storm Wind	50	0
Morgan	8/1/2020	T-Storm Wind	55	0
Morgan	8/1/2020	T-Storm Wind	55	0
Morgan	8/25/2020	T-Storm Wind	50	0
Morgan	8/25/2020	T-Storm Wind	50	0
Morgan	8/25/2020	T-Storm Wind	50	0
Berkeley	8/28/2020	T-Storm Wind	50	0
Berkeley	11/15/2020	T-Storm Wind	55	0
Morgan	11/15/2020	T-Storm Wind	50	0

Table 4.3.13-3 Hazardous Wind Events in Berkeley and Morgan County, 1990 – May 2021 (NCEI NOAA, 2021)									
County	Date	Type	Wind Speed (Knots)	Property Damage ($)	County	Date	Type	Wind Speed (Knots)	Property Damage ($)
Berkeley	7/8/2012	T-Storm Wind	56	1000					
Morgan	7/8/2012	T-Storm Wind	52	1000					
Morgan	7/8/2012	T-Storm Wind	52	1000					
Berkeley	7/18/2012	T-Storm Wind	52	1000					
Morgan	8/9/2012	T-Storm Wind	52	500					
Morgan	8/10/2012	T-Storm Wind	52	500					

4.3.13.4. Future Occurrence

For the period between 1990 and 2021, 10 tornadoes were reported in Berkeley and Morgan County by NCEI. Therefore, the annual probability of being in the path of a tornado in the region is relatively minor. While the chance of being hit by a tornado is small, the damage that results when the tornado arrives can be potentially devastating. An F4 tornado, with a 0.01-percent-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. While most of the recent windstorms and tornadoes have occurred outside of the county, their proximity contributes to future risk. Because more windstorms have been seen in the region, it is possible that an increasing number of tornadoes will be seen in Berkeley and Morgan County.

According to these NCEI records, there have been 359 hazardous wind events in Berkeley County and/or Morgan County. The region experiences windstorm events more commonly than tornadoes, which causes power failures, loss of communication networks, and residents requiring temporary shelters and provision of supplies. The probability of tornadoes and windstorms in Berkeley and Morgan County can be considered *likely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

4.3.13.5. Vulnerability Assessment

For tornadoes or high winds, aged and dilapidated structures or structures not built to applicable building codes are more susceptible to damage. Mobile homes and campgrounds are especially susceptible to damage due to tornado or high wind. Strong winds can rip roofs off any dilapidated structures and overturn mobile homes. Past experiences with tornadoes in the region show that, while rara, death and injury are indeed possibilities. Vulnerability to the effects of a tornado or high wind is somewhat dependent upon the age of a structure because as building codes become more stringent, buildings are capable of enduring greater wind forces.

In Berkeley and Morgan County, high winds occur annually. The most common detrimental effects are interruptions in power supply and communications services due to downed wires and blocked

roadways due to downed trees. Most severe power failures or outages are regional events. With the loss of power, electrical-powered equipment and systems will not be operational. Examples include lighting, HVAC and ancillary support equipment, communication systems, ventilation system, refrigerators, sterilizers, and medical equipment. This can cause food spoilage, loss of heat or air conditions, basement flooding (sump pump failure), lack of light, loss of water (well pump failure), lack of phone service, or lack of internet. While it is most often a short-term nuisance rather than a catastrophic hazard, utility interruptions can cause challenges for communications and response, particularly in more rural areas of the county. A worst-case scenario for utility interruption in the region would involve a power outage during winter snow or ice storms, which have the potential to cause power outages for prolonged periods of time.

High winds often occur during hurricanes and tropical storms. Information about potential annualized losses due to hurricane winds can be found in Section 4.3.7.

All structures and infrastructure might be exposed to the effects of a tornado or other high winds. Depending upon the severity of a tornado or high wind, any existing structures might be damaged to some extent. Any future structures might be exposed to tornados or high winds as this hazard does not occur in specific locations. However, future buildings will be somewhat protected from the effects of tornado or high wind as they will meet the most current State building code requirements for bracing and roof design.

Manufactured housing (i.e. mobiles homes or trailers) is particularly vulnerable to high winds and tornadoes. The U.S. Census Bureau defines manufactured homes as “movable dwellings, eight feet or wider and 40 feet or longer, design to be towed on its own chassis, with transportation gear integral to the unit when it leaves the factory, and without need of a permanent foundation (U.S. Census Bureau, 2021).” They can include multi-wide and expandable manufactured homes but exclude travel trailers, motor homes, and modular housing. Due to their lightweight and often unanchored design, manufactured housing is extremely vulnerable to high winds and will generally sustain the most damage.

Table 4.3.13-4 below displays the number of manufactured housing units per county. The highest proportions of mobile homes are in Morgan County (12.9 percent).

Table 4.3.14-4 Mobile Homes per County (U.S. Census Bureau, 2019)

County	Total Housing Units	Number Mobile Homes	Percent Mobile Homes
Berkeley	50,340	5,513	11.0%
Morgan	9,976	1,288	12.9%

According to the NOAA Strom Events Database, Berkeley and Mogen County have reported a combined $2,687,000 in property damages due to tornados and extreme wind events, and $1,320,000 in crop damage from wind events (NOAA NCEI, 2021).

4.3.14. Winter Storm, Nor'easter

4.3.14.1. Location and Extent

Winter storms tend to encompass the entire two counties whereas flooding generally occurs within predictable boundaries along the regulatory SFHA and its main branches and tributaries. Nor'easters typically develop as extra-tropical storms which can produce winds equivalent to hurricane or tropical storm force as well as heavy precipitation, sometimes in the form of snow. These storms are regional events that can impact very large areas hundreds to thousands of miles across over the life of the storm. Risks associated and identified with severe winter storms include but are not limited to the following:

- Emergency medical evacuation of the sick, elderly, and infirmed to shelters.
- Power outages to those on life support systems.
- Communications interruptions and/or outages.
- Loss of the ability to heat homes.
- Interruption of the delivery of home supplies and food.

These above-described events fall within 2 general categories 1) road closures due to snow drifts and 2) utility failures (such as damaged supply lines). Additionally, data indicates that structural damage has occurred in several instances in the past as a result of extremely heavy snowfall. Structures damaged were usually buildings such as barns, garages, carports, etc. Additionally, because of the county's mountainous terrain, severe winter storms frequently result in dangerous driving conditions.

According to the 2018 WV Statewide HMP, the western half of Berkeley County and all of Morgan County average 2.4 to 4.4 days per year with snowfall equal or greater than 10.0 inches. The eastern half of Berkeley County averages 1.1 to 2.4 days of the year. Ten inches of snowfall in a day represents a winter storm of significant magnitude.

4.3.14.2. Range of Magnitude

Winter storms consist of cold temperatures, heavy snow or ice and sometimes strong winds. They begin as low-pressure systems that move through West Virginia either following the jet stream or developing as extra-tropical cyclonic weather systems over the Atlantic Ocean called nor'easters. Due to their regular occurrence, these storms are considered hazards only when they result in damage to specific structures or cause disruption to traffic, communications, electric power, or other utilities.

A winter storm can adversely affect roadways, utilities, business activities, and can cause loss of life,

frostbite, and freezing conditions. These storms may include one or more of the following weather events:

1. **Heavy Snowstorm:** Accumulations of four inches or more in a six-hour period, or six inches or more in a twelve-hour period.

2. **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.

3. **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.

4. **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.

5. **Severe Blizzard:** Wind velocity of 45 miles per hour, temperatures of 10 degrees Fahrenheit or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period time.

Any of the above events can result in the closing of secondary roads, particularly in rural locations, loss of utility services and depletion of oil heating supplies. Environmental impacts often include damage shrubbery and trees due to heavy snow loading, ice build-up and/or high winds which can break limbs or even bring down large trees. An indirect effect of winter storms is the treatment of roadway surfaces with salt, chemicals, and other de-icing materials which can impair adjacent surface and ground waters. Another important secondary impact for winter storms is building or structure collapses; if there is a heavy snowfall or a significant accumulation over time, the weight of the snow may cause building damage or even collapse. Winter storms have a positive environmental impact as well; gradual melting of snow and ice provides groundwater recharge. However, abrupt high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding.

A recent snowstorm on January 22, 2016, represents the largest impact Berkeley and Morgan County is anticipated to encounter from a winter storm hazard. During this event, 25 to 40 inches of heavy snow fell across the Eastern Panhandle in less than two days. A photo of the snowfall can be seen in Figure 4.3.14-1. The governor issued a state of emergency, and it took until the evening of January 23 to reopen one lane on both Interstate 81N and 81S, temporarily paralyzing travel. The amount of snow put a strain on critical operations as well, and local emergency management officials were tasked with transporting local medical professionals safely to the medical centers they were employed at. The National Guard was activated to transport emergency responders using Humvees (West Virginia Press Association, 2016). A storm of this magnitude could be considered a worst-case scenario winter storm for Berkeley and Morgan County. This is the most recent winter storm of this magnitude. Several other large winter storms have occurred since 2016, but none of this magnitude.

Figure 4.3.14-1: Radio Station Van in Martinsburg Covered by the January 2016 Storm (Fogle, 2016)

4.3.14.3. Past Occurrence

Winter storms are one of the most frequently occurring hazard in the region. Table 4.3.14-1 illustrates the number of winter storm (i.e., snow, ice, and blizzard) events in each county between 2016 and May 2021, which total 89 between the two counties. Some of these instances may have also been categorized as nor'easters; however, this was not differentiated within the database. According to the 2018 WV Statewide HMP, there are 13.75 annualized events in Region 9, totaling $27,000 from 2000-2016.

The January 2016 snowstorm was the most severe snowstorm in recent memory, but a December 16, 2020 snowstorm also impaired both counties, which was also labeled as a nor'easter. WV Metro News meteorologists claimed there could be as much as 12 to 18 inches of snow in Berkeley, Morgan, and Jefferson Counties.

The 2016 storm resulted in about 16 inches of snowfall across the Eastern Panhandle. The Berkeley County Council President declared a state of emergency for Berkeley. State Senator John Unger requested that Governor Earl Tomblin issue a state of emergency for Berkeley and Jefferson County to deploy additional assistance in snow removal and bring in other emergency services. Many

businesses and schools were forced to close, and the governor told non-essential state employees not to report to work (Francis, 2020).

Figure 4.3.14-2: Downtown Martinsburg on December 16, 2020 (Francis, 2020)

Table 4.3.13-1 Winter Storm Events Impacting Berkeley and Morgan County from 2016 to May 2021 (NCEI NOAA, 2021)

County	Date	Type	County	Date	Type
Morgan	1/8/2016	Winter Weather	**Berkeley**	1/29/2019	Winter Weather
Berkeley	1/22/2016	Winter Storm	**Morgan**	2/1/2019	Winter Weather
Morgan	1/22/2016	Winter Storm	**Berkeley**	2/1/2019	Winter Weather
Berkeley	1/26/2016	Winter Weather	**Morgan**	2/10/2019	Winter Storm
Morgan	1/26/2016	Winter Weather	**Berkeley**	2/10/2019	Winter Weather
Morgan	2/9/2016	Winter Weather	**Morgan**	2/17/2019	Winter Weather
Berkeley	2/9/2016	Winter Weather	**Berkeley**	2/17/2019	Winter Weather
Morgan	2/14/2016	Ice Storm	**Berkeley**	2/20/2019	Winter Storm
Berkeley	2/14/2016	Ice Storm	**Morgan**	2/20/2019	Winter Storm
Morgan	12/11/2016	Winter Weather	**Morgan**	3/1/2019	Winter Weather
Berkeley	12/11/2016	Winter Weather	**Berkeley**	3/1/2019	Winter Weather
Morgan	12/17/2016	Winter Storm	**Morgan**	3/1/2019	Winter Weather
Berkeley	12/17/2016	Winter Storm	**Berkeley**	3/1/2019	Winter Weather

Morgan	12/29/2016	Winter Weather	**Berkeley**	3/3/2019	Winter Storm
Berkeley	12/29/2016	Winter Weather	**Morgan**	3/3/2019	Winter Storm
Berkeley	1/5/2017	Winter Weather	**Morgan**	12/13/2019	Winter Weather
Morgan	1/5/2017	Winter Weather	**Berkeley**	12/13/2019	Winter Weather
Berkeley	1/10/2017	Winter Weather	**Berkeley**	12/16/2019	Winter Weather
Morgan	1/10/2017	Winter Weather	**Morgan**	12/16/2019	Winter Weather
Berkeley	1/14/2017	Winter Weather	**Morgan**	1/7/2020	Winter Weather
Morgan	1/14/2017	Winter Weather	**Berkeley**	1/7/2020	Winter Weather
Berkeley	3/13/2017	Winter Storm	**Morgan**	1/18/2020	Winter Weather
Morgan	3/13/2017	Winter Storm	**Berkeley**	1/18/2020	Winter Weather
Berkeley	3/24/2017	Winter Weather	**Morgan**	12/16/2020	Winter Storm
Morgan	3/24/2017	Winter Weather	**Berkeley**	12/16/2020	Winter Storm
Morgan	1/8/2018	Winter Weather	**Berkeley**	1/1/2021	Winter Weather
Berkeley	1/8/2018	Winter Weather	**Morgan**	1/25/2021	Winter Weather
Berkeley	1/16/2018	Winter Weather	**Berkeley**	1/25/2021	Winter Weather
Morgan	1/16/2018	Winter Weather	**Berkeley**	1/31/2021	Winter Storm
Morgan	2/4/2018	Winter Weather	**Morgan**	1/31/2021	Winter Storm
Berkeley	2/4/2018	Winter Weather	**Morgan**	2/7/2021	Winter Weather
Berkeley	2/7/2018	Winter Storm	**Berkeley**	2/7/2021	Winter Weather
Morgan	2/7/2018	Winter Storm	**Morgan**	2/10/2021	Winter Storm
Morgan	2/17/2018	Winter Weather	**Berkeley**	2/10/2021	Winter Weather
Berkeley	2/17/2018	Winter Weather	**Morgan**	2/10/2021	Winter Weather
Berkeley	3/20/2018	Winter Storm	**Morgan**	2/13/2021	Winter Weather
Morgan	3/20/2018	Winter Storm	**Berkeley**	2/13/2021	Winter Weather
Morgan	4/2/2018	Winter Weather	**Morgan**	2/18/2021	Winter Storm
Berkeley	11/15/2018	Winter Storm	**Berkeley**	2/18/2021	Winter Storm
Morgan	11/15/2018	Winter Storm	**Morgan**	2/18/2021	Winter Weather
Morgan	11/24/2018	Winter Weather	**Berkeley**	2/18/2021	Winter Weather
Berkeley	11/24/2018	Winter Weather	**Berkeley**	2/22/2021	Winter Weather
Morgan	1/12/2019	Winter Storm	**Morgan**	2/22/2021	Winter Weather
Berkeley	1/12/2019	Winter Storm			
Morgan	1/19/2019	Winter Weather			
Berkeley	1/19/2019	Winter Weather			

Table 4.3.14-2 Number of Winter Storm Events per year in Berkeley and Morgan County (NOAA NCEI, 2021)

Year	Number of Storms	Year	Number of Storms
1996	0	2009	5
1997	4	2010	5

Table 4.3.14-2 Number of Winter Storm Events per year in Berkeley and Morgan County (NOAA NCEI, 2021)

Year	Number of Storms	Year	Number of Storms
1998	2	2011	3
1999	10	2012	2
2000	9	2013	8
2001	3	2014	9
2002	6	2015	3
2003	9	2016	4
2004	5	2017	2
2005	7	2018	6
2006	0	2019	7
2007	9	2020	2
2008	0	**Total**	122

4.3.14.4. Future Occurrence

Data from NOAA shows that winter storms are a regular occurrence in Berkeley and Morgan County. So, the probability of the occurrence of a damaging heavy snow or ice storm in the region in any given year is 100 percent. The future occurrence of winter storms and nor'easter hazards can be considered *highly likely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

The severity and frequency of major winter storms and nor'easters is expected to remain fairly constant. However, due to increased dependence on various modes of transportation and use of public utilities for light, heat, and power, the disruption from these storms is more significant today than in the past. The future occurrence of climatic events cannot be predicted exactly. As noted in the table above, the region has been affected by two to seven winter storm events each year from 2015 to 2020. Given this record of reported events, it is safe for planning purposes to assume that in an average year the county can expect to experience four to five winter storm events.

4.3.14.5. Vulnerability Assessment

Since winter storms are a regular occurrence in Berkeley and Morgan County, as well as other counties throughout West Virginia, strategies have been developed to respond to 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 specific structures. Locations 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. Some rural areas of the region are susceptible to isolation due to the loss of telephone communications and road closings. Power failure and interruption of water supplies are common from ice storms, heavy snow, and blizzard conditions. All critical facilities in the region are vulnerable to winter storms

Ice storms also tend to occur several times per year. These storms usually cause temporary icy conditions that result in increased numbers of traffic accidents and falls, but little other impact. Severe ice storms bring a significant accumulation of ice, which can pull down branches, trees, and power lines. These can cause widespread power outages and it can take hours to days to restore service to all customers.

Areas of vulnerability include low-income and elderly populations, mobile homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding related to rapid snow melt.

Critical facilities would be impacted by a storm event, but these structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage. Because power interruption can occur, backup power is recommended for critical facilities and infrastructure. Motorists may occasionally become stranded on major highways, especially I-81, during these storms. The people must be rescued and provided with shelter until conditions improve. Stranded motorists are also likely on WV Route 9 and in remote and mountain locations.

Vulnerability to the effects of winter storms on buildings is somewhat dependent on the age of a building. As building codes become more stringent, buildings can support heavier loads and as buildings age, various factors may deteriorate their structural integrity. Vulnerability also depends upon the type of construction and the degree to which a structure has been maintained. It is assumed that older structures are more vulnerable, but additional information on construction type and building codes enforced at time of construction would allow a more thorough assessment of the vulnerability of structures to winter storm impacts such as severe wind and heavy snow loading.

The most vulnerable structures are those that were poorly built or are dilapidated. The weight of heavy snow or ice may lead to structural collapse or to minor damage. Some shed roofs that protect township and borough road maintenance or firefighting equipment have large span roofs that may collapse under the weight of especially heavy snow or ice although none have collapsed due to recent heavy snow or ice storms.

All structures and infrastructure in Berkeley and Morgan County are exposed to heavy snow and ice. For this analysis, structures built prior to 1940 are identified as being potentially at risk of being somewhat weakened and more susceptible to damage due to heavy snow or ice. Figure 4.3.13-3 and 4.3.13-4 shows the distribution of building ages in Berkeley and Morgan County; about 14.7 percent

of all buildings were constructed prior to 1940 in Berkeley County and about 11.2 percent in Morgan County.

Figure 4.3.13-3: Age of structures for buildings with known ages (U.S. Census Bureau, 2019)

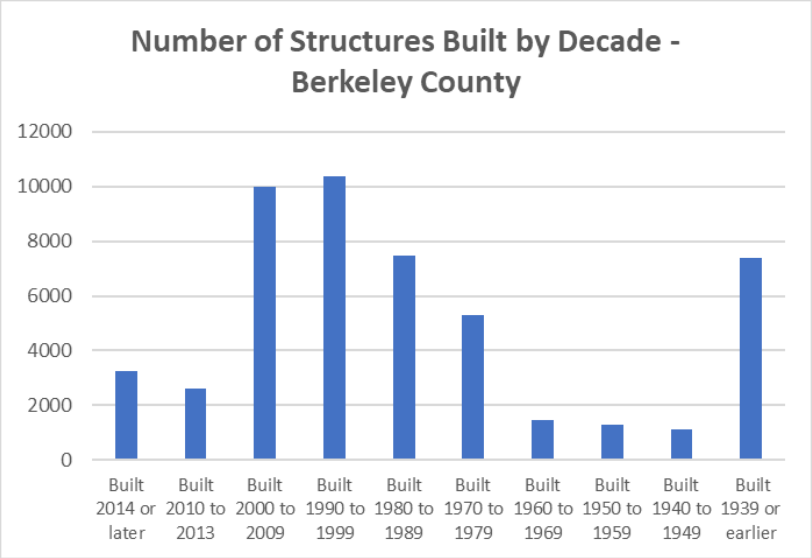
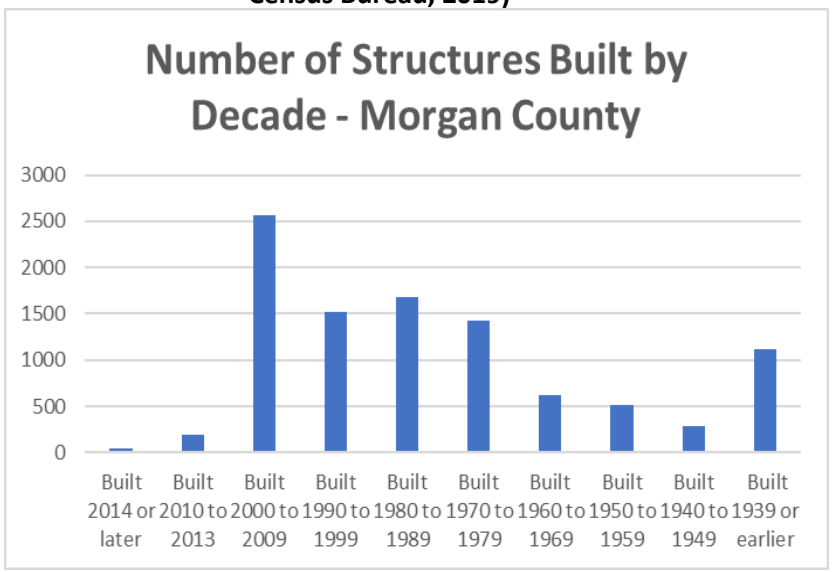


Figure 4.3.13-4: Age of structures for buildings with known ages (U.S. Census Bureau, 2019)



HUMAN-MADE HAZARDS

Human-made hazards are events caused by humans and typically occur close to or within human settlements. These hazards include environmental degradation, violence, pollution, and accidents. Human-made hazards profiled in this HMP include civil disturbance, cyber terrorism, dam failure, hazardous materials incidents, substance abuse disorder, source water contamination, terrorism, transportation accidents, and utility interruption.

4.3.15. Civil Disturbance

4.3.15.1. Location and Extent

Civil disturbance is a broad term that is typically used by law enforcement to describe one or more forms of disturbance caused by a group of people. Civil disturbances are typically a symptom of, and a form of protest against, major socio-political problems. Civil disturbance hazards include the following:

- **Famine:** Involving a widespread scarcity of food leading to malnutrition, increased mortality, and a period of psychosocial instability associated with the scarcity of food, such as riots, theft of food, and the falls of governments caused by political instability borne of an inability to deal with the crisis caused by famine
- **Economic Collapse, Recession:** Very slow or negative growth
- **Misinformation:** Erroneous information spread unintentionally
- **Civil Disturbance, Public Unrest, Mass Hysteria, Riot**: Group acts of violence against property and individuals, for example
- **Strike, Labor Dispute:** Controversies related to the terms and conditions of employment, for example

Typically, the severity of the action coincides with the level of public outrage. In addition to a form of protest major socio-political problems, civil disturbances can also arise out of union protest, institutional population uprising, or from large celebrations that become disorderly. The scale and scope of civil disturbance events varies widely. However, government facilities, landmarks, prisons, and universities are common sites where crowds and mobs may gather.

4.3.15.2. 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 (Juniata County, PA MJHMP, 2008):

1. **Casual Crowd:** A casual crowd is a group of people who happen to be in the same place at the same time. Violent conduct does not occur.
2. **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. They require substantial provocation to arouse to action.
3. **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 for a cause.
4. **Aggressive Crowd:** An aggressive crowd is comprised of individuals who have assembled and are visibly angry or violent. 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.

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 (Alvarez and Bachman, 2007):

- **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.

The worst-case scenario for the region would be an aggressive crowd or expressive mob protesting on or within a major thoroughfare, most likely formed near a major population hub, like Martinsburg. This scenario would also involve property damage

4.3.15.3. Past Occurrences

In late May 2020, an uprising against racism and police brutality swept the nation. Triggered by the murder of George Floyd by Minneapolis Police in Minnesota, groups in cities and towns across the country hosted protests for several weeks, including Berkeley and Morgan County. Peaceful protests and riots occurred throughout the region during the summer months of 2020, in Berkeley Springs, Martinsburg, and other communities. In one instance at a Berkeley Springs protest in August 2020, thirty to fifty people gathered to show support for the Black Lives Matter protest but were met with hundreds of counter protesters carrying Confederate flags and overpowering the speakers of the rally with chants of "U.S.A" and "all lives matter." Police intervened and created a barricade with riot shields when counter protesters advanced towards the gazebo holding the speakers (Rhee, 2020).

During the June 15, 2021 RAMS meeting, Berkeley County Police Chief Swartwood commented that police monitor Facebook, Snapchat, and other social media for incidents of protests and civil disturbance. He stated this is the best way to obtain real-time data.

4.3.15.4. Future Occurrences

Civil disturbance is always a possibility as long as there is discrimination or other perceived social or economic injustices. However, it may be possible to recognize the potential for an event to occur in the near-term. For example, an upcoming significant sporting event or other large public gathering in the State may result in gathering of large crowds or immediately after significant national news involving political or social debates. Local law enforcement should anticipate these types of events and be prepared to handle a crowd so that peaceful gatherings are prevented from turning into unruly public disturbances. Therefore, the probability of civil disturbance occurring in the region is considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

4.3.15.5. Vulnerability Assessment

Berkeley and Morgan County are most vulnerable to civil disturbance in their most populated municipalities: Martinsburg and Berkeley Springs. However, response training and anticipation to disturbances have diminished associated impacts and damages.

Jurisdictional losses for civil disturbance events are difficult to predict and can vary significantly in range. The two communities identified in this section are locations where such events are more likely to occur and therefore should be considered more vulnerable. Adequate law enforcement at these locations minimizes the changes of a small assembly of people turning into a significant disturbance. This will ensure improved response times, optimal communications, and containment of the event as during these events major roadways can be blocked and disturb traffic and larger events may involve

the interruption or removal of communication. More broadly, in the case of large civil disturbance events, the region may incur losses related to work stoppages in addition to any acts of vandalism that my occur. Failure to pursue a program of civil disturbance awareness may result in increased loss of lives and property

4.3.16. Cyber Terrorism

4.3.16.1. Location and Extent

Cyber terrorism is a broad term that refers to acts associated with the convergence of terrorism and cyberspace. Generally, cyberterrorism involves unlawful attacks or threats against computers, networks, and the information stored therein to intimidate or coerce a government or its people to achieve political or social objectives (Denning, 2000). These acts can range from taking control of a host website, to using networked resources to directly cause destruction and harm. Table 4.3.16-1 includes the types and methods of cyberattacks as defined by the Pennsylvania Department of Homeland Security (PA DHS). A Pennsylvania resource was consulted because a similar West Virginia Resource could not be located and the information below is applicable beyond Pennsylvania state boundaries.

Table 4.3.16-1 Methods of Cyberattacks (PA DHS, 2017)

Threat	Description
Botnet (also zombies)	A collection of computers subject to control by an outside party, usually without the knowledge of the owners, using secretly installed software robots. The robots are spread by trojan horses and viruses. The botnets can be used to launch denial-of-service attacks and transmit spam.
Card Skimming	The act of using a skimmer to illegally collect data from the magnetic stripe of a credit, debit or ATM card. This information, copied onto another blank card's magnetic stripe, is then used by an identity thief to make purchases or withdraw cash in the name of the actual account holder. Skimming can take place at an ATM and can occur at restaurants, taxis, or other places where a user surrenders his or her card to an employee.
Denial-of-Service Attack	Flooding the networks or servers of individuals or organizations with false data requests so they are unable to respond to requests from legitimate users.

Table 4.3.16-1 Methods of Cyberattacks (PA DHS, 2017)	
Threat	**Description**
Malicious Code (also malware)	Any code that can be used to attack a computer by spreading viruses, crashing networks, gathering intelligence, corrupting data, distributing misinformation and interfering with normal operations.
Pharming	The act of sending an e-mail to a user falsely claiming to be an established legitimate enterprise to scam the user into surrendering private information that will be used for identity theft. The e-mail directs the user to visit a website where they are asked to update personal information, such as passwords and credit card, social security, and bank account numbers that the legitimate organization already has. The website, however, is bogus and set up only to steal the user's information.
Phishing	Using fake e-mail to trick individuals into revealing personal information, such as Social Security numbers, debit and credit card account numbers and passwords, for nefarious uses.
Spam	Unsolicited bulk e-mail that may contain malicious software. Spam is now said to account for around 81 percent of all e-mail traffic.
Spear Phishing	A type of phishing attack that focuses on a single user or department within an organization, addressed from someone within the company in a position of trust and requesting information such as login IDs and passwords. Spear phishing scams will often appear to be from a company's own human resources or technical support divisions and may ask employees to update their username and passwords. Once hackers get this data, they can gain entry into secured networks. Another type of spear phishing attack will ask users to click on a link, which deploys spyware that can thieve data.
Spoofing	Making a message or transaction appear to come from a source other than the originator.
Spyware	Software that collects information without a user`s knowledge and transfers it to a third party.
Trojan Horse	A destructive program that masquerades as a benign application. Unlike viruses, Trojan horses do not replicate themselves, but they can be just as destructive. One of the most insidious types of Trojan horse is a program that claims to rid your computer of viruses but instead introduces viruses onto your computer.

Table 4.3.16-1 Methods of Cyberattacks (PA DHS, 2017)	
Threat	**Description**
Virus	A program designed to degrade service, cause inexplicable symptoms or damage networks.
Worm	Program or algorithm that replicates itself over a computer network and usually performs malicious actions, such as using up the computer's resources and possibly shutting the system down. A worm, unlike a virus, has the capability to travel without human action and does not need to be attached to another file or program.

Cyberattacks may not always constitute acts of cyberterrorism because some acts may have relatively small impacts and only produce annoyances. A cyberattack is generally considered an act of cyberterrorism when the following motivations are present:

- **Effects-based:** When computer attacks result in effects that are disruptive enough to generate fear comparable to a traditional act of terrorism.
- **Intent-based:** When unlawful or politically motivated computer attacks are done to intimidate or coerce a government or people to further a political objective, or to cause grave harm or severe economic damage (Rollins and Wilson, 2007).

Cyberattacks can be further divided into the following categories based on the complexity of the attack:

- **Simple-Unstructured:** Simple-unstructured attacks are the most common. These are amateurish attacks with relatively minimal consequences.
- **Advanced-Structured:** Advanced-structured attacks are more sophisticated and consequential and have a greater emphasis on targeting victims prior to an attack, resulting in a more debilitating effect.
- **Complex-Coordinated**: Complex-coordinated attacks are the most advanced and most troublesome type of attacks where success could mean a network shutdown (Denning, 2000).

Cyber terrorism can cause severe disruptions to transportation, public safety, and utility services, all of which are critical infrastructure that are highly dependent on information technology. Cyber terrorism can take many forms, including attacks through physical means, electronic means, and use of malicious code. Cyber terrorists can also have a wide range of personal, political, or cultural agendas. All state agencies, as well as individuals, businesses, and other institutions in the region, are

potential targets for cyberterrorism. Potential threats include identity theft, loss of sensitive information, disruption of services, and other malicious activity.

Cyber terrorists can be difficult to identify because the internet provides a meeting place for individuals from various parts of the world. Individuals or groups planning a cyber-attack are not organized in a traditional manner, as they are able to effectively communicate over long distances without delay. Cyberattacks are also unpredictable and typically occur without warning.

4.3.16.2. Range of Magnitude

In recent years, cyber terrorism has become a significant threat and can impact people, businesses, institutions, local governments, and state agencies to varying degrees. Impacts from a large-scale cyberterrorism event could disrupt the state's economy and potentially threaten its economic stability. The magnitude of a cyber terrorism attack will vary greatly based on the extent of systems affected and duration of the impact. Additionally, the magnitude will vary based upon which specific system is affected by an attack, the ability to preempt an attack, and an attack's effect on continuity of operations. The largest threat to institutions from cyber terrorism comes from any processes that are networked and controlled via computer. The county and individual municipalities should address and take measures to reduce any vulnerabilities that could allow access to sensitive data or processes.

4.3.16.3. Past Occurrences

During the COVID-19 Pandemic of 2020-2021, more than 50,000 West Virginians received attempted unemployment scam in their mail or email. Scott Adkins, acting commissioner with Workforce West Virginia, said they received more than 50,000 fraudulent claims based around the Pandemic Unemployment Assistance (PUA) program (WSAZ 3, 2020). Many attacks seemed to stem from credit bureau data breaches that exposed personally identifying details, and public officials sought to shore up government defenses to avoid agencies falling to such a breach themselves. This led to the creation and signing by Governor Justice of the Creating WV Cyber Incident Reporting Bill. The legislation is designed to lay the groundwork for tightening up cyber defenses and enable faster response to threats by helping state officials better understand the scope of problems impacting various agencies, learn about attacks soon after they happen and regularly review defense strategies (Patterson-Gordon, 2021).

On May 7, 2021, the Colonial Pipeline suffered a ransomware attack that impacted equipment managing the pipeline. In response, the Colonial Pipeline Company halted all the pipeline's operations. This caused gas shortages across the east coast, with some (limited) effects in West Virginia. This was the largest cyberattack on an oil infrastructure target in the history of the United States.

Another large-scale attack was the Equifax data breach in 2017, which was estimated to potentially impact over 700,000 residents of West Virginia and over 145.5 million nationally. The information accessed included names, Social Security numbers, birthdates, addresses, and driver's license numbers (WHSV, 2019). Additionally, in 2014 the largest data breach in history impacted over 3 billion Yahoo user accounts, including the names, email address, date of birth, and telephone numbers of over 500 million users (CSO, 2018). In terms of a data breach cyber-attack, this could be considered a worst-case scenario event. Large-scale data breach events are becoming more common.

Locally, Region 9 mentioned during the June 15, 2021 RAMS meeting that Morgan County's server was hacked in 2020. To better protect themselves in the future, the county installed firewalls, created a Cloud, created a backup server, and hired an IT Director.

In addition to large-scale acts of cyber terrorism, smaller cyberattacks occur daily. Billions of emails are sent each day, and spam and phishing emails account for a significant share of all email traffic. Additionally, brute force attacks, which are trial and error attempts to obtain user passwords and pins, are frequently used by criminals attempting to crack encrypted data or gain access to private accounts. Firewalls can be effective at keeping security threats such as these out, but once a cybercriminal gains access to a system, they can attack from within. For example, gaining access to a state employees email account would allow a hacker to send additional phishing emails from within a network, which may not be as monitored as closely as attacks from outside the system. This is known as spear phishing.

4.3.16.4. Future Occurrences

Cyber terrorism is an emerging hazard that has the potential to impact the region's computer infrastructure and the systems and services that are provided to the public. Concerns about cyberterrorism throughout the United States is growing as its impacts could have potentially crippling effects. Security experts describe the threat of cyberterrorism as imminent. The future occurrence of cyberterrorism can be considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1).

West Virginia Office of Technology website details mitigation tactics that individuals and business owners can take to prevent breaches in cybersecurity, including daily cyber security tips and presentations (WV Office of Technology, 2021).

4.3.16.5. Vulnerability Assessment

Generally, cyber terrorism has no direct effect on the environment; however, the environment may be affected if a hazardous materials release occurred because of critical infrastructure failure as a result of cyber terrorism. Similarly, an act of cyber terrorism on a nuclear facility could have

devastating environmental consequences if the plant suffered an intentional catastrophic failure. Please see Section 4.3.18 for more information on Hazardous Materials Release.

All county and municipal facilities are vulnerable to cyber terrorism. While the physical structures of these buildings are generally not at risk, information systems and data stored within them are vulnerable. Government computer networks contain sensitive information that is integral to the security of the State and could be the target of a cyberattack. County and municipal governments may also possess and maintain forms of personal and financial information, including tax filings, birth and death records, Social Security numbers, medical information, and more. Additionally, many critical facilities that are essential to Berkeley and Morgan County's operations are reliant upon computer networks to monitor and control critical functions. For example, an attack on internet access or the power grid could have detrimental impacts on county services and functions. Additionally, a large-scale computer breach could lead to economic costs in lost productivity to the impacted agency/organization and potentially related businesses and industries. However, lost revenues and productivity would depend on the type of magnitude of the cyber terrorism event.

All communities in the region are vulnerable on some level, directly or indirectly, to a cyber terrorism attack. However, in general, areas with higher concentrations of government or industry facilities may have higher risk. Berkeley County is likely more susceptible to a cyber terrorism attack than Morgan County as it has higher concentrations of people, businesses, and critical infrastructure.

4.3.17. Dam Failure

Due to data sensitivity, the Dam Failure profile can be found in Appendix F.

4.3.18. Hazardous Materials Incident

4.3.18.1. Location and Extent

Hazardous material releases pose threats to the natural environment, the built environment, and public safety through the diffusion of harmful substances, materials, or products. Hazardous materials can include toxic chemicals, infectious substances, bio-hazardous waste, and any materials that are explosive, corrosive, flammable, or radioactive. Hazardous material releases can occur wherever hazardous materials are manufactured, used, stored, or transported. Such releases can occur along transportation routes, including road and rail, or at fixed-site facilities. Hazardous material releases can result in human and wildlife injury, property damage, and contamination of air, water, and soils.

Fixed-site facilities that use, manufacture, or store hazardous materials in Berkeley and Morgan County pose risk and 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). This legislation requires that all owners or operators of facilities that manufacture, produce, use, import, export, store, supply, or distribute any extremely hazardous substance, as defined by the EPA, at or above the threshold planning quantity, as established by EPA, shall report to the county where the facility is located and to the Commonwealth that the facility is subject to the requirement to assist the Local Emergency Planning Committee (LEPC) in the development of an Off-site Emergency Response Plan. The community right-to-know reporting requirements keep communities abreast of the presence and release of chemicals at individual facilities. Due to the sensitive nature of SARA facility information, Berkeley and Morgan County will not release information regarding specific SARA facilities for this plan. However, reports from facilities that have release toxic material into the environment are accessible by the public under the Toxic Release Inventory (TRI). TRI was established under EPCRA and expanded under the Pollution Prevention Act of 1990. Some notable facilities which report through the EPA TRI are listed in Table 4.3.18-1.

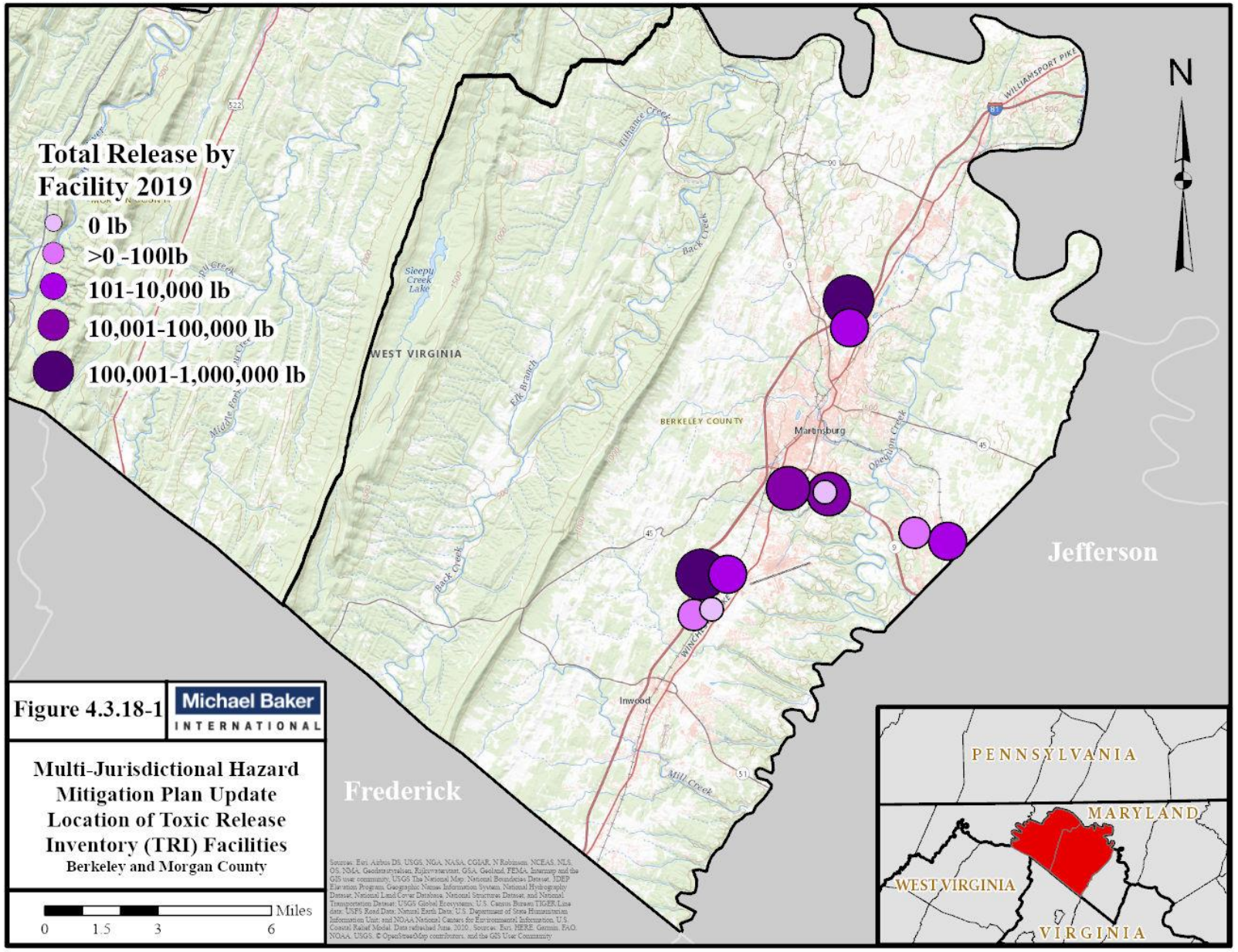
Table 4.3.18-1 TRI Facilities in Berkeley and Morgan County and Each Facility's Top Three Released Chemicals (EPA, 2021c)

Facility	Address	Chemical 1 Released	Chemical 2 Released	Chemical 3 Released
Associated Asphalt Martinsburg	855 Corning Way, Martinsburg, WV 25405	Polycyclic aromatic compounds		
Quad/Graphics Inc.	855 Caperton Blvd. Martinsburg, WV 25403	Toluene	Glycol Ethers	Chromium compounds
Maax US Corp.	718 Midatlantic PKWY Martinsburg, WV 25401	Styrene	Methyl methacrylate	
Argos USA	1826 S Queen St. Martinsburg, WV 25401	Xylene	Ammonia	Lead Compounds
Continental Brick Co.	154 Charles Town Rd. Martinsburg, WV 25405	Hydrogen Fluoride	Hydrochloric Acid	
Chem-Pak Inc	242 Corning Way, Martinsburg, WV 25405	Toluene	Xylene (mixed isomers)	n-Hexane
Bureau of Alcohol, Tobacco, Firearms, & Explosives	244 Needy Rd. Martinsburg, WV 25405	Lead		
Proctor & Gamble	396 Development Dr, Martinsburg, WV 25405	Zinc Compounds	Glycol Ethers	
Ecolab Inc.	942 Baker Rd. Martinsburg, WV 25405	Zinc Compounds	Nitric Acid	Glycol Ethers
Knauf Insulation Inc.	4812 Tabler Station Rd. Inwood, WV, 25428	Ammonia	Chromium Compounds	Manganese Compounds
Variform Inc.	91 Variform Dr, Martinsburg, WV 25405	Antimony Compounds	Manganese Compounds	Chromium Compounds
Morgan County:				
None				

In general, facilities that utilize hazardous materials are located near major thoroughfares and in more developed areas of each county. Figure 4.3.18-1 shows the general location of hazardous materials facilities in each county.

In addition to fixed-site hazardous materials release, there are increasingly large numbers of chemicals, oils, radioactive materials, and other hazardous substances spilled as a result of highway, rail, and waterway accidents, storage tank leakage, pipeline break, and/or other accidents. On occasion, these events become a major disaster and force people to evacuate and/or lose their homes and businesses. According to the U.S. DOT's Office of Operations and the U.S. Census Bureau, it is estimated that 11 percent of all freight transported by trucks is hazardous material.

A number of major highways can be used in the region for the transport of hazardous materials including I-81, US-11, US-522, and WV-9. Additionally, many of these roads cross rivers and streams and travel through downtown and residential areas, increasing the potential to pollute surface water and groundwater and cause harm to life and property.


Total Release by Facility 2019
0 lb
>0 -100lb
101-10,000 lb
10,001-100,000 lb
100,001-1,000,000 lb
N
WEST VIRGINIA
BERKELEY COUNTY
Martinsburg
Jefferson
Frederick
Inwood
Sleepy Creek Lake
Back Creek
Mill Creek
Opequon Creek
WILLIAMSPORT PIKE
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA
Figure 4.3.18-1
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Location of Toxic Release Inventory (TRI) Facilities
Berkeley and Morgan County
Miles
0 1.5 3 6

4.3.18.2. Range of Magnitude

Hazardous material releases can contaminate air, water, and soils, possibly resulting in death and/or injuries. Dispersion can take place rapidly when transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events. Hazardous materials can include toxic chemicals, radioactive materials, infectious substances, and 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 mitigating circumstances that will affect its severity or impact. Mitigating 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**. Affects 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 (i.e., centuries to millennia for radioactive materials), resulting in extensive impacts on people and the environment.

A worst-case scenario event of a hazardous material release would be if a release occurred in the most populous areas, such as dense Martinsburg neighborhoods. A hazardous material release would likely cause the evacuation of all nearby residents. Alternatively, a release on a major regional highway, such as I-81, could injure motorists and/or shut down traffic for hours.

The environmental impacts of hazardous material releases include:

- Hydrologic effects – surface and groundwater contamination
- Other effects on water quality such as changes in water temperature
- Damage to streams, lakes, ponds, estuaries, and wetland ecosystems
- Air quality effects – pollutants, smoke, and dust

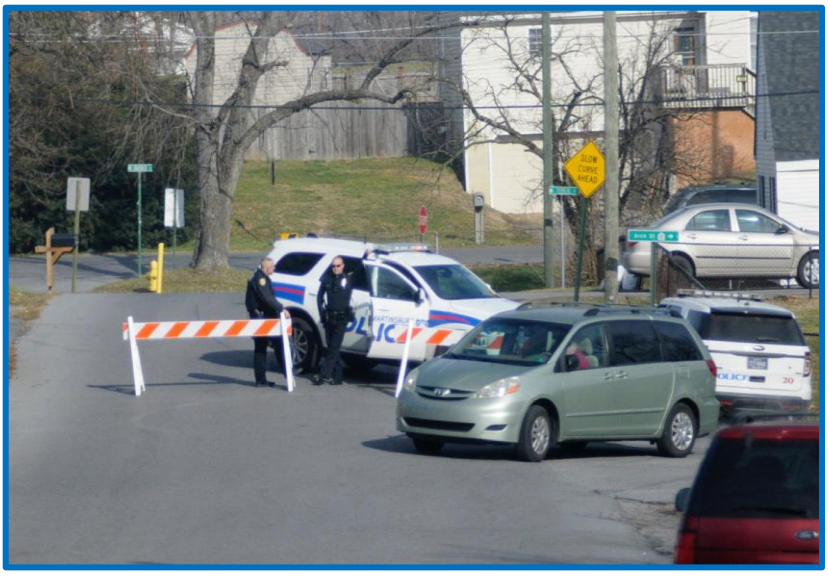
- Loss of quality in landscape
- Reduced soil quality
- Damage to plant communities – loss of biodiversity; damage to vegetation
- Damage to animal species – animal fatalities; degradation of wildlife and aquatic habitat; pollution of drinking water for wildlife; loss of biodiversity; disease.

4.3.18.3. Past Occurrence

There have been no catastrophic or worst-case scenario hazardous materials incidents in Berkeley or Morgan County. However, several recent minor incidents have been identified that could be indicative of the risk Berkeley and Morgan County may face. These incidents had the potential to be much more severe than their final resolution, but thanks to proper and rapid responses by emergency responders and facility employees, the impact of these incidents was limited.

Martinsburg Chemical Leak (December 23, 2019) - The site of the incident was a sewage treatment plant on 500 East John Street, where a chlorine spill caused vapor to escape into the surrounding area. The evacuation order extended in a half-mile radius from the treatment plant. The spill occurred during a transport tanker offload in which sodium hypochlorate and ferric chloride were accidentally mixed (Holmes, 2019). A photo of a road closure caused by this incident can be seen in Figure 4.3.18-2.

Figure 4.3.18-2: Martinsburg Police block traffic along State Circle, closing traffic due to a chlorine leak at the water treatment plant on East John Street (LeRose & Francis, 2019)



- **Berkeley Springs Fuel Spill** (October 16, 2014) – A diesel fuel of unknown origin leaked into Warm Springs Run and the sanitary sewer system. Several reports of a fuel odor were made to 911 by Bath residents. There was no contamination of source water, as the water intake for the municipal water system was not located near the spill (Lovelace, 2015).

- **U.S. Silica Acid Spill** (May 13, 2014) – An employee of U.S. Silica in Berkeley Springs was moving an empty tank and failed to uncouple a hose attached to a pipe. This caused three lines to rear, resulting in a release of 50 gallons of sulfuric acid 250 gallons of sodium hydroxide, and 75 gallons petroleum sulfonate into a secondary containment area. Emergency responders prepared to evacuate parts of Sand Mine Road and Fairview Drive should any vapors impact nearby residential areas, and initially closed Route 522, though it was quickly reopened (Strader, 2014).

- **Ecolab Acid Leak** (January 31, 2014) – A small fire in the insulation of an aboveground storage tank (with a 10,000 gallon maximum capacity) holding 4,000 gallons of acetic acid at the Ecolab Martinsburg plant resulted in a release of the tank's contents into a concrete containment area. Nearby residents downwind of the plant were evacuated and the release of students was delayed at nearby schools. There were no injuries and no chemicals were released into the environment, and the fire was controlled in about 15 minutes (Umstead & Dearth, 2014).

- **I-81 Ecolab HazMat Spill** (August 25, 2009) – A leak was discovered by a tractor trailer driver shipping material from Ecolab in Martinsburg. The interstate was closed down and a response perimeter was established. Emergency responders identified the leaking material as floor wax, which is not considered hazardous. However, other materials being shipped by the tractor trailer were corrosive and hazardous. The interstate was re-opened shortly after the leak was identified (Your4State, 2009a).
- **Quad/Graphics Facility Fire** (June 12, 2009) – A fire began at one of the commercial printing presses at the Quad/Graphics Martinsburg facility. The fire began when a broken part of the press caused a hydraulic fluid leak, which then ignited due to the high ambient air temperatures in the building. The fire was confined to the press. No injuries were reported, and though it took about an hour to control the fire, most of that time was spent trying to draw smoke out of the facility. The smoke caused about $100,000 in damages. According to Table 4.3.16-1, Quad/Graphics is one of the largest hazardous material facilities in the region, with significant amounts of highly flammable chemicals on-site (Printing Impressions, 2009). A worst case scenario event for a hazardous materials incident would likely be a much larger fire at the Quad/Graphics facility or other hazardous material-containing facilities of similar size. A large fire would result in the release and/or combustion of significant quantities of hazardous chemicals, threatening nearby residents and businesses and endangering or preventing any response from firefighters.

  Another incident connected to hazardous materials was the discovery of a clandestine methamphetamine laboratory in the basement of a house in Berkeley Springs that resulted in the arrest of two individuals on March 5, 2014. Such labs are identified as a source of hazardous material, as methods used to "cook" the drug involve caustic and explosive chemicals. These chemicals are

typically not disposed of properly either and can contaminate soil and water on the property. The WV DEP and police receive special training in how to conduct a proper and safe response to methamphetamine laboratory situations. These labs can pose not only a risk to responders and those manufacturing the drug, but also to nearby residents (Shunney, 2014).

Table 4.3.18-2 highlights all HazMat Incident Reports reported by the U.S. Department of Transportation from 2000- May 2021.

Table 4.3.18-2 HazMat Incident Statistics for Berkeley and Morgan County (USDOT 2021)

Incident City	Date of Incident	Commodity Released	Mode of Transport
Martinsburg	10/20/2020	hydrogen peroxide, aqueous solutions	Highway
Berkeley Springs	2/8/2009	Liquefied petroleum gas	Highway
Martinsburg	6/5/2015	hydrogen peroxide, aqueous solutions	Highway
Martinsburg	8/19/2014	hydrogen peroxide, aqueous solutions	Highway
Charles Town	4/28/2014	toxic liquid, inorganic, n.o.s.	Highway
Martinsburg	12/10/2013	gasoline includes gasoline mixed with ethyl alcohol, with not more than 10% alcohol	Highway
Martinsburg	10/24/2013	hydrogen peroxide, aqueous solutions	Highway
Berkeley Springs	11/12/2012	gasoline includes gasoline mixed with ethyl alcohol, with not more than 10% alcohol	Highway
Martinsburg	1/18/2012	elevated temperature liquid, n.o.s., at or above 100 c and below its flash point (including molten metals, molten salts, etc.)	Highway
Martinsburg	8/30/2010	liquefied petroleum gas	Highway
Martinsburg	1/27/2010	acetic acid, glacial or acetic acid solution, with more than 80 percent acid, by mass	Highway
Martinsburg	12/30/2009	resin solution, flammable	Highway
Hedgesville	3/17/2009	fuel oil, no. 1, 2, 4, 5, or 6	Highway

Martinsburg	7/3/2007	resin solution, flammable	Highway
Martinsburg	10/11/2006	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Falling Waters	10/11/2006	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Martinsburg	8/30/2006	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Kearneysville	2/4/2006	sodium hydroxide, solution	Rail
Inwood	1/18/2006	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Martinsburg	9/16/2005	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Falling Waters	7/16/2005	paint including paint, lacquer, enamel, stain, shellac solutions, varnish, polish, liquid filler and liquid lacquer base	Highway
Martinsburg	11/9/2004	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Inwood	10/12/2004	sodium hydroxide, solution	Highway
Martinsburg	9/27/2004	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Martinsburg	7/27/2004	corrosive liquid, acidic, organic, n.o.s.	Highway
Martinsburg	6/4/2004	resin solution, flammable	Highway
Berkeley Springs	4/29/2004	phosphoric acid solution	Highway
Inwood	12/24/2003	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Berkeley Springs	12/23/2003	elevated temperature liquid, n.o.s., at or above 100 c and below its flash point (including molten metals, molten salts, etc.)	Highway
Martinsburg	12/22/2003	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Martinsburg	11/25/2003	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Martinsburg	7/11/2003	hypochlorite solutions	Highway
Martinsburg	5/7/2003	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Berkeley Springs	4/29/2003	phosphoric acid solution	Highway
Martinsburg	3/17/2003	diesel fuel	Highway
Martinsburg	2/5/2003	resin solution, flammable	Highway
Inwood	2/3/2003	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Bunker Hill	11/13/2002	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Martinsburg	8/8/2002	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Martinsburg	4/29/2002	hydrogen peroxide, aqueous solutions	Highway
Martinsburg	2/28/2002	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Hedgesville	10/10/2001	fuel oil, no. 1, 2, 4, 5, or 6	Highway

Inwood	9/27/2001	sulfuric acid with more than 51 percent acid	Highway
Berkeley Springs	5/9/2000	Hydrochloric acid solution	Rail
Martinsburg	3/5/2001	diesel fuel	Highway
Martinsburg	1/4/2001	sulfuric acid	Highway
Martinsburg	9/28/2000	fuel oil, no. 1, 2, 4, 5, or 6	Highway
Martinsburg	9/11/2000	styrene monomer, stabilized	Highway
Martinsburg	8/2/2000	elevated temperature liquid, n.o.s., at or above 100 c and below its flash point (including molten metals, molten salts, etc.)	Highway

Hazardous material releases on transportation routes cannot be discounted either. According to data from the U.S. Department of Transportation, seven hazardous materials transportation incidents have occurred in Martinsburg since 1977 that resulted in $5,000 of damage or more. One particular incident occurred in 1992 when 300 gallons was released from a portable tank of sodium hydrosulfide that resulted in 11 injuries. Four incidents with damages of $5,000 or more have occurred in Berkeley Springs since 1986. A cargo tank motor vehicle carrying elevated temperature liquid released 2,000 gallons in Berkeley Springs in 2003, causing over $100,000 in damages. All reported incidents occurred on the highway (USDOT, 2021).

There is also active construction of a 24-mile natural-gas distribution-line project that Mountaineer Gas Co. is constructing from Morgan County, W.Va., to the northern end of the company's system in the Martinsburg. A second segment of the expansion project includes extending natural-gas service from near the Berkeley-Jefferson County line where it currently ends to the Rockwool stone-wool-insulation manufacturing plant under construction about three miles away in Ranson, W.Va. A third segment project also has been considered for the Shepherdstown area. Statewide, Mountaineer Gas has proposed more than $119 million in infrastructure and system enhancements through 2023, including about $16.5 million in the Eastern Panhandle that includes the extension of gas service to the Rockwool plant site off Charles Town Road. This pipeline poses a hazard for both counties, but no serious incidents have been reported thus far.

4.3.18.4. Future Occurrence

While some hazardous material release incidents have occurred in Berkeley and Morgan 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. Intentional acts are addressed under Section 4.3.21, Terrorism. Future occurrences could take place at any facility making use of or storing hazardous materials or any thoroughfare for hazardous materials into, out of, or through each county.

Many steering committee members indicated their predictions for an increase in hazardous waste incidents moving forward. These incidents are likely to occur in areas of growth, such as the I-81 corridor near Martinsburg, as indicated in the Berkeley County Comprehensive Plan Growth Management Map. Highway improvements, such as the Berkeley Springs US-522 Bypass project that is currently taking place, may also cause an increase in truck traffic as highways are widened and improved. Overall, the probability of future hazardous materials incidents is *likely* as defined by the Risk Factor Methodology (See Section 4.4.1).

4.3.18.5. Vulnerability Assessment

Areas that are home to one or more hazardous materials facilities should be considered vulnerable to hazardous materials releases from fixed facilities. Table 4.3.18-3 shows the most significant TRI facilities in Berkeley County. Morgan County and western Berkeley County do not have any current TRI facilities and therefore, have a much lower relative vulnerability to fixed hazardous materials incidents. Within a 1.5-mile radius from each TRI facility, there are 17,123 structures. This represents about 24 percent of all buildings in Berkeley County. Within a 1.5-mile radius from each TRI Facility, there are 42 critical facilities, representing about 36 percent of all critical facilities in Berkeley County. Berkeley County is much more susceptible to hazardous materials due to higher population density, number of main highways, and greater number of SARA Facilities. These findings are summarized in Table 4.3.18-4.

Table 4.3.18-4 Structures and Critical Facilities Vulnerable to Hazardous Materials Release

County	Total Structures	Structures in Hazardous Materials Area	% Structures in Hazardous Materials Area
Berkeley	71,288	17,123	24%
County	**Total Critical Facilities**	**Critical Facilities in Hazardous Material Area**	**% Critical Facilities in Hazardous Materials Area**
Berkeley	125	45	36%

Areas of each county located near major transportation routes that could be used to transport hazardous materials locally or regionally could be sources of non-fixed hazardous materials incidents. I-81, Route 522, and WV Route 9 as demonstrated by previous incidents, pose a significant threat in Berkeley County. Hazardous material incidents here can result from crashes, overturning, leaks, or other events involving vehicles carrying hazardous materials. Railroads are also used to transport some types of hazardous materials. The location of rail lines in Berkeley and Morgan County is shown in Figure 4.3.22 and discussed further in Section 4.3.22. CSX rail lines run along the northern and western edge of Morgan County and through the center of Berkeley County. It is possible that these rail lines are used to transport crude oil and other hazardous materials that could leak if crashes, derailments, or other disastrous events occur along rail lines (Evans, 2015).

Many areas of West Virginia are vulnerable to hazardous materials incidents connected directly with oil and gas wells, but according to the WV DEP's Office of Oil and Gas there are no permitted oil or gas operations in the Eastern Panhandle region (TAGIS WV DEP, 2021).

4.3.19. Substance Use Disorder

4.3.19.1. Location and Extent

The name of this hazard was changed from Opioid Addiction to Substance Use Disorder based on a discussion at the June 15, 2021 Berkeley County RAMS meeting. Tim Czaja, Director at Berkeley Day Report Center, suggested the name change to better encompass the substance use and abuse in the region.

Substance Use Disorder (SUD) is complex a condition in which there is uncontrolled use of a substance despite harmful consequence. People with SUD have an intense focus on using a certain substance(s) such as alcohol, tobacco, or illicit drugs, to the point where the person's ability to function in day-to-day life becomes impaired. People keep using the substance even when they know it is causing or will cause problems (American Psychiatric Association, 2021).

Drugs most abused throughout the region, as reported by West Virginia Department of Health and Human Resources Data Dashboard on fatal overdoses, include opioids, fentanyl, heroin, cocaine, and methamphetamines. This Plan will discuss the abuse of those substances within the region, with a focus on opioid addiction due to the opioid crisis public health emergency declared in October 2017, and Emergency Declarations relating to the opioid epidemic in neighboring states.

Opioid addiction occurs when an individual becomes physically dependent on opioid, a class of drugs that reduces pain. Opioid is used as a broad term and includes opiates, which are drugs naturally extracted from certain types of poppy plants and narcotics. Opioids can also be synthetically made to emulate opium.

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

- **Prescription Opioids**: Opioid medication prescribed by doctors for pain treatment. Prescription opioids can be synthetic-oxycodone (OxyContin) or hydrocodone (Vicodin), or natural, like morphine.
- **Fentanyl:** A powerful synthetic opioid that is 50 to 100 times more powerful than morphine and is used for treating severe pain. Illegally made and distributed fentanyl is becoming more prevalent.

- **Heroin:** An illegal natural opioid processed from morphine and is also becoming more commonly used in the United States.

Opioids are highly addictive. They block the body's ability to feel pain and can create a sense of euphoria. Additionally, individuals often build a tolerance to opioids, which can lead to misuse and overdose. Fentanyl and fentanyl-related substances are hazardous materials and should be treated as such. Contact with fentanyl can impact first responders and family and friends of opioid users. Depending on the potency of the drug, it can take as a little as the equivalent of a few grams of table salt to cause health complications (DEA, 2020).

A Drug Enforcement Administration (DEA) Intelligence report found that, "Drug abuse and trafficking, particularly of opioids, is a critical threat to West Virginia. The Centers for Disease Control and Prevention (CDC) report that there was a statistically significant increase (16.9 percent) in drug overdose deaths in West Virginia between 2014 and 2015. The state had the highest rate of overdose deaths in the country in 2015, approximately 42 for every 100,000 people; CDC data indicate that 725 people died of drug overdoses in West Virginia in 2015, more than double the number who died from car accidents" (DEA, 2017).

The report also states that controlled prescription drug abuse and trafficking is widespread throughout the state, and the state has one of the highest prescription rates for opioids in the U.S.

According to a recent study, environmental scientists at the Cary Institute of New York found traces of opioid and other drugs in streams, rivers, and lakes. These traces came from human urine and feces, and medications that have been flushed down the toilet. However, the ecological and environmental impacts are unknown. The EPA suggests that while the risks of pharmaceuticals found in wastewater, ambient water, and drinking water is low, further research is needed (US EPA, 2014a).

4.3.19.2. Range of Magnitude

Substance Use Disorder (SUD) can lead to overdose, which can be fatal. The most dangerous side effect of a drug overdose is depressed breathing. The lack of oxygen to the brain causes permanent brain damage, leading to organ failure, and eventually, death. Signs and symptoms include respiratory depression, drowsiness, disorientation, pinpoint pupils, and clammy skin.

Many drug addictions such as opioids and methamphetamines can also be passed from mother to child in the womb. This condition, known as neonatal abstinence syndrome, has increased five-fold from 2000 to 2012, according to the National Institute of Drug Abuse (NIDA), resulting in an estimated 22,000 babies in the United States born with this condition (NIDA, 2019).

First responders – paramedics, police officers, and fire fighters, are also affected by West Virginia's SUD crisis. In addition to the crisis consuming time and resources, first responders also face exposure risk, particularly to synthetic fentanyl. According to the DEA, it takes two to three milligrams of

fentanyl to induce respiratory depression, arrest, and possibly death. Since fentanyl is indistinguishable from several other narcotics and powdered substances, first responders must take extra precaution when dealing with calls related to drug abuse (Rushton, 2019).

4.3.19.3. *Past Occurrences*

The CDC found that opioids are the main cause of drug-related overdoses and deaths, being responsible for nearly 70 percent of drug-related deaths nationally in 2017. In West Virginia in 2018, drug overdose deaths involving opioids total 702. Figure 3.3.19-1 details number and overall trend of overdose deaths caused by opioids in West Virginia. Morgan and Berkeley County are the first and second highest counties in West Virginia for opioid related deaths.

Figure 4.3.19-1: Number of overdose deaths involving opioids in West Virginia, by opioid category (NIH, 2018).

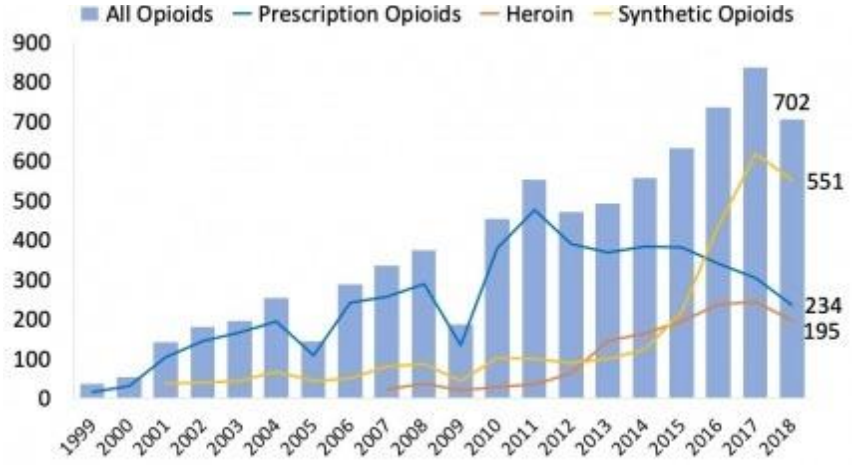


Table 4.3.19-1 depicts statistics for all drug related mortality in Berkeley and Morgan County as found on the NORC at University of Chicago's Appalachian overdose mapping tool. Counties saw an increase in drug related deaths from 2010-2014 to 2015-2019.

Table 4.3.19 -1 All Drug Related Mortalities for Berkeley and Morgan County (NORC, 2021)

County	Total Deaths	Population	Deaths per 100k	Deaths Change from 2010-2014 to 2015-2019
Berkeley	333	115,329	88.4	+168
Morgan	42	17,709	85.4	+18

Table 4.3.19-2 depicts statistics for opioid related mortality in Berkeley and Morgan County. Counties saw an increase in opioid related deaths from 2010-2014 to 2015-2019.

Table 4.3.19 -2 Opioid Related Mortality for Berkeley and Morgan County (NORC, 2021)				
County	**Total Deaths**	**Population**	**Deaths per 100k**	**Deaths Change from 2010-2014 to 2015-2019**
Berkeley	311	115,329	82.8	+166
Morgan	38	17,709	78.3	+14

Though an opioid addiction crisis is complex and unprecedented, it is widely acknowledged that the opioid crisis began in the late 1990s when pharmaceutical companies introduced opioid-based pain medication, such as OxyContin, Percocet, and Vicodin. As these drugs become more frequently prescribed, misuse and overdose increased, and it became clear that prescription opioids were highly addictive (NIDA, 2020).

Figure 4.3.19-2 depicts Berkeley County EMS calls for suspected overdoes for 2018-2021 to date. There are spikes in 2018 and 2020, during the summer months. Figure 4.3.19-3 depicts Morgan County EMS calls for suspected overdoses for 2018-2021 to date. The trendlines show that EMS calls in Morgan County generally peak in winter and summer months.

Figure 4.3.19-2: Berkeley County EMS calls for suspected drug overdoses 2018-2021 (WVDHHR, 2021).

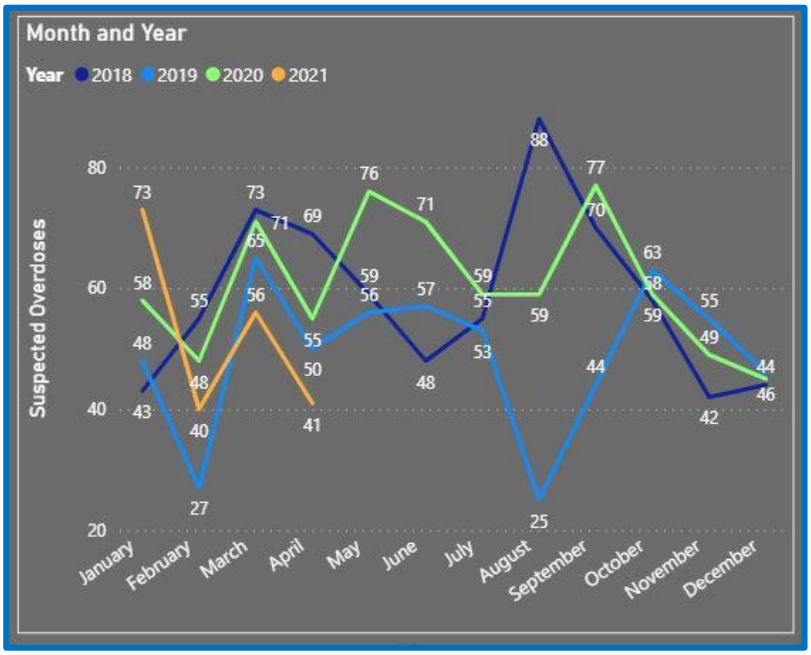
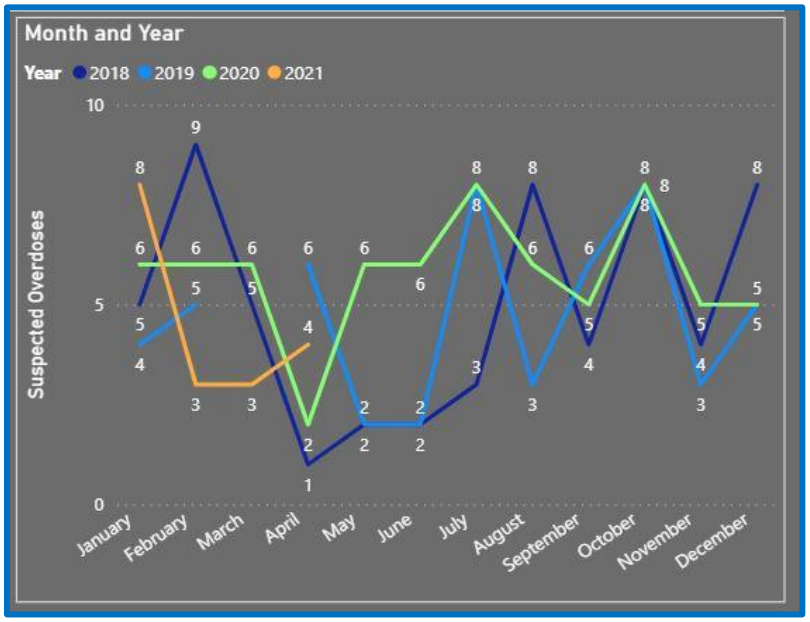


Figure 4.3.19-3: Morgan County EMS calls for suspected drug overdoses 2018-2021 (WVDHHR, 2021)



The WVDHHR also collects statistics on fatal drug overdoses on a county level in the past five years. Berekely County fatal overdoses peaked in 2017 with 333, and 332 in 2020. These figures can be seen in Figure 4.3.19-4. Morgan County fatal drug overdoses peaked in 2017 with 33, and again in 2018 with 35 (Figre 4.3.19-5).

Figure 4.3.19-4: Berkeley County Fatal Drug Overdoses 2015-2020

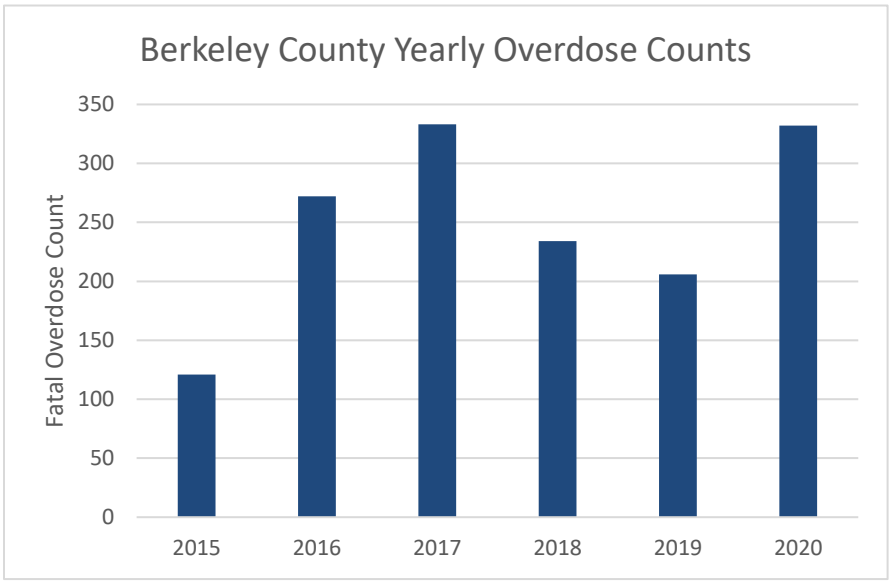
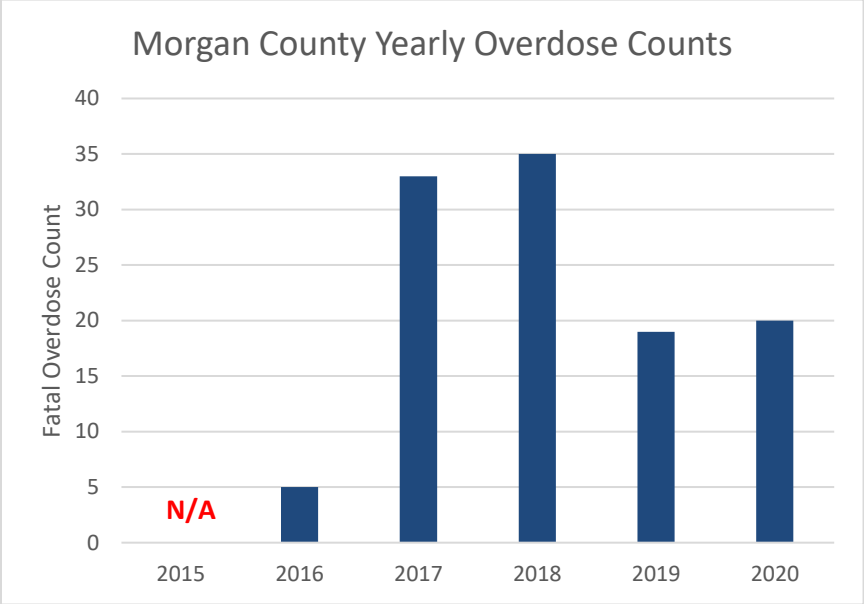


Figure 4.3.19-5: Morgan County Fatal Drug Overdoses 2015-2020



4.3.19.4. *Future Occurrences*

West Virginia has experienced statistically significant increases in drug overdose deaths every year since 2013 with an age-adjusted death rate of 57.8 per 100,000 in 2017. These increases have occurred across multiple drug categories—including heroin, synthetic and prescription opioids, and psychostimulants with significant increases in overdose deaths attributed to multiple drugs. Synthetic opioids, including fentanyl and its analogs, have been attributed to an increasing number of deaths in the state, with rates almost tripling between 2015 and 2017 (12.7 to 37.4 per 100,000). Prescription opioid deaths remain high (19.7 per 100,000 in 2016) with a slight decline in 2017 (17.2 per 100,000), the highest in the USA for both years (Ondocsin et al., 2020).

In October 2017, President Trump declared a nationwide Opioid Emergency Declaration. President Trump's declaration would allow the government to cut red tape and direct resources, including expanded access to medical services in rural areas, but so far it will not bring much in the way of additional money to fight the heroin and pain pill problem. Overall, future occurrence of substance use disorder can be considered *highly likely* across the region according to the Risk Factor Methodology (see Table 4.4.1-1).

West Virginia has a well-established Prevention First Network (https://preventionfirstwv.org/) that includes state, regional and local leaders who contribute to prevention planning and coordination activities in the state, including the information and resources shared on Help and Hope West Virginia (https://helpandhopewv.org) and Stigma Free West Virginia (https://stigmafreewv.org). DHHR funds

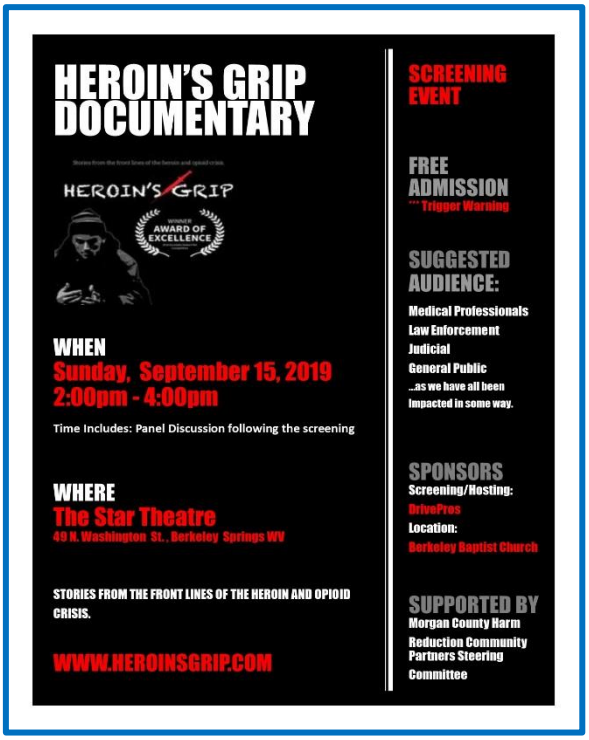
six Regional Prevention Lead Organizations and community coalitions via multiple federal SAMHSA grants. Several of these agencies also receive funds directly from SAMHSA's Drug Free Community program, Health Resources and Services Administration (HRSA), and other private and government grant programs. With support from DHHR, Prevention Lead Organizations collaborate with 51 county coalitions to implement evidence-based interventions in all 55 counties.

In 2016, formation of the Berkeley Community Corrections Program had officially begun when the county placed three staff members in a unit called the Berkeley County Day Report Center (BDRC) which immediately serviced six clients struggling with substance abuse in 2016; to date, the Berkeley County Day Report Center averages 180 clients at any given time and hosts a staff of 20. The Berkeley Day Report Center, a primary component of the Berkeley County Community Corrections Program, serves substance offenders that are sentenced to the program in lieu of incarceration or are clients as a condition of their parole or probation. These clients must be nonviolent offenders, with no history of crimes against children or sexual assault. The BDRC has taken in 1,259 participants in its first 40 months of operation. In that time, there have been 140 successful graduates of the program. Of those 140 graduates, 75 percent have remained clean over the last 9 months, a recidivism rate of 25 percent against a national average of 44 percent.

The Morgan County Day Report Center also exists for eligible participants in Morgan County. The Morgan County Day Report Center is a treatment alternative to incarceration for nonviolent offenders whose substance abuse problems have led to legal involvement. The goals of the center are (1) To provide much needed substance abuse treatment and drug screening which is not available in the Eastern Regional Jail to appropriate offenders (2) To reduce taxpayer cost associated with incarceration. Multiple resources can also be access through their website at http://morgancountydayreport.org/resources/.

The Morgan County Harm Reduction Steering Committee (MCHRSC) held their first meeting on December 10, 2018. They continued to meet monthly until the Morgan County Partnership received a HRSA planning grant related to the opioid epidemic. They then merged the MCHRSC with the planning grant committee which then became known as Project Resolve. The Morgan County Partnership is a coalition made up of local citizens united in a shared vision of building a supportive network for our young people, their families and others connected with them to create a safe, healthy, and drug-free community. The Partnership includes all sectors of the community, such as area nonprofits, government groups, agencies, volunteer organizations, the school district, churches, businesses, parents, and youth. On June 15, 2019, the MCHRSC held a Community Opioid Crisis & Harm Reduction Forum. Topics included perspectives on substance abuse disorder, understanding medically assisted treatment, harm reduction needs in the state and harm reduction experiences.

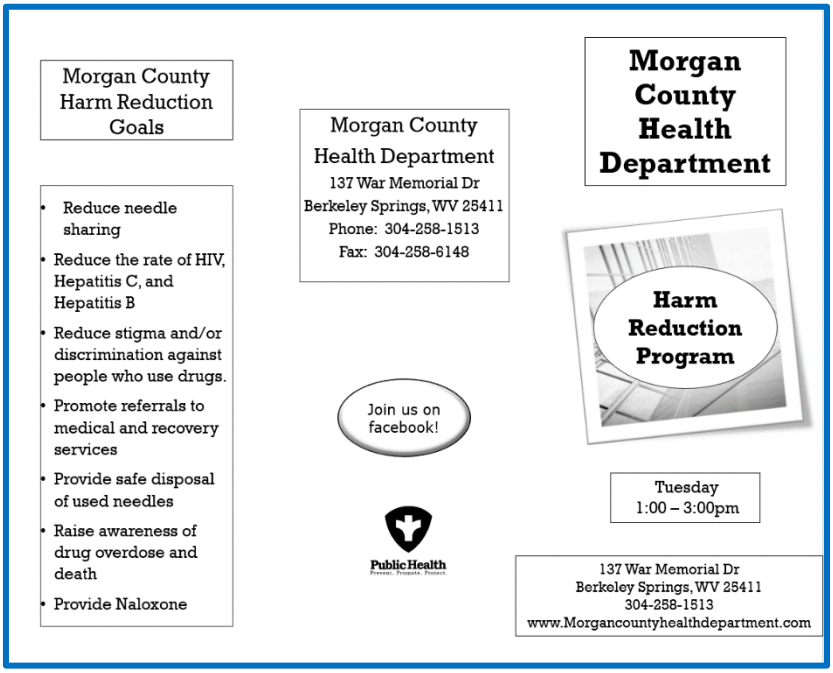
Figure 4.3.19-6: Heroin's Grip Documentary Screening and Panel Discussion Flyer



For continued public outreach, the MCHRSC planned a screening and panel discussion of the documentary: Heroin's Grip, as seen in Figure 4.3.19-6. The Committee also hosts a Chronic Self Pain Management Program and starting in August 2020, hosts a weekly Harm Reduction Program at the Morgan County Health Department (Figure 4.3.19-7).

Berkeley County also hosts a harm reduction program through their Recovery Resource Center. The program focuses on the area youth with outreach programs at community centers and after-school programs. Through the Recovery Resource Center, the county also hosts the Juvenile Opioid Treatment, Intervention & Prevention Program Team which works to support those most vulnerable to the opioid epidemic. Weekly youth groups are also hosted at the Center.

Figure 4.3.19-7: MCHRSC Harm Reduction Program Flyer



Several grassroots organizations also exist within the region:

- **Life or Drugs, Tri-State Support:** This organization began in November 2013 as a support mechanism for loved ones of those battling substance use disorder. Very quickly those battling SUD themselves asked to join. The organization began holding weekly combined support group meetings which allowed those suffering from SUD who were in various stages of recovery, and the loved ones of those suffering from SUD or those who had lost loved ones to SUD, to learn from each other. The organization partners with school systems and organizations to provide speakers to present SUD education and awareness.
- **Team Hope:** Under the Life or Drugs TSS Non-profit various group members with a passion to help children began a support group for youth, ages 9 - 16 that began meeting weekly in August of 2017. The organization's focus is on peer and leader support for those dealing with split family situations, substance use disorder of loved ones and/or self, low self-esteem, coping with grief/loss, building positive life and coping skills, education and prevention of SUD and bullying.

4.3.19.5. Vulnerability Assessment

County facilities are not at risk to the Substance Use Disorder crisis, but there are some occupation-specific risks that may make some employees more vulnerable. Employees working in direct patient

care are vulnerable to fentanyl exposure. Since fentanyl can be ingested orally, inhaled through the nose or mouth, or absorbed through the skin or eyes, any substance suspected to contain fentanyl should be handled with extreme caution. Exposure to a small amount of fentanyl can lead to respiratory depression or death. Fentanyl-related substances have been found in powders, pills, capsules, liquids, and on blotter paper. The DEA recommends that all first responders carry a Personal Protective Equipment (PPE) kit that includes: nitrile gloves, N-95 dust masks, sturdy eye protection, paper coveralls and show protection, and naloxone injectors. The DEA also suggests using extreme caution when using police dogs, as they are at serious risks to health complications from inhaling fentanyl and fentanyl-related substances (DEA, 2016).

Additionally, absenteeism from jobs associated with a substance abuse addiction in high-risk areas could lead to economic loss through lost productivity and increased medical costs.

In general, jurisdictions that are more densely populated are more vulnerable to substance addiction threats as access to the drugs increases. However, rural communities have experienced larger per-capita substance-related deaths.

Jurisdictional losses in the SUD crisis stem from lost wages, productivity, and resources rather than losses to buildings or land. Locally, many West Virginia counties have seen an increase of time and resources devoted to the substance abuse as overdose and response increases, however there is no comprehensive tracking mechanism to record total local losses associated with the SUD.

Impacts including total costs to jurisdictions are only beginning to be understood, researched, and tracked. There is no comprehensive database currently tracking monetary losses at the local level. However, the American Enterprise Institute (AEI), using national data from the CDC and White House Council of Economic Advisors, calculated a total cost per capita ($4,739), of the opioid epidemic for West Virginia, the highest in the country (AEI, 2018). Using this per capita estimate in combination with county population estimates, losses can be estimated for Berkeley and Morgan County. It is important to note that this methodology assumes equal per capita opioid misuse and fatalities across all counties, however, based on reported drug overdoses and drug related deaths, it is known that some counties, including those in the southern and eastern panhandle regions, are more vulnerable and more likely to experience higher per capita costs while counties in central West Virginia tend to be less vulnerable and likely have lesser costs per capita. Another important caveat regarding this methodology is that a portion of the costs will have been state losses rather than county or jurisdictional, but the ratio of state to local cost burden is unknown at this time. It is estimated that Berkeley County has had a total per capita cost of $546,751,369 and Morgan County has had a total per capita cost of $84,752,276.

4.3.20. Source Water Contamination

Source water is made up of surface waters, such as streams, rivers, and lakes, and groundwater (aquifers) that can be used as a source of drinking water. Source water provides the water for both public water suppliers and private water wells. Source water contamination occurs when a physical, chemical, biological or radiological substance enters the source water, degrades the water quality, and causes it to be become unsafe or unfit for human use and consumption (EPA, 2021d). Water is vital to everyday life, and contamination can create serious health hazards and/or leave a community without a local source of drinking water.

The federal Safe Drinking Water Act sets standards on the construction and operation of public water systems and requires the protection of surface water sources and source water contribution areas near ground water supply wells from contaminants. The WV Bureau for Public Health also completed assessments regarding the location and susceptibility of source water for WV public water systems. In 2014, WV regulations were amended, requiring water utilities to develop Source Water Protection Plans analyzing the threat of contamination, planning for contamination emergencies, and developing potential mitigation measures (Berkeley County Public Service Water District, 2016)

4.3.20.1. Location and Extent

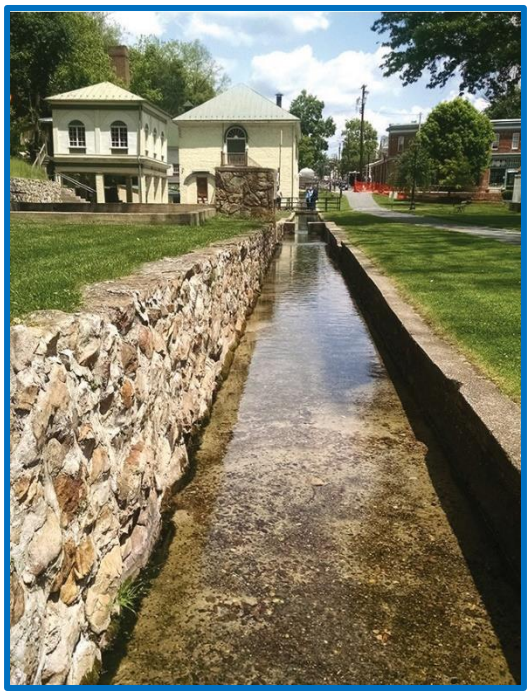
Private water wells are used extensively across West Virginia. However, contamination of a private water well would likely only endanger a few individuals, while contamination of a major source water used by a public water utility could impact thousands. In Berkeley County, the largest public water suppliers are the Berkeley County Public Service Water District (BCPSWD) and the City of Martinsburg's Water & Sewer Department. The BCPSWD has three major public water supply plants, the Bunker Hill location, serving a population of about 27,563, the Potomac River system (seen in Figure 4.3.17-1), serving roughly 22,396, and the Glenwood Forest plant, which serves 987. The Bunker Hill plant draws water from one surface water, the Baker Lakes Quarry, and two groundwater sources, the LeFevre Spring and Quarry Well. It typically

Figure 4.3.20-1: Potomac River Water Treatment Facility Operated by the Berkeley County Public Service Water District (GD&F Engineering, 2009)

relies on groundwater and uses the surface water when conditions require it. The Potomac River system utilizes water from the Potomac River and three groundwater wells, utilizing all of the sources simultaneously. The City of Martinsburg water system serves 15,650 customers, and it relies on two groundwater sources, Kilmer Springs and Big Springs Well, for water during its normal operations. It is also equipped to draw from Lake Thomas Reservoir in an emergency. This is the most updated information as the Source Water Protection Plan was last updated in 2016 (BCPSWD and Martinsburg Source Water Protection Plans).

Morgan County also has two major public water systems, Berkeley Springs Water Works and Paw Paw Water Works. Berkeley Springs Water Works serves about 2,583 people and draws its water from three springs, and a water channel leading to a plant intake can be seen in Figure 4.3.20-2 (WV DHHR, 2002). The Paw Paw Water Works withdraws its water from the Potomac River (WV DHHR, 2004).

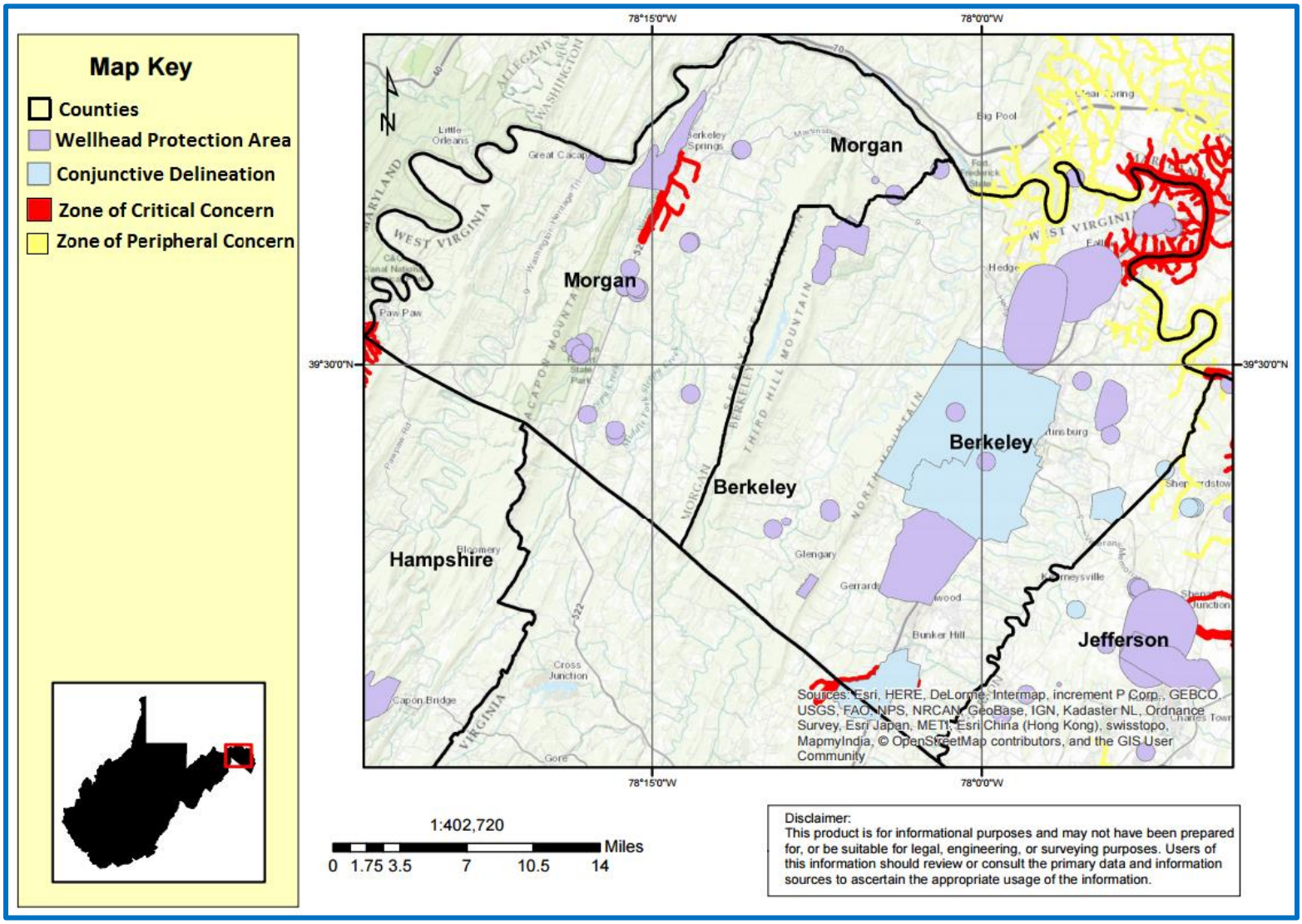
Figure 4.3.20-2: Channel in Berkeley Springs State Park Leading to Intake for Berkeley Springs Water Works (Shunney, 2016)



It is important to consider that contamination does not have to directly impact the source water, because contaminants can be washed into surface waters through runoff and transported through tributaries into larger bodies of water that may be used for drinking water. Contaminants released underground can migrate through groundwater and contaminate wells and springs. Therefore, the state and federal government created special protections and assessment requirements for source water areas. These special protection areas include wellhead protection areas, which are areas contributing to the recharge of groundwater source (well or springs) within a five-year time of travel, and conjunctive delineation areas, which combine these recharge area with additional connected areas surrounding surface water body that contribute water to these groundwater sources. There are also two "zones of concern". The Zone of Critical Concern (ZCC) is corridor along streams that warrant more detailed scrutiny due to the proximity of the area to a surface water intake for drinking water and the intake's susceptibility to potential contaminants within the corridor. The ZCC is 1,000 feet measured horizontally from each bank of the principal stream and 500 feet measured horizontally from each bank of the tributaries draining into the principal stream. The other zone is the Zone of Peripheral Concern (ZPC), which is similar to the ZCC, but includes an additional five-hour time-of-travel of water in the streams further than the perimeter of the ZCC, which creates a protection zone of ten hours above public water supply intakes (Berkeley County Public Service Water District, 2016).

A map of these source water protection areas in Berkeley and Morgan County can be seen in Figure 4.3.20-3. This data is the most recent supplied by the WV DEP. This figure shows that most of source water areas susceptible to contamination appear to be congregated in the middle of both counties, running in a line from southwest to northeast. The areas are often near more developed parts of the county as well, as these locations tend to have more residents and require the water treatments plants necessary to supply water to these residents. Residents in rural areas typically rely on private water wells.

Figure 4.3.20-3: Source Water Protection Areas, Berkeley and Morgan County (WV DEP, 2021c)



4.3.20.2. Range of Magnitude

There are four general categories of drinking water contaminants:

- **Physical** - impact the physical appearance or other physical properties of water. (Ex. sediment suspended in the water from soil erosion)
- **Chemical** - include naturally occurring or man-made elements or compounds. (Ex. nitrogen, bleach, salts, pesticides, metals, , drugs, toxins produced by bacteria)
- **Biological** - organisms in water, typically referred to as microbes or microbiological contaminants. (Ex. bacteria, viruses, and parasites)
- **Radiological** - chemical elements with unstable atoms that can emit ionizing radiation. (Ex. cesium, plutonium and uranium)

The impact of source water contamination varies widely with the amount of and type of contaminant. Drinking water is reasonably expected to contain small amounts of contaminants, and the presence of contaminants alone does not indicate that water poses a health risk. Some contaminants are harmless, such as small levels of naturally occurring calcium or magnesium or proper levels of artificially added chlorine. Water treatment plants are well-equipped to deal with some types of contaminants as well, such as naturally occurring levels of bacteria and other microbes. However, some contaminants can be extremely dangerous and cause a health hazard at small levels, such as hazardous chemicals or radiological material (EPA, 2021d).

4.3.20.3. Past Occurrence

The push across the State of West Virginia for greater source water protection occurred in 2014 when more than 10,000 gallons of an industrial chemical used to process coal spilled into the Elk River upstream of an intake for a water treatment plant serving Charleston. This left 300,000 residents without potable water, with a do-not-use order lasting up to 10 days in some areas (Gerken, 2015). Some residents reported minor adverse health effects from inhalation of the chemical after contaminated water was used to flush toilets or when contaminated water was flushed from plumbing systems. These health effects included skin irritation, nausea, diarrhea, sore throat, and respiratory symptom (Venere, 2015). This had significant impacts in Charleston outside of health impacts too, including shortages of drinkable bottled water, economic stresses on residents who could not afford to buy bottled water, public distrust of local and state government, and ecological impacts (Gerken, 2015). A similar occurrence on the Potomac River, which provides water to multiple public water systems in the Eastern Panhandle, could be considered a worst-case scenario.

Source water contamination impacted the Eastern Panhandle directly the next year, when 10,000 gallons of synthetic latex used for paper coating was spilled into the North Branch of the Potomac River by a Verso paper mill in Luke, MD. This resulted in a five-day shutdown of the BCPSWD Potomac River plant's river intake as the chemical plume passed by the intake. This intake closure forced the BCPSWD to purchase water from the City of Martinsburg water system, as the other two BCPSWD

were not able to accommodate the additional demand (McVey, 2016). A contaminated section of the Potomac River can be seen in Figure 4.3.20-4.

Figure 4.3.20-4: Potomac River after September 2015 Verso Paper Mill Contaminant Release (Sawyers, 2015)

More recently, in 2020 a lawsuit was filed in the U.S. District Court for the Northern District of West Virginia Martinsburg location against seven companies for the alleged damages and injury to the individuals who drank and used water in the City of Martinsburg municipal water system. It alleges the City's water had been contaminated with toxic per- and polyfluoroalkyl substances, collectively known as "PFAS" and often referred to as "forever chemicals" and used at the Shepherd Field Air National Guard Base at the Martinsburg airport. Exposure to PFAS is alleged to possibly cause decreased fertility; pregnancy induced hypertension and/or preeclampsia; liver damage; thyroid disease; problems with cholesterol levels; immune system problems; and increased likelihood of cancer, especially kidney and testicular cancers (LeRose, 2020).

4.3.20.4. Future Occurrence

As aforementioned, statewide initiatives to mitigate future source water occurrences hope to prevent any future events. Local public utilities are also seeking to limit contaminant sources and have plans in place to mitigate the effects of any severe contamination. However, severe source water

contamination is still possible and future occurrences are difficult to predict. An occurrence is largely dependent upon the accidental or intentional actions of a person or group. Intentional acts are addressed under Section 4.3.21, Terrorism. Any increase in hazardous material facilities or the transportation of hazardous materials (addressed in Section 4.3.18) will increase the risk of source water contamination. Overall, the probability of future source water contamination events is *likely* as defined by the Risk Factor Methodology (See Section 4.4.1-1).

The Town of Bath outlined several concept plans that propose stormwater management practices throughout the area. The locations were selected based on the criteria of existing land use, amount of impervious surface, proximity to the run or point of high-water flow, and feasibility based on opportunity to incorporate with already planned projects. The study utilizes a retrofit philosophy that if a project is being planned then what is being done or can be done to incorporate green infrastructure in a way that it does not impact the goal of construction and is cost effective to the owner. The main point of these concept plans is to designate opportunities within the watershed where green infrastructure could be most effective. Preventing stormwater runoff is a critical step in mitigating source water contamination especially in urbanized areas.

4.3.20.5. Vulnerability Assessment

Both Berkeley and Morgan County's public water systems are vulnerable to contamination. All of the Berkeley County water supply facilities rate highways, specifically I-81, as the largest contamination concern due to the possibility of vehicle fluid spills or hazardous material freight which could impact Potomac River intakes and nearby groundwater supply wells. This threat is underlain by karst topography which enable contaminants to spread underground more effectively. I-70 and WV Route 522 as well as the construction and subsequent completion of the 522-bypass project, could impact Morgan County water systems. The second largest concern is the nearby CSX rail lines, which can be seen in Figure 4.3.22-5. Derailments and spills could impact source water, and CSX rail lines run through source water protection areas in both counties.

Other major concerns for both Berkeley and Morgan County facilities include industrial and commercial activity that lies within source water protection areas, such as gas stations, auto repair shops, and mining operations which have the potential to improperly release hazardous waste into environment. Agricultural activities can increase nutrient runoff, and old septic and sewer systems can leak into protection areas. Wastewater treatment plants can release excess nutrients into surface water or pathogens upstream of source water intakes. Sinkholes are also a hazard, as they can create direct conduits from the surface to groundwater supplies, bypassing natural soil filtration processes and making groundwater wells more vulnerable (BCPSWD & Martinsburg Source Water Protection Plans; WV DHHR, 2002 & 2004; McVey, 2016). Water systems without backup source water or with source waters that are located very close together are particularly vulnerable.

Furthermore, increased development, specifically in Berkeley County, but also parts of Morgan

County will likely lead to increased nonpoint source pollution (NPS). NPS pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification. NPS pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and ground waters (EPA, 2021d). Urbanized areas affect water quality through increased runoff from impervious surfaces and increased pollutant loads. With increased impervious surfaces through development, the region can expect to experience an increase in stormwater runoff carrying harmful pollutants.

4.3.21. Terrorism

4.3.21.1. Location and Extent

The term "terrorism" refers to intentional, criminal, malicious acts, but 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).

An important consideration in evaluating terrorism hazards is the existence of facilities, landmarks, or other buildings of international, national, or regional importance. Outside of several federal government buildings in Martinsburg, while possessing many notable landmarks from a local historic perspective, there are no sites in Berkeley or Morgan County which are considered significant landmarks in terms of national or international importance. Threats against the agricultural community and major transportation corridors, however, could be potential terrorist targets. The Eastern Panhandle could also be impacted by terrorism due to its proximity to the National Capital Region, which is one of the most target-rich areas of the country. Should a terrorist strike the National Capital Region, the region could see a mass influx of residents evacuating the area and major highways such as I-81 could become impassable due to the volume of traffic. The region could also suffer the indirect economic effects of the incident as many residents work in or close to D.C.

Nonetheless, terrorism can take many forms and terrorists have a wide range of personal, political, or cultural agendas. Therefore, there is no location that is not a potential terrorist target. Workplace and school shootings and bomb threats have received much attention in recent years. Two other types of terrorist activity that may be particularly relevant to Eastern Panhandle is agriterrorism and intentional hazardous material releases. Agriterrorism is the direct, intentional, generally covert contamination of food supplies or introduction of pests and/or disease agents to crops and livestock. Berkeley and Morgan County have significant amounts of rural land and a substantial local agricultural

economy.

There are also several SARA Title III facilities and a few major transportation routes that traverse the region; making intentional hazardous material releases a potential threat to citizens and the environment. This hazard is addressed in Section 4.3.18. Critical facilities including police stations, hospitals, fire stations, schools, wastewater treatment plants, and water supply facilities, may be potential terrorist targets.

4.3.21.2. Range of Magnitude

Terrorist attacks can take many forms, including agriterrorism, arson/incendiary attack, armed attack, biological agent, chemical agent, cyberterrorism, conventional bomb, intentional hazardous material release, nuclear bomb, and radiological agent. The severity of terrorist incidents depends upon the type of method used, the proximity of the device to people, animals, or other assets, and the duration of exposure to the incident or device. For example, chemical agents are poisonous gases, liquids, or solids that have toxic effects on people, animals, or plants. Many chemical agents can cause serious injuries or death. Severity of injuries depends on the type and amount of the chemical agent used and the duration of exposure. Biological agents are organisms or toxins that have illness-producing effects on people, livestock, and crops. Because some biological agents cannot be easily detected and may take time to develop, it is difficult to know that a biological attack has occurred until victims display symptoms. In other cases, the effects are immediate. Those affected by a biological agent require the immediate attention of professional medical personnel. Some agents are contagious, and victims may need to be quarantined.

The West Virginia State Fusion Center defines eight signs of Terrorism (West Virginia Fusion Center, 2021):

- **Surveillance:** Someone recording or monitoring activities. This may include the use of cameras, note taking, drawing diagrams, annotating on maps, or using binoculars or other vision-enhancing devices.
- **Elicitation:** People or organizations attempting to gain information about operations, capabilities, or people. Elicitation attempts may be made by mail, email, telephone, or in person. This could also include eavesdropping or friendly conversation.
- **Tests of Security:** Any attempts to measure reaction times to security breaches, attempts to penetrate physical security barriers, or monitor procedures in order to assess strengths and weakness.
- **Funding:** Suspicious transactions involving large cash payments, deposits, or withdrawals. Collections for donations, the solicitation for money, and criminal activity are common signs of terrorist funding.

- **Supplies:** Purchasing or stealing explosives, weapons, ammunition, etc. This also includes acquiring military uniforms, decals, flight manuals, passes or badges (or the equipment to manufacture such items), and any other controlled items.
- **Impersonation:** People who do not seem to belong in the workplace, neighborhood, business establishment, or anywhere else.
- **Rehearsal:** Putting people in position and moving them around according to their plan without actually committing the terrorist act.
- **Deployment:** People and supplies getting into position to commit the act. This is the person's last chance to alert authorities before the terrorist act occur.

A worst-case scenario event for Berkeley and Morgan County would likely involve an active shooter incident at a public event, school, place of assembly, or area with high population density. A disaster of this scale could result in widespread injuries and fatalities.

4.3.21.3. Past Occurrence

There have been several high-profile incidents that could be considered under the umbrella of terrorism or brought charges of terrorism against an individual.

Figure 4.3.21-1: Military Style Gear Identified in Alemar's Apartment by Police (WJLA, 2012)

An incident resulting in terrorism charges that garnered national attention was the arrest of William Alemar on August 20, 2012. Alemar was arrested after he was reportedly jogging in a bulletproof vest, carrying two knives, holding a training rifle, and possessing unloaded ammunition clips near several Martinsburg schools. Gear from Alemar's apartment can be seen in Figure 4.3.18-1. It was eventually uncovered that Alemar was an Army veteran and a member of the National Guard. Alemar was charged with a felony committing a terroristic act and wearing body armor while committing a felony offense, as well as misdemeanors including public intoxication and willful disturbance of a school. The case resulted in a plea deal where Alemar accepted the penalty for the misdemeanors and the felony charges, including the charge of a committing a terroristic act, were dropped (WJLA, 2012).

Other reported incidents have included threats of violence by students and young adults against local schools. A February 2016 incident resulted in four Hedgesville students being taken into custody by

police and recommended for expulsion by Hedgesville High School Administrators. The students were involved with threats posted online against the high school. A former Mussleman High School student was arrested in October 2014 and was charged with making threats of terrorist acts after using a Twitter account to threaten the Berkeley County school. A few of the Twitter posts resulting in the incident can be seen in Figure 4.3.21-2, and other posts specifically name individual school staff, target racial groups, and involve inflammatory and explicit language. The investigation involved the Federal Bureau of Investigation, West Virginia State Police, Martinsburg Police, and the Berkeley County Sheriff's Department. Police presence was increased at Musselman High School and throughout the county during the incident (Miistich & McCormick, 2014). Nationwide, all terrorist threats are taken seriously, and resulting investigations and response expend significant resources and require specialized training and equipment for emergency response personnel. These types of incidents are of serious concern to all communities.

Figure 4.3.21-2: Three of the Threatening Twitter Posts (Miistich & McCormick, 2014)

In August of 2020, a Berkeley Springs man was arrested after allegedly posting terrorist threats prior to a protest held in the town. A press release stated: "Sheriff Bohrer became aware of threats made on social media from investigation in house and also with assistance from the West Virginia Fusion Center that a subject was posting concerning threats to public safety at the Black Lives Matter Rally to be held in Berkeley Springs State Park on (Aug. 21)." The Sheriff's Office stated they had already been scanning social media for threats leading up to the rally. (Rhee, 2020b).

4.3.21.4. Future Occurrence

The probability of terrorism occurring cannot be quantified with as great a level of accuracy as that of many natural hazards. Furthermore, these incidents generally occur at a specific location, such as a government building, rather than encompassing an area such as a floodplain. Thus, planning should be asset-specific, identifying potentially at-risk critical facilities and systems in the community. Once a comprehensive list of critical assets has been developed, it should be prioritized so that efforts can be directed to protect the most important assets first. Then, beginning with the highest-priority assets, the vulnerabilities of each facility or system to each type of hazard should be assessed.

For the purpose of developing a realistic prioritization of terrorism hazard mitigation projects, three elements should be considered in concert:

- Relative importance of the various facilities and systems in the asset inventory
- Vulnerabilities of those facilities
- Threats that are known to exist

Critical assets and infrastructures are systems whose incapacity or destruction would have a debilitating effect on the county:

- Emergency services
- Government services
- Water supply systems
- Transportation networks
- Telecommunications infrastructure
- Electrical power systems
- Gas and oil facilities

As previously noted, aside from some federal buildings there are no sites which are considered significant landmarks in terms of national or international importance in the region. The potential threat of an incident occurring at these federal government facilities or during a major event or public is greater, while the many notable landmarks from a local historic perspective throughout the region are less at risk.

Based on historical events, it is possible that Berkeley and Morgan County will experience a suspected terrorist incidents or threat in a given year. Previous events have been limited in scope, but the severity of a future incidents cannot be predicted with any sufficient level of certainty. Prediction of terrorist attacks is almost impossible because terrorism is a result of human factors. As long as fringe groups maintain radically different ideas than that of the government or general population, terrorism is a possibility. Overall, the future occurrence of a terrorist attack can be considered *possible* across the region according to the Risk Factor Methodology (see Table 4.4.1-1).

4.3.21.5. Vulnerability Assessment

Since the probability of terrorism occurring cannot be quantified in the same way as that of many natural hazards, it is not possible to assess vulnerability in terms of likelihood of occurrence. Instead, 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. All communities in Berkeley and Morgan County are vulnerable on some level, directly or indirectly, to a terrorist attack. However, communities where specific potential targets are located should be considered more vulnerable. Site-specific assessments should be based on the relative importance of a particular site to the surrounding community or population, threats that are known to exist and vulnerabilities including:

Inherent Vulnerability

- Visibility – How aware is the public of the existence of the facility?

- Utility – How valuable might the place be in meeting the objectives of a potential terrorist?
- Accessibility – How accessible is the place to the public?
- Asset mobility – is the asset's location fixed or mobile?
- Presence of hazardous materials – Are flammable, explosive, biological, chemical and/or radiological materials present on site? If so, are they well secured?
- Potential for collateral damage – What are the potential consequences for the surrounding area if the asset is attacked or damaged?
- Occupancy – What is the potential for mass casualties based on the maximum number of individuals on site at a given time?

Tactical Vulnerability

Site Perimeter

- Site planning and Landscape Design – Is the facility designed with security in mind – both site-specific and with regard to adjacent land uses?
- Parking Security – Are vehicle access and parking managed in a way that separates vehicles and structures?

Building Envelope

- Structural Engineering – Is the building's envelope designed to be blast-resistant? Does it provide collective protection against chemical, biological, and radiological contaminants?

Facility Interior

- Architectural and Interior Space Planning – Does security screening cover all public and private areas?
- Mechanical Engineering – Are utilities and HVAC systems protected and/or backed up with redundant systems?
- Electrical Engineering – Are emergency power and telecommunications available? Are alarm systems operational? Is lightning sufficient?
- Fire Protection Engineering – Are the building's water supply and fire suppression systems adequate, code-compliant, and protected? Are on-site personnel trained appropriately? Are local first responders aware of the nature of the operations at the facility?
- Electronic and Organized Security – Are systems and personnel in place to monitor and protect the facility?

Sites that may potentially be vulnerable to terrorist attacks include the following:

- U.S. Courthouse, 217 W King Street, Martinsburg
- Martinsburg Computing Center, 250 Murall Drive, Martinsburg
- Federal Building, 244 Needy Road, Martinsburg

- Eastern WV Regional Airport and WV Air National Guard Facilities, 170 Aviation Way, Martinsburg
- Foxcroft Towne Center at Martinsburg, 800 Foxcroft Ave, Martinsburg
- Public schools and education centers
- Major regional employers including Quad/Graphics, Inc., the Martinsburg Veterans Administration Center, Orgill, Inc., U. S. Silica Company, and Morgan County War Memorial Hospital.
- County facilities in Berkeley Springs and Martinsburg
- Berkeley and Morgan County fairs and festivals

The West Virginia Fusion Center also exists to provide resources, expertise, and information to the center with the goal of maximizing the ability to detect, prevent, investigate, and respond to criminal and terrorist activity. Intelligence processes through which information is collected, integrated, evaluated, analyzed, and disseminated are a primary focus. Data fusion involves the exchange of information from different sources including law enforcement, public safety, and the private sector. Relevant and actionable intelligence results from analysis and data fusion. The fusion process helps agencies be proactive and protect communities.

4.3.22. Transportation Accidents

4.3.22.1. Location and Extent

For this analysis a transportation incident is defined as an incident involving highway, air, or rail travel. Incidents involving hazardous materials are considered under Section 4.3.18 of this report. This analysis includes the location of all public airports, passenger and freight rail lines, and highways where major accidents are likely to occur.

Within Berkeley and Morgan County, there are thousands of miles of roads and 172 bridges; 118 in Berkeley and 54 in Morgan County. Of these bridges, 25 (14.5 percent) are classified as poor by the Federal Highway Administration (FHWA) (FHWA, 2021). Key freight routes include I-81, WV Route 9, and US 11, and are heavily traveled by large trucks. These trucks can create additional traffic hazards. Figures 4.3.22-1 and 4.3.22-2 show the major roads in the counties and railroads. Figure 4.3.22-3 shows the road network in Berkeley and Morgan County and the average annual daily traffic that can be expected on those roads. A CSX main rail service line runs horizontally across the entire Eastern Panhandle, along the eastern and northern edge of Morgan County and cuts across Berkeley County through Martinsburg. A CSX short line partner runs north-south through Berkeley County and Martinsburg (CSX, 2021). The service line is shown in blue and the short line is shown in green in Figure 4.3.22-4. There is a potential for major accidents on any of these roads, bridges, or railways. Berkeley and Morgan County have average

to above average numbers of crash fatalities compared to the rest of West Virginia and the United States, as seen in Figure 4.3.22-5.

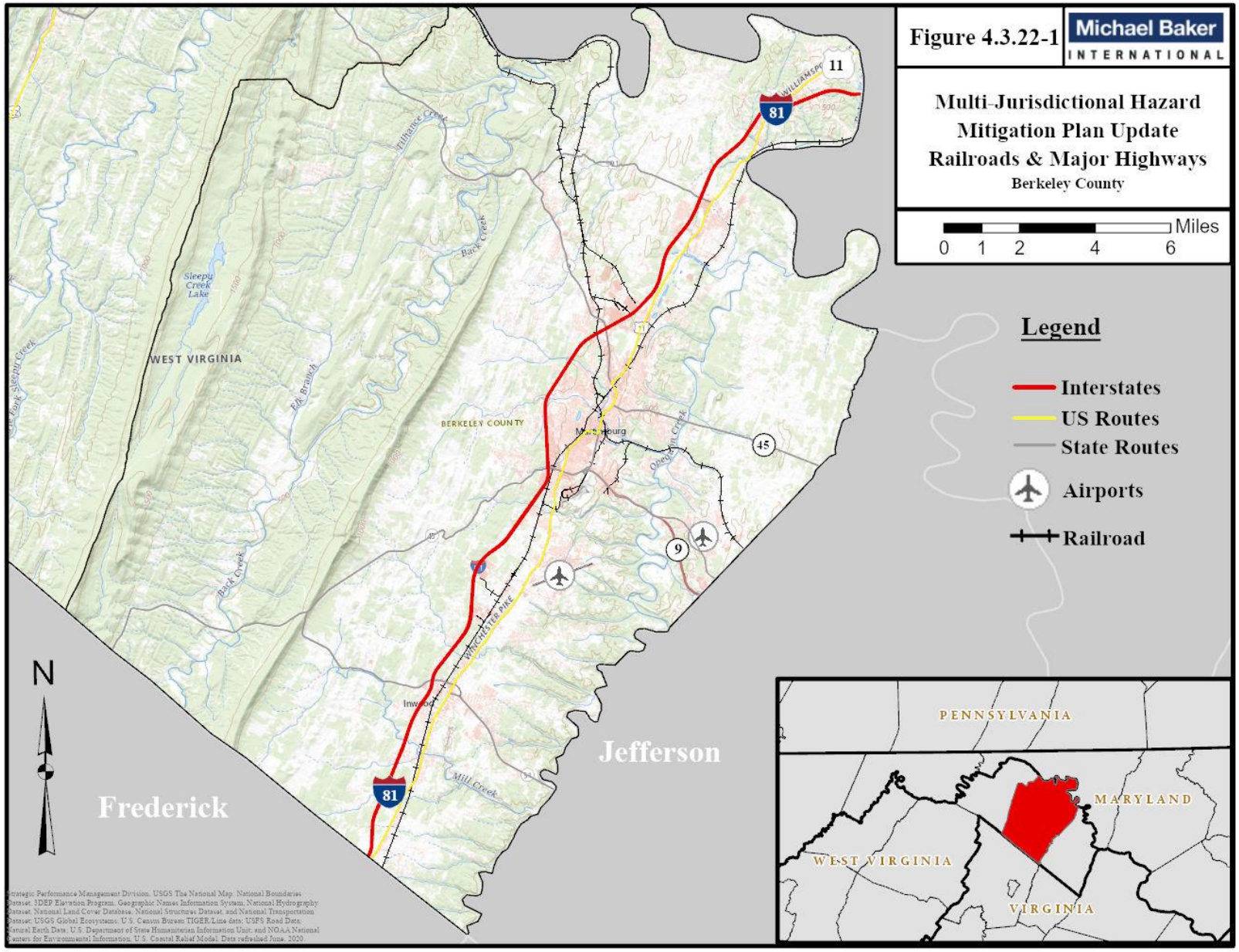
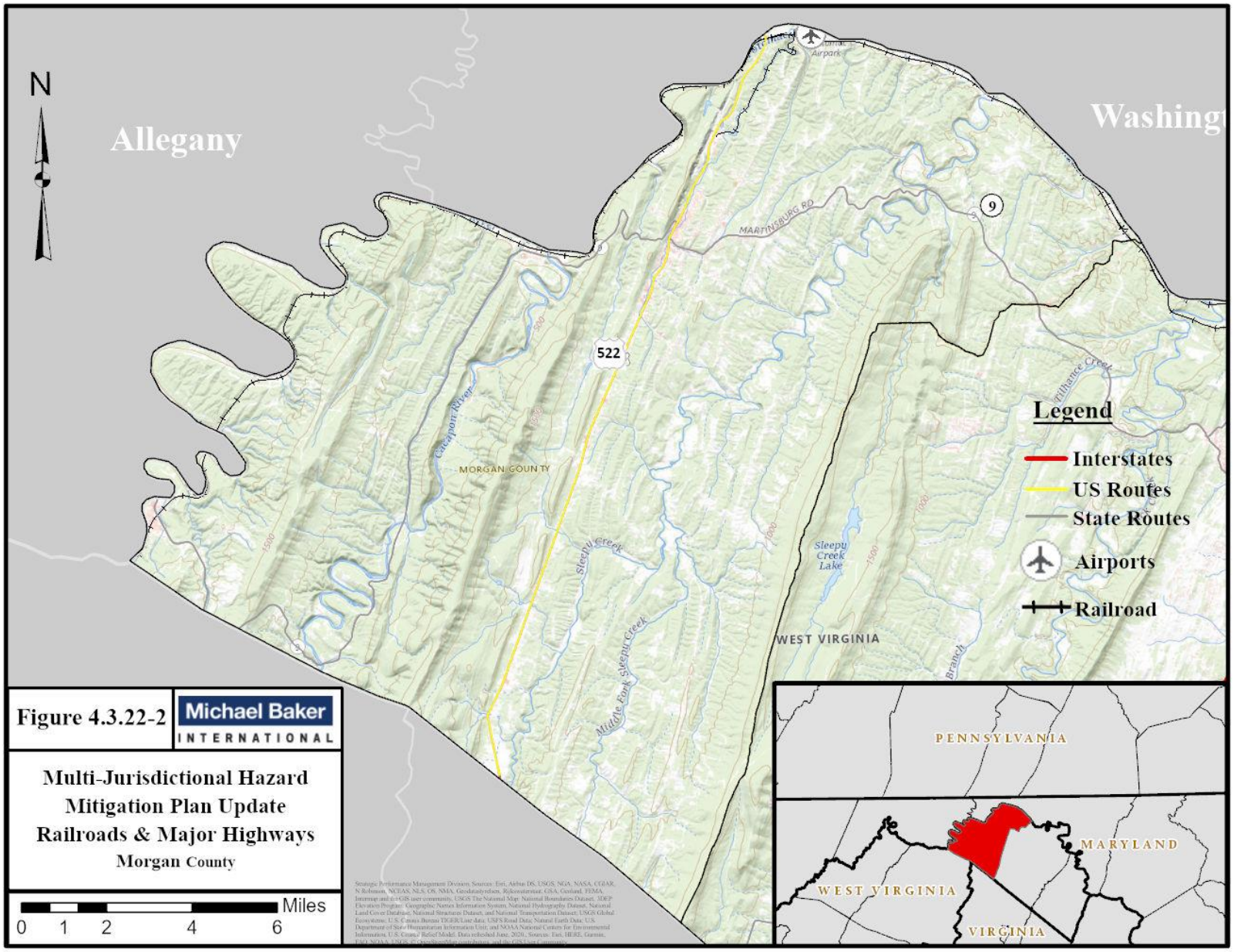


Figure 4.3.22-1
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Railroads & Major Highways
Berkeley County
0 1 2 4 6 Miles
Legend
Interstates
US Routes
State Routes
Airports
Railroad
WEST VIRGINIA
BERKELEY COUNTY
Jefferson
Frederick
81
11
45
9
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA
N


N
Allegany
Washing
MORGAN COUNTY
WEST VIRGINIA
MARTINSBURG RD
522
9
Sleepy Creek
Sleepy Creek Lake
Middle Fork Sleepy Creek
Legend
Interstates
US Routes
State Routes
Airports
Railroad
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA
Figure 4.3.22-2
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Railroads & Major Highways
Morgan County
Miles
0 1 2 4 6

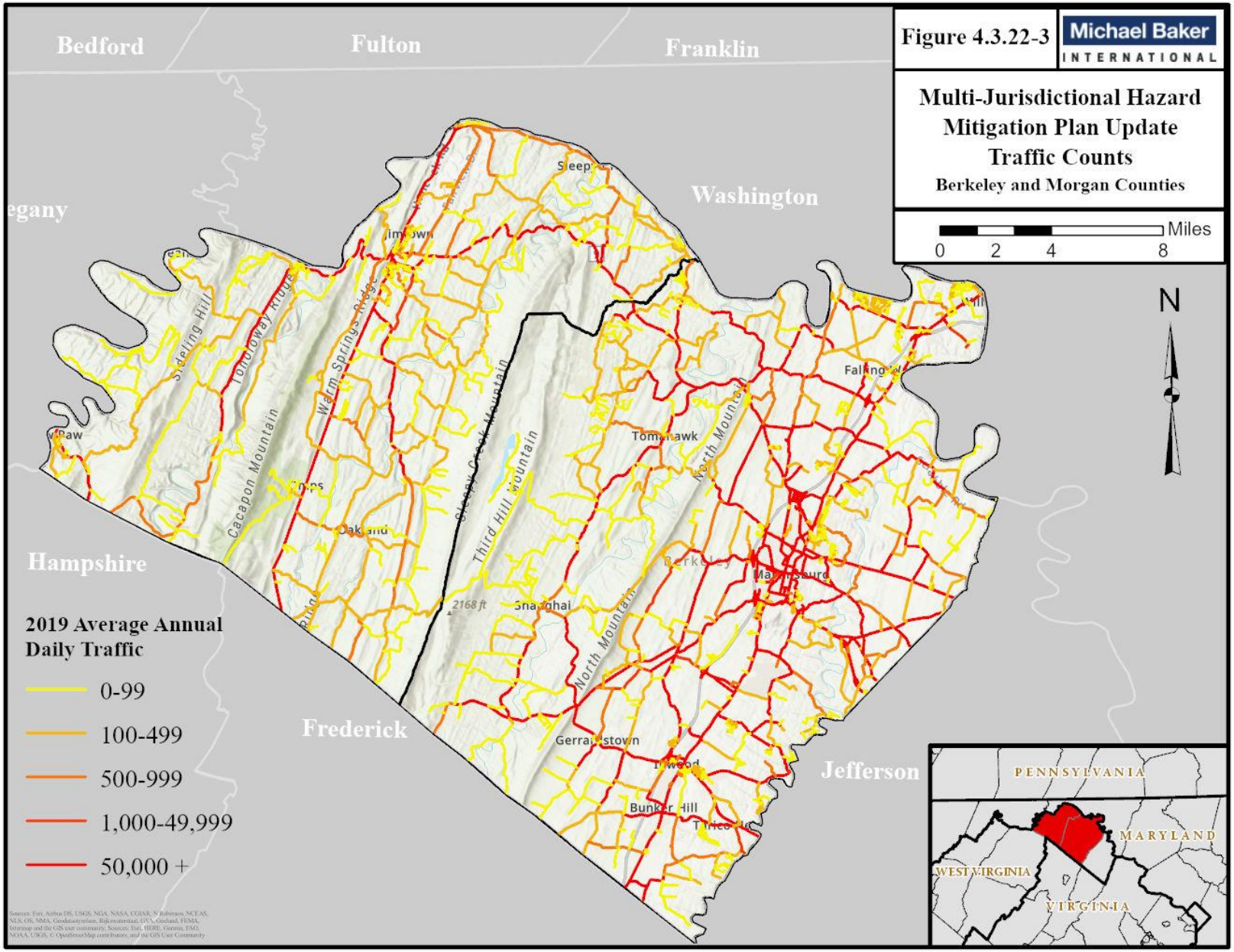


Figure 4.3.22-3
Michael Baker INTERNATIONAL
Multi-Jurisdictional Hazard Mitigation Plan Update
Traffic Counts
Berkeley and Morgan Counties
Miles
0 2 4 8
N
Bedford
Fulton
Franklin
Washington
Hampshire
Frederick
Jefferson
Sleepy Creek Mountain
Third Hill Mountain
North Mountain
Cacapon Mountain
Warm Springs Ridge
Tonoloway Ridge
Sideling Hill
Oakland
Gerrardstown
Bunker Hill
2168 ft
2019 Average Annual Daily Traffic
0-99
100-499
500-999
1,000-49,999
50,000 +
PENNSYLVANIA
MARYLAND
WEST VIRGINIA
VIRGINIA

Figure 4.3.22-4: CSX Rail Lines in Berkeley and Morgan County (CSX, 2021)

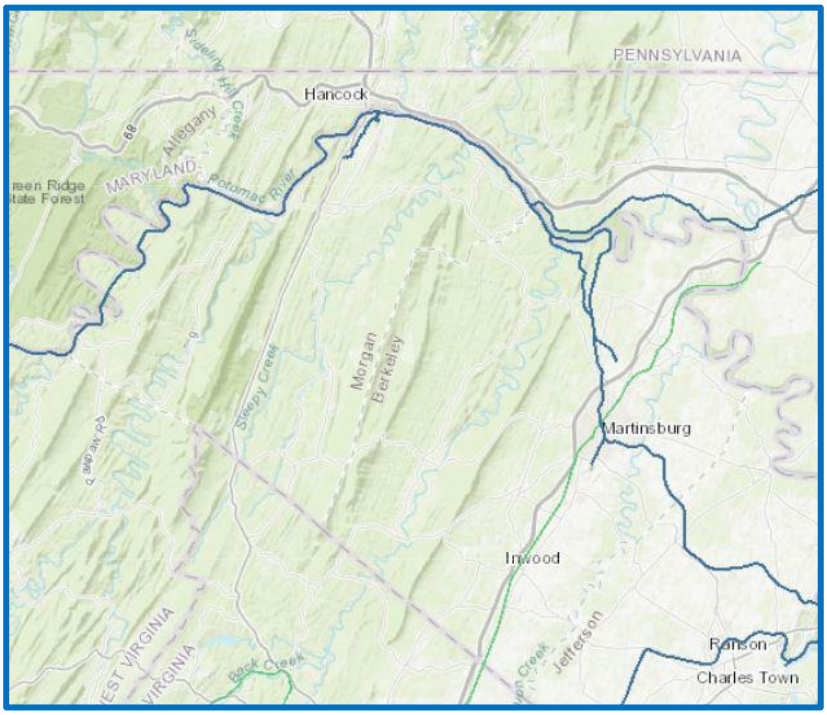
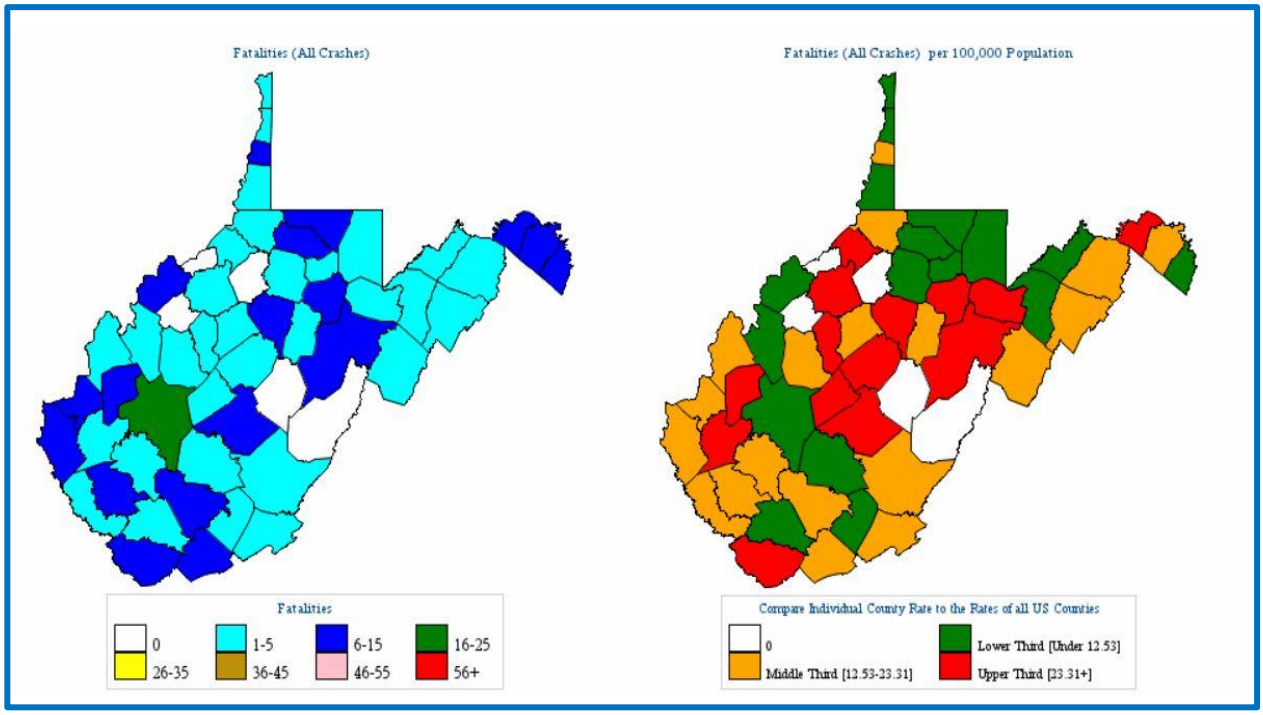


Figure 4.3.19-5 2015 Vehicular Fatalities in West Virginia, Per County (NHTSA, 2021)



There is also one public airport in Berkeley County. This airport is the Eastern WV Regional Airport, which is a joint public and military use airport, located south of Martinsburg. It is used for general aviation and by the WV Air National Guard. Numerous major air traffic routes for the northern United States also pass over Berkeley and Morgan County.

4.3.22.2. Range of Magnitude

Traffic incidents and crashes are measured two ways. First, insurance companies look at the level of damage sustained to the vehicle. They identify them as undamaged, damage has occurred that is cost effective to repair, or the vehicle is considered a complete loss, as it would cost more to fix than it is currently worth. Secondly, deaths or injuries that have occurred as a result of the event must be considered. For the purpose of this community-oriented analysis, consideration of what damage has occurred to the motor vehicle is not included.

Significant passenger vehicle, air, and rail transportation incidents can result in a wide range of outcomes from damage solely to property to serious injury or death. The most serious transportation incidents include a release of hazardous material. As described in Section. 4.3.18, weather condition, micro-meteorological effect of buildings and terrain, and non-compliance with applicable codes can exacerbate these releases. Response time and quantity and type of material release also impact the severity of an incident.

Railway and roadway incidents in particular have the potential to result in hazardous materials release. Transportation incidents can also result in broader infrastructure damage. Like the range of magnitude, the environmental impacts of transportation incidents can vary greatly. In the case of a simple motor vehicle crash, train derailment, or aviation incident, the environmental impact is minimal. However, if the incident involves any type of vehicle moving chemicals or other hazardous materials, the impact will be considerably larger and may include an explosion or the release of potentially hazardous material. For a complete discussion of the environmental impacts of hazardous materials releases, see Section 4.3.18.

The worst-case scenario for a transportation accident impacting Berkeley and Morgan County would be a road accident which results in a hazardous material spill in a densely population area, such as in or near Martinsburg. Such an event would constitute an immediate health hazard to the local population and require a community evacuation.

4.3.22.3. Past Occurrence

The most common transportation incidents in the region are highway incidents involving motor vehicles. The region's most serious road transportation concerns involve U.S. 522, I-81, and WV 9. These routes have the highest annual average traffic counts in the region. Additionally, there is a temporal aspect to highway transportation incidents; in the spring and early summer, when construction and narrowed lanes are commonplace, the incidence of large-scale transportation

accidents increases. On a smaller time scale, rush hour periods will see much higher volume of traffic than other times of the day depending on the location.

Vehicle crashes continue to be a risk throughout both counties. The National Highway Traffic Safety Administration (NHTSA) statistics for reportable vehicle accidents in Berkeley and Morgan County are shown in Table 4.3.22-1. There do not appear to be comparable records available of rail or air traffic incidents that have affected the region.

Table 4.3.22-1 Fatalities Attributed to Vehicular Crashes in Berkeley and Morgan County for 2015-2019, Fatalities per 100,000 Population in Parentheses (NHTSA, 2021)

Fatality Crash Type	Berkeley County									
	Fatalities					Fatalities Per 100,000 Population				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Total Fatalities (All Crashes)	10	16	10	16	15	8.95	14.10	8.69	13.65	12.59
Alcohol-Impaired Driving (BAC=.08+) Fatalities	2	4	2	6	6	1.79	3.52	1.74	5.12	5.03
Single Vehicle Crash Fatalities	4	12	7	7	10	3.58	10.57	6.08	5.97	8.39
Large Truck Involved Crash Fatalities	0	2	2	1	2	0.00	1.76	1.74	0.85	1.68
Speeding Involved Crash Fatalities	4	4	3	8	8	3.58	3.52	2.61	6.82	6.71
Rollover Involved Crash Fatalities	2	8	2	3	4	1.79	7.05	1.74	2.56	3.36
Roadway Departure Involved Crash Fatalities	7	11	6	12	11	6.27	9.69	5.21	10.24	9.23
Intersection Crash Fatalities	1	0	1	4	2	0.90	0.00	0.87	3.41	1.68
Passenger Car Occupant Fatalities	5	5	5	3	5	4.48	4.41	4.35	2.56	4.20
Light Truck Occupant Fatalities	4	9	3	7	5	3.58	7.93	2.61	5.97	4.20
Motorcyclist Fatalities	0	0	0	6	3	0.00	0.00	0.00	5.12	2.52
Pedestrian Fatalities	1	2	1	0	2	0.90	1.76	0.87	0.00	1.68
Fatality Crash Type	Morgan County									
	Fatalities					Fatalities Per 100,000 Population				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Total Fatalities (All Crashes)	0	4	1	1	6	0.00	22.69	5.64	5.61	33.55
Alcohol-Impaired Driving (BAC=.08+) Fatalities	0	1	0	0	3	0.00	5.67	0.00	0.00	16.77
Single Vehicle Crash Fatalities	0	2	1	1	2	0.00	11.35	5.64	5.61	11.18
Large Truck Involved Crash Fatalities	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
Speeding Involved Crash Fatalities	0	0	1	0	6	0.00	0.00	5.64	0.00	33.55

Rollover Involved Crash Fatalities	0	1	1	0	1	0.00	5.67	5.64	0.00	5.59
Roadway Departure Involved Crash Fatalities	0	2	1	1	6	0.00	11.35	5.64	5.61	33.55
Intersection Crash Fatalities	0	1	0	0	0	0.00	5.67	0.00	0.00	0.00
Passenger Car Occupant Fatalities	0	2	1	0	0	0.00	11.35	5.64	0.00	0.00
Light Truck Occupant Fatalities	0	2	0	1	6	0.00	11.35	0.00	5.61	33.55
Motorcyclist Fatalities	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
Pedestrian Fatalities	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00

Table 4.3.22-1 identified some of the factors associated with vehicle fatalities, including drivers under the influence of alcohol, speeding, roadway departure, large trucks, and intersections. It also shows pedestrian and motorcyclist fatalities. This data reveals that crashes involving roadway departure are the most significant issue in Berkeley County, and crashes involving alcohol use and speeding are a consistent threat from year to year. The smaller population of Morgan County makes identifying crash fatality trends more difficult. In 2015, no crash fatalities were reported for Morgan County, and remained consistently between one to six since then.

A study commissioned by the WV Division of Highway identified a one and a half mile stretch of road in Martinsburg as a problem area for crashes. The study cited the road as having an accident rate 1.5 times the state-wide average. Traffic flow during peak traffic can back up the stretch of road excessively, frustrating area residents. The WV Division of Highways is proposing solutions to address this problem area (Blackburne, 2016). It is important for state and local officials to identify stretches of road that disproportionately contribute to crashes and vehicle fatalities in order to mitigate the hazard posed by transportation accidents.

I-81 continues to be an issue for Berkeley County and has the highest traffic incident account rate of the region, with accidents occurring regularly. A common incident type for this roadway would be similar to an occurrence on June 15, 2021: Berkeley County Sheriff's Office responded to the area of I-81 southbound between the one and half mile marker near the West Virginia and Virginia State line. Officials reported at least one fatality on the scene (Mphofe, 2021). Or: On February 18, 2021, I-81 closed following a crash involving over ten tractor trailers, due to ice on the road.

While there have been no serious incidents of train derailments or accidents in Berkeley or Morgan County, in 2019 a CSX train derailment occurred in nearby Harpers Ferry, Jefferson County. Seven cars were derailed both on and off the tracks with some falling into the river, causing structural damage to the bridge and railcars (Wilt, 2020).

Crashes involving aircrafts have also occurred in the region. The Bureau of Aircraft Accidents Archives (BAAA) lists one 1992 incident that resulted in six fatalities in Berkeley Springs; and one incident that

resulted in one fatality in Martinsburg, in 1958 (BAAA, 2021).

4.3.22.4. Future Occurrence

Berkeley and Morgan County have experienced up to 14.4 percent and two percent, respectively, population growth over the past decade according to the US Census Bureau QuickFacts, which could indicate that traffic volumes have risen accordingly. New residents have limited knowledge of detour routes and alternate routes around accidents, contributing to the possibility of incident-related congestion. The continued or elevated numbers of tractor-trailers on the county's road system could also contribute to incidences of transportation incidents. While air and rail-related transportation incidents are not as likely to impact the region because of their lower frequency, it is possible that highway incidents may increase slightly without proper mitigation strategies in place.

Recognizing the changing transportation network within each county and the fluctuating transportation volume, number of accidents, injuries and deaths from accidents, environmental impacts, and property damages is important when addressing and mitigating this hazard. The expected increases in transportation related responses in Berkeley County will require specialized training and equipment to be maintained at a high level of preparedness. The future occurrence of transportation accidents can be considered *highly likely* across the region according to the Risk Factor Methodology (see Table 4.4.1-1).

Specific transportation related concerns voiced by stakeholders include the Berkeley Springs 522-Bypass Project, increased traffic along I-81 in conjunction with construction and bottlenecking of WV Route 9. The Berkeley Springs Bypass Project is set to commence construction in mid-2021, with the goal to ease congestion around Berkeley Springs. Concerns are related to new and changing traffic patterns in coincidence with construction.

Increased commercial and residential growth around the I-81 corridor will likely continue to cause regular traffic incidents. Coupled with construction, such as the I-81 widening project between Exit 23 and U.S. 11, work on ramps at Exit 16 in Berkeley County, and other routine maintenance and updating of the roadway, the region can expect continued transportation incidents along I-81.

WV Route 9 is also a corridor of concern, as the population of both counties has grown and the route remains a small, rural two-lane expressway. Residents note it is often backed up during peak traffic times and sees a fair number of accidents. The road is also vastly important to development, and the Berkeley County Development Authority has about 50 acres of available grounds in that area the agency can use to sell to potential businesses. During the 2019 West Virginia Legislative session, there was heightened tension and passionate floor speeches about the condition of roads. Discussions around the subject grew so loud that the West Virginia Division of Highways (DOH) made a point to improve transparency after the session ended by creating a list of all secondary road projects in the state. The chief engineer for the West Virginia DOH, Aaron Gillespie said WV Route 9 is on his radar, but the widening of nearby I-81 Corridor is the DOH's main priority.

4.3.22.5. Vulnerability Assessment

A transportation-related incident can occur on any stretch of road in Berkeley or Morgan County. However, severe accidents are more likely to occur on the highways, such as I-81, U.S. 11, and W.V. 9, which experience heavier traffic volumes including heavy freight vehicles. The combination of high traffic volume, severe winter weather, and large numbers of hazardous materials haulers increase the chances of traffic accidents occurring. Accidents may also occur on any rail line or air flight path.

Like highway incidents, rail incidents can impact population living near rail lines. Crude oil shipping across the United States has grown by a factor of seventeen in the last five years, increasing the risk for a derailment or rail incident to involve this material. The average fatal rate of aviation incidents nation-wide is 1.069 incidents per 100,000 flight hours in 2019 (NSC, 2021). Therefore, the likelihood of a serious aviation incident in the region is considered low.

Freight transportation through the region is facilitated through highways, freight railroads, and air service. The West Virginia State Freight Plan estimates by 2045, domestic freight flows within the State are expected to grow to almost 95M tons, an increase of almost 23M tons from current flows. Over the same time horizon, total (domestic and international) exports from the State are expected to grow to 180M tons while total imports from the State are expected to grow to 120M tons (WVDOT, 2018). Continued increases in freight transportation require planning and regulatory efforts to ensure keep transportation routes safe.

Berkeley and Morgan County's future population growth and land use will be significantly impacted by the safety and capacity of the transportation systems traversing the region. Most residents, visitors, and tourists will use automobiles as their primary transportation throughout the community. Immigration and commercial development are also largely dependent on motor vehicle transportation systems.

All critical infrastructure within Berkeley and Morgan County is vulnerable to traffic incidents, in that facility operators may be injured or delayed in performing their duties due to traffic incidents. Transportation infrastructure may be directly affected by being damaged during the incident.

Given the importance of motor vehicle traffic to the future of Berkeley and Morgan County, traffic and road infrastructure planning must be a high priority for community planners and development officials. Given the opportunity to establish long-term traffic planning programs and mitigate incidents by improving safety at dangerous intersections, the region can greatly enhance the safety of its residents and visitors alike. Furthermore, taking the opportunity to learn from other high-growth areas, the region can take steps now to promote the proper balance between development and road infrastructure growth, to mitigate future problems.

WVDOT is undertaking a planning process to draft a 2050 Multimodal Long-Range Transportation Plan (LRTP). The WVDOT is conducting an update to its statewide multimodal long-range transportation

plan to help guide future transportation policies and investments. The plan will provide a 30-year blueprint to fund and improve the preservation, management, and expansion of West Virginia's multimodal transportation system, as well as further support WVs economy, enhance quality of life, foster safe and reliable transportation options, and better connect WV residents and businesses to opportunities. The 2050 Plan will be considered during annual HMP reviews once it is complete.

4.3.23. Utility Interruption

4.3.23.1. Location and Extent

Utility interruptions include any impairment of the functioning of telecommunication, gas, electric, water, or waste networks. Interruptions or outages occur because of geomagnetic storms, fuel or resources shortage, electromagnetic pulses, information technology failures, transmission facility or linear utility accident, and major energy, power, or utility failure. The focus of utility interruptions as a hazard lies in fuel, energy, or utility failure. These kinds of interruptions rarely spontaneously occur on their own; this hazard is often secondary to other natural hazard events, particularly transportation crashes and incidents, lightning strikes, extreme heat or cold events, and coastal and winter storms. The causes for outages are usually downed power wires or utility poles as a result of inclement weather or vehicle incidents. Additionally, outages can be caused by blown transformers or tripped circuit breakers. Most often, there is no cause reported and power is restored within the hour.

Utility interruptions in Berkeley and Morgan County occur regularly but are usually small-scale, localized incidents. Utility interruptions are possible anywhere there is utility service. Table 4.3.23-1 lists the major utility companies in the region. Utility interruptions and power failures can take place throughout the region.

Table 4.3.23 -1 Major Utility Companies in Berkeley and Morgan County (Berkeley County Comprehensive Plan, 2016)

Company Name	Type of Utility
First Energy, Potomac Edison	Electricity
Mountaineer Gas Company	Natural Gas
Blueflame, Inc. – Morgan County	Propane Gas
Thompson Gas – Morgan County	Propane Gas
Verizon	Telecom
Frontier Communications	
Comcast Cable	

According to the 2019 5-year American Community Survey, in Berkeley County, 69.0 percent of housing units use electricity as their heat source, followed by 11.5 percent of homes using gas for

heat. In Morgan County, 52.2 percent of housing units use electricity as their heat source, followed by 10.2 percent of homes using fuel oil for heat, and 8.3 percent using bottled, tank, or LP gas (ACS 205-2019). As a result, an interruption in any of those utilities could affect a significant number of residents. In addition, an increasing reliance on internet access and telecommunications could also impact many residents at any given time.

4.3.23.2. Range of Magnitude

The most severe utility interruptions will be regional or widespread power and telecommunications outages. With the loss of power, electrically powered equipment and systems will not be operational. Examples may include lighting; HVAC and ancillary support equipment; communication (i.e. public address systems, telephone, computer servers, and peripherals); ventilation systems; fire and security systems; refrigerators, sterilizers, trash compactors, office equipment; and medical equipment. This can cause food spoilage, loss of heat or air conditions, basement flooding (sump pump failure), lack of light, loss of water (well pump failure), lack of phone service, or lack of internet service. However, this is most often a short-term nuisance rather than a catastrophic hazard.

The severity of a utility interruption can be compounded with extreme weather events, especially winter weather events. Interruptions can also be more severe for special needs populations that are dependent on electronic medical equipment. Utility interruptions can significantly hamper first responders in their efforts to provide aid in a compound disaster situation, especially with losses of telecommunications and wireless capabilities. Telecommunications interruptions will also hinder first responders' efforts. Additionally, an internet outage could be crippling to the economy, as many companies and government entities process payments and invoices electronically rather than with cash or physical checks.

In a possible worst-case scenario for Berkeley and Morgan County, a winter storm event could cause widespread power outages, leaving citizens without heat in the midst of subzero temperatures for several days. The power outage would also put elderly populations or others at risk of health problems due to the lack of heat and the inability to call for assistance or leave their homes. Power lines could also be difficult to repair depending on the magnitude of the storm. A power outage during the summer could also have serious consequences for much the same reason. During the summer the temperatures in Berkeley and Morgan County can occasionally exceed 100°F, and with no air conditioning this can put elderly and other vulnerable populations in danger of dehydration, heat exhaustion, or heat stroke.

4.3.23.3. Past Occurrence

Berkeley and Morgan County do have a history of regular utility interruptions. Table 4.3.23-1 shows a sample of power outage events in the area reported by local news media. It is not a comprehensive list, but it does represent the magnitude and impact of recent utility interruptions.

Table 4.3.23-2 Recent Utility Interruptions in Berkeley and Morgan County				
Date	**Cause**	**Location**	**Area Customers Impacted**	**Source**
9/25/2009	Vehicle Collision with Utility Pole	Hedgesville Elementary School	Limited to School	Your4State, 2009b
2/25/2011	Damage from Strong Winds	Maryland and West Virginia	600+	Armstrong, 2011
10/30/2012	Damage from Hurricane Sandy	Maryland and West Virginia	12,002	The Journal, 2012
11/27/2013	Transmission Station Transformer Malfunction	Western Morgan County	1,800	Clark, 2013
4/29/2014	Crossbeam Damage	Morgan County	2,271	MorganCountyUSA, 2014
7/9/2014	Severe Thunderstorm Damage	Eastern Panhandle	14,379	Marshall, 2014
8/18/2014	Transformer Fire	Apple Harvest Drive, Martinsburg	Limited to Road Only	Herald-Mail Media, 2014
3/26/2016	Transformer Fire (See Figure 4.3.20-1)	Berkeley County	3,500+	Agnir, 2016
4/26/2016	Falling Tree Damaged Substation	Martinsburg	3,000+	Emke, 2016
2/12/2019	Snow, Ice, and Rain	Great Cacapon	700	The Morgan Messenger 2019
2/17/2019	High Winds	Morgan County	2,000+	(Rudder & Shunney, 2019)

Figure 4.3.20-1 Crew Repairs Damage from Transformer Fire in Berkeley County 3/26/16 (Agnir, 2016)

4.3.23.4. Future Occurrence

Utility interruptions will continue to occur annually with minimal impact. Widespread utility interruption events usually occur approximately once every five years, usually as a secondary effect of an extreme weather event. These interruptions should be anticipated, and first responders should be prepared during severe weather events. Research by the National Oceanic and Atmospheric Administration (NOAA) suggests that climate change may cause more extreme storms in West Virginia (Climate.gov, 2021).

Power outages can be expected at any time of year, on a nearly monthly basis. Iced power lines; falling tree limbs due to ice, wind, or lightning strikes; and vehicle incidents damaging power lines, or their support poles can all be reasons for power outages.

The region around Berkeley and Morgan County is expected to see large increases in precipitation and numbers of very hot and very cold days (Climate Central, 2019). These factors can increase the occurrence of hazards such as flooding, hurricanes and tropical storms, landslides, tornados and windstorms, wildfires, and winter storms. Impacts from any of these hazards can lead to utility interruption on a range of scales. Overall, the probability of future utility outages impacting the region can be considered *highly likely* according to the Risk Factor Methodology (see Table 4.4.1-1).

Aging infrastructure also brings risk in the form of potential utility interruptions, particularly for places like Berkeley and Morgan County with aging infrastructure. In many utility systems, significant portions of the equipment and facilities date from the growth periods of the 1950s and 1960s that

followed World War II. As this equipment ages, it deteriorates from the constant wear and tear of service. Eventually the equipment reaches a point at which it will either fail on its own or because of outside forces (storms, loads it was designed to handle but no longer can, etc.). These failures cause service interruptions and can require expensive emergency repairs. In addition, as repairs have taken place along transmission routes, there is often a mix of new and old equipment along the line, as repair and not replacement is generally the choice made to resolve an issue.

The wholesale replacement of a system is not a feasible solution for utility companies. This would require the interruption of services while the replacement occurs, as well as accessing the existing system (which may lay under roads, private property, or other inconvenient places). Utility companies face the challenge of managing the issue of the aging infrastructure. They are tasked with reducing the effects of aging equipment while also controlling the deterioration of the existing system as much as possible. This balance will be tenuous as transmission equipment continues to age and break down. These breakdowns will likely lead to more frequent utility disruptions as time goes by.

4.3.23.5. Vulnerability Assessment

All jurisdictions are vulnerable on some level to utility interruptions, but because this hazard often occurs in conjunction with other hazards, jurisdictions that have been identified as more vulnerable to winter storms, windstorms, tornado, flooding, and other natural hazard events may be more vulnerable to a utility interruption.

Emergency medical facilities, including 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 temperatures for which elderly populations are particularly vulnerable. Conservation and improved technology have resulted in more efficient use of energy sources. The increasing use of alternative fuel supplies, such as kerosene heaters, wood burning stoves, coal burners, etc., has also decreased our vulnerability to future shortages. However, severe weather extremes, accidents, labor strikes, terrorism, or nationwide shortages could cause significant energy shortage problems. Emergency management officials can reduce vulnerability to utility interruption through training and exercises, such as the “Dark Grid” exercise conducted by the Local Emergency Planning Committee of Berkeley County, which prepare emergency responders and community leaders for a coordinated response to widespread utility interruptions (Rossbach, 2016).

The region is also well known to have many areas with limited cellular and broadband access. Areas of concern are the rural portions of Berkeley and Morgan County. The West Virginia Broadband Council provides Broadband Mapping Data and Resources (https://broadband.wv.gov/broadband-development-hub/). The West Virginia Broadband Enhancement Council was established in code during the 2017 Regular Legislative Session with the passage of House Bill 3093 and signed into law by Governor Jim Justice. The Code sets the many directives for the Council with the primary emphasis being on the development of broadband infrastructure in unserved and underserved areas of the

State (WV Broadband Enhancement Council, 2021). Stakeholders and community members have noted concern about broadband and cellular interruption in receiving and sending of emergency communications.

Since implementing an enhanced vegetation management program in 2014, Potomac Edison infrastructure has experienced significantly fewer tree-related outages in areas where tree trimming has been conducted to the new standards. The company services 1,550 miles of lines in its territory in the Eastern Panhandle. In 2020, the company saw a 45 percent reduction in tree-related outages compared to 2019, and the amount of time customers experienced service interruptions due to trees dropped by 75 percent. Actions like this can be taken by utility providers to reduce an area's utility interruption vulnerability (PRNewsWire, 2021).

4.4. Hazard Vulnerability Summary

4.4.1. Methodology

Ranking hazards helps communities set goals and priorities for mitigation based on their vulnerabilities. A risk factor (RF) is a tool used to measure the degree of risk for identified hazards in a particular planning area. The RF can also assist local community officials in ranking and prioritizing hazards that pose the most significant threat to a planning area based on a variety of factors deemed important by the planning team and other stakeholders involved in the hazard mitigation planning process. The RF system relies mainly on historical data, local knowledge, general consensus from the planning team, and information collected through development of the hazard profiles included in Section 4.3. The RF approach produces numerical values that allow identified hazards to be ranked against one another; the higher the RF value, the greater the hazard risk.

RF values were obtained by assigning varying degrees of risk to five categories for each of the hazards profiled in the HMP update. Those categories include probability, impact, spatial extent, warning time, and duration. Each degree of risk was assigned a value ranging from one to four. The weighting factor agreed upon by the planning team is shown in Table 4.4.1-1. 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:

Risk Factor Value = [(Probability x .30) + (Impact x .30) +
(Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]

Table 4.4.1-1 summarizes each of the five categories used for calculating a RF for each hazard. According to the weighting scheme applied, the highest possible RF value is 4.0.

Table 4.4.1-1 Summary of Risk Factor approach used to rank hazard risk				
Risk Assessment Category	**Degree of Risk**			**Weight Value**
	Level	**Criteria**	**Index**	
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	**UNLIKELY**	LESS THAN 1% ANNUAL PROBABILITY	**1**	**30%**
	POSSIBLE	BETWEEN 1% & 49.9% ANNUAL PROBABILITY	**2**	
	LIKELY	BETWEEN 50% & 90% ANNUAL PROBABILITY	**3**	
	HIGHLY LIKELY	GREATER THAN 90% ANNUAL PROBABILTY	**4**	
IMPACT *In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*	**MINOR**	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 *How large of an area could be impacted by a hazard event? Are impacts*	**NEGLIGIBLE**	LESS THAN 1% OF AREA AFFECTED	**1**	**20%**
	SMALL	BETWEEN 1 & 10.9% OF AREA AFFECTED	**2**	
	MODERATE	BETWEEN 11 & 25% OF AREA AFFECTED	**3**	

localized or regional?	**LARGE**	GREATER THAN 25% OF AREA AFFECTED	**4**	
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	**MORE THAN 24 HRS** **12 TO 24 HRS** **6 TO 12 HRS** **LESS THAN 6 HRS**	SELF-DEFINED SELF-DEFINED SELF-DEFINED SELF-DEFINED	*(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	**1** **2** **3** **4**	**10%**
DURATION *How long does the hazard event usually last?*	**LESS THAN 6 HRS** **LESS THAN 24 HRS** **LESS THAN 1 WEEK** **MORE THAN 1 WEEK**	SELF-DEFINED SELF-DEFINED SELF-DEFINED SELF-DEFINED	*(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	**1** **2** **3** **4**	**10%**

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, Table 4.4.2-1 lists the Risk Factor calculated for each of the 23 hazards identified in the 2022 HMP Update. Hazards identified as high risk have risk factors of 2.5. or greater. 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. Based on the results, there are thirteen high risk hazards, three moderate risk hazards and seven low risk hazards in Berkeley County. There are four high risk, ten moderate risk, and nine low risk hazards in Morgan County. Mitigation actions were developed for all high, moderate, and low risk hazards (see Section 6.4).

Table 4.4.2-1 Berkeley County Ranking of Hazard Types Based on Risk Factor Methodology							
Risk Class	Hazard	Risk Assessment Category (1 = least severe, 4 = most severe)					Calculated Risk Factor
		Probability (1-4)	Severity (1-4)	Spatial Extent (1-4)	Warning Time (1-4)	Duration (1-4)	
High	Source Water Contamination	3	4	4	4	4	3.7
	Transportation Accidents	4	4	3	4	2	3.6
	Winter Storm, Nor'easter	4	4	4	1	2	3.5
	Windstorm, Tornado	4	4	4	2	1	3.5
	Hazardous Materials	4	2	4	4	4	3.4
	Flooding	4	3	3	2	2	3.1
	Utility Interruption	4	3	2	3	2	3.0
	Pandemic and Infectious Disease	3	3	3	2	4	3.0
	Terrorism	2	3	4	4	2	2.9
	Hurricane, Tropical Storm	3	3	4	1	2	2.9
	Substance Use Disorder	3	3	2	2	3	2.7
	Drought	3	1	4	3	3	2.6
	Cyber Terrorism	3	3	2	3	1	2.6
Mod.	Thunderstorm, Lightning Strike	3	2	3	2	1	2.4
	Radon Exposure	2	3	2	3	1	2.3
	Extreme Temperature	2	2	3	3	1	2.2
Low	Civil Disturbance	2	2	1	3	2	1.9
	Wildfire	1	1	1	3	1	1.2
	Hailstorm	1	1	2	1	1	1.2
	Invasive Species	1	1	2	1	1	1.2
	Earthquake	1	1	1	1	1	1.0
	Land Subsidence	1	1	1	1	1	1.0
	Dam Failure	1	1	1	1	1	1.0

Table 4.4.2-2 Morgan County Ranking of Hazard Types Based on Risk Factor Methodology							
Risk Class	Hazard	Risk Assessment Category (1 = least severe, 4 = most severe)					Calculated Risk Factor
		Probability (1-4)	Severity (1-4)	Spatial Extent (1-4)	Warning Time (1-4)	Duration (1-4)	
High	Substance Use Disorder	4	3	3	2	3	3.2
	Pandemic and Infectious Disease	3	3	3	1	4	2.9
	Utility Interruption	3	2	3	4	2	2.7
	Flooding	3	2	3	3	2	2.6
Moderate	Winter Storm, Nor'easter	4	2	2	1	1	2.4
	Hazardous Materials	3	2	2	3	2	2.4
	Wind Storm, Tornado	3	2	2	3	2	2.4
	Cyber Terrorism	2	2	2	3	4	2.3
	Wildfire	3	2	1	4	2	2.3
	Transportation Accidents	4	1	1	4	1	2.2
	Hailstorm	2	2	2	4	2	2.2
	Hurricane, Tropical Storm,	2	2	3	1	3	2.2
	Thunderstorm, Lightning Strike	3	2	1	4	1	
	Source Water Contamination	2	2	2	2	3	2.1
	Dam Failure	2	2	2	3	2	2.1
Low	Drought	1	1	4	1	4	1.9
	Invasive Species	2	1	2	2	2	1.7
	Civil Disturbance	2	2	1	1	1	1.6
	Terrorism	1	1	1	4	2	1.4
	Extreme Temperature	1	2	1	1	2	1.4
	Earthquake	1	1	1	4	1	1.3
	Land Subsidence	1	1	1	4	1	1.3
	Radon Exposure	1	1	1	1	1	1.0

4.4.3. Potential Loss Estimates

Potential loss estimates for hazard events help a community better understand monetary value of what might be at stake during a hazard event. 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.

Loss estimates provided in this section fall into three broad categories: historical losses, current-condition losses, and predictive losses. Historical loss estimates come from three primary sources: the NCEI NOAA storm events database, the NFIP, and the USDA's Risk Management Agency annual crop indemnities dating from 1980-2021. Current condition losses come from geospatial analysis of the value of buildings identified as vulnerable. Finally, predictive losses were generated using HAZUS-MH. Historical losses do not consider any of the aforementioned components, but they do provide insight into what future losses might be. The current-condition losses consider replacement value as well as exposure value. Hazus modeling takes into account all four components and provides the most comprehensive description of potential losses. For more details on the Hazus methodology used and additional results reports, see **Appendix G.**

Historic Losses

Historical losses were able to be determined for drought, flooding, coastal storms (hurricanes/tropical storms/tropical depressions), tornadoes and windstorms, lightning, and winter storms from NCEI NOAA, USDA RMA, and the NFIP. While these historic losses give a glimpse of potential losses in hazard events, they are not reported for all events and should be considered a broad estimate.

NCEI reports include property and crop damage estimates with their incident reports. As noted in many of the hazard profiles, though, many of the events have no damages reported. This does not mean that there were no damages; rather, it indicates that no damages were reported to NCEI. As a result, these should be considered low-end estimates of losses. The flood and flash flood events reported in NCEI list $264,500 in property damage for Berkeley County and $1,044,000 for Morgan County. Windstorm and tornado events resulted in over $2,314,000 for Berkeley County and $745,600 in Morgan County in property and crop damages and one injury reported to NCEI. There are $29,000

in damages for Berkeley County and $75,000 for damages in Morgan County due to lightning events listed in NCEI. There were no damages, deaths, or casualties reported for extreme temperature or coastal storm events in the NCEI database.

Agriculture is a vital part of Berkeley and Morgan County's economy, and agricultural production is highly vulnerable to natural hazard events. As previously mentioned, losses are available from the USDA Risk Management Agency (RMA). The RMA operates and manages the Federal Crop Insurance Corporation, which provides crop insurance to American farmers. While not all crops are insured through RMA, their records provide strong insight into agricultural losses nationwide and in Berkeley and Morgan County. Table 4.4.3-1 illustrates the total amount of indemnities paid through RMA since 1996 in Berkeley and Morgan County by type of crop failure. Only crop failures related to the hazards discussed in this plan are listed. There has been over $3.9 million in indemnity paid out due to crop losses between 1996 and 2020 in Berkeley and Morgan County. The greatest amount of indemnity paid out was due to crop losses from drought, which accounts for about 32 percent of the losses, followed by losses due to frost, which accounted for over 22 percent of the losses.

Table 4.4.3-1 Historic Insured Crop Losses, 1996-2020 (USDA RMA, 2021)

Reason for Loss	Indemnity Amount		
	Berkeley County	Morgan County	Total
Cold Wet Weather	$74,519.00	$4,836.00	$79,355.00
Cold Winter	-	$684.00	$684.00
Drought	$1,192,905.00	$73,718.75	$1,266,623.75
Excess Moisture/Precipitation/Rain	$201,857.56	$65,811.50	$267,669.06
Excess Sunlight	-	$11,239.00	$11,239.00
Freeze	$81,356.00	$87,444.00	$168,800.00
Frost	$888,626.00	-	$888,626.00
Hail	$482,269.00	$402,528.00	$884,797.00
Heat	$139,206.00	$29,682.00	$168,888.00
Hurricane/Tropical Depression	$522.00	-	$522.00
Wildlife	$117,326.00	$30,447.75	$147,773.75
Wind/Excess Wind	$3,295.00	$27,050.00	$30,345.00
Total	**$3,181,881.56**	**$733,441.00**	**$3,915,322.56**

The final set of historic losses relates solely to prior flood losses and comes from the NFIP's records of claims paid. Table 4.4.3-2 shows the total amount of claims paid in each municipality according to FEMA's Community Information System (CIS). There has been over $9.54 million paid to residents of Berkeley and Morgan County.

Table 4.4.3-2 Berkeley and Morgan County NFIP Policies and Claim Information

Community	Policies in Force	Total Coverage	Prior Claims	Total Amount of Paid Claims	A-Zone
Berkeley County	165	$34,220,300	377	$5,517,937	79
Martinsburg	23	$4,818,600	34	$680,792	14
Hedgesville	Does not participate in NFIP				
Morgan County	116	$26,421,300	199	$2,864,757	71
Bath	19	$3,240,500	24	$397,983	14
Paw Paw	6	$768,500	6	$79,550	6
Total	**329**	**$69,469,200**	**640**	**$9,541,019**	**184**

Current Condition Losses

The current condition losses were derived using the total assessed value, including land and building values, from the building inventory used in the Hazus analysis. This building inventory was assembled from county assessor tax surface parcels and E-911 addressable structures. Table 4.4.3-3 details the total assessed values by type of land.

Table 4.4.3-3 Total Assessed Value by Land Type and County

Occupancy Classification	Building Count	Total Building Exposure ($)	Percent of Total
Berkeley County			
Residential	670	$56,717K	94.4%
Commercial	33	$57,131K	4.6%
Other	7	$1,408K	0.98%
Total	**710**	**115,255K**	
Morgan County			
Residential	519	$43,705K	80.7%
Commercial	103	$24,141K	16%
Other	21	$40,015K	3.3%
Total	**643**	**$107,862K**	

Predictive Losses

This plan employed a Hazus analysis for floods. For details on the Hazus methodology used and additional results reports, see Appendix G. Within the online interface, the user can toggle on the Building Exposure Cost risk map, to determine high general occupancy class and building exposure cost of each mapped structure.

4.4.4. Future Development and Vulnerability

Population change is perhaps the most significant indicator of changes in vulnerability and risk in the future. A rise or decrease in population not only impacts the level of risk (as to how many individuals could be affected), but also foreshadows development and land use changes for the County and its municipalities. Berkeley and Morgan County is expected to experience a variety of factors that will, in some areas, increase vulnerability to hazards while in other areas, vulnerability may be reduced.

Population change is perhaps the most significant indicator of changes in vulnerability in the future. As discussed in Section 2.3, the total population in the region is expected to increase. However, these changes are not equally distributed across each county either. Figure 2.4-1 demonstrates where Berkeley County anticipates and is encouraging future growth within the county. Development can often change the hazard threat level of an area by placing additional critical facilities, businesses, transportation networks, and populations within vulnerable areas. Any development along transportation routes can increase the vulnerability to transportation incidents and hazardous material spills. Most often, development occurs along these transportation networks because of access and increased demand for travel and access to services. Therefore, the impact of these hazards can increase along with their frequency. While it can be difficult to curb development, it is to the municipality's advantage to be aware of development trends in order to successfully mitigate future hazards as risks increase.

Lack of current zoning and development regulations or enforcement abilities allow future development to occur within the Special Flood Hazard Area in some municipalities and unincorporate areas; this suggests that there is potential for additional loss due to flooding in the future. Special Flood Hazard Area development regulations relate to the base flood elevation, which is the estimated level of flooding that has a 1-percent chance of being equaled or exceeded in any given year. Because Special Flood Hazard Area or floodplain development regulations specify that residential structures must be elevated to or above the base flood elevation and commercial structures must either be elevated or flood-proofed to or above this level, the degree to which future structures are exposed to flood damages should be minimal. However, calculations of base flood elevations are based on models that rely upon data about previous flood events; should future floods be greater than those experienced in the past, the base flood elevation may not provide sufficient protection.

Population projections are useful in determining if a given area's population trends will continue. The State of West Virginia produces County population projections to aid county comprehensive planning.

Projections developed for the region are shown in Table 4.4.4-1.

Table 4.4.4-1 Population Projections to 2035 (State of West Virginia, 2015)		
Data	Berkeley County	Morgan County
	Forecasted Population	Forecasted Population
2015	112,289	17,579
2020	120,240	17,611
2025	128,196	17,599
2030	136,015	17,459
2035	144,886	17,416

Roughly 34 percent of Berkeley County's population is over the age of 62, and fifty-two percent of Morgan County's population is over the age of 62. Older residents pose unique challenges when it comes to evacuation and/or mobility during the rescue and recovery processes that typically occur in the case of a hazard event. Officials may consider partnering with human services organizations to specifically plan for this vulnerable population.

The rural nature of the Morgan County and parts of Berkeley County impacts vulnerability because remote and sparsely populated regions also face higher vulnerability to certain hazards because they may not have as easy access to care facilities or response personnel. For example, tele-communications services (high-speed internet cell phone, and 9-1-1), are sparse and non-existent in some parts of Morgan County. These individuals may miss out on critical hazard information and warnings, as well as be unable to call for help. For instance, the less populated municipalities mainly in Morgan County, face increased vulnerability to winter storms due to isolation, access issues, and longer emergency response times.

The counties also each have a Subdivision Development Review Ordinance, and Berkeley County has three zoning ordinances for different areas. The subdivision ordinances include requirements for protecting sensitive areas including streams, sinkholes, springs, floodplain, severe slopes, and significant karst features. These ordinances are detailed in the Capability Assessment Section (5.2.1).

In 2018 the Hagerstown/Eastern Panhandle Metropolitan Planning Organization (HEPMPO) completed a Long-Range Transportation Plan Update (LRTP). The current LRTP was adopted April 11, 2018 (HEMPO, 2018). The integration of both plans will influence future development in the region and its concentrated plan for growth. Concentrating growth may help to reduce isolation-based vulnerability of communities with few access routes, no municipal water supply, and low cell phone reception. On the other hand, higher densities mean that more people are likely to be impacted in a

hazard event should it strike those more populated areas.

Both counties also have stormwater management plans that focuses on encouraging best management practices that help enforce environmentally sensitive development and encourage development that will limit runoff. Encouraging better development practices in relation to stormwater management could help make communities less vulnerable to the impacts of flooding. The Berkeley County 2016 Stormwater Ordinance specifically includes higher standards to meet requirements of CRS Class 7 Rating.

There is one significant development change in the region that has occurred in the last five years and is expected to continue – construction of warehouses and industrial parks. This development is expected to be one of the most influential variables in the region's future vulnerability and risk.

The expansion of industrial parks, mainly in Berkley County along I-81, can have cumulative and longer-lasting environmental impacts, some of which aren't fully known. As discussed in Section 2.4, this development is converting large amounts of land to impervious surface within the past five years. This significant amount of development affects flooding, transportation, hazardous waste spills, as well as water supply, and other environmental concerns.

When planning for future development, there are several measures the region could take to help mitigate the impacts of industrial parks on transportation infrastructure and impervious surfaces. If continued investment and development in the warehousing industry is inevitable, then how the counties regulate new park locations and the industry as whole will become important in shaping Berkeley and Morgan County's future vulnerabilities and risk, greater care and oversight could be taken to balance future warehouse development with watershed needs and conservation goals.

5. Capability Assessment

5.1. Update Process Summary

The purpose of the Capability Assessment is to identify strengths and weaknesses that will affect the ability of the counties and participating jurisdictions to implement mitigation actions. It is important to perform a mitigation capability assessment in order to develop a comprehensive and implementable mitigation strategy. Capabilities include a variety of regulations, existing planning mechanisms, and administrative capabilities provided through established agencies or authorities.

The Capability Assessment comprises a number of main components:

1. Document Review - an inventory of the county's existing planning and regulatory tools and a review and incorporation of existing plans and other technical information as appropriate;
2. Participation in the National Flood Insurance Program; and
3. Municipal Capability Assessment - an analysis of municipal capacity from a planning, policy,

staffing, training, outreach, and political standpoint.

Based on these components as well as the vulnerability analysis identified earlier in the plan, Berkeley and Morgan County can assess their current resources and begin to address the legal, regulatory, administrative, financial, and other capabilities which it currently has at its disposal to address the potential hazards which make the counties and its local municipalities vulnerable.

Through the planning process, this HMP has attempted to identify the presence of local plans, ordinances, and codes in each municipality and specify local, state, and federal resources available for mitigation efforts. This update hopes to provide an inventory of the most critical local planning tools available within each county and municipality and a summary of the fiscal and technical capabilities available through programs and organizations outside of the region. It also identifies emergency management capabilities and the processes used for implementation of the NFIP.

The Capability Assessment Survey was provided in both hard copy (at meetings) and electronic format (via e-mail and the project website) to each municipality.

The capability assessment is a good tool to identify local capabilities and to recognize gaps and weaknesses that can be addressed through future mitigation actions. The results of the capability assessment provide useful information for developing an effective mitigation strategy.

Additionally, a number of documents have been reviewed as part of this Plan Update. While some reviews have been derived from the 2012 and 2017 Plans and updated where applicable, additional documents have been identified and reviewed for purposes of integration into other local planning mechanisms. Several plans and ordinances at the county and municipal level have been reviewed and a summary with options to integrate the data, information, and hazard mitigation goals and actions into other planning mechanisms are included.

The Mitigation Strategy, including the goals and actions, is incorporated into relevant planning mechanisms based on their pertinence and relevance to specific plans and ordinances. For example, all structural projects should be included in the Capital Improvements Program. Land use and zoning related projects should be incorporated into the next update of the Community's Comprehensive Plan and Zoning Ordinance though collaboration with the Planning and Zoning departments. Likewise, information from relevant planning documents was used to inform and update the Hazard Mitigation Plan. A general list of relevant plans and documents and corresponding areas for incorporation are listed below:

5.2. Capability Assessment Findings

A capability assessment involves an evaluation of each county in regard to its governmental structure, political framework, legal jurisdiction, fiscal status, policies and programs, regulations and ordinances and resource availability. These factors are evaluated with respect to their strengths and weaknesses

in preparing for, responding to, and mitigating the effects of the profiled natural hazards. By doing so, reasonable conclusions can be drawn regarding the relative appropriateness of various hazard mitigation action items that may be identified as part of the hazard mitigation strategy. As such, the capability assessment plays an important role in the hazard mitigation planning process.

No capability assessment would be complete without considering the constituent municipalities either. Local municipalities have their own governing body, enforce their own rules and regulations, purchase their own equipment, maintain their own infrastructure, and manage their own resources. In many ways, the county is only as good as the capabilities of its constituent municipalities. As such, this capability assessment does not consider either county as a lone entity but evaluates it in light of the various characteristics and differences of and between their constituent municipalities.

5.2.1. Planning and Regulatory Capability

There are numerous existing regulatory and planning mechanisms in place at the state, county, regional, and municipal level of government which support hazard mitigation planning efforts. These tools include the West Virginia Statewide Standard All-Hazard Mitigation Plan, floodplain and stormwater management ordinances, source water protection plans, the Berkeley and Morgan County Comprehensive Plans, building codes, Emergency Operation Plans, zoning ordinances and subdivision and land development ordinances. These mechanisms were discussed at community meetings and are described in Section 5.2. Information from several of these documents has been incorporated into this plan and mitigation actions have been developed to further integrate these planning mechanisms into the hazard mitigation planning process. These planning mechanisms are tools that can be used to implement adopted mitigation strategies. The subsections below provide details about how these tools are implemented in Berkeley and Morgan County, followed by a comprehensive look at which municipalities have adopted these tools.

State of West Virginia Document Review

- The 2018 Update of the **West Virginia Statewide Standard Hazard Mitigation Plan** goals and objectives that are applicable to this Multi-Jurisdictional Plan update include:
    - Identify and implement projects that will reduce or eliminate long-term risk, directly reduce impacts from hazards, and maintain critical societal functions. This includes reducing flood risk to repetitive loss and severe repetitive loss properties.
    - Incorporate mitigation concepts and objectives into existing and future policies, plans, regulations, and laws in the State.
    - Promote and support a whole community approach to awareness of hazards, their risk, and potential mitigation actions to increase resiliency.

Hazard identification and risk assessment data for Berkeley and Morgan County has been incorporated into the appropriate sections of this Plan update from the 2018 WV Statewide

Standard Hazard Mitigation Plan.

- The **West Virginia State Building Code (WVSBC)** is a statewide building code that took effect in West Virginia in 1990. Local governments are not required to enforce the WVSBC. However, no other code provisions pertaining to building construction, repair, or maintenance may be enforced in West Virginia. The code:
    - Provides uniformity and compliance with minimum standards of building construction and property maintenance;
    - Helps ensure the construction of safe buildings, protecting lives and personal property;
    - Utilizes proven industry standards, including new technologies and commonly accepted construction practices and materials.
- The **West Virginia Statewide Flood Protection Plan (2005)** was developed with both short and long-term goals, strategies, and implementation schedules for flood management. Specific goals include:
    - Reduce the unnecessary loss of lives due to flooding;
    - Reduce private and public property damage;
    - Develop technical and legislative tools that will reduce excessive runoff from land conversion activities;
    - Promote technical and legislative tools that will reduce excessive runoff from land conversion activities;
    - Reduce personal and economic loss due to flooding while supporting state economic growth; and
    - Protect the state's waterways and floodplain environments.

Regional/County Document Review

Comprehensive Plans

- 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. Chapter 8A of the West Virginia Code establishes the scope and requirements of community comprehensive plans. A comprehensive plan is required if a governing body wants to enact a zoning ordinance, enact a subdivision and land development ordinance, require plans and plats for land development, or issue improvement location permits for construction.
- With regard to hazard mitigation planning, Section §8A-3-4 of the West Virginia Code requires comprehensive plans to include a plan for future land use, which, among other provisions, suggests that the Plan give consideration to flood-prone and subsidence areas during development. The code also requires comprehensive plans to include a plan for community

facilities and services and recommends considering storm drainage and floodplain management.

- Existing Comprehensive Plans that were reviewed and included in this Update are the Berkeley County Comprehensive Plan Update (2016), Martinsburg, West Virginia Comprehensive Plan (2018), Morgan County Comprehensive Plan (2017), and Town of Bath, West Virginia Comprehensive Plan (2017)
- These plans serve as the official policy guide for influencing the location, type, and extent of future development by establishing the basis for decision-making and review processes on zoning matters, subdivision and land development, land uses, public facilities, natural resource protection, cultural resources, and housing needs over time.

Zoning Ordinances

- Zoning ordinances allow for local communities to regulate the use of land in order to protect the interested and safety of the general public. Zoning ordinances can be designed to address unique conditions or concerns within a given community. They may be used to create buffers between structures and high-risk areas, limit the type or density of development, and/or require land development to consider specific hazard vulnerabilities. Zoning ordinances contain both a map that delineates zoning districts and text documenting the regulations that apply in each zoning district.
- The Berkeley County Planning Commission and Berkeley County Council administer three zoning ordinances: Airport Height, Sound, and Runway Protection Zoning Ordinance (2020), Tuscarora Community Zoning Ordinance (1975), and Windewald Neighborhood Zoning Ordinance (1975)
- Martinsburg adopted their own zoning ordinance, which is in review for a rewrite during the drafting of this Plan (2021).
- There are no existing zoning ordinances for Morgan County.

Building Codes

- Building codes are important in mitigation, because codes are developed for regions of the Country in consideration of the hazards present within that region. Consequently, structures that are built to applicable codes are inherently resistant to many hazards such as strong winds, floods, and earthquakes, and can help mitigate regional hazards like wildfires. In 1990, West Virginia Adopted the WV State Building Code. The code is not required for adoption, but protects the public health and promotes the safety, protection, and sanitation of new and existing buildings and structures. It also protects financial investments and property values; if construction does not comply with current recommended codes the structure may be at greater risk for damage and loss.
- Berkeley County has adopted the International Building Code, a model building code used widely throughout the United States. Berkeley County has also adopted a Building Code

Ordinance, enforced by the Engineering and Permits Department. Any time a structure is proposed in a hazardous area, a review is completed by the engineering and building inspections team, which normally entails added engineering practices and then reviewed against adopted code/ordinance. Martinsburg and Hedgesville recognize the International Building Code as well. Morgan County does not have a building code or do building inspections. However, the county does conduct inspections in floodplains to comply with NFIP.

Floodplain Management Ordinances

- Through administration of floodplain ordinances, municipalities can ensure that all new construction or substantial improvements to existing structures located in the floodplain are flood-proofed, dry-proofed, or built above anticipated flood elevations. Floodplain ordinances may also prohibit development in certain areas altogether. The NFIP establishes minimum ordinance requirements which must be met in order for that community to participate in the program. However, a community is permitted and in fact, encouraged, to adopt standards which exceed NFIP requirements.
- Through participation in the NFIP, Berkeley County, Morgan County, Martinsburg, the Town of Bath (Berkeley Springs), and Paw Paw have floodplain regulations. Hedgesville does not participate in the NFIP and does not have a floodplain management ordinance.
- Berkeley County's floodplain ordinance, "Berkeley County Floodplain Ordinance," was adopted in July 2009, around the same time the FIRM became effective for the county. It is administered by the Planning Director, who is responsible for tracking Letters of Map Changes. The floodplain administrator, or designee within the planning department, also evaluates all proposed development for compliance with the floodplain ordinance. All building permits for structures within the floodplain are evaluated to determine if the proposed construction qualifies as substantially improved by comparing the value of the proposed construction to the assessed value of the structure. If the proposed construction value has the potential to reach 50% of the assessed value, a more detailed estimate for construction costs is requested. The floodplain administrator, or designee, also reviews all floodplain complaints regarding potential violations for compliance with the floodplain ordinance. If a violation is detected, the property owner is sent a letter with instructions on the steps necessary to remedy the violation. To date, there have been no corrective actions to be completed.
- Morgan County's most recent floodplain ordinance, "Flood Plain Area and Improvement Permit Ordinance", was adopted in March 2009, around the same time the FIRM became effective for the county. It is administered by the Planning Director who is responsible for tracking Letters of Map Changes and accepting map updates. The county provides floodplain certificates, conducts inspections and reviews, and enforces penalties through the floodplain ordinance. The NFIP worksheet for Morgan County indicated that the county has had a Community Assistance Visit and needs to address missing elevation certificates. The county is

working with the WV GIS Technical Center and other GIS sources to compile a comprehensive database of elevation certificates.

    - Morgan County is also responsible for the administration of the Town of Paw Paw's floodplain management and NFIP program.

- The City of Martinsburg most recent floodplain ordinance, Ordinance 2009-06 City of Martinsburg Floodplain Ordinance", was adopted in June 2009, around the same time the FIRM became effective for the county. It is administered by the Certified Floodplain Manager, who is located in the Planning Department. Services offered include site visits and recommendations for: retrofitting, drainage improvements, flood proofing, elevation, additions, demolition, relocation, stream/creek maintenance, and mitigation options. Certified Floodplain Managers are also available to provide information regarding building code, maps, historical data, basic insurance information, financial assistance advice, and City of Martinsburg Flood Map Availability. The city also has the ability to enact penalties through the floodplain ordinance.
- Chapter 38: Flood Prevention of The Code of the Town of Bath, West Virginia works as the town's floodplain ordinance. The municipal code was adopted in January 2009. The town currently lacks administrative and finical resources to administer the floodplain ordinance. Based on the NFIP worksheet returned form the town, they do not currently have a floodplain manager and do not enforce the floodplain ordinance. The municipality also does not currently have a permit process for structures in the SFHA. Much of the administrative and finical burden thus falls on Morgan County to administer the floodplain regulations and the NFIP.
- The WV Flood Tool is the primary source for updated data and modeling for all jurisdictions. The Advisory Flood Heights available in the expert layer on this tool are used to provide information to property owners regarding best practices for existing structures, new building permits and new subdivisions.

Subdivision and Land Development Ordinances

- West Virginia Code Section §8A-4 outlines guidance for creation and enactment of subdivision and land development ordinance (SALDOs). Relating to hazard mitigation, the Code states SALDOs must include standards for flood-prone and subsidence areas and standards for setback requirements, lot sizes, streets, sidewalks, walkways, parking, easements, rights-of-way, drainage, utilities, infrastructure, curbs, gutters, streetlights, fire hydrants, storm water management and water and wastewater facilities.
- Subdivision and land development ordinances (SALDOs) are intended to regulate the development of housing, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Within these ordinances, guidelines on how land will be divided, the placement and size of roads and the location of infrastructure can reduce exposure of development to hazard events

- Berkeley County, Martinsburg, and Hedgesville have adopted SALDOs, and Morgan County has adopted a subdivision ordinance. Ordinances include requirements for protecting sensitive areas including streams, sinkholes, springs, floodplain, severe slopes, and significant karst features.

Emergency Management

- An Emergency Operations Plan (EOP) is a document upon which the disaster operations of a county are formulated. It is concerned with all types of emergency situations and how they may develop, be prevented, and resolved. Consequently, these plans also account for activities before, during and after emergency operations. Both Berkeley County and Morgan County have EOPs in place.
- One part of Morgan County's emergency planning includes an emergency mass notification system launched in 2016. Once residents opt into the program, the system will notify residents living in areas impacted by a hazard and provide them with urgent alerts and information. It can send alerts via home phone, cell phone, email, text message, or smartphone application. The Morgan County OES has also begun an initiative where it is encouraging local businesses to construct emergency business plans and submit them to the county. The county OES will then incorporate these plans into its emergency planning and increase the synergy between the county and local business during an emergency.

Drinking Water

- Public water suppliers are required by the State of West Virginia to develop Source Water Protection Plans in order to identify possible sources of contamination and develop mitigation measures.
- Berkeley County Public Service Water District has developed plans for its water distribution plants, and Morgan County suppliers are in the process of developing these plans. The WV Department of Health and Humans Resources conducted Source Water Assessments of water supplier to identify sources of contamination also. Additionally, Berkeley County Public Service Water District has a Drought Contingency Plan in place to document mitigation measures that will be taken during a drought. Martinsburg has adopted a Water Distribution Backflow Prevention Ordinance.

Stormwater Management

- The proper management of stormwater runoff can improve conditions and decrease the chance of flooding. Proper stormwater management planning results in sound engineering standards and criteria being incorporated into local codes and ordinances to manage stormwater runoff from new development in a coordinated, watershed-wide approach. Without such planning, stormwater is either not controlled by municipal or county ordinances

or is addressed on a site-to-site or municipal boundary basis. Municipalities within the same watershed may require different levels of control of stormwater. The result is often the total disregard of downstream impacts or the compounding of existing flooding problems. Stormwater management plans are adopted in order to mitigate potential negative impacts from future land uses, improve the condition of impaired waterways, and address flooding associated with stormwater runoff. Berkeley County, Morgan County, and Martinsburg all have stormwater management ordinances or regulations.

Other Plans

Numerous other plans and organizations are also in place at the municipal and county level for topics such as economic development, snow removal, and green infrastructure. These types of plans can be implemented, amended, or repurposed to target hazard mitigation as well.

Table 5.2.1-1 is an overview of local plans and regulations including updates collected during the 2022 HMP process.

5.2.1-1 Summary of Major Plans and Regulations in Region 9

Community	COMPREHENSIVE LAND USE PLAN	NFIP/FP REGULATIONS	SUBDIVISION REGULATIONS	ZONING REGULATIONS	STORMWATER MANAGEMENT PLAN AND ORDINANCE	BUILDING CODE ORDINANCE
Berkeley County	✓	✓	✓	✓	✓	✓
Martinsburg	✓	✓	✓	✓	✓	✓
Hedgesville	-	-[1]	-	-	-	✓
Morgan County	✓	✓	✓	-[2]	✓	✓
Bath (Berkeley Springs)	✓	✓	✓[3]	-	✓[3]	✓[3]
Paw Paw	-	✓	-[4]	✓	✓	-[4]

[1]The community does not participate in the NFIP.
[2] Individual jurisdictions may have their own zoning regulations; however, Morgan County lacks the administrative capability to enforce a zoning ordinance.
[3] Included within the town's Municipal Code.
[4]Due to the size of the town, Paw Paw generally lacks the administrative and financial capability to create and enforce these documents.

Participation in the National Flood Insurance Program (NFIP)

Both counties, the Town of Bath (Berkeley Springs), the Town of Paw Paw, and the City of Martinsburg are participants in the NFIP. The Town of Hedgesville does not participate in the NFIP, as they are

located within the low-risk flood zone, Zone X. The Town of Hedgesville is still encouraged to join the NFIP, with support from Region 9 and Berkeley County available. Community participation in the NFIP allows for property owners to obtain flood insurance. Flood insurance provides a means for homeowners, renters and business owners to financially protect themselves. This capability greatly improves resilience after a flood hazard event by allowing residents to repair and rebuild. Table 5.2.1-1 provides details about the participation of Berkeley and Morgan County and their municipalities in the NFIP and the number of flood insurance policies and coverage that exist.

Table 5.2.1-2 Berkeley and Morgan County NFIP Claims Information (FEMA CIS, 2021)

Community	Prior Claims	Total Amount of Paid Claims
Berkeley County	377	$5,517,937
Martinsburg	34	$680,792
Hedgesville	Does not Participate in NFIP	
Morgan County	199	$2,864,757
Bath (Berkeley Springs)	24	$397,983
Paw Paw	6	$79,550
Total for Both Counties	**640**	**$9,541,019**

For a community to participate in the NFIP, it must adopt and enforce floodplain management regulations that meet or exceed the minimum NFIP standards and requirements. These standards are intended to prevent loss of life and property, as well as economic and social hardships that result from flooding. Once FEMA provides communities with flood hazard information upon which floodplain management regulations are based, the community is required to adopt a floodplain ordinance that meets or exceeds the minimum NFIP requirements. All NFIP participating communities in the region have either adopted a stand-alone ordinance or have arranged for county administration of floodplain regulations.

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 damage 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 CRS in the NFIP and 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 CRS, 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:

- Reduce flood losses
- Reduce damage to property
- Protect public health and safety
- Prevent increases in flood damage from new construction
- Reduce the risk of erosion damage
- Protect natural and beneficial floodplain functions
- Facilitate accurate insurance rating
- Promote the awareness of flood insurance

There are 10 CRS classes that provide varied reduction in insurance premiums for property owners in both the SFHA and non-SFHA. 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 percent for Class 9 communities up to 45 percent for Class 1 communities. The CRS recognizes 19 creditable activities that are organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness.

There are a few existing limitations to flood mitigation in Berkeley and Morgan County. Management and coordination of the program mostly occurs at the county level. The City of Martinsburg is the only municipality independently rated under the CRS among these HMP participants (CRS Class 8). Morgan County (Class 9) and Berkeley County (Class 7) also both participate in the CRS. Greater municipal action could allow flood mitigation efforts to better address specific local flooding issues. Hedgesville does not participate in the program because the entire community is within a single low risk flood zone, Zone X. This leaves Hedgesville residents without the ability to purchase flood insurance through the NFIP and with fewer flood mitigation resources. Additionally, older residents of both counties may be less likely to have flood insurance, as many tend to drop their NFIP coverage once they have paid off their mortgage.

5.2.2. Administrative and Technical Capability

Administrative capability is described by an adequacy of departmental and personnel resources for the implementation of mitigation-related activities. Technical capability relates to an adequacy of knowledge and technical expertise of local government employees or the ability to contract outside resources for this expertise in order to effectively execute mitigation activities. Common examples of skill sets and technical personnel needed for hazard mitigation include: planners with knowledge of land development/ management practices, engineers or professionals trained in construction

practices related to buildings and/or infrastructure (e.g. building inspectors), planners or engineers with an understanding of natural and/or human caused hazards, emergency managers, floodplain managers, land surveyors, scientists familiar with hazards in the community, staff with the education or expertise to assess community vulnerability to hazards, personnel skilled in geographic information systems, resource development staff or grant writers, and fiscal staff to handle complex grant application processes.

It should be noted municipalities in Berkeley and Morgan County tend to have limited administrative and technical staff needed to conduct hazard mitigation-activities, except for Martinsburg. Paw Paw, Bath, and Hedgesville all have under 1,000 residents, so correspondingly have few paid staff and a limited supply of available resources compared to municipalities like Martinsburg, which have higher populations, a larger tax base, and more resources. However, each municipality carries out its own daily operations and provides various community services according to their local needs and limitations. Administrative capabilities in Berkeley and Morgan County include:

- **Berkeley County Development Authority** and **Morgan County Development Authority** help to plan, implement & coordinate development activities in a structured way.

- **Engineers** perform 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 reviews and/or prepares plans, specifications, and estimates of the work undertaken within the jurisdiction. The Berkeley County Engineering and Building Inspections Office reported that they employee thirteen people dedicated to the enforcement of code/ordinances, from permits to plan reviews, and inspections. These employees address hazardous impacts through adopted building code/ordinance, storm water ordinance, and MS4 compliance.

  When staff who are responsible for community planning or engineering the structures on which people rely are familiar with the hazards that can impact the community, there is a great potential for synergy. These staff members will design the communities and structures with hazard impacts in mind, resulting in more sustainable communities and stronger structures. Berkeley County, Morgan County, and the City of Martinsburg reported having an engineering resource.

- **Floodplain Administrators (FPAs)** are experts in the rules and regulations of development in a floodplain and can provide vast amounts of information on the risks and impacts of building within those hazard areas. They are an integral part of the mitigation planning team and can make recommendations based on the needs and conditions of the community. All municipalities except Hedgesville participate in the NFIP and have a designated FPA. In some municipalities floodplain management duties are a component of a current job rather than a separate position. For Berkeley or Morgan County, it is not out of the ordinary for a municipal

official to hold more than one title. Those municipalities that noted having a Floodplain Administrator often listed their planning department or City Engineer as responsible.

- **Berkeley County Office of Emergency Management** and **Morgan County Office of Emergency Management** coordinates countywide emergency management efforts. They are responsible for managing activities that aim to reduce the loss and lives and property and protect the environment from the effects of natural or man-made disasters, catastrophes, or terrorist threats through prevention, mitigation, preparedness, response and recovery efforts. The OEM also contains a **Local Emergency Planning Committee (LEPC),** which is a county level planning committee that is responsible for the development and distribution of the chemical emergency preparedness and response plan, to provide training and assist emergency responders, other agencies and organizations with their training programs, for development of a public education program, and to develop and implement a compliance and enforcement program for the district.

- **The Morgan County GIS Office** performs mapping and spatial database maintenance work for various county departments including, E-911 Communications, Office of Emergency Services, Planning and Addressing. They are responsible for updating the Morgan County portion of the State of WV Mapping and Addressing Website with all current feature class data as required by State Code.
- **Berkeley County Planning Commission** and **Morgan County Planning Commission** act as advisory groups to the municipal governing body on issues and policies related to planning, land use regulation, and community development, and other duties as outlined in the West Virginia Code Chapter 8A Article 2.

- The **City of Martinsburg Planning and Zoning Department** is responsible for administering the City's Comprehensive Plan, Stormwater Ordinance, Zoning Ordinance and Subdivision Ordinance.

- Transportation planning in Berkeley County is conducted through the **Hagerstown/Eastern Panhandle Metropolitan Planning Organization** (HEPMPO). One of the primary roles and responsibilities of the HEMPO is the develop and update the Long-Range Transportation Plan, as mandated by federal transportation authorization legislation.

- **Berkeley County Department of Emergency Communications** serves residents and businesses across the region with various types of emergency and non-emergency situations. This office act as the primary contact for those needing police, ambulance, or fire assistance**.**

- **Eastern Panhandle Conservation District** provides local assistance to individuals and organizations that interact with the region's natural resources. Their mission is to work collectively to sustain and improve natural resources in the Eastern Panhandle

- There are a number of **watershed associations** and other water related institutions in the region:
    - Warm Springs Watershed Association
    - Elks Run Watershed Group
    - Cacapon Institute
    - The Mountain Institute
    - Sleepy Creek Watershed Association
    - Friends of Cacapon River

- Berkeley County also houses Hazmat 90, a West Virginia Regional Response Team truck and that provides service to Region III that consists of Berkeley, Jefferson, Morgan, Hampshire, Hardy, Mineral and Grant Counties. This apparatus contains various types of emergency response, safety, testing and containment equipment to be utilized in the event of a hazardous material spill response, seen in Figure 5.2.2-1.

Figure 5.2.2-1: Hazmat 90 located in Berkeley County, WV

In addition to the institutional capability of the municipal government structure described above, each county itself can engage in mitigation activities. Berkeley and Morgan County have their own staff, resources, budget, and objectives, which may or may not be similar to those of its constituent municipalities. Therefore, each county has its own capabilities to mitigate the profiled hazards and can coordinate local mitigation efforts.

Finally, regional organizations can enhance Berkeley and Morgan County's mitigation capabilities. Region 9 encompasses both Berkeley and Morgan County and provides a variety of planning and project management services and can assist counties and municipalities in planning or implementation of mitigation projects.

Other local organizations that could act as partners for future mitigation activities include local business development organizations such as the Chamber of Commerce, and historical or cultural societies and agencies. Table 5.2.3-1 provides a summary of administrative capabilities within each jurisdiction.

Table 5.2.2-1 Summary of Administrative Capabilities in Region 9					
Community	ENGINEERING	PLANNING COMMISSION/PLANNING DEPARTMENT	FLOODPLAIN MANAGER	GRANT ADMINISTRATOR	CODE ENFORCEMENT
Berkeley County	✓	✓	✓	✓	✓
Martinsburg	✓	✓	✓	✓	✓
Hedgesville	-*	✓	-[1]	✓	-[4]
Morgan County	✓	✓	✓	✓	✓
Bath (Berkeley Springs)	-*	✓	-[2]	✓	-[5]
Paw Paw	-*	✓	-[3]	✓	-[6]

*The municipality outsources this technical capability to consultants or relies on the county
[1] Does not participate in NFIP.
[2] Agreement in place with Morgan County Planning Commission to provide floodplain management.
[3] Agreement in place with Morgan County Planning Commission to provide floodplain management.
[4] The Town of Hedgesville has a building ordinance; however, they do not currently have the administrative capability to enforce penalties.
[5] The Town of Bath includes building regulations within their Municipal Code; however, they do not currently have the administrative capability to enforce penalties.
[6] The Town of Paw Paw does not have a building code ordinance.

State agencies agency which can provide technical assistance for mitigation activities include, but are not limited:

- West Virginia Department of Health and Human Resources;
- West Virginia Department of Agriculture
- West Virginia Division of Natural Resources
- West Virginia Geological and Economic Survey
- West Virginia Emergency Management Division
- Environmental Protection; and
- West Virginia Department of Transportation.

The region can also partner with Federal agencies for technical assistance on mitigation activities. These agencies include but are not limited to:

- Army Corp of Engineers;
- Department of Housing and Urban Development (HUD);
- Department of Agriculture (DOA);

- Economic Development Administration;
- Emergency Management Institute (EMI);
- Environmental Protect Agency (EPA);
- Federal Emergency Management Agency (FEMA); and
- Small Business Administration.

5.2.3. Financial Capability

In general, the more financial resources a municipality has, the more technically capable it will be from a resource availability perspective. This is not necessarily the case, however when analyzing technical capability from a knowledge/skill level perspective. As such, technical capability must be analyzed by each municipality prior to implementing any hazard mitigation activity. It is important to note; however, that much like fiscal capability, shortfalls in technical capability may be overcome by cooperative arrangements, coordinated efforts, and/or resource efficiency.

Financial capability is important to the implementation of hazard mitigation activities. Every jurisdiction must operate within the constraints of limited financial resources. During the 1960s and 1970s, state and federal grants-in-aid were available to finance many programs, including street improvements, water and sewer facilities, airports, and 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, resulting in the need to identify alternate means to augment revenue. After the COVID-19 pandemic, communities across the country will face new challenges in balancing community economic recovery while also implementing hazard mitigation.

Financial status is not the only factor in determining hazard mitigation capability. There are also numerous partnering opportunities and grant programs available to assist in offsetting the expenses of local hazard mitigation efforts. While some mitigation actions are less costly than others, it is important that money is available locally to implement policies and projects. Financial resources are particularly important if communities are trying to take advantage of state or federal mitigation grant funding opportunities that require local-match contributions. Based on the assessment results received, most municipalities within the County perceive fiscal capability to be limited; however, several communities listed their capability to be moderate.

Capital Improvement Program

The most common fiscal tool available to communities is the Capital Improvement Program (CIP). A CIP is a community planning and fiscal management tool used to coordinate the timing and financing of capital improvements over a multi-year period. A CIP includes a prioritized list of improvements to roads, parks, and other facilities that the community plans to undertake in a given period. The City of Martinsburg was the only jurisdiction noted having a CIP in place in the capability assessments.

Community Development Block Grants

Morgan and Berkeley County are also eligible for Community Development Block Grant (CDBG) funding from the US Department of Housing and Urban Development (HUD). The program is designed to assist vulnerable populations within the community by ensuring affordable housing, creating jobs, and providing direct services. The amount of each grant is determined by a formula that accounts for the community's need, poverty, population, housing, and comparison to other areas. The annual appropriation is divided among the states and local jurisdictions (referred to as "non-entitlement communities" and "entitlement communities"). The majority of CDBG funds are required to be spent to benefit low- and moderate-income citizens. The City of Martinsburg and Morgan County specifically noted they are responsible for coordinating HUD funding.

Water and Sewer Authority Fees

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 a 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 constructing 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 directly operated by municipal governments and by privately owned public utilities regulated by the Public Service Commission of West Virginia.

Sewer authorities include multipurpose authorities with sewer projects. The authorities issue bonds to finance acquisition of existing systems or to finance construction, extension, and improvements. 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 the imposition of liens against real estate.

State programs which may provide financial support for mitigation activities include, but are not limited to:

- WV DOC Land & Water Conservation Fund
- WV DEP Abandoned Mine Lands & Reclamation Program
- WV DEP Watershed Project Grants/Nonpoint Source Projects
- WV DEP Rehabilitation Environmental Action Plan (REAP) Grants
- WV DOT Transportation Alternatives Program
- WV DOH Recreational Trails Fund Program
- WV DOF Municipal Tree Restoration Program
- WV DOF Mountaineer Treeways Program
- WV NRCS Conservation Technical Assistance
- WVDO Community Participation Program
- Center for Rural Health Development – WV Rural Health Infrastructure Loan Program

Federal programs which may provide financial support for mitigation activities include, but are not limited to:

- The Building Resilient Infrastructure and Communities (BRIC) Program is a new funding program that will support states, local communities, tribes, and territories undertake hazard mitigation projects. BRIC is replacing the existing Pre-Disaster Mitigation (PDM) program that was previously housed under HMA programs.
- Department of Commerce (DOC)/Economic Development Authority (EDA) Construction Grant Program
- Department of Energy Weatherization Assistance Program
- Department of Homeland Security Grant Program (HSGP)
- Department of Transportation/Federal Highway Administration Emergency Relief Program
- DOC/EDA Planning Grants
- DOC/EDA Revolving Loan Fund
- DOC/EDA Technical Assistance Grants
- FEMA Community Assistance Program – State Support Services Element (CAP-SSSE)
- FEMA Community Disaster Loan Program
- FEMA Community Rating System
- FEMA Emergency Management Performance Grants (EMPG)
- FEMA Environmental Planning and Historic Preservation Program (EHP)
- FEMA Flood Mitigation Assistance Program
- FEMA Hazard Mitigation Grant Program (HMGP)
- FEMA Individuals and Households Program (IHAP)
- FEMA National Dam Safety Program
- FEMA National Flood Insurance Program
- FEMA Pre-Disaster Mitigation Program
- FEMA Public Assistance Program (PA)
- FEMA Regional Catastrophic Preparedness Grant Program
- FEMA Severe Repetitive Loss Grant Program
- Housing and Urban Development (HUD) 5-H Homeownership Program
- HUD Community Development Block Grants (CDBG)
- HUD Community Development Block Grant Disaster Recovery Program (CDBG-DR)
- HUD Disaster Housing Assistance Program
- HUD/Federal Housing Administration (FHA) Title 1 Home Repair Loan Program
- HUD/FHA Section 203(h) Mortgage Insurance for Disaster Victims
- HUD/FHA Section 203(k) Rehabilitation Mortgage Insurance Program
- HUD Partnership for Advancing Technology in Housing
- HUD Section 108 Loan Guarantee Programs
- Internal Revenue Service Casualty Loss-Special Disaster Provisions
- National Oceanic and Atmosphere Administration (NOAA) StormReady Program
- Natural Resources Conservation Service (NRCS) easement programs
- Small Business Administration Disaster Loan Programs

- United States Army Corps of Engineers (USACE) General Investigation (GI)
- USACE Continuing Authorities Program
- USACE Flood Plain Management Services Program (FPMS)
- USACE Inspection of Completed Works Program (ICW)
- USACE Planning Assistance to States
- USACE Rehabilitation and Inspection Program (RIP)
- United States Department of Agriculture (USDA)/Farm Service Agency (FSA) Emergency Conservation Program
- USDA Emergency Conservation Program
- USDA/FSA Emergency Farm Loans
- USDA Non-insured Crop Disaster Assistance Program (NAP)
- USDA/NRCS Emergency Watershed Protection Program
- USDA Repair and Rehabilitation Loan
- USDA/Rural Housing Service (RHS) Community Facilities Loans and Grants
- USDA/RHS Rural Rental Loans
- USDA/RHS Section 502 Single-Family Housing Direct and Guaranteed Loans
- USDA/RHS Section 504 Repair Loans and Grants
- USDA/RHS Self-Help Housing Loans
- USDA/Risk Management Agency Federal Multi-Peril Crop Insurance
- USDA/Rural Business Service Business and Industrial Loans
- USDA Watershed Protection and Flood Prevention Program
- USDOT Pipeline and Hazardous Materials Safety Administration (PHMSA) Hazardous Materials Grant Program

Many of most significant mitigation grants are processed through the WVEMD, including:

- Emergency Management Performance Grants (EMPG)
- Hazardous Materials Emergency Planning (HMEP) Grants
- Severe Repetitive Loss Program
- Repetitive Flood Claims (RFC)
- Recovery Grants including Hazard Mitigation, Public Assistance (PA), and Flood Mitigation Assistance (FMA) Program
- Statewide Local Implementation Grant (SLIGP)
- Community Assistance Program State Support Services Element (CAPSSE)
- Cooperating Technical Partners (CTP)

Chesapeake Bay funding initiatives may be applicable to fund some types of water protection mitigation actions as well.

5.2.4. Education and Outreach

Education and outreach programs and methods are used to implement mitigation activities and communicate hazard-related information. Berkeley and Morgan County may benefit from greater involvement in educational programs such as fire safety programs that fire departments deliver to

students at local schools, participation in community programs, such as Firewise USA® or StormReady®, and activities conducted as part of hazard awareness campaigns, such as Tornado or Flood Awareness Month.

Firewise USA® Program

The National Fire Protection Association (NFPA) administers the Firewise USA® Program to encourage local solutions for safety by involving homeowners in taking individual responsibility for preparing their homes from the risk of wildfire. The program provides resources to help homeowners learn how to adapt to living with wildfire and encourages neighbors to work together to take action to prevent losses. The national Firewise USA® Recognition Program has nearly 1,000 active member communities in 40 states, as well as a participation retention rate of 80 percent over the past decade. The program, aimed at homeowners, provides specific criteria for communities regarding wildfire preparedness, and offers national recognition for their work.

StormReady®

StormReady® is an education and outreach program that helps arm communities with the communication and safety skills needed to save lives and property before, during, and after an event. Morgan County Indicated they participate in WV StormReady.

NOAA Weather-Ready Nation (WRMN) Ambassador

NOAA WRMN Ambassador is a designation which recognizes NOAA partners that are improving resilience against extreme weather events. Partners help unify efforts across government, non-profits, academia, and private industry toward making the community and the nation more ready. According to NOAA, Ambassadors:

- Promote Weather-Ready Nation messages and themes to their stakeholders;
- Engage with NOAA personnel on potential collaboration opportunities;
- Share their success stories of preparedness and resiliency; and
- Serve as an example by educating employees on workplace preparedness.

NOAA supports Ambassadors by:

- Providing outreach content about creating a Weather-Ready Nation;
- Exploring innovative approaches for collaboration; and
- Assisting with StormReady/TsunamiReady opportunities.

Farmland Preservation

Farmland preservation measures are important to hazard mitigation. Preserved farms protect soil from erosion and prevent the contamination of local surface water. In addition, farms and forest

land are important for recharging the community's aquifer and providing habitat for local wildlife. Both Berkeley and Morgan County have Farmland Protection Programs.

West Virginia Parcel Viewer

This program allows users to map parcel, floodplain, E-911 addresses, and zoning information among other things, from the State website at https://www.mapwv.gov/parcel/.

The WV Flood Tool, https://www.mapwv.gov/flood/map/, is a tool available for more in-depth information related to flooding and landslide susceptibility. This is a helpful tool for the State's residents to assess their level of flood risk more accurately.

5.2.5. Plan Integration

Plan integration recognizes that hazard mitigation is most effective when it works in concert with other plans, regulations, and programs. Per FEMA, plan integration is described as the regular consideration and management of hazard risks in a community's existing planning framework. Plan integration is the process by which communities critically analyze their existing planning framework and align efforts to build a safer, smarter community. Plan integration involves a two-way exchange of information and incorporation of ideas and concepts between hazard mitigation plans (state and local) and other community plans. Specifically, plan integration involves the incorporation of hazard mitigation principles and actions into community plans and community planning mechanisms into hazard mitigation plans (FEMA, 2015).

When updating the HMP, County Comprehensive Plans, Multi-Municipal Plans, EOPs, and various land use ordinances and regulations provided key information. These documents are referenced where appropriate throughout the plan. Moving forward, each of these documents should not be treated as unrelated and updated separately. The county and each participating municipality are responsible for incorporating the specific mitigation actions recommended in this Plan into the necessary planning documents, including the appropriate comprehensive plan, the County EOP, and any land use ordinances and regulations.

For example, zoning and other land use regulations can be amended to reflect the newly identified hazard areas, to ensure that development in those areas is minimized or at least conducted in a way that otherwise mitigates against the effects of hazards (e.g., requiring structures built in the floodplain to be elevated). As proposed changes to building codes are presented, their potential for mitigating damage due to hazards will be examined, and the changes will only be adopted if they are shown to lower risk. Changes to stormwater management plans will incorporate identified mitigation actions and will encourage increased participation in the NFIP.

Berkeley and Morgan County will continue to integrate the HMP into each individual jurisdiction's Comprehensive Plans as it is updated and will ask the Comprehensive Plan contractor to recommend

additional areas for integration. The counties will also communicate with local governments to encourage them to incorporate the HMP into their local plans as applicable.

Plan integration is not only accomplished through planning tools such as comprehensive plans and zoning ordinances, but through capital improvement planning, area plans such as highway corridors and downtown plans, functional plans like stormwater and open space plans, and public and stakeholder outreach and education. This section highlights key opportunities for plan integration in Berkeley and Morgan County.

Overall, the administrative and technical capabilities of many of the jurisdictions within the region has been a limiting factor in HMP integration into local documents. Moving forward with HMP updates, Region 9 should have a more apparent presence in the drafting and updating of municipal planning and enforcement documents, to reinforce the integration of the HMP. Region 9 should make sure that HMP integration is on the LEPC agenda, and that representatives from each municipality are present at these meetings.

Berkeley County Comprehensive Plan and Morgan County Comprehensive Plan

The Berkeley County Council and Berkeley County Planning Commission is responsible for updating and maintaining the County Comprehensive Plan and Subdivision Ordinance. The existing countywide Comprehensive Plan for Berkeley County was updated in June 2016. The Morgan County Commission is responsible for updating and maintaining the County Comprehensive Plan and Subdivision Ordinance. The existing countywide Comprehensive Plan for Berkeley County was updated in 2017.

Future comprehensive plan updates and improvements should consider 2022 HMP findings. For example, Chapter 5a: The Land Use and growth Management Plan, Chapter 6: The Housing Plan, and Chapter 7: The Transportation Plan of the Berkeley County Comprehensive Plan. Chapter 1: The Land Use, Chapter 3: Transportation, and Chapter 4: Public Utilities, Chapter 5: Public Services, and Chapter 6: Sensitive Areas of the Morgan County Comprehensive Plan can guide future growth and development away from the hazard-prone areas identified in Chapter 4: Risk Assessment of the HMP.

In addition to the Berkeley County Comprehensive Plan, the City of Martinsburg has adopted their own local Comprehensive Plan, last updated in 2018. Martinsburg's Comprehensive Plan could incorporate this objective into Chapter 4: Land Use, Chapter 6: Transportation, or Chapter 8: Community Facilities & Services. This municipal comprehensive plan was reviewed in conjunction with the Berkeley County Comprehensive Plan to inform the Community Profile, as well as other sections of the 2021 Berkeley and Morgan HMP.

Statements regarding housing plans can recommend not only that the public sector make investments in infrastructure primarily within planned growth areas, but also recommend that investments be made primarily in areas which have not been identified as being hazard prone in Chapter 4: Risk Assessment of the HMP. The data provided in Chapter 4: Risk Assessment of the HMP can also be

used to design transportation systems and other critical infrastructure to withstand the effects of known hazards so that they will still function in the event of an emergency or disaster. Components of the County Comprehensive Plan can be incorporated into the HMP and plans can share recommendations related to hazard mitigation. For example, Morgan County's Comprehensive Plan mentions the US Route 522 bypass to address both increased traffic and unsafe traffic conditions in the county. Morgan County also listed the bypass construction as a potential transportation accident vulnerability due to changing traffic patterns.

In Berkeley and Morgan Counties both the HMP and comprehensive plan are currently used to mutually support integrated content. HMP data is available to update the county and local comprehensive plans and ensures hazard mitigation elements are considered in planning documents, ordinances, and funded development projects.

Berkeley and Morgan Counties should continue to make hazard data available when the 2022 HMP update is complete. The updated hazard data can be used to help update the county and local comprehensive plans and other planning documents. Additionally, hazard related data from consistency reviews should be transmitted annually to be used as part of the Region's annual HMP review. This data can be used to help track plans and projects not only for the annual HMP review but for the 2027 HMP update.

Emergency Operations Plan

West Virginia Code §15-5 requires that state and local jurisdictions develop and maintain current emergency operations plans (EOPs) in order to be prepared for a variety of natural and human-caused hazards. Both county's EOPs are administered by the county's respective Office of Emergency Management.

Berkeley and Morgan County EOPs are all-hazards plans that comply with the National Incident Management System (NIMS) and is the basis for a coordinated and effective response to any disaster that may affect lives and property in Berkeley or Morgan County. The EOP, or portions thereof, would be implemented when emergency circumstances warrant it.

Evacuation Plan

Evacuation is one of the most widely used methods of protecting the public from hazard impacts. The easiest way to minimize death and injury due to a hazard event is to remove as many people as possible from its path. Evacuation plans include descriptions of the area(s) being evacuated, the demographics and characteristics of people within those area(s), transportation routes to safe areas, and how the community will support those individuals who do not have access to their own transportation. The county's EOPs notes above addresses various evacuation situations, such as evacuation plans for hazardous material spills and flooding. Emergency Action Plans developed for dams also contain evacuation.

Drought Planning

Under management of the Berkeley County Public Service District, Berkeley County maintains a Drought Contingency Plan to deal with drought emergencies. Included in the document is the outlined graduated stages of response to the onset of drought conditions.

Berkeley County Community Corrections Program

The Berkeley County Day Report Center serves substance offenders that are sentenced to the program in lieu of incarceration or are clients as a condition of their parole or probation. Once patients are assessed and placed, the program utilizes a biopsychosocial model of treatment using Substance Abuse and Mental Health Services Administration's (SAMHSA's) evidence based Balanced Recovery Lifestyle program. SAMSHA's evidenced-based protocol focuses on altering not just behavior, but one's lifestyle and mindset by helping patients alter their patterns of thinking, social networks, money management skills, work, and relationships. It also promotes the integration of a new focus on recreation, spirituality, and wellness. This plan was incorporated into the HMP under the new hazard profile, Substance Use Disorder.

Morgan County Day Report Center

The Morgan County Day Report Center is a treatment alternative to incarceration for nonviolent offenders whose substance abuse problems have led to legal involvement. The goals of the center are (1) To provide much needed substance abuse treatment and drug screening which is not available in the Eastern Regional Jail to appropriate offenders (2) To reduce taxpayer cost associated with incarceration. Participants of the program follow an individualized treatment plan which may consist of inpatient detox/treatment, intensive outpatient treatment, outpatient treatment, individual therapy, peer recovery coaching, and random drug/alcohol screening. This program was incorporated into the HMP under the new hazard profile, Substance Use Disorder.

Green Infrastructure Plan

The Town of Bath outlined several generalized concept ideas and an overview of green infrastructure practices that would likely have major positive impacts for water quality and quantity of runoff entering and within the town. The study also identified various methods of implementation, such as retrofitting new infrastructure with green stormwater management as part of initial construction and routine site maintenance. The intended result of the study is to be used as an educational tool for the public and to create a prioritized project list that can be used to carry out various green stormwater projects. By 2018, with the help of local and regional partnerships, Berkeley Springs had added new green infrastructure elements into already scheduled development projects—a cost-effective solution for the small town. The new elements included permeable pavers, tree boxes with bioretention cells and a rain garden at the bottom of a historic cemetery.

6. Mitigation Strategy

6.1. Update Process Summary

The mitigation strategy serves as the long-term road map to reduce the potential losses, vulnerabilities, and shortcomings identified in the Hazard Identification and Risk Assessment section. A typical mitigation strategy includes a list of goals and objectives, with mitigation actions to address the goals and objectives, that are then prioritized based on the community's need.

Goals are long-term aspirations about the resiliency of the community given the potential effects of hazards. **Objectives** are measurable strategies that the Berkeley and Morgan County communities have determined will be necessary to move closer to attaining each goal. **Actions** are the tasks that are proposed for realizing each objective.

The following definitions based on FEMA's State and Local Mitigation Planning How-To Guide were used:

- Goals are general guidelines that explain what the jurisdiction would like to achieve. They are usually broad policy-type statements, long term, and represent global visions.
- Objectives define specific and measurable strategies or implementation steps that must be implemented to attain identified goals.
- Mitigation Actions are more specific than objectives, and have identified responsible parties, timeframes, and potential funding sources. They are the specific actions to achieve goals and objectives.

A list of goals and objectives from the 2017 HMP is provided in Table 6.1-1. The 2017 goals and objectives were discussed at the 2022 HMP Update Kick-Off Meeting on May 4, 2021, and at the Risk Assessment and Mitigation Solutions Workshop on June 15, 2021, with a request for attendees to provide suggested revisions. As no comments were received, Michael Baker International reviewed the 2017 goals and objectives and provided suggested revisions and additions, as indicated below in Table 6.1-1. The new objectives are intended to be inclusive, to cover a range of actions and hazard types, including the hazard profiles added in the 2022 Update: civil disturbance, cyber terrorism, and Substance Use Disorder. Additionally, one objective was added for each county related to High-Hazard Potential Dams. The presentation for the Draft Plan Review Meeting on August 24, 2021, again called attention to and solicited comments on the Goals and Objectives. No comments were received from the public during the August 24, 2021 public meeting nor the 30-day comment period after the Draft Plan Review Meeting.

Table 6.1-1 List of 2017 Mitigation Strategy Goals and Objectives and Review.	
Region 9 Planning and Development Council Goals and Objectives	
Goals & Objectives	**Review**
Goal 1R: Support communities in lessening flood risk by encouraging them to maintain compliance with the National Flood Insurance Program (NFIP) and undertaking buyout projects when funding is available; Perform annual checks regarding NFIP compliance.	
Objective 1A: Assist communities in maintaining compliance with the NFIP.	
Goal 2R: Support counties in performing annual HMP strategies review.	
Objective 2A: Assist counties in ensuring compliance with FEMA guidelines regarding plan maintenance.	
Berkeley County Goals and Objectives	
Goal 1B: Protect surface water and groundwater sources by limiting future development in floodplains and flood damage, effectively managing stormwater, and reducing the possibility of source water contamination.	
Objective 1A: Minimize future flood damage in municipal areas through effective stormwater management.	
Objective 1B: Minimize future flood damage throughout Berkeley County by prohibiting development in the floodplain.	
Objective 1C: Minimize future flood damage in Berkeley County through structural projects.	
Objective 1D: Participate in the Community Rating System (CRS) to help monitor hazard mitigation efforts and to improve the affordability of flood insurance for citizens.	
Objective 1E: Reduce the potential for injury and loss of life due to severe flooding events.	
Objective 1F: Coordinate with other federal, state, and county agencies to facilitate flood mitigation activities.	
Objective 1G: Flood Mitigation Reconstruction- Seek Hazard Mitigation Assistance funds for the mitigation reconstruction of eligible at-risk, repetitive or non-repetitive loss, damaged or destroyed properties.	
Objective 1H: Construct upgrades to water supply infrastructure and increase awareness about how to reduce water contamination and pollution.	
Objective 1I: Protect local watersheds and the greater Chesapeake Bay Watershed.	
Goal 2B: Reduce the current and future risks from hazards in Berkeley County.	
Objective 2A: Reduce or eliminate the effects of drought by undertaking public water infrastructure upgrades or extensions.	
Objective 2B: Reduce landslide occurrences through structural projects.	
Objective 2C: Minimize future damage from landslides throughout Berkeley County by increasing control over construction activities.	
Objective 2D: Minimize effects of extreme power outages on community.	
Objective 2E: Minimize future damage from severe wind or tornadoes throughout Berkeley County by increasing control over construction activities.	

Table 6.1-1 List of 2017 Mitigation Strategy Goals and Objectives and Review.	
Objective 2F: Minimize future damage from severe winter storms and nor'easters throughout Berkeley County by increasing control over construction activities.	
Objective 2G: Reduce the potential for transportation accidents in Berkeley County.	
Objective 2H: Identify and control hazardous materials within the county.	
Goal 3B: Improve emergency preparedness and response in Berkeley County, Martinsburg, and Hedgesville.	
Objective 3A: Provide local residents with more advanced warning of impending hailstorms.	
Objective 3B: Increase public awareness that a severe thunderstorm is imminent.	
Objective 3C: Increase public awareness and knowledge after an epidemic has been declared.	**The words "and/or pandemic" were added to Objective 3C.**
Objective 3D: Increase public awareness and knowledge after an infestation has been discovered.	**The word "infestation" was replaced with "invasive species."**
Objective 3E: Reduce communication failures (dead spots) in Berkeley County.	
Goal 4B: Promote hazard mitigation as a public value in recognition of its importance to the health, safety, and welfare of the population.	
Objective 4A: Educate the public as to the potential for earthquakes in West Virginia, specifically Berkeley County.	
Objective 4B: Educate the public on how to avoid starting wildfires.	
Objective 4C: Increase public knowledge of protective measures to take during a heat wave.	
Objective 4D: Increase public awareness as to the agricultural effects of drought, as well as the ramifications of drought to the public water supply.	
Morgan County Goals and Objectives	
Goal 1M: Minimize flood damages and risks from flood hazards in Morgan County.	
Objective 1A: Evaluate and update existing floodplain ordinances to meet or exceed the NFIP standards.	
Objective 1B: Flood Mitigation Reconstruction- Seek Hazard Mitigation Assistance funds for the mitigation reconstruction of eligible at-risk, repetitive or non-repetitive loss, damaged or destroyed properties.	
Goal 2M: Reduce the current and future risks from hazards in Morgan County.	
Objective 2A: Identify all repetitive loss structures throughout the county.	
Objective 2B: Direct new development away from hazard areas.	
Objective 2C: Evaluate and update existing floodplain ordinances to meet or exceed the NFIP standards.	
Objective 2D: Improve the enforcement of existing floodplain regulations.	
Objective 2E: Ensure that flood insurance policies remain affordable through the county and municipal government programs.	
Objective 2F: Update flood hazard mapping.	
Objective 2G: Assess vulnerability of transportation systems and assets located in hazard areas.	

Table 6.1-1 List of 2017 Mitigation Strategy Goals and Objectives and Review.	
Objective 2H: Conduct a Hazardous Materials Survey to better understand the nature and extent of hazardous material risks throughout the county.	
Goal 3M: Improve emergency preparedness in Morgan County, Bath, and Paw Paw.	
Objective 3A: Update Emergency Operations Plans (EOP).	
Objective 3B: Equipment assessment at the 911 Communications Center.	
Objective 3C: Improve coordination and communication among disaster response organizations, local and county governments.	**Objective 3C was expanded to "**Develop relationships and maintain coordination with hazard and hazard mitigation related organizations such as emergency services providers, utilities, Substance Use Disorder organizations, facilities with hazardous materials, and dam owners."
Objective 3D: Improve coordination of mitigation efforts between the National Park Service and the Town of Paw Paw.	
Goal 4M: Reduce the potential impact of natural and man-made disasters on private property.	
Objective 4A: Encourage participation in the National Flood Insurance Program.	
Objective 4B: Develop public/private partnerships toward the protection of private properties.	
Goal 5M: Reduce the potential impact of natural disasters on the County's historic treasures.	
Objective 5A: Identify and protect other historic structures throughout the county that are at risk of hazards.	

Mitigation actions provide detailed descriptions of specific work tasks to accomplish in order to achieve the mitigation goals and objectives. Table 6.1-2 provides a review of the 2017 mitigation actions, specifies whether an action is continued into the 2022 Mitigation Action Plan, and offers status update notes from coordinating agencies.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
Action		**Review**
Region 9 Actions		
1R	Perform annual review to ensure communities are maintaining compliance with the National Flood Insurance Program (NFIP) at the jurisdictional level by attending training, monitoring development, and ensuring that local floodplain regulations are as current and applicable as possible.	Continued into 2022 Action Plan.
2R	Perform annual review to ensure communities are undertaking buyout, elevation, and/or relocation projects in the Region IX Planning and Development Council area when and if funding is available.	Continued into 2022 Action Plan.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
	Action	**Review**
3R	Coordinate, as appropriate, with partners throughout the region to identify the location of privately-owned dams.	Continued into 2022 Action Plan with addition of "and contact information."
Berkeley County Actions		
1B	Develop an informational brochure to distribute to local farmers and residents regarding drought.	Completed. Farm Bureau and WVU Extension Agency to take lead on disseminating information to farmers and residents. Berkeley OEM has brochure to disseminate.
2B	Evaluate current public water system to identify the most feasible locations to construct upgrades that would reduce or eliminate the effects of drought. A survey of residential wells and public water customers should also be conducted to evaluate the status of residential drinking water in the county and identify trends.	Continued into 2022 Action Plan.
3B	Develop stringent storm water management codes for future development.	Continued into 2022 Action Plan. 2009 Floodplain Ordinance is in effect and is being enforced. Ongoing process for updating ordinance.
4B	Consider conducting acquisition and relocation projects (buyouts) in flood-prone areas. This includes repetitive, severe repetitive loss and nonrepetitive and severe repetitive loss structures.	Continued into 2022 Action Plan. Buyouts occurring/have occurred at Sportsman's Paradise. Ongoing project to transition into a green space park.
5B	Coordinate with the National Weather Service in Sterling, Virginia to warn residents of impending severe thunderstorm conditions.	Completed. Alerts disseminated by Berkeley County OEM via Alert Berkeley.
6B	Educate local residents on the benefits of conserving water during a heat wave.	Completed. Berkeley County OEM has brochure to disseminate.
7B	Distribute information concerning the leading causes of wildfires and steps the general public can take to avoid starting wildfires.	Completed. Berkeley County OEM has brochure to disseminate.
8B	Work with airport safety officials to determine how best to respond to a crash involving larger planes.	Continued into 2022 Action Plan. Zoning has provided for increased runway protection areas. Ongoing cooperative work with 167th ANG Fire/Rescue and enacted mutual aid agreements.
9B	Coordinate efforts with local media to post advance warnings of hailstorms.	Completed. Notifications disseminated via Alert Berkeley and National Weather Service.
10B	Continue coordinating county efforts to meet the requirements of participation in the CRS.	Continued into 2022 Action Plan.
11B	In the event of a release of a hazardous material it is imperative to quickly & safely identify what the material is to ensure responder and community safety.	Completed. Berkeley OEM and Berkeley Fire has equipment to sample and test various HazMat and foreign/unknown substances.
12B	Conduct a study to determine what hazardous materials & how much is transported on the roadways and rail.	Completed. Commodity Flow study completed 2016, Commodity Flow Study Railway Addendum completed 2020, future updates as funding is available.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
Action		**Review**
13B	Opt into a mass notification system that can warn residents of potential incoming weather events so that they may be better prepared prior to the event. Mass notification can also be used to send community members information on how to prepare for other potential threats and community awareness events.	Completed. Alerts disseminated from Berkeley OEM via Alert Berkeley.
14B	Develop a plan with cooperation from all agencies that may be directly or indirectly involved that would manage traffic in the event of an accident that requires roadways to be shut down.	Completed. Traffic Incident Management Committee had been formed and met (prior to COVID) to discuss and work through problems and determine best practices. Meetings will resume as soon as feasible.
15B	Create an informational brochure and/or digital media to inform/educate community members on how to be prepared for an event that may render them immobile for a period of time. Brochure should include suggested items and quantities of goods to have on hand.	Completed. Berkeley OEM has brochure to disseminate.
16B	Maintain county Source Water protection Plan (SWPP) according to state regulatory requirements.	Continued into 2022 Action Plan.
17B	Assist Berkeley County in educating the public regarding radon systems and home testing available.	Continued into 2022 Action Plan.
18B	Prohibit new facilities for persons with special needs or mobility concerns in hazard areas.	Continued into 2022 Action Plan.
19B	Continue coordinating county efforts to meet the requirements of participation in the CRS.	Continued into 2022 Action Plan.
20B	Develop an informational brochure to distribute to local farmers and residents concerning the potential effects of an infestation.	Continued into 2022 Action Plan. The county is working with the Farm Bureau and WVU Extension Service.
21B	Construct a stabilization wall or safety fence along roadways which pass through areas that are prone to landslides.	Continued into 2022 Action Plan.
22B	Coordinate with railroad companies to provide more emergency access to railroad rights-of-way for emergency response activities in the event of a train wreck.	Continued into 2022 Action Plan.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
Action		**Review**
23B	Berkeley County will continue to seek out opportunities to apply for Hazard Mitigation Assistance (HMA) funds for mitigation reconstruction, elevations, relocations or acquisitions of identified at risk, repetitive loss, non-repetitive loss, substantial damaged, partially or completely demolished or destroyed properties within Berkeley County. If mitigation reconstruction is chosen, properties identified as partially or completely demolished, outside of the regulatory floodway, as identified by available flood hazard data, will be reconstructed in accordance with the standards established in the local floodplain ordinance and in accordance with the same conditions as an elevated structure. Berkeley County will comply with all acquisition, elevation, relocation and mitigation reconstruction requirements, as per the HMA Guidance.	Continued into 2022 Action Plan. Berkeley County is continuing efforts to evaluate areas of repetitive loss and apply for applicable grants and funding as necessary.
24B	Utilize electronic tools and/or broadcast systems to communicate to citizens in Special Flood Hazard Areas.	Completed. Alerts disseminated by Berkeley OEM via Alert Berkeley
25B	Complete Sportsman's Paradise Park acquisition of area within floodplain and turn it into a green space park.	Continued in 2022 Action Plan. Buyouts occurring/have occurred at Sportsman's Paradise. Ongoing project to transition into a green space park.
26B	Create an informational brochure and/or digital media to inform/educate community members on the effects of a drought. Information should include water conservation initiatives.	Completed. Brochures and information can/will be distributed by various applicable agencies, including but not limited to: Berkeley OEM, Water Authority, Farm Bureau, WVU Extension Service, etc.
27B	Create an informational brochure and/or digital media to inform/educate community members on the effects of an epidemic. Information should include how to prevent the spread during an event.	Completed. Berkeley OEM to disseminate brochures. Various other partners, including Health Department, hospitals, etc. to provide timely public information as needed.
28B	Create an informational brochure and/or digital media to inform/educate community members on the effects that extreme temperatures can have on them as well as outside pets. Information should include how to be prepared for an event as well as what to do during an event.	Completed. Berkeley County OEM to disseminate brochures and NWS typically will issue information and alerts regarding extreme temperatures.
29B	Educate the community members on how to be prepared for a power interruption as well as reporting and handling a power outage with First Energy through digital media and/or brochures.	Completed. Berkeley County OEM has preparedness brochures, and utility companies typically issue information on reporting and have various methods for reporting outages.
30B	Work with area school/libraries/public facilities to include source water protection curriculum/classroom events/public education events.	Continued into 2022 Action Plan.
31B	Consider updating the existing Tier 2 report to include agricultural substances such as herbicides.	Canceled. Tier II reporting procedures and what must be reported is set by federal and state law. County has little to no authority to require additional Tier II reporting.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
Action		**Review**
32B	Coordinate with partners throughout the region to identify the location and contact information of privately owned dams.	Continued into 2022 Action Plan. Berkeley County OEM is working with Region 9 on updating contact information. Berkeley County OEM has dam emergency plans for those that are required to submit such.
33B	Create an informational brochure and/or digital media as to the potential of earthquakes in West Virginia as well as potential damages from those earthquakes. Brochure should include information on measures to take to prepare for prior to, during and after an earthquake.	Completed. Berkeley County OEM has brochures to disseminate.
34B	Create an informational brochure and/or digital media to inform/educate local farmers and residents on the potential effects of an infestation.	Continued into 2022 Action Plan. Berkeley County is seeking appropriate brochures to disseminate. Farm Bureau and WVU Extension Service are lead agencies in providing information.
35B	Create an informational brochure and/or digital media as to how to prepare for a terrorism event and what to do if a terrorism event occurs.	Continued into 2022 Action Plan. Berkeley County OEM and Berkeley County Sheriff's Office will continue to monitor and disseminate information as needed and necessary.
36B	Create an informational brochure and/or digital media as to the potential of wildfire. Brochure should include information on how wildfires are commonly started and steps to take to prevent wildfires.	Completed. Berkeley County OEM has brochures to disseminate.
Morgan County Actions		
1M	Review all existing regulations to ensure adequacy in reducing the amount of future identified hazard areas.	Continued into 2022 Action Plan.
2M	Expand the mission and membership of the Morgan County Local Emergency Planning Committee to act as a countywide disaster task force.	Continued into 2022 Action Plan. The LEPC has created different social media outlets to provide community outreach and marketing materials.
3M	Develop adequate emergency shelter and evacuation plans for citizens and animals (domestic pets, livestock and wildlife).	Continued into 2022 Action Plan, The Morgan County OHSEM and the ARC has an established jurisdictional commitment and expectation profile clarifying roles, responsibilities settings and operational capacities during disasters and evacuation needs of the community.
4M	Construct a bypass along US Route 522 to improve safety and ease of access.	Continued into 2022 Action Plan. The construction is set to begin July 2021.
5M	Reduce utility interruption by establishing standards for tree trimming, burying power lines, and installing redundancies and loop feeds.	Continued into 2022 Action Plan.
6M	Educate water system operators and workers about the importance of safe available water and SWPPs and update the SWPP as necessary.	Continued into 2022 Action Plan.
7M	Use floodplain ordinances, NFIP, CRS participation, public education, and property acquisition to remove existing developed properties from flood hazard areas and limit new development.	Continued into 2022 Action Plan.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
Action		**Review**
8M	Increase awareness of key hazardous material transportation routes and storage areas and conduct drills with local agencies focusing on high-risk areas.	Continued into 2022 Action Plan. Morgan County participates in yearly regional trainings with community partners that consist of tabletop, functional, and full-scale exercises. The county ensures and monitors yearly updates to their Tier II participants within the county.
9M	Assist vulnerable populations and publicize road conditions using news stations, newspapers, and radio during winter storms and nor'easters.	Continued into 2022 Action Plan. Information is shared via a mass notification system (Everbridge), webpage, and other social media outlets.
10M	Review and maintain agreement with Morgan County Planning Commission to provide floodplain management	Continued into 2017 Action Plan. Coordination is ongoing.
11M	Review and maintain agreement with Morgan County Planning Commission to provide floodplain management.	Continued into 2022 Action Plan.
12M	Apply for TAP grant through DOH to fund the addition and repair of sidewalks within town; include stormwater management practices to reduce flooding events on town/state roads.	Continued into 2022 Action Plan.
13M	Collect address data to assist in the creation of accurate disaster mapping.	Completed. Address verification completed July 2020.
14M	Develop updated aerial photography to assist in analyzing disaster risks to property.	Completed. Flyover in 2018.
15M	Ensure that flood insurance policies remain affordable through the county and municipal government programs.	Canceled. Local government has no control over insurance premiums.
16M	Support Morgan County's efforts in the CRS program, and provide training to municipalities on the CRS program and encourage them to participate.	Continued into 2022 Action Plan.
17M	Collect updated information on the number and location of all repetitive loss properties throughout the county and develop a database and maps for storage.	Continued into 2022 Action Plan.
18M	Identify owners of repetitive and severe repetitive loss properties that may be willing to participate in future property acquisition and relocation projects	Continued into 2022 Action Plan.
19M	Review all comprehensive plans to ensure that designated growth areas are not in hazard areas.	Continued into 2022 Action Plan.
20M	Provide training to municipalities on the CRS program and encourage them to participate.	Completed. Morgan County still has to review.
21M	Work with WV Department of Highways to identify areas of frequent roadway flooding and develop mitigation strategies.	Continued into 2022 Action Plan.
22M	Identify strategies to mitigate risks from the transportation and/or storage of hazardous materials in Morgan County.	Continued into 2022 Action Plan. Morgan County reviews all Tier II Emergency Plans on a yearly basis within the LEPC to identify and mitigate any risks.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
Action		**Review**
23M	Establish a protocol for the sharing of annual shelter survey information between the local Red Cross chapter and the Morgan County Office of Emergency Services.	Continued into 2022 Action Plan. The Morgan County OHSEM and the Local ARC meet yearly to discuss and update shelter survey information. Changes are made accordingly to shelter locations as necessary to accommodate the needs of the public during different types of disasters.
24M	Establish a formal process for the city and the Park Service to coordinate disaster related efforts, which will include defining boundaries and establishing responsibilities.	Continued into 2022 Action Plan. OES coordinated logistics for all hazards.
25M	Conduct training exercises that include representatives from the city and the Park Service to facilitate increased coordination.	Continued into 2022 Action Plan.
26M	Continue to enforce ordinances that new structures do not interfere with flood mitigation measures.	Continued into 2022 Action Plan.
27M	Obtain updated information on the number of NFIP policyholders in Morgan County and its municipalities.	Continued into 2022 Action Plan.
28M	Develop mitigation strategies to protect any at-risk historic properties.	Continued into 2022 Action Plan.
29M	Conduct a survey of all historic sites that are located in hazard areas.	Continued into 2022 Action Plan.
30M	Apply for Hazardous Materials Emergency Preparedness (HMEP) grant from WVOES to finance the development of a hazardous materials survey for Morgan.	Continued into 2022 Action Plan. A commodity flow study grant has been submitted to the SERC through HMEP.
31M	Review all capital improvement plans to ensure that infrastructure improvements are not directed towards hazardous areas.	Continued into 2022 Action Plan.
32M	Continue to support initiatives established under the Morgan County Office of Emergency Services.	Continued into 2022 Action Plan.
33M	Morgan County will continue to seek out opportunities to apply for Hazard Mitigation Assistance (HMA) funds for mitigation reconstruction, elevations, relocations or acquisitions of identified at risk, repetitive loss, non-repetitive loss, substantial damaged, partially or completely demolished or destroyed properties within Morgan County. If mitigation reconstruction is chosen, properties identified as partially or completely demolished, outside of the regulatory floodway, as identified by available flood hazard data, will be reconstructed in accordance with the standards established in the local floodplain ordinance and in accordance with the same conditions as an elevated structure. Morgan County will comply with all acquisition, elevation, relocation and mitigation reconstruction requirements, as per the HMA Guidance.	Continued into 2022 Action Plan.
34M	Reinforce structures and infrastructure against hail and increase awareness before hailstorms with public announcements.	Continued into 2022 Action Plan.
35M	Use building codes, retrofits, and increased risk awareness to protect property, infrastructure, and utilities from wind storms and tornadoes.	Canceled. Morgan County does not enforce building codes.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
	Action	**Review**
36M	Assess areas vulnerable to wildfires and publicize outdoor burning regulations and wildfire risks using pamphlets, news articles, and the Firewise Program.	Continued into 2022 Action Plan. Morgan County participates in a yearly Fire Prevention Week through the Board of Education. Information is also distributed throughout the year via social media outlets. .
37M	Work with WVDOH to find solutions to flood impacted parts of US Route 522 within town limits, such as S. Washington Street.	Continued into 2022 Action Plan. Coordination is ongoing with WVDOH.
38M	Establish shelters within existing government facilities.	Deferred. The Morgan County Homeless Coalition has identified other facilities that are better suited for providing comfortable overnight shelters. Also, in the case of an emergency, the Red Cross would have access to better facilities in the vicinity of the Town for establishing temporary emergency shelters.
39M	Seek funding for generators and other equipment to aid in the continuation of essential services in the event of utility interruption.	Continued into 2022 Action Plan. The Town of Bath has a generator in place at the Berkeley Spring Water Works plant. The Town Council will examine this issue further to determine the need for acquiring a generator for the Town Municipal Center.
40M	Establish shelters within existing government facilities.	Continued into 2022 Action Plan.
41M	Post information about source water protection on town website & consider sending brochures to residents/businesses in Zone of Critical Concern, alerting public of need for conservation and protection. Include information regarding proper disposal of prescriptions and regular septic maintenance. Follow similar recommendations as outlined in 2016 Source Water Protection Plan.	Completed.
42M	Seek funding for generators and other equipment to aid in the continuation of essential services in the event of utility interruption.	Continued into 2022 Action Plan.
43M	Post and distribute terrorism preparedness information based on current data.	Continued into 2022 Action Plan.
44M	Provide NWS sponsored weather-related classes to the public, distribute emergency preparedness information on severe weather hazards, and provide classes on severe weather preparedness to the public.	Continued into 2022 Action Plan. Weather spotter classes have been offered locally through the assistance of the NWS, pre COVID. Monthly preparedness safety tips are provided via social media outlets and local newspaper.
45M	Provide pamphlets and educational material to county residents to encourage annual residential radon testing.	Continued into 2022 Action Plan.
46M	Monitor water supply and conserve water through public awareness campaigns conducted using news and radio stations. A survey of residential wells and public water customers should also be conducted to evaluate the status of residential drinking water in the county and identify trends.	Continued into 2022 Action Plan.

Table 6.1-2 List of 2017 Mitigation Actions, and a Review of Changes made in 2022 Update		
Action		**Review**
47M	Monitor rainfall and conduct annual inspections of berms to protect against structural failures.	Continued into 2022 Action Plan.
48M	Adopt and enforce building codes, perform building inspections, and conduct outreach to the public and builders through pamphlets.	Deferred. Morgan County does not enforce building codes.
49M	Educate the public about the risks associated with extreme temperatures using the county website and local radio stations.	Continued into 2022 Action Plan. Monthly preparedness safety tips are provided via social media outlets, local radio, and newspaper.
50M	When a disease reoccurs in a community, use pamphlets, local news media, and online resources to educate the public about mitigation.	Continued into 2022 Action Plan. Community awareness and education information is shared by the Local Health Department via WVPH Alert System, social media sites, and email communication with the LEPC membership.
51M	Protect roadways and remove buildings in potential landslide and land subsidence hazard areas.	Continued into 2022 Action Plan.
52M	Utilize pamphlets and articles about the warning signs and the potential damages of thunderstorms and lightning strikes.	Continued into 2022 Action Plan. Morgan County distributes information through social media pages and provides pamphlets to community partners during LEPC meetings.
53M	Conduct control initiatives, such as the Gypsy Moth Spray Program, and conduct public education and awareness campaigns.	Continued into 2022 Action Plan.

6.2. Mitigation Goals and Objectives

Based on the results of the review of current conditions and the mitigation goals and objectives established in 2017, the HMSCs developed goals and objectives for inclusion in the 2022 HMP. Table 6.2-1 details the mitigation goals and objectives that support the 2022 mitigation strategy.

Table 6.2-1 List of 2022 Mitigation Strategy Goals and Objectives.	
Region 9 Planning and Development Council Goals	
Goal	**Objective(s)**
Goal 1R: Support communities in lessening flood risk by encouraging them to maintain compliance with the National Flood Insurance Program (NFIP) and undertaking buyout projects when funding is available; Perform annual checks regarding NFIP compliance.	**Objective 1A:** Assist communities in maintaining compliance with the NFIP.
Goal 2R: Support counties in performing annual HMP strategies review.	**Objective 2A:** Assist counties in ensuring compliance with FEMA guidelines regarding plan maintenance.
Berkeley County Goals	

Table 6.2-1 List of 2022 Mitigation Strategy Goals and Objectives.	
Goal 1B: Protect surface water and groundwater sources by limiting future development in floodplains and flood damage, effectively managing stormwater, and reducing the possibility of source water contamination.	**Objective 1A:** Minimize future flood damage in municipal areas through effective stormwater management.
	Objective 1B: Minimize future flood damage throughout county by increasing control over development in the floodplain.
	Objective 1C: Minimize future flood damage in county through structural projects.
	Objective 1D: Participate in the Community Rating System (CRS) to help monitor hazard mitigation efforts and to improve the affordability of flood insurance for citizens.
	Objective 1E: Reduce the potential for injury or loss of life due to severe flooding events.
	Objective 1F: Coordinate with other federal, state, and county agencies to facilitate flood mitigation activities.
	Objective 1G: Flood Mitigation Reconstruction- Seek Hazard Mitigation Assistance funds for the mitigation reconstruction of eligible at-risk, repetitive or non-repetitive loss, damaged or destroyed properties.
	Objective 1H: Construct upgrades to water supply infrastructure and increase awareness about how to reduce water contamination and pollution
	Objective 1I: Protect local watersheds and the greater Chesapeake Bay Watershed.
Goal 2B: Reduce the current and future risks from hazards in Berkeley County.	**Objective 2A:** Reduce or eliminate the effects of drought by undertaking public water infrastructure upgrades or extensions.
	Objective 2B: Reduce landslide occurrences through structural projects.
	Objective 2C: Minimize future damage from landslides throughout Berkeley County by increasing control over construction activities.
	Objective 2D: Minimize effects of extreme power outages on community.
	Objective 2E: Minimize future damage from severe wind or tornadoes throughout the county by increasing control over construction activities.
	Objective 2F: Minimize future damage from severe winter storms and nor'easters throughout Berkeley County by increasing control over construction activities.
	Objective 2G: Reduce the potential for transportation accidents in the county.
	Objective 2H: Identify and control hazardous materials within the county.
	Objective 2I*: Work with municipalities to create, update, and enforce land use regulations, plans, models, maps, and databases to support hazard mitigation.
	Objective 2J*: Modify existing structures and infrastructure or construct new structures to reduce hazard vulnerability.
	Objective 2K*: Protect natural systems such as streams, wetlands, and forests.
	Objective 2L*: Take measures to counteract civil disturbance, terrorism, and cyber terrorism.
	Objective 2M*: Maintain and expand Substance Use Disorder support services.
	Objective 3A: Provide local residents with more advanced warning of impending hailstorms.

Table 6.2-1 List of 2022 Mitigation Strategy Goals and Objectives.	
Goal 3B: Improve emergency preparedness and response in Berkeley County, Martinsburg, and Hedgesville.	**Objective 3B:** Increase public awareness that a severe thunderstorm is imminent.
	Objective 3C: Increase public awareness and knowledge after an epidemic and/or pandemic has been declared.
	Objective 3D: Increase public awareness and knowledge after an invasive species has been discovered.
	Objective 3E: Reduce communication failures (dead spots) in county.
	Objective 3F: Develop relationships and maintain coordination with hazard and hazard mitigation related organizations such as emergency services providers, utilities, Substance Use Disorder organizations, facilities with hazardous materials, and dam owners.
Goal 4B: Promote hazard mitigation as a public value in recognition of its importance to the health, safety, and welfare of the population.	**Objective 4A:** Educate the public as to the potential for earthquakes in West Virginia and Berkeley County.
	Objective 4B: Educate the public on how to avoid starting wildfires.
	Objective 4C: Increase public knowledge of protective measures to take during a heat wave.
	Objective 4D: Increase public awareness as to the agricultural effects of drought, as well as the ramifications of drought to the public water supply.
	Objective 4E*: Educate citizens, elected officials, and property owners about hazards and hazard mitigation via public outreach, training, and/or participation in national programs.
	Objective 4F*: Coordinate with High-Hazard Potential Dam owners and affected officials on dam rehabilitation and funding.
Morgan County Goals	
Goal 1M: Minimize flood damages and risks from flood hazards in Morgan County.	**Objective 1A:** Evaluate and update existing floodplain ordinances to meet or exceed the NFIP standards.
	Objective 1B: Flood Mitigation Reconstruction- Seek Hazard Mitigation Assistance funds for the mitigation reconstruction of eligible at-risk, repetitive or non-repetitive loss, damaged or destroyed properties.
	Objective 1C*: Coordinate with High-Hazard Potential Dam owners and affected officials on dam rehabilitation and funding.
Goal 2M: Reduce the current and future risks from hazards in Morgan County.	**Objective 2A:** Identify all repetitive loss structures throughout the county.
	Objective 2B: Direct new development away from hazard areas.
	Objective 2C: Evaluate and update existing floodplain ordinances to meet or exceed the NFIP standards.
	Objective 2D: Improve the enforcement of existing floodplain regulations.
	Objective 2E: Ensure that flood insurance policies remain affordable through the county and municipal government programs.
	Objective 2F: Update flood hazard mapping.
	Objective 2G: Assess vulnerability of transportation systems and assets located in hazard areas.
	Objective 2H: Conduct a Hazardous Materials Survey to better understand the nature and extent of hazardous material risks throughout the county.

Table 6.2-1 List of 2022 Mitigation Strategy Goals and Objectives.	
	Objective 2I*: Work with municipalities to create, update, and enforce land use regulations, plans, models, maps, and databases to support hazard mitigation.
	Objective 2J*: Modify existing structures and infrastructure or construct new structures to reduce hazard vulnerability.
	Objective 2K: Protect natural systems such as streams, wetlands, and forests.
	Objective 2L*: Educate citizens, elected officials, and property owners about hazards and hazard mitigation via public outreach, training, and/or participation in national programs.
	Objective 2M*: Take measures to counteract civil disturbance, terrorism, and cyber terrorism.
	Objective 2N*: Maintain and expand Substance Use Disorder support services.
Goal 3M: Improve emergency preparedness in Morgan County, Bath, and Paw Paw.	**Objective 3A:** Update Emergency Operations Plans (EOP).
	Objective 3B: Equipment assessment at the 911 Communications Center.
	Objective 3C: Develop relationships and maintain coordination with hazard and hazard mitigation related organizations such as emergency services providers, utilities, Substance Use Disorder organizations, facilities with hazardous materials, and dam owners.
	Objective 3D: Improve coordination of mitigation efforts between the National Park Service and the Town of Paw Paw.
	Objective 3E*: Coordinate with High-Hazard Potential Dam owners and affected officials on dam rehabilitation and funding.
Goal 4M: Reduce the potential impact of natural and man-made disasters on private property.	**Objective 4A:** Encourage participation in the National Flood Insurance Program.
	Objective 4B: Develop public/private partnerships toward the protection of private properties.
Goal 5M: Reduce the potential impact of natural disasters on the county's historic treasures.	**Objective 5A:** Identify and protect other historic structures throughout the county that are at risk of hazards.

***Indicates that objective was added during 2022 HMP update**

6.3. Identification and Analysis of Mitigation Techniques

The mitigation strategy in the updated HMP should include analysis of a comprehensive range of specific techniques or actions. FEMA, through the March 2013 Local Mitigation Handbook, identifies four categories of hazard mitigation techniques.

- **Local plans and regulations:** Government authorities, policies, or codes that influence the way land and buildings are developed and built. Examples include, but are not limited to: comprehensive plans, subdivision regulations, building codes and enforcement, and NFIP and CRS.
- **Structure and infrastructure:** Modifying existing structures and infrastructure or constructing new structures to reduce hazard vulnerability. Examples include but are not limited to:

acquisition and elevation of structures in flood prone areas, utility undergrounding, structural retrofits, floodwalls and retaining walls, detention and retention structures, and culverts.

- **Natural systems protection:** Actions that minimize damage and losses and also preserve or restore the functions of natural systems. Examples include but are not limited to: sediment and erosion control, stream corridor restoration, forest management, conservation easements, and wetland restoration and preservation.

- **Education and awareness:** Actions to educate citizens, elected officials, and property owners about hazards and ways to mitigate the hazards and may also include participation in national programs. Examples include but are not limited to: radio/television spots, websites with maps and information, provide information and training, NFIP outreach, StormReady, and Firewise Communities.

Table 6.3-1 provides a matrix identifying the mitigation techniques used for the hazards identified in the risk assessment for Berkeley County. Table 6.3-2 provides a similar matrix for Morgan County. The specific actions associated with these techniques are included in Table 6.4-1.

Table 6.3-1 Mitigation Techniques Used for All Hazards in Berkeley County

Hazard *(In Order of Risk Factor Ranking)*	Mitigation Technique			
	Plans and Regulations	Structure and Infrastructure	Natural Systems Protection	Education and Awareness
Source Water Contamination	X	X	X	X
Transportation Accidents	X	X		
Winter Storm, Nor'easter		X		
Windstorm, Tornado	X	X		
Hazardous Materials	X			
Flooding	X	X	X	
Utility Interruption		X		
Pandemic and Infectious Disease		X		X
Terrorism		X		X
Hurricane, Tropical Storm	X	X		
Substance Use Disorder	X			X
Drought	X	X		X
Cyber Terrorism		X		
Thunderstorm, Lightning Strike		X		
Radon Exposure				X
Extreme Temperature		X	X	
Civil Disturbance	X			X

Wildfire	X			
Hailstorm				
Invasive Species				X
Earthquake	X	X		X
Land Subsidence	X	X	X	
Dam Failure				X

Table 6.3-2 Mitigation Techniques Used for All Hazards in Morgan County

Hazard *(In Order of Risk Factor Ranking)*	Mitigation Technique			
	Plans and Regulations	Structure and Infrastructure	Natural Systems Protection	Education and Awareness
Substance Use Disorder	X			X
Pandemic and Infectious Disease	X			X
Utility Interruption	X	X		X
Flooding	X	X		X
Winter Storm, Nor'easter	X			X
Hazardous Materials	X			X
Wind Storm, Tornado	X			X
Cyber Terrorism	X			
Wildfire	X		X	X
Transportation Accidents	X	X		
Hailstorm	X	X		X
Hurricane, Tropical Storm	X			X
Source Water Contamination	X		X	X
Dam Failure	X	X		X
Drought	X		X	X
Invasive Species	X		X	X
Civil Disturbance	X			
Terrorism	X			X
Extreme Temperature	X			X
Thunderstorm, Lightning Strike	X			X
Earthquake	X			X
Land Subsidence	X	X		
Radon Exposure	X			X

6.4. Mitigation Action Plan

A kick-off meeting for the Berkeley and Morgan County Multi-Jurisdictional Hazard Mitigation Plan 2022 Update was held on May 4, 2021 to develop a framework for the plan. The goals and objectives were presented during this meeting. During the RAMS Workshop on June 15, 2021, Mitigation Techniques were discussed using FEMA's *Mitigation Ideas* document. During the workshop, municipalities were provided their Mitigation Action Progress Report Form which listed their actions and projects from the 2017 HMP for review and update as described in Section 6.1. Actions that have been deferred or ongoing have been carried over to the 2022 Action Plan and are again proposed for implementation.

In addition, participants were given Mitigation Action Forms to provide any new actions or projects to be included in the plan update. Mitigation Action forms were also posted to the project website and sent out via email (or post if requested). Meeting participants who were not affiliated with a municipality were provided with New Mitigation Action Forms to include new mitigation actions in the 2022 plan if they so wished.

The final list of 111 mitigation actions is contained in Table 6.4-1. This table provides an overview of the strategy that will be utilized in order to implement each of the proposed mitigation actions. For each action listed in Table 6.4-1, the associated strategy identifies the agency or job title that will be responsible for initiating the work and potential sources of funding for the work. Each strategy also indicates a timeframe for when the action will happen. At least one mitigation action was established for each hazard in Berkeley and/or Morgan County identified in the Risk Assessment. More than one action is identified for several hazards. Every participating jurisdiction has at least one mitigation action. Region 9 provided three new actions. Berkeley County provided five new actions, while the City of Martinsburg provided 25 new actions. Morgan County provided six new actions, and the Town of Bath provided three new actions. Each mitigation action is intended to address one or more of the goals and objectives identified in Section 6.2.

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
Region 9 Planning and Development Council Actions							
1R	Perform annual review to ensure communities are maintaining compliance with the National Flood Insurance Program (NFIP) at the jurisdictional level by attending training, monitoring development, and ensuring that local floodplain regulations are as current and applicable as possible.	Region 9	Plans and Regulations	Flooding	Local Floodplain Coordinators, Local Planning Commissions	5 Years	Local Funding, Hazard Mitigation Grant Program
2R	Perform annual review to ensure communities are undertaking buyout, elevation, and/or relocation projects in the Region IX Planning and Development Council area when and if funding is available.	Region 9	Structure and Infrastructure	Flooding	Local Floodplain Coordinators, Local Planning Commissions	5 Years	Hazard Mitigation Grant Program
3R*†	Coordinate, as appropriate, with partners throughout the region to identify the location and contact information of privately-owned dams.	Region 9	Education and Awareness	Dam Failure	County Emergency Managers	>5 Years	Staff Time
4R*†	Collaborate with WVEMD, West Virginia Department of Environmental Protection (Dam Safety Section), and HHPD owners to better document location and size of populations at risk and impacts to institutions and critical infrastructure/facilities/lifelines from dam breach or failure. This may include digitization of inundation mapping if available.	Region 9	Structure and Infrastructure	Dam Failure	Region 9 Staff, Dam Owners, WVEMD, WV DEP	>5 Years	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
5R*†	Collaborate with WVEMD, West Virginia Department of Environmental Protection (Dam Safety Section), to educate HHPD dam owners on the USACE NID update and work with the State to add additional information to the database.	Region 9	Structure and Infrastructure, Education and Awareness	Dam Failure	Region 9 Staff, Dam Owners, WVEMD, WV DEP	>5 Years	Staff Time
Berkeley County and Municipal Actions							
1B	Construct upgrades to the public water system that would reduce or eliminate the effects of drought. Conduct a survey of residential wells and public water customers to evaluate the status of residential drinking water in the county and identify trends.	Berkeley County	Structure and Infrastructure	Drought, Source Water Contamination	Local Public Service District	Ongoing	Local funding
2B	Develop stringent stormwater management codes for future development.	Berkeley County	Plans and Regulations	Flooding	County Commission	Ongoing	Local Funding
3B	Conduct acquisition and relocation projects (buyouts) in flood-prone areas. This includes repetitive, severe repetitive loss and non-repetitive and severe repetitive loss structures.	Berkeley County	Structure and Infrastructure	Flooding	County Commission	Ongoing	HMGP, BRIC, FMA, SRL
4B	Work with airport safety officials to determine how best to respond to a crash involving larger planes.	Berkeley County	Plans and Regulations	Transportation Accident	Office of Emergency Services	Ongoing	Local Funding
5B	Continue coordinating county efforts to meet the requirements of participation in the CRS.	Berkeley County	Plans and Regulations	Flooding	County Council and Floodplain Administrator	Ongoing	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
6B	Maintain county Source Water protection Plan (SWPP) according to state regulatory requirements.	Berkeley County	Plans and Regulations, Natural Systems Protection	Source Water Contamination	Berkeley County Public Service Water District	Ongoing - updates every three years	BCPWD Budget
7B*	Maintain and expand programs offered through Berkeley County Recovery Resource Center, Berkeley County Day Report Center, and Berkeley County Home Confinement Program.	Berkeley County	Education and Awareness	Substance Use Disorder	Berkeley County Council, Berkeley Day Report Center, Berkeley County Recovery Resource Center and Berkeley County Home Confinement Program	Ongoing	Berkeley County Council, Washington Baltimore HIDTA, WV DHHR, WV Supreme Court of Appeals, WV Justice and Community Services, Department of Justice.
8B	Assist Berkeley County in educating the public regarding radon systems and home testing available.	Town of Hedgesville	Education and Awareness	Radon Exposure	Hedgesville Town Council	Short-term	Local Funding

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
9B	Prohibit new facilities for persons with special needs or mobility concerns in hazard areas.	City of Martinsburg	Plans and Regulations	Flooding, Landslides and Land Subsidence	City of Martinsburg Planning and Zoning Department	2 Years	Staff Time
10B*	Prohibit or block cyber terrorism on public facilities by transitioning to Microsoft 365 and continuing routine server backups.	City of Martinsburg	Structure and Infrastructure	Cyber Terrorism	City of Martinsburg Council	Ongoing	Staff Time
11B*	Update Martinsburg Water Model in order to ensure redundancy remains between Martinsburg's water plans and to continue inflow and infiltration reduction efforts.	City of Martinsburg	Plans and Regulations	Drought	City of Martinsburg Stormwater Management	5 Years	Local Funding
12B*	Educate residents about benefits of conserving water and where Martinsburg's water resources come from.	City of Martinsburg	Education and Awareness	Drought	City of Martinsburg Council, Stormwater Management	Ongoing	Local Funding
13B*	Reduce impact of flooding by enforcing floodplain ordinance and Martinsburg Stormwater Ordinance.	City of Martinsburg	Plans and Regulation	Flooding	City of Martinsburg Stormwater Management, Berkeley County Homeland Security, FEMA, EPA	Ongoing	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
14B*	Ensure current and newly constructed critical facilities are out of the floodplain.	City of Martinsburg	Structure and Infrastructure	Flooding	City of Martinsburg Planning and Zoning Department, Berkeley County Homeland Security, FEMA, EPA	Ongoing	Local Funding
15B*	Enforce building code to ensure structural stability during hazard events.	City of Martinsburg	Plans and Regulations, Structure and Infrastructure	Windstorm, Flooding, Earthquake, Hurricane, Radon, Winter Storm, Nor'easter	City of Martinsburg Planning and Zoning Department	Ongoing	Staff Time
16B*	Identify areas prone to land subsidence to better inform building decisions.	City of Martinsburg	Natural Systems Protection	Land subsidence	City of Martinsburg Planning and Zoning Department, Berkeley County Homeland Security, WVU GIS Technical Center	Ongoing	Local Funding

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
17B*	Invest and strengthen core public health infrastructure, including water and sanitation systems; increasing situational awareness; and rapidly extinguishing sparks that could lead to pandemics.	City of Martinsburg	Structure and Infrastructure	Pandemic and Infection Disease	City of Martinsburg Department of Public Works, Berkeley County Health Department	Ongoing	Local Funding
18B*	Coordinate with governmental partners, medical providers and private sector with the focus on maintenance of situational awareness, public health messaging, reduction of transmission, and care for and treatment of the ill.	City of Martinsburg	Education and Awareness	Pandemic and Infectious Disease	City of Martinsburg Council, Berkeley County Health Department	Ongoing	Staff Time
19B*	Update the City's existing Well Head Protection Plan to address growth, land use, and contamination threats, and be correlated with development regulations, including the Zoning Ordinance, to ensure the safety of local drinking water.	City of Martinsburg	Plans and Regulation	Source Water Contamination	City of Martinsburg Stormwater Management, WVDEP, Watershed Associations	Ongoing	Staff Time
20B*	Reduce consequences and impacts of Substance Use Disorder through continued partnership in the Martinsburg Initiative, participation in Eastern Panhandle Violent Crimes Task Force, utilization of Martinsburg Drug House Ordinance, police enforcement against distribution chains, and continued participation and partnership with schools and school children.	City of Martinsburg	Education and Awareness, Plans and Regulations	Substance Use Disorder	City of Martinsburg Council, Berkeley County Health Department	Ongoing	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
21B*	Work towards a complete network that allows convenient pedestrian and/or bicycle travel to all areas of the City by increased road and sidewalk maintenance and increased access to Downtown and West End redevelopment zones.	City of Martinsburg	Structure and Infrastructure	Transportation Accidents	City of Martinsburg Planning and Zoning Department, WVDOT	Ongoing	Local Funding
22B*	Explore increased public transit, addressing convenience, efficiency, and user-friendly accessibility, improve Ride-Share and Park & Ride solutions for commuters, and ensure Public Safety Agencies has appropriate equipment and staffing to respond.	City of Martinsburg	Plans and Regulations, Structure and Infrastructure	Transportation Accidents	City of Martinsburg Planning and Zoning Department, WVDOT	Ongoing	Staff Time
23B*	Continually monitor, maintain, and upgrade lines, tanks, and other system infrastructure to avoid leaks that water and wastewater could potentially cause damage to City infrastructure or private property.	City of Martinsburg	Structure and Infrastructure	Utility Interruption	City of Martinsburg Public Works, WV PSC	Ongoing	Local Funding
24B*	Reduce impacts of windstorms and tornados by coordinating with power companies to ensure trees adjacent to power lines are properly trimmed and encourage/requiring undergrounding of new or replaced utilities.	City of Martinsburg	Structure and Infrastructure	Utility Interruption, Windstorm/Tornado, Hurricane, Tropical Storm	City of Martinsburg Public Works	Ongoing	Staff Time
25B*	Establish official Memorandums of Agreement between the City and electric/utility companies to ensure utilities are winter ready and preventative maintenance has occurred.	City of Martinsburg	Structure and Infrastructure	Utility Interruption, Winter Storm, Nor'easter	City of Martinsburg Public Works	Ongoing	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
26B*	Eliminate or reduce risk due to either accidental releases of hazardous materials or exposure to toxic substances by promoting compliance with safety codes, regulations, and statutes and enforcing land-use plans that regulate the location of sites with hazardous chemicals.	City of Martinsburg	Plans and Regulations	Hazardous Materials	City of Martinsburg Planning and Zoning Department, Berkeley County Homeland Security	Ongoing	Staff Time
27B*	Conduct a comprehensive review and evaluation of the Flood Hazus analysis information and communicate any deficiencies/inaccuracies to the West Virginia GIS Technical Center. This includes obtaining and providing flood elevation certificates to the Technical Center for incorporation into the WV Flood Tool.	All	Plans and Regulations	Flooding	Local Floodplain Coordinators, WV GIS Tech. Center	Year 1	Staff Time
28B*	Conduct a thorough review of all community assets in order to assess status, vulnerabilities, and prioritization of mitigation funding. This includes compiling a list or database to be referenced in future updates to the Plan.	All	Structure and Infrastructure	Flooding	Local Floodplain Coordinators	Years 2 – 5	Local Funding
29B	Continue coordinating county efforts to meet the requirements of participation in the CRS.	Berkeley County	Plans and Regulations	Flooding	County Commission	Ongoing	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
30B	Develop an informational brochure to distribute to local farmers and residents concerning the potential effects of an infestation.	Berkeley County	Education and Awareness	Invasive Species	Farm Bureau, Natural Resource Conservation Service, WVDNR	Ongoing	USDA (if necessary), WVDNR
31B	Construct a stabilization wall or safety fence along roadways which pass through areas that are prone to landslides.	Berkeley County	Structure and Infrastructure	Landslides and Land Subsidence	WVDOH	Ongoing	WVDOT, Local Funding
32B	Coordinate with railroad companies to provide more emergency access to railroad rights-of-way for emergency response activities in the event of a train wreck.	Berkeley County	Plans and Regulations	Transportation Accident	County Commission, Railroad Companies	Ongoing	Local Funding

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
33B	Berkeley County will continue to seek out opportunities to apply for Hazard Mitigation Assistance (HMA) funds for mitigation reconstruction, elevations, relocations or acquisitions of identified at risk, repetitive loss, non-repetitive loss, substantial damaged, partially or completely demolished or destroyed properties within Berkeley County. If mitigation reconstruction is chosen, properties identified as partially or completely demolished, outside of the regulatory floodway, as identified by available flood hazard data, will be reconstructed in accordance with the standards established in the local floodplain ordinance and in accordance with the same conditions as an elevated structure. Berkeley County will comply with all acquisition, elevation, relocation and mitigation reconstruction requirements, as per the HMA Guidance.	Berkeley County	Structure and Infrastructure	Flooding	County Commission, Floodplain Coordinators	Ongoing	Hazard Mitigation Assistance
34B	Complete Sportsman's Paradise Park acquisition of area within floodplain and turn it into a green space park.	Berkeley County	Natural Systems Protection	Flooding	County Council	3 Years	Local Funding
35B*	Develop repetitive loss area maps and publicize through the WV Flood Tool.	Berkeley County	Structure and Infrastructure	Flooding	County CRS Coordinator, WVU GIS Tech. Center	1 year	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
36B	Work with area school/libraries/public facilities to include source water protection curriculum/classroom events/public education events.	Town of Hedgesville	Education and Awareness	Source Water Contamination	Town of Hedgesville Council	Short-term	Local Funding, Education Grants, DEP Grants, BPH Grants
37B*	Continue to educate the public as to the potential for earthquakes in West Virginia, specifically Berkeley County.	City of Martinsburg	Education and Awareness	Earthquake	City of Martinsburg Council, Berkeley County Homeland Security, FEMA	Ongoing	Staff Time
38B*	Maintain and continue to plant shade trees to reduce urban heat island effect.	City of Martinsburg	Natural Systems Protection	Extreme Temperatures	City of Martinsburg Planning and Zoning Department, NWS, WVDOF	Ongoing	Local Funding
39B*	Coordinate and ensure heating and cooling shelters when appropriate.	City of Martinsburg	Structure, and Infrastructure	Extreme Temperatures	City of Martinsburg Council, NWS, WVDOF	Ongoing	Local Funding
40B*	Ensure public facilities have backup power and are properly grounded.	City of Martinsburg	Structure and Infrastructure	Thunderstorm, Lightning Strike	City of Martinsburg Public Works	Ongoing	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
41B*	Prohibit and reduce impacts of wildfire by developing a Fire Inspection Program with newly hired Fire Inspector, and ensuring Department has adequate equipment and staffing.	City of Martinsburg	Plans and Regulations	Wildfire	City of Martinsburg Fire Department, City Administration	3 Years	Local Funding
42B*	Reduce impacts of terrorism through ensuring public buildings and facilities are well-lit and secure, and critical offices and facilities are away from uncontrolled public areas. Also locate critical assets (people, activities, systems) away from entrances, vehicle circulation and parking, and loading and maintenance areas.	City of Martinsburg	Structure and Infrastructure	Terrorism	City of Martinsburg Public works, Planning and Zoning, City Administration	5 Years	Local Funding
43B*	Work with subject matter experts to create or share an already created informational brochure and/or digital media to inform/educate local farmers and residents on the potential effects of an infestation.	City of Martinsburg	Education and Awareness	Invasive Species	City of Martinsburg Council, Farm Bureau	1 Year	Local funding
44B†	Coordinate with partners throughout the region to identify the location and contact information of privately owned dams.	Berkeley County	Education and Awareness	Dam Failure	BCHSEM	1 Year	Staff Time
45B	Create an informational brochure and/or digital media to inform/educate local farmers and residents on the potential effects of an infestation.	Berkeley County	Education and Awareness	Invasive Species	BCHSEM	1 Year	Staff Time
46B	Create an informational brochure and/or digital media as to how to prepare for a terrorism event and what to do if a terrorism event occurs.	Berkeley County	Education and Awareness	Terrorism	BCHSEM	1 Year	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
47B*	Prohibit and reduce impacts of civil disturbance by providing pertinent and timely information to the public so public is engaged and educated about issues affect local community, and maintain intelligence and law enforcement relationships with local, state, and federal agencies. Continue to encourage "See Something; Say Something."	City of Martinsburg	Education and Awareness/ Plans and Regulations	Civil Disturbance	City of Martinsburg Police, WV State Police	Ongoing	Local Funding
48B*†	Provide notice of funding opportunity to HHPD owners to promote rehabilitation and safety.	Berkeley County	Education and Awareness	Dam Failure	Berkeley County OEM	Annually by December	County
49B*†	Evaluate and prioritize actions and efforts related to HHPD that are cost effective and reduce risks from HHPDs.	Berkeley County	Education and Awareness/ Structure and Infrastructure	Dam Failure	Berkeley County OEM	Ongoing	County
50B*†	Collect information on and conduct a thorough review of all dam assets within Berkeley County in order to assess their status, vulnerabilities, potential losses (financial, social, and lifeline related), and prioritize specific dams for the Rehabilitation of High Hazard Potential Dams (HHPD) grant and other funding streams.	Berkeley County	Structure and Infrastructure	Dam Failure	Berkeley County OEM	2 Years	County
51B*†	Create an alternatives analysis to identify a preferred plan for eligible HHPD rehabilitation and the estimated cost for design and construction.	Berkeley County	Structure and Infrastructure	Dam Failure	HHPD Owners/Bekrley County OEM	2 Years	HHPD Grant Funding

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
52B*†	Work to develop conceptual, preliminary, or final design plans and specifications for eligible HHPD rehabilitation projects that have been planned using an alternative evaluation process that complies with National Environmental Policy Act (NEPA) requirements.	Berkeley County	Structure and Infrastructure	Dam Failure	HHPD Owners/Berkeley County OEM	4 Years	HHPD Grant Funding
Morgan County and Municipal Actions							
1M	Review all existing regulations to ensure adequacy in reducing impacts in hazard areas.	Morgan County	Plans and Regulations	All hazards	Planning Commission, Floodplain Coordinator, County Commission, OES and FEMA	Ongoing	County funding/ grant funding when available
2M	Expand the mission and membership of the Morgan County Local Emergency Planning Committee to act as a countywide disaster task force.	Morgan County	Plans and Regulations	All Hazards	LEPC, OES	Ongoing	Staff Time
3M	Develop adequate emergency shelter and evacuation plans for citizens and animals (domestic pets, livestock and wildlife).	Morgan County	Plans and Regulations	All Hazards	County Commission, OES, LEPC, Red Cross, DNR, Humane Society, Sheriff's Office	Ongoing	FEMA, WVEMD, Local, State Funding
4M	Construct a bypass along US Route 522 to improve safety and ease of access.	Morgan County	Structure and Infrastructure	Transportation Accidents	WV DOT	3 Years	Grant Funding, FHA

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
5M	Establish official Memorandums of Agreement between individual jurisdictions and electric/utility companies for maintenance regarding tree trimming to reduce power outages from storm events, burying power lines, and installing redundancies and loop feeds.	Morgan County	Plans and Regulations, Structure and Infrastructure	Utility Interruption	First Energy	Ongoing	Staff Time
6M	Educate water system operators and workers about the importance of safe available water and SWPPs and update the SWPP as necessary.	Morgan County	Education and Awareness, Plans and Regulations	Source Water Contamination	Planning Commission, County Commission,	Ongoing	Various
7M*	Curtail pollution and sediment runoff in Sleepy Creek by continuing to work with partners to identify non-point sources of pollution and coordinate funding and other assistance to curtail these sources from entering Sleepy Creek. Such contaminant sources include home septic systems, farm animals, farm cultivation practices, flooding, and high-water streambank erosion.	Morgan County	Natural Systems Protection	Source Water Contamination	Sleepy Creek Water Association	Ongoing, Long-term	Federal Chesapeake Bay Program, WV State, Morgan County, landowner and other private contributors
8M	Use floodplain ordinances, NFIP, CRS participation, public education, and property acquisition to remove existing developed properties from flood hazard areas and limit new development.	Morgan County	Plans and Regulations, Education and Awareness	Flooding	Floodplain Coordinators, County Commission	Ongoing	Local Funding and Grants

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
9M*	Enhance Warm Springs Run channel mitigation and urbanized flow obstruction.	Morgan County	Structure and Infrastructure	Flooding	Floodplain Coordinators, County Commission, EPA	Short-term, 2024 implementation	FEMA, WV Homeland Security and flood mitigation
10M	Increase awareness of key hazardous material transportation routes and storage areas and conduct drills with local agencies focusing on high- risk areas.	Morgan County	Education and Awareness	Hazardous Materials	LEPC, County Commission, WVDOH	Ongoing	WVDOH and WVDEP Funding, Local Funding
11M	Assist vulnerable populations and publicize road conditions using news stations, newspapers, and radio during winter storms.	Morgan County	Education and Awareness	Winter Storm, Nor'easter	County Commission	Ongoing	Local Funding, FEMA Funding
12M*	Strengthen community opioid crisis response through support and expansion of the Morgan County Harm Reduction Steering Committee, Chronic Pain Self-Management Program, and Morgan County Harm Reduction Program.	Morgan County	Education and Awareness	Substance Use Disorder	Morgan County Harm Reduction Steering Committee	Ongoing	WVDHHR and various grassroots organizations
13M	Review and maintain agreement with Morgan County Planning Commission to provide floodplain management.	Town of Bath	Plans and Regulations	Flooding	Town of Bath Council	1 Year	Staff Time
14M	Review and maintain agreement with Morgan County Planning Commission to provide floodplain management.	Town of Paw Paw	Plans and Regulations	Flooding	Town of Paw Paw Council	1 Year	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
15M	Apply for TAP grant through DOH to fund the addition and repair of sidewalks within town; include stormwater management practices to reduce flooding events on town/state roads.	Town of Paw Paw	Structure and Infrastructure	Flooding	Town of Paw Paw Council, Local Floodplain Coordinators	1-4 Years	WV DOH Funding
16M*	Conduct a comprehensive review and evaluation of the Flood Hazus analysis information and communicate any deficiencies/inaccuracies to the West Virginia GIS Technical Center. This includes obtaining and providing flood elevation certificates to the Technical Center for incorporation into the WV Flood Tool.	All	Structure and Infrastructure	Flooding	Local Floodplain Coordinators, WV GIS Tech. Center	1 Year	Staff Time
17M*	Conduct a thorough review of all community assets in order to assess status, vulnerabilities, and prioritization of mitigation funding. This includes compiling a list or database to be referenced in future updates to the Plan.	All	Structure and Infrastructure	Flood	Local Floodplain Coordinators	2-5 Years	Staff Time
18M	Support Morgan County's efforts in the CRS program, by providing training to municipalities on the CRS program and encouraging them to participate.	Morgan County	Education and Awareness	Flooding	Local Floodplain Coordinators	Ongoing	Staff Tine
19M	Collect updated information on the number and location of all repetitive loss properties throughout the county and develop a database and maps for storage.	Morgan County	Education and Awareness	Flooding	Local Floodplain Coordinators	Ongoing	Staff Time

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
20M	Identify owners of repetitive and severe repetitive loss properties that may be willing to participate in future property acquisition and relocation projects.	Morgan County	Education and Awareness	Flooding	Local Floodplain Coordinators	5 Years	Staff Time
21M	Review all comprehensive plans to ensure that designated growth areas are not in hazard areas.	Morgan County	Plans and Regulations	All hazards	Planning Commission, Local Floodplain Coordinators	Ongoing	Local funds, F&W Federation
22M	Work with WV Department of Highways to identify areas of frequent roadway flooding and develop mitigation strategies.	Morgan County	Education and Awareness	Flooding	DOT, OES, Local Floodplain Coordinators	Ongoing	Local Funds
23M	Identify strategies to mitigate risks from the transportation and/or storage of hazardous materials in Morgan County.	Morgan County	Plans and Regulations	Transportation Accidents, Hazardous Materials	OES, LEPC	Ongoing	HMEP, Local funds when available
24M	Establish a protocol for the sharing of annual shelter survey information between the local Red Cross chapter and the Morgan County Office of Emergency Services.	Morgan County	Education and Awareness	All Natural Hazards	Red Cross, OES	3 Years	Staff Time
25M	Establish a formal process for the city and the Park Service to coordinate disaster related efforts, which will include defining boundaries and establishing responsibilities.	Morgan County	Plans and Regulations	All Hazards	OES, County Commission	Ongoing	Local Funding when available, FEMA, EMA

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
26M	Conduct training exercises that include representatives from the city and the Park Service to facilitate increased coordination.	Morgan County	Education and Awareness	Multiple Hazards	Local WVDOH	1 Year	FEMA Flood Emergency Program, Local funds, Town of Paw Paw
27M	Continue to enforce ordinances that new structures do not interfere with flood mitigation measures.	Morgan County	Plans and Regulations	Flooding	County Commission, Planning Commission	Ongoing	Staff Time
28M	Obtain updated information on the number of NFIP policyholders in Morgan County and its municipalities.	Morgan County	Education and Awareness	Flooding	Floodplain Coordinator, OES, FEMA	Ongoing	Local funding, FEMA, EMA
29M	Develop mitigation strategies to protect any at-risk historic properties by conducting a survey of all historic sites that are located in hazard areas.	Morgan County	Structure and Infrastructure	All Natural Hazards	County Historic Society, Floodplain Coordinator	1-5 Years	Staff Time
30M	Apply for Hazardous Materials Emergency Preparedness (HMEP) grant from WVOES to finance the development of a hazardous materials survey for Morgan County.	Morgan County	Education and Awareness	Hazardous Materials	OES, LEPC	5 Years	HMEP, Local funds when available
31M	Review all capital improvement plans to ensure that infrastructure improvements are not directed towards hazardous areas.	Morgan County	Plans and Regulations	Flooding, Landslides and Land Subsidence	County Commission, Planning Commission	Ongoing	Local Funding

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
32M	Continue to support initiatives established under the Morgan County Office of Emergency Services.	Morgan County	Plans and Regulations	All Hazards	OES, Planning Commission	Ongoing	Staff Time
33M	Morgan County will continue to seek out opportunities to apply for Hazard Mitigation Assistance (HMA) funds for mitigation reconstruction, elevations, relocations or acquisitions of identified at risk, repetitive loss, non-repetitive loss, substantial damaged, partially or completely demolished or destroyed properties within Morgan County. If mitigation reconstruction is chosen, properties identified as partially or completely demolished, outside of the regulatory floodway, as identified by available flood hazard data, will be reconstructed in accordance with the standards established in the local floodplain ordinance and in accordance with the same conditions as an elevated structure. Morgan County will comply with all acquisition, elevation, relocation and mitigation reconstruction requirements, as per the HMA Guidance.	Morgan County	Structure and Infrastructure	Flooding	County Commission, Local Floodplain Coordinators	Ongoing	Hazard Mitigation Assistance
34M	Reinforce structures and infrastructure against hail and increase awareness before hailstorms with public announcements.	Morgan County	Structure and Infrastructure, Education and Awareness	Hailstorm	Morgan County Commission, Insurance Providers	Ongoing	Various

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan

Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
35M	Assess areas vulnerable to wildfires and publicize outdoor burning regulations and wildfire risks using pamphlets, news articles, and the Firewise Program.	Morgan County	Natural Systems Protection, Education and Awareness	Wildfire	Morgan County Commission	Ongoing	Local Funding
36M*	FirstEnergy will trim trees on a four-year cycle as well as request permission to cut right-of-way hazard trees from property owners.	Morgan County	Structure and Infrastructure	Utility Interruption	Potomac Edison	Ongoing	FirstEnergy
37M	Work with WVDOH to find solutions to flood impacted parts of US Route 522 within town limits, such as S. Washington Street.	Town of Bath	Structure and Infrastructure	Flooding	Town of Bath Council, Local Floodplain Coordinators	Ongoing, Long-term	Local Funding, WVDOH Funding
38M	Install generators and other equipment to aid in the continuation of essential services in the event of utility interruption.	Town of Bath	Structure and Infrastructure	Utility Interruption	Town of Bath Council	Ongoing	WVEMD
39M*	Develop a Capital Improvements Program that identifies capital projects and equipment purchases.	Town of Bath	Plans and Regulations	All Hazards	Town of Bath Planning Commission	5 Years	Local Funding
40M*	Develop a Climate Change Adaptation Plan to better help the town in addressing and adapting to climate change.	Town of Bath	Plans and Regulations	All Hazards	Town of Bath Planning Commission	5 Years	Local Funding
41M*	Obtain StormReady Certification.	Town of Bath	Education and Awareness	All Natural Hazards	Town of Bath Planning Commission	Ongoing	Local Funding

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
42M*	Renovate fire hall to be used as shelter, evacuation site, and quarantine site.	Town of Paw Paw	Structure and Infrastructure	All Natural Hazards	Town of Bath Public Safety Committee	2 Years	FEMA, WVEMD, Local, County Funding
43M	Install generators and other equipment to aid in the continuation of essential services in the event of utility interruption.	Town of Paw Paw	Structure and Infrastructure	Utility Interruption	Town of Paw Paw Council	5 Years	WVEMD Funding
44M	Post and distribute terrorism preparedness information based on current data.	Morgan County	Education and Awareness	Terrorism	State OHSEM	1 Year	Staff Time
45M	Provide NWS sponsored weather-related classes to the public, distribute emergency preparedness information on severe weather hazards, and provide classes on severe weather preparedness to the public.	Morgan County	Education and Awareness	Hurricane, Tropical Storm	State OHSEM	Ongoing	Grants, Community Partners
46M	Provide pamphlets and educational material to county residents to encourage annual residential radon testing.	Morgan County	Education and Awareness	Radon Exposure	County Commission	1 Year	Staff Time
47M	Monitor water supply and conserve water through public awareness campaigns conducted using news and radio stations. A survey of residential wells and public water customers should also be conducted to evaluate the status of residential drinking water in the county and identify trends.	Morgan County	Natural System Protection, Education and Awareness	Drought	Local, State, Federal Government	Ongoing	Various

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan

Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
48M	Monitor rainfall and conduct annual inspections of berms to protect against structural failures.	Morgan County	Structure and Infrastructure	Dam Failure	Property Owners, Morgan County Unsafe Structure and Property Enforcement Agency	Ongoing	Local Funding, WVDEP, FEMA Funding
49M	Educate the public about the risks associated with extreme temperatures using the county website and local radio stations.	Morgan County	Education and Awareness	Extreme Temperatures	Morgan County Commission	Ongoing	Local Funding and Grants
50M	When a disease reoccurs in a community, use pamphlets, local news media, and online resources to educate the public about mitigation.	Morgan County	Education and Awareness	Pandemic and Infectious Disease	Morgan County Health Department	Ongoing	State, Federal Funding
51M	Protect roadways and remove buildings in potential landslide and land subsidence hazard areas.	Morgan County	Structure and Infrastructure	Landslides and Land Subsidence	Planning Commission, Morgan County Unsafe Structure and Property Enforcement Agency	Ongoing	State, Federal Funding
52M	Utilize pamphlets and articles about the warning signs and the potential damages of thunderstorms and lightning strikes.	Morgan County	Education and Awareness	Thunderstorm, Lightning Strike	County Commission, NOAA, NWS	Ongoing	Local, Federal Funding

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan

Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
53M	Conduct control initiatives, such as the Gypsy Moth Spray Program, and conduct public education and awareness campaigns.	Morgan County	Education and Awareness, Natural System Protection	Invasive Species	Morgan County Commission, WV Department of Ag	Ongoing	Local, State Funding
54M*†	Provide notice of funding opportunity to High-Hazard Potential Dam owners to promote rehabilitation and safety.	Morgan County	Education and Awareness	Dam Failure	Morgan County OHSEM	Annually by December	County
55M*†	Evaluate and prioritize actions and efforts related to High-Hazard Potential Dams that are cost effective and reduce risks from HHPDs.	Morgan County	Education and Awareness/ Structure and Infrastructure	Dam Failure	Morgan County OHSEM	Ongoing	County
56M*†	Collect information on and conduct a thorough review of all dam assets within Morgan County in order to assess their status, vulnerabilities, potential losses (financial, social, and lifeline related), and prioritize specific dams for the Rehabilitation of High Hazard Potential Dams (HHPD) grant and other funding streams.	Morgan County	Structure and Infrastructure	Dam Failure	Morgan County OHSEM	2 Years	County
57M*†	Create an alternatives analysis to identify a preferred plan for Warm Springs No. 1 and other HHPD dam rehabilitation and the estimated cost for design and construction.	Morgan County	Structure and Infrastructure	Dam Failure	HHPD Owners/Morgan County OHSEM	2 Years	HHPD Grant Funding

Table 6.4-1 2022 Berkeley and Morgan County Mitigation Action Plan							
Action Number	Action	Jurisdiction	Category	Hazard(s) Addressed	Lead Agency/ Department	Implementation Schedule	Funding Source
58M*†	Work to develop conceptual, preliminary, or final design plans and specifications for Warm Springs No. 1 and other HHPD rehabilitation projects that have been planned using an alternative evaluation process that complies with National Environmental Policy Act (NEPA) requirements.	Morgan County	Structure and Infrastructure	Dam Failure	HHPD Owners/Morgan County OHSEM	4 Years	HHPD Grant Funding

*Indicates that action was added during 2022 HMP update.

† Indicates actions that focus on reducing long-term vulnerabilities from HHPDs and align with Goal 2B Objective 2J, Goal 4B Objective 4F, Goal 2M Objective 2J, and Goal 3M Objective 3E.

Table 6.4-1 lists 111 mitigation actions, many of which will require substantial time commitments from staff at the county and local municipalities. While all these activities will be pursued over the next five years, the reality of limited time and resources requires the identification of the feasibility and priority level of mitigation actions. Prioritization allows the individuals and organizations involved to focus their energies and ensure progress on mitigation activities.

Evaluating mitigation actions involves judging each action against certain criteria to determine its feasibility and potential impact. Actions evaluated and prioritized by applying the Multi-Objective Mitigation Action Prioritization criteria. For each action, scores were assigned to each criterion using the following weighted, multi-objective mitigation action prioritization criteria.

- **Effectiveness** (weight: 20% of score): The extent to which an action reduces the vulnerability of people and property.
- **Efficiency** (weight: 30% of score): The extent to which time, effort, and cost is well used as a means of reducing vulnerability.
- **Multi-Hazard Mitigation** (weight: 20% of score): The action reduces vulnerability for more than one hazard.
- **Addresses High Risk Hazard** (weight: 15% of score): The action reduces vulnerability for people and property from a hazard(s) identified as high risk.
- **Addresses Critical Communications/Critical Infrastructure** (weight: 15% of score): The action pertains to the maintenance of critical functions and structures such as transportation, supply chain management, data circuits, etc.

Scores of 1, 2, or 3 were assigned for each multi-objective mitigation action prioritization criterion where 1 is a low score and 3 is a high score. The Efficiency criterion, which considers the cost and effort of each action versus its overall vulnerability reduction benefit, is the most highly weighted criterion as part of the total prioritization score. Actions were prioritized using the cumulative score assigned to each. Each mitigation action was then given a priority ranking (Low, Medium, and High) based on the following:

- Low Priority: 1.0 – 1.8
- Medium Priority: 1.9 – 2.4
- High Priority: 2.5 – 3.0

Table 6.4-2 presents the cumulative results of the prioritization of mitigation actions. Four Region 9 action are ranked High Priority, while one is ranked Medium Priority. In Berkeley County, 12 actions were ranked High Priority, 26 are ranked Medium Priority, while the remaining 14 ranked as Low Priority. In Morgan County, 15 actions were ranked as High Priority, 31 actions were ranked as Medium Priority, and the remaining 12 were ranked as Low Priority.

Table 6.4-2 Mitigation Action Prioritization							
MITIGATION ACTIONS		MULTI-OBJECTIVE MITIGATION ACTION PRIORITIZATION CRITERIA					
		Low = 0.0-1.8		Medium = 1.9-2.4		High = 2.5-3.0	
NO.	NAME	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High Risk Hazard	Addresses Communications / Critical	Total Score
Region 9 Planning and Development Council Actions							
1	Perform annual review to ensure communities are maintaining compliance with the National Flood Insurance Program (NFIP) at the jurisdictional level by attending training, monitoring development, and ensuring that local floodplain regulations are as current and applicable as possible.	3	3	1	3	3	2.6
2	Perform annual review to ensure communities are undertaking buyout, elevation, and/or relocation projects in the Region IX Planning and Development Council area when and if funding is available.	3	2	1	3	3	2.3
3*	Coordinate, as appropriate, with partners throughout the region to identify the location of privately-owned dams.	3	3	1	3	3	2.6
4*	Collaborate with WVEMD, West Virginia Department of Environmental Protection (Dam Safety Section), and HHPD owners to better document location and size of populations at risk and impacts to institutions and critical infrastructure/facilities/lifelines from dam breach or failure. This may include digitization of inundation mapping if available.	3	3	1	3	3	2.6
5*	Collaborate with WVEMD, West Virginia Department of Environmental Protection (Dam Safety Section), to educate HHPD dam owners on the USACE NID update and work with the State to add additional information to the database.	3	3	1	3	3	2.6

Berkeley County and Municipal Actions							
1B	Evaluate current public water system to identify the most feasible locations to construct upgrades that would reduce or eliminate the effects of drought. A survey of residential wells and public water customers should also be conducted to evaluate the status of residential drinking water in the county and identify trends.	2	3	1	1	1	2.4
2B	Develop stringent stormwater management codes for future development.	3	3	2	3	2	2.5
3B	Consider conducting acquisition and relocation projects (buyouts) in flood-prone areas. This includes repetitive, severe repetitive loss and non-repetitive and severe repetitive loss structures.	3	2	1	3	1	2.0
4B	Work with airport safety officials to determine how best to respond to a crash involving larger planes.	1	3	1	3	2	1.9
5B	Continue coordinating county efforts to meet the requirements of participation in the CRS.	2	3	1	3	2	2.3
6B	Maintain county Source Water protection Plan (SWPP) according to state regulatory requirements.	3	3	1	3	2	2.3
7B*	Maintain and expand programs offered through Berkeley County Recovery Resource Center, Berkeley County Day Report Center, and Berkeley County Home Confinement Program.	3	3	1	3	1	2.5
8B	Assist Berkeley County in educating the public regarding radon systems and home testing available.	1	1	1	1	1	1.3
9B	Prohibit new facilities for persons with special needs or mobility concerns in hazard areas.	3	2	3	3	1	2.4
10B*	Prohibit or block cyber terrorism on public facilities by transitioning to Microsoft 365 and continuing routine server backups.	3	3	1	3	3	2.6
11B*	Update Martinsburg Water Model in order to ensure redundancy remains between Martinsburg's water plans and to continue inflow and infiltration reduction efforts.	1	3	1	3	2	2.1

12B*	Educate residents about benefits of conserving water and where Martinsburg's water resources come from.	1	3	1	1	1	1.6
13B*	Reduce impact of flooding by enforcing floodplain ordinance and Martinsburg Stormwater Ordinance.	3	2	1	3	3	2.3
14B*	Ensure newly constructed critical facilities are out of the floodplain.	3	2	1	3	3	2.3
15B*	Enforce building code to ensure structural stability during hazard events.	3	2	3	3	3	2.7
16B*	Identify areas prone to land subsidence to better inform building decisions.	2	2	1	1	2	1.7
17B*	Invest and strengthen core public health infrastructure, including water and sanitation systems; increasing situational awareness; and rapidly extinguishing sparks that could lead to pandemics.	3	1	3	3	2	2.3
18B*	Ensure partnerships and coordinated response between governmental partner, medical providers and private sector should be implemented focusing on maintenance of situational awareness, public health messaging, reduction of transmission, and care for and treatment of the ill.	3	2	2	3	2	2.4
19B*	Update City's existing Well Head Protection Plan to address growth, land use, and contamination threats, and be correlated with development regulations, including the Zoning Ordinance, to ensure the safety of local drinking water.	3	2	1	3	1	2.0
20B*	Reduce consequences and impacts of Substance Use Disorder through continued partnership in the Martinsburg Initiative, participation in Eastern Panhandle Violent Crimes Task Force, utilization of Martinsburg Drug House Ordinance, police enforcement against distribution chains, and continued participation and partnership with schools and school children.	3	3	1	3	1	2.3
21B*	Work towards a complete network that allows convenient pedestrian and/or bicycle travel to all areas of the City by increased road and sidewalk maintenance and increased access to Downtown and West End redevelopment zones.	2	1	2	3	1	1.7

22B*	Explore increased public transit, addressing convenience, efficiency, and user-friendly accessibility, improve Ride-Share and Park & Ride solutions for commuters, and ensure Public Safety Agencies has appropriate equipment and staffing to respond.	2	1	2	3	1	1.7
23B*	Continually monitor, maintain, and upgrade lines, tanks, and other system infrastructure to avoid leaks that water and wastewater could potentially cause damage to City infrastructure or private property.	3	2	1	3	2	2.2
24B*	Reduce impacts of windstorms and tornados by coordinating with power companies to ensure trees adjacent to power lines are properly trimmed and encourage/requiring undergrounding of new or replaced utilities.	3	3	2	3	2	2.7
25B*	Coordinate with power company and other utilities to ensure utilities are winter ready and preventative maintenance has occurred.	3	3	2	3	2	2.7
26B*	Eliminate or reduce risk due to either accidental releases of hazardous materials or exposure to toxic substances by promoting compliance with safety codes, regulations, and statutes and enforcing land-use plans that regulate the location of sites with hazardous chemicals.	3	3	3	3	2	2.9
27B*	Conduct a comprehensive review and evaluation of the Flood Hazus analysis information and communicate any deficiencies/inaccuracies to the West Virginia GIS Technical Center. This includes obtaining and providing flood elevation certificates to the Technical Center for incorporation into the WV Flood Tool.	3	3	2	3	3	2.8
28B*	Conduct a thorough review of all community assets in order to assess status, vulnerabilities, and prioritization of mitigation funding. This includes compiling a list or database to be referenced in future updates to the Plan.	3	2	3	3	3	2.7
29B	Continue coordinating county efforts to meet the requirements of participation in the CRS.	2	3	1	3	3	2.4
30B	Develop an informational brochure to distribute to local farmers and residents concerning the potential effects of an infestation.	1	2	1	1	1	1.3

31B	Construct a stabilization wall or safety fence along roadways which pass through areas that are prone to landslides.	3	1	1	1	2	1.6
32B	Coordinate with railroad companies to provide more emergency access to railroad right-of-ways for emergency response activities in the event of a train wreck.	2	3	2	3	3	2.6
33B	Berkeley County will continue to seek out opportunities to apply for Hazard Mitigation Assistance (HMA) funds for mitigation reconstruction, elevations, relocations or acquisitions of identified at risk, repetitive loss, non-repetitive loss, substantial damaged, partially or completely demolished or destroyed properties within Berkeley County. If mitigation reconstruction is chosen, properties identified as partially or completely demolished, outside of the regulatory floodway, as identified by available flood hazard data, will be reconstructed in accordance with the standards established in the local floodplain ordinance and in accordance with the same conditions as an elevated structure. Berkeley County will comply with all acquisition, elevation, relocation and mitigation reconstruction requirements, as per the HMA Guidance.	3	3	2	3	3	2.8
34B	Complete Sportsman's Paradise Park acquisition of area within floodplain and turn it into a green space park.	3	2	1	3	1	2.0
35B*	Develop repetitive loss area maps and publicize through the WV Flood Tool.	3	2	1	3	2	2.3
36B	Work with area school/libraries/public facilities to include source water protection curriculum/classroom events/public education events.	1	2	1	3	1	1.6
37B*	Continue to educate the public as to the potential for earthquakes in West Virginia, specifically Berkeley County.	1	1	1	1	3	1.3
38B*	Maintain and continue to plant shade trees to reduce urban heat island effect.	2	2	1	1	1	1.5
39B*	Coordinate and ensure heating and cooling shelters when appropriate.	3	2	3	3	1	2.4
40B*	Ensure public facilities have backup power and are properly grounded.	3	2	3	3	3	2.7

41B*	Prohibit and reduce impacts of wildfire by developing a Fire Inspection Program with newly hired Fire Inspector, and ensuring Department has adequate equipment and staffing.	2	1	1	1	3	1.5
42B*	Reduce impacts of terrorism through ensuring public buildings and facilities are well-lit and secure, and critical offices and facilities are away from uncontrolled public areas. Also locate critical assets (people, activities, systems) away from entrances, vehicle circulation and parking, and loading and maintenance areas.	3	2	1	3	3	2.3
43B*	Work with subject matter experts to create or share an already created informational brochure and/or digital media to inform/educate local farmers and residents on the potential effects of an infestation.	1	3	1	1	1	1.6
44B	Coordinate with partners throughout the region to identify the location and contact information of privately owned dams.	1	3	1	1	3	2.2
45B	Create an informational brochure and/or digital media to inform/educate local farmers and residents on the potential effects of an infestation.	1	2	1	1	1	1.3
46B	Create an informational brochure and/or digital media as to how to prepare for a terrorism event and what to do if a terrorism event occurs.	1	2	1	1	1	1.3
47B*	Prohibit and reduce impacts of civil disturbance by providing pertinent and timely information to the public so public is engaged and educated about issues affect local community, and maintain intelligence and law enforcement relationships with local, state, and federal agencies. Continue to encourage “See Something; Say Something.”	2	2	1	3	3	2.1
48B*	Provide notice of funding opportunity to HHPD owners to promote rehabilitation and safety.	1	3	1	1	3	1.9
49B*	Evaluate and prioritize actions and efforts related to HHPD that are cost effective and reduce risks from HHPDs.	2	3	1	1	3	2.1

50B*	Collect information on and conduct a thorough review of all dam assets within Berkeley County in order to assess their status, vulnerabilities, potential losses (financial, social, and lifeline related), and prioritize specific dams for the Rehabilitation of High Hazard Potential Dams (HHPD) grant and other funding streams.	3	2	1	2	3	2.1
51B*	Create an alternatives analysis to identify a preferred plan for eligible HHPD rehabilitation and the estimated cost for design and construction.	3	2	1	2	3	2.1
52B*	Work to develop conceptual, preliminary, or final design plans and specifications for eligible HHPD rehabilitation projects that have been planned using an alternative evaluation process that complies with National Environmental Policy Act (NEPA) requirements.	3	3	1	2	3	2.4
Morgan County and Municipal Actions							
1M	Review all existing regulations to ensure adequacy in reducing impacts in hazard areas.	3	3	3	3	3	3.0
2M	Expand the mission and membership of the Morgan County Local Emergency Planning Committee to act as a countywide disaster task force.	3	3	3	3	3	3.0
3M	Develop adequate emergency shelter and evacuation plans for citizens and animals (domestic pets, livestock and wildlife).	3	2	3	3	3	2.7
4M	Construct a bypass along US Route 522 to improve safety and ease of access.	3	3	2	1	2	2.4
5M	Reduce utility interruption by establishing standards for tree trimming, burying power lines, and installing redundancies and loop feeds.	3	3	1	3	2	2.5
6M	Educate water system operators and workers about the importance of safe available water and SWPPs and update the SWPP as necessary.	2	2	2	2	2	2.0
7M*	Curtail pollution and sediment runoff in Sleepy Creek by continuing to work with partners to identify non-point sources of pollution and coordinate funding and other assistance to curtail these sources from entering Sleepy Creek. Such contaminant sources include home septic systems,	3	1	1	1	1	1.4

	farm animals, farm cultivation practices, flooding, and high-water streambank erosion.						
8M	Use floodplain ordinances, NFIP, CRS participation, public education, and property acquisition to remove existing developed properties from flood hazard areas and limit new development.	3	1	2	3	3	2.2
9M*	Enhance Warm Springs Run channel mitigation and urbanized flow obstruction.	2	1	2	3	2	1.9
10M	Increase awareness of key hazardous material transportation routes and storage areas and conduct drills with local agencies focusing on high-risk areas.	3	2	2	1	3	2.2
11M	Assist vulnerable populations and publicize road conditions using news stations, newspapers, and radio during winter storms.	3	3	2	1	2	2.4
12M*	Strengthen community opioid crisis response through support and expansion of the Morgan County Harm Reduction Steering Committee, Chronic Pain Self-Management Program, and Morgan County Harm Reduction Program.	2	3	1	3	1	2.1
13M	Review and maintain agreement with Morgan County Planning Commission to provide floodplain management.	2	3	1	3	3	2.4
14M	Review and maintain agreement with Morgan County Planning Commission to provide floodplain management.	2	3	1	3	3	2.4
15M	Apply for TAP grant through DOH to fund the addition and repair of sidewalks within town; include stormwater management practices to reduce flooding events on town/state roads.	2	3	1	3	3	2.4

16M*	Conduct a comprehensive review and evaluation of the Flood Hazus analysis information and communicate any deficiencies/inaccuracies to the West Virginia GIS Technical Center. This includes obtaining and providing flood elevation certificates to the Technical Center for incorporation into the WV Flood Tool.	3	3	2	3	3	2.8
17M*	Conduct a thorough review of all community assets in order to assess status, vulnerabilities, and prioritization of mitigation funding. This includes compiling a list or database to be referenced in future updates to the Plan.	3	2	3	3	3	2.7
18M	Support Morgan County's efforts in the CRS program, by providing training to municipalities on the CRS program and encouraging them to participate.	2	2	1	3	2	2.0
19M	Collect updated information on the number and location of all repetitive loss properties throughout the county and develop a database and maps for storage.	3	3	1	3	3	2.6
20M	Identify owners of repetitive and severe repetitive loss properties that may be willing to participate in future property acquisition and relocation projects.	3	2	1	3	2	2.2
21M	Review all comprehensive plans to ensure that designated growth areas are not in hazard areas.	3	3	3	3	3	3.0
22M	Work with WV Department of Highways to identify areas of frequent roadway flooding and develop mitigation strategies.	2	3	1	3	2	2.3
23M	Identify strategies to mitigate risks from the transportation and/or storage of hazardous materials in Morgan County.	2	2	2	2	2	2.0
24M	Establish a protocol for the sharing of annual shelter survey information between the local Red Cross chapter and the Morgan County Office of Emergency Services.	3	2	2	1	1	1.9

25M	Establish a formal process for the city and the Park Service to coordinate disaster related efforts, which will include defining boundaries and establishing responsibilities.	3	2	3	3	1	2.4
26M	Conduct training exercises that include representatives from the city and the Park Service to facilitate increased coordination.	2	2	3	3	1	2.2
27M	Continue to enforce ordinances that new structures do not interfere with flood mitigation measures.	3	3	1	3	3	2.6
28M	Obtain updated information on the number of NFIP policyholders in Morgan County and its municipalities.	3	2	1	3	3	2.3
29M	Develop mitigation strategies to protect any at-risk historic properties by conducting a survey of all historic sites that are located in hazard areas.	2	2	3	2	3	2.4
30M	Apply for Hazardous Materials Emergency Preparedness (HMEP) grant from WVOES to finance the development of a hazardous materials survey for Morgan County.	3	3	3	2	3	2.9
31M	Review all capital improvement plans to ensure that infrastructure improvements are not directed towards hazardous areas.	3	2	1	1	2	1.9
32M	Continue to support initiatives established under the Morgan County Office of Emergency Services.	3	3	3	3	3	3.0
33M	Morgan County will continue to seek out opportunities to apply for Hazard Mitigation Assistance (HMA) funds for mitigation reconstruction, elevations, relocations or acquisitions of identified at risk, repetitive loss, non-repetitive loss, substantial damaged, partially or completely demolished or destroyed properties within Morgan County. If mitigation reconstruction is chosen, properties identified as partially or completely demolished, outside of the regulatory floodway, as identified by available flood hazard data, will be reconstructed in accordance with the standards established in the local floodplain ordinance and in accordance with the same conditions as an elevated structure. Morgan County will comply with all acquisition, elevation, relocation	3	3	3	3	3	3.0

	and mitigation reconstruction requirements, as per the HMA Guidance.						
34M	Reinforce structures and infrastructure against hail and increase awareness before hailstorms with public announcements.	3	2	2	3	3	2.5
35M	Assess areas vulnerable to wildfires and publicize outdoor burning regulations and wildfire risks using pamphlets, news articles, and the Firewise Program.	3	1	1	1	2	1.6
36M*	FirstEnergy will trim trees on a four-year cycle as well as request permission to cut right-of-way hazard trees from property owners.	2	2	1	1	2	1.7
37M	Work with WVDOH to find solutions to flood impacted parts of US Route 522 within town limits, such as S. Washington Street.	3	3	1	2	2	2.3
38M	Seek funding for generators and other equipment to aid in the continuation of essential services in the event of utility interruption.	2	2	2	1	3	2.0
39M*	Develop a Capital Improvements Program that identifies capital projects and equipment purchases.	2	2	3	3	2	2.4
40M*	Develop a Climate Change Adaptation Plan to better help the town in addressing and adapting to climate change.	3	2	3	3	2	2.6
41M*	Seek StormReady Certification.	2	2	3	3	2	2.4
42M*	Renovate fire hall to be used as shelter, evacuation site, and quarantine site.	3	3	2	3	2	2.7
43M	Seek funding for generators and other equipment to aid in the continuation of essential services in the event of utility interruption.	2	1	2	3	1	1.7
44M	Post and distribute terrorism preparedness information based on current data.	2	2	3	3	2	2.4

45M	Provide NWS sponsored weather-related classes to the public, distribute emergency preparedness information on severe weather hazards, and provide classes on severe weather preparedness to the public.	1	2	1	1	1	1.3
46M	Provide pamphlets and educational material to county residents to encourage annual residential radon testing.	3	1	3	3	2	2.3
47M	Monitor water supply and conserve water through public awareness campaigns conducted using news and radio stations. A survey of residential wells and public water customers should also be conducted to evaluate the status of residential drinking water in the county and identify trends.	1	2	1	1	1	1.3
48M	Monitor rainfall and conduct annual inspections of berms to protect against structural failures.	3	2	2	1	1	1.9
49M	Educate the public about the risks associated with extreme temperatures using the county website and local radio stations.	3	2	2	1	3	2.2
50M	When a disease reoccurs in a community, use pamphlets, local news media, and online resources to educate the public about mitigation.	2	3	1	1	1	1.8
51M	Protect roadways and remove buildings in potential landslide and land subsidence hazard areas.	2	3	1	2	1	2.0
52M	Utilize pamphlets and articles about the warning signs and the potential damages of thunderstorms and lightning strikes.	3	2	1	1	3	2.0
53M	Conduct control initiatives, such as the Gypsy Moth Spray Program, and conduct public education and awareness campaigns.	1	2	1	1	2	1.5
54M*	Provide notice of funding opportunity to High-Hazard Potential Dam owners to promote rehabilitation and safety.	3	3	1	1	1	2.0

55M*	Evaluate and prioritize actions and efforts related to High-Hazard Potential Dams that are cost effective and reduce risks from HHPDs.	1	3	1	1	3	1.9
56M*	Collect information on and conduct a thorough review of all dam assets within Morgan County in order to assess their status, vulnerabilities, potential losses (financial, social, and lifeline related), and prioritize specific dams for the Rehabilitation of High Hazard Potential Dams (HHPD) grant and other funding streams.	3	2	1	2	3	2.1
57M*	Create an alternatives analysis to identify a preferred plan for Warm Springs No. 1 and other HHPD dam rehabilitation and the estimated cost for design and construction.	3	2	1	2	3	2.1
58M*	Work to develop conceptual, preliminary, or final design plans and specifications for Warm Springs No. 1 and other HHPD rehabilitation projects that have been planned using an alternative evaluation process that complies with National Environmental Policy Act (NEPA) requirements.	3	3	1	2	3	2.4

*Indicates that action was added during 2022 HMP update.

7. Plan Maintenance

7.1. Update Process Summary

Once this plan has received approval from WVEMD and FEMA, the plan will be adopted by Berkeley and Morgan County and all participating jurisdictions. This HMP Update is intended to be a 'living document.' Plan adoption is not considered the final step in the planning process, but rather as a first step to 'realization.' The plan monitoring and maintenance schedule is a cycle of events that involve periodic review, adjustments, and improvement. Plan monitoring also provides an opportunity to recognize other planning initiatives within the county that may benefit from the incorporation of risk and/or mitigation objectives detailed in this HMP. This section establishes a method to monitor how the plan will be evaluated and maintained in the future.

Monitoring, evaluating, and updating this plan is critical to maintaining its value and success in Berkeley and Morgan 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 HMSC elected to keep the methodology and schedule similar to what is outlined in the 2017 HMP, but to add more hazards and put more emphasis on integrating the mitigation goals, objectives, and actions identified in the Mitigation Strategy into the other ongoing planning efforts to ensure implementation and tracking of actions throughout the five-year plan maintenance process.

7.2. Monitoring, Evaluating and Updating the Plan

Hazard mitigation planning in Berkeley and Morgan County is the responsibility of all levels of government (i.e., county and local), as well as the citizens of the counties. As listed in FEMA 386-4, the planning team (the Berkeley and Morgan County HMSC) must continuously monitor and document the progress of the Plan's recommended actions. The HMSC (listed in Section 3.2), under the direction of the Eastern Panhandle Planning and Development Council, will be responsible for maintaining this Multi-Jurisdictional HMP. The HMSC will meet annually and following each emergency declaration, with the purpose of reviewing the Plan. The HMSC will lead annual reviews of the HMP. Each year, the counties will solicit new projects from the municipalities by sending out Project Opportunity Forms and informing the municipalities of the opportunity to update their mitigation measures.

Each review process will ensure that the Hazard Vulnerability Analysis and Risk Assessment reflect current conditions in the counties and the municipalities, the Capability Assessment accurately reflects local circumstances, and the hazard mitigation strategies are updated based on the county's damage assessment reports and local mitigation project priorities. Upon each HMP evaluation, the HMSC will consider whether applications should be submitted for existing mitigation grant programs. A decision to apply for funding will be based on appropriate eligibility and financial need requirements. All state and federal mitigation funding provided to the county or local municipalities will be reported in subsequent plan updates. The HMSC will complete a Progress Report to evaluate the status and accuracy of the HMP and record the Steering Committee's findings. The Eastern Panhandle Planning and Development Council will maintain a copy of these records.

The Hazard Risk table will be reviewed and any changes to rankings based on frequency or severity to profiled hazards will be documented. Municipal officials will be asked to provide a mitigation action progress information each year and the Mitigation Action Plan will be updated accordingly. The HMPSC will prepare an annual update report of the mitigation actions based on the annual report forms from the municipalities as well as the counties. The annual HMP review will be scheduled each year during the week of the HMP approval anniversary. The following questions will be considered as criteria for assessing the effectiveness of the HMP:

- Has the nature or magnitude of hazards affecting the region changed?
- Are there new hazards that have the potential to impact the region?

- Is there updated, or more quantitative, risk assessment data available related to the identified hazards in the plan? Can this data be integrated into the analysis to better assess the vulnerability, and depict the risk, of communities to the hazards?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the plan?
- Should additional local resources be committed to address identified hazards?
- Are there current or upcoming planning mechanisms or initiatives in which the mitigation strategy should be considered for integration?

In addition to conducting an annual review of the Plan, the HMPSC will review the Plan within 30 days of a disaster. The Risk Assessment and Mitigation Strategy will be evaluated and any changes to community priorities or status will be documented. The HMP will receive a full, detailed update every five years, as required to reflect the current risk, vulnerabilities, development trends and as mitigation actions are implemented. While an annual report will be completed each year, any state and Federal mandates from WVEMD and FEMA respectively, will be addressed in the five-year update. The municipalities will not be responsible for making any changes to the HMP document as part of annual reviews; their role will consist of information for the review and report only. A copy of each Annual Plan Review will be provided to WVEMD and FEMA and included as official documentation in the next 5-year HMP update.

Additional agencies throughout the region, such as the county-level offices of emergency management and LEPCs, will actively integrate the information contained in this risk assessment into other planning initiatives, such as the maintenance of their jurisdiction- specific Emergency Operations Plans (EOPs). These documents should support the strengthening of capabilities to respond to the hazards identified by the risk assessment. As mitigation projects are implemented and risk is thus reduced, the emergency services community may need to “re-plan” its response to address what has become (thanks to the mitigation project) a more critical risk.

The HMSC will complete a Progress Report to evaluate the status and accuracy of the HMP and record the Steering Committee’s findings. As directed by FEMA 386-4, the Progress Report will include the following information: the hazard mitigation action’s objectives; who the lead and supporting agencies responsible for implementation are; how long the project should take, including a delineation of the various stages of work along with timelines (milestones should be included); whether the resources needed for implementation, funding, staff time, and technical assistance are available, or if other arrangements must be made to obtain them; the types of permits or approvals necessary to implement the action; details on the ways the actions will be accomplished within the organization, and whether the duties will be assigned to agency staff or contracted out; and the current status of the project, identifying any issues that may hinder implementation.

7.3. Continued Public Involvement

The Eastern Panhandle Planning and Development Council will ensure that the HMP is posted and maintained on the Region 9 website and will continue to encourage public review and comment on the plan through information posted to the website and public notices in the local newspaper.

The citizens of Berkeley and Morgan County are encouraged to submit their comments to elected officials and/or members of the Hazard Mitigation Steering Committee. To promote public participation, Region 9 welcomed comments on the HMP for a 30-day period. This offered the public the opportunity to share their comments and observations. All comments received will be maintained and considered by the Hazard Mitigation Steering Committee when updating the HMP. No comments were received during the 30-day review period.

The Comprehensive Plan; Building Code, Municipal Floodplain Management Regulations, Emergency Operations Plan, and Zoning Ordinance are identified for incorporation of hazard mitigation actions once the Plan is adopted. Each of these mechanisms will continue to be used to meet the intent of this Plan, as appropriate. Likewise, as these planning mechanisms are updated, they will be considered for incorporation into the HMP during the annual review process and/or the five-year cycle update.

The region and participating jurisdictions may propose additional mitigation actions for inclusion throughout the five-year cycle but must submit new mitigation actions through the Emergency Management Agency which will request an HMP amendment by contacting the WVEMD State Hazard Mitigation Planner. FEMA must officially approve all additions and will amend the HMP by issuing an HMP Amendment Approval letter.

8. Plan Adoption

The Plan was submitted to the West Virginia Department of Homeland Security and Emergency Management on September 28, 2021 and forwarded to FEMA for final review and approval-pending-adoption on October 18, 2021. FEMA granted approval-pending-adoption on _____, 2022. Full approval from FEMA was received after each jurisdiction adopted the plan.

This section of the plan includes copies of the local adoption resolutions passed by Berkeley County, Morgan County, and their municipal governments. Adoption resolution templates are provided to assist the county and municipal governments with recommended language for future adoption of the HMP.

A completed Mitigation Plan Review Tool can be seen in Appendix B.

2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County
County Adoption Resolution

Resolution No. _____
Berkeley County, West Virginia

WHEREAS, the municipalities of Berkeley County, West Virginia are most vulnerable to natural and human-caused hazards which may result in loss of life and property, economic hardship, and threats to public health and safety, and
WHEREAS, Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop and submit for approval to the President a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities, and
WHEREAS, Berkeley County acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County has been developed by the Region 9 Eastern Panhandle Regional Planning and Development Council in cooperation with county departments, local municipal officials, institutional stakeholders, and the citizens of Berkeley County, and
WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,
NOW THEREFORE BE IT RESOLVED by the governing body for the County of Berkeley that:

- The 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County is hereby adopted as the official Hazard Mitigation Plan of the County, and
- The respective officials and agencies identified in the implementation strategy of the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: **BERKELEY COUNTY COUNCIL**

_____ By _____
By _____
By _____
By _____
By _____

2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County
Municipal Adoption Resolution

Resolution No. _____
<*Borough/Township of Municipality Name*>, Berkeley County, West Virginia

WHEREAS, the <*Borough/Township of Municipality Name*>, Berkeley County, West Virginia is most vulnerable to natural and human-caused hazards which may result in loss of life and property, economic hardship, and threats to public health and safety, and
WHEREAS, Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop and submit for approval to the President a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities, and
WHEREAS, the <*Borough/Township of Municipality Name*> acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County has been developed by the Region 9 Eastern Panhandle Regional Planning and Development Council in cooperation with county departments, local municipal officials, institutional stakeholders, and the citizens of Berkeley County, and
WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,
NOW THEREFORE BE IT RESOLVED by the governing body for the <*Borough/Township of Municipality Name*>:

- The 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County is hereby adopted as the official Hazard Mitigation Plan of the <*Borough/Township*>, and
- The respective officials and agencies identified in the implementation strategy of the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: ***<BOROUGH/TOWNSHIP OF MUNICIPALITY NAME>***
_____ By _____
By _____

2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County
Municipal Adoption Resolution

Resolution No. _____
<*Borough/Township of Municipality Name*>, Berkeley County, West Virginia

WHEREAS, the <*Borough/Township of Municipality Name*>, Berkeley County, West Virginia is most vulnerable to natural and human-caused hazards which may result in loss of life and property, economic hardship, and threats to public health and safety, and
WHEREAS, Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop and submit for approval to the President a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities, and
WHEREAS, the <*Borough/Township of Municipality Name*> acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County has been developed by the Region 9 Eastern Panhandle Regional Planning and Development Council in cooperation with county departments, local municipal officials, institutional stakeholders, and the citizens of Berkeley County, and
WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,
NOW THEREFORE BE IT RESOLVED by the governing body for the <*Borough/Township of Municipality Name*>:

- The 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County is hereby adopted as the official Hazard Mitigation Plan of the <*Borough/Township*>, and
- The respective officials and agencies identified in the implementation strategy of the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: <***BOROUGH/TOWNSHIP OF MUNICIPALITY NAME***>
_____ By _____
By _____

2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County
County Adoption Resolution

Resolution No. _____
Morgan County, West Virginia

WHEREAS, the municipalities of Morgan County, West Virginia are most vulnerable to natural and human-caused hazards which may result in loss of life and property, economic hardship, and threats to public health and safety, and
WHEREAS, Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop and submit for approval to the President a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities, and
WHEREAS, Morgan County acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County has been developed by the Region 9 Eastern Panhandle Regional Planning and Development Council in cooperation with county departments, local municipal officials, institutional stakeholders, and the citizens of Morgan County, and
WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,
NOW THEREFORE BE IT RESOLVED by the governing body for the County of Morgan that:

- The 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County is hereby adopted as the official Hazard Mitigation Plan of the County, and
- The respective officials and agencies identified in the implementation strategy of the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: **MORGAN COUNTY COMMISSION**

_____ By _____
By _____
By _____

2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County
Municipal Adoption Resolution

Resolution No. _____
<*Borough/Township of Municipality Name*>, Morgan County, West Virginia

WHEREAS, the <*Borough/Township of Municipality Name*>, Morgan County, West Virginia is most vulnerable to natural and human-caused hazards which may result in loss of life and property, economic hardship, and threats to public health and safety, and
WHEREAS, Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop and submit for approval to the President a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities, and
WHEREAS, the <*Borough/Township of Municipality Name*> acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County has been developed by the Region 9 Eastern Panhandle Regional Planning and Development Council in cooperation with county departments, local municipal officials, institutional stakeholders, and the citizens of Morgan County, and
WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,
NOW THEREFORE BE IT RESOLVED by the governing body for the <*Borough/Township of Municipality Name*>:

- The 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County is hereby adopted as the official Hazard Mitigation Plan of the <*Borough/Township*>, and
- The respective officials and agencies identified in the implementation strategy of the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: ***<BOROUGH/TOWNSHIP OF MUNICIPALITY NAME>***

_____ By _____

By _____

2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County
Municipal Adoption Resolution

Resolution No. _____
<*Borough/Township of Municipality Name*>, Morgan County, West Virginia

WHEREAS, the <*Borough/Township of Municipality Name*>, Morgan County, West Virginia is most vulnerable to natural and human-caused hazards which may result in loss of life and property, economic hardship, and threats to public health and safety, and
WHEREAS, Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) requires state and local governments to develop and submit for approval to the President a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities, and
WHEREAS, the <*Borough/Township of Municipality Name*> acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County has been developed by the Region 9 Eastern Panhandle Regional Planning and Development Council in cooperation with county departments, local municipal officials, institutional stakeholders, and the citizens of Morgan County, and
WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County, and
WHEREAS, the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that face the County and its municipal governments,
NOW THEREFORE BE IT RESOLVED by the governing body for the <*Borough/Township of Municipality Name*>:

- The 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County is hereby adopted as the official Hazard Mitigation Plan of the <*Borough/Township*>, and
- The respective officials and agencies identified in the implementation strategy of the 2022 Multi-Jurisdictional Hazard Mitigation Plan Update for Berkeley and Morgan County are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _____ day of _____, 2021

ATTEST: ***<BOROUGH/TOWNSHIP OF MUNICIPALITY NAME>***

_____ By _____

By _____

The date each jurisdiction adopted the 2022 plan is listed in Table 8.1.

Table 8.1.1 Adoption Date of the Hazard Mitigation Plan by Berkeley County, Morgan County and Local Municipalities

Jurisdiction	2022 HMP Adoption Date
Berkeley County	
Morgan County	
Martinsburg	
Hedgesville	
Bath	
Paw Paw	

9. Appendices