Bedford County
Hazard Mitigation Plan
2017 Update

October 2017

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EXECUTIVE SUMMARY

The 2017 update to the Bedford County Hazard Mitigation Plan (HMP) was prepared in accordance with the Disaster Mitigation Act of 2000 (DMA 2000). DMA 2000 requires states and local governments to prepare HMPs to remain eligible to receive pre-disaster mitigation grant funds made available in the wake of federally declared disasters. Additionally, DMA 2000 effectively improves the disaster planning process by increasing hazard mitigation planning requirements for hazard events. DMA 2000 requires participating municipalities to (1) document their hazard mitigation planning process and (2) identify hazards; potential losses; and mitigation needs, goals, and strategies.

The Bedford County HMP represents the work of citizens, elected and appointed government officials, business leaders, and volunteer and nonprofit groups to protect community assets, preserve economic viability of the community, and save lives. DMA 2000 regulations require formal updates and adoptions of local plans every 5 years, reassessing risks and updating local strategies to manage and mitigate those risks. To comply, Bedford County and inclusive jurisdictions actively participated in updating the County HMP. Extensive outreach efforts by Bedford County's Planning Commission and Emergency Management resulted in participation from all 38 municipalities. Upon completion and approval of the HMP, participating jurisdictions will continue to address and implement findings and recommendations of this plan update. This 2017 version is the second update of the County HMP, with the original HMP developed in 2006, and the first update occurring in 2011.

Table ES-1 identifies municipal governments that actively participated in the HMP update process.

Table ES-1. Participating Jurisdictions in the 2017 Bedford County HMP Update

Jurisdictions		
Bedford County	Hopewell, Township of	Pavia, Township of
Bedford, Borough of	Hyndman, Borough of	Pleasantville, Borough of
Bedford, Township of	Juniata, Township of	Rainsburg, Borough of
Bloomfield, Township of	Kimmel, Township of	Saxton, Borough of
Broad Top, Township of	King, Township of	Schellsburg, Borough of
Coaldale, Borough of	Liberty, Township of	Snake Spring, Township of
Colerain, Township of	Lincoln, Township of	South Woodbury, Township of
Cumberland Valley, Township of	Londonderry, Township of	Southampton, Township of
East Providence, Township of	Mann, Township of	St. Clairsville, Borough of
East St. Clair, Township of	Manns Choice, Borough of	West Providence, Township of
Everett, Borough of	Monroe, Township of	West Saint Clair, Township of
Harrison, Township of	Napier, Township of	Woodbury, Borough of
Hopewell, Borough of	New Paris, Borough of	Woodbury, Township of

During the plan update process, Bedford County and its participating municipalities engaged in the following planning process steps:

1. Identified and prioritized hazards that may affect the County and its municipalities.
2. Assessed the County's and each municipalities' vulnerabilities to these hazards.
3. Identified mitigation actions that can reduce those vulnerabilities.
4. Developed a strategy for implementing those actions, including identifying the agency (or agencies) responsible for each implementation.

Throughout the planning process, the general public was offered an opportunity to comment on the existing HMP and provide suggestions for the updated version. The County hosted four Planning Team meetings that were open to the public, during which residents could provide input on the HMP.

The following hazards were identified by the Planning Team as presenting the highest risk to the County and its municipalities:

- Flood
- Environmental Hazards
- Wildfires
- Invasive Species
- Utility Interruptions
- Winter Storms
- Pandemic Disease
- Tornado, Windstorms
- Transportation Accidents
- Subsidence and Sinkholes

This HMP also includes hazard profiles for the following hazards (listed in order of risk factor analysis ranking):

- Levee Failure
- Hailstorm
- Radon Exposure
- Drought
- Earthquake
- Dam Failures
- Extreme Temperatures
- Landslide
- Lightning Strike
- Terrorism

To mitigate the effects of those hazards, the Planning Team identified the following goals for hazard mitigation over the next 5 years:

1. **Goal 1:** Increase public education and awareness of existing and potential hazards in Bedford County
2. **Goal 2:** Protect the citizens of Bedford County as well as public and private property from the impacts of natural and human-caused hazards.
3. **Goal 3:** Prevent death, injury, and damage from natural and man-made hazards in Bedford County.
4. **Goal 4:** Improve emergency services and capabilities in Bedford County to protect citizens from natural and human-caused hazards.

Objectives and actions to be implemented are discussed in the Mitigation Action Plan in Section 6.2 of this HMP.

Additionally, Planning Team members will meet annually to evaluate the status of plan implementation and prepare a summary report of HMP status and any needed updates. The mitigation evaluation will address changes as new hazard events occur, as the area develops, and as more information becomes available pertaining to hazards and their impacts. The evaluation will include an assessment of whether the planning process and actions have been effective, whether development or other issues warrant changes to the HMP or its priorities, if progress toward the communities' goals is satisfactory, and whether changes are warranted. The public is encouraged to give feedback (1) by directly contacting the County Hazard Mitigation Planning Team Coordinator, (2) during recurring review meetings, and (3) during the 5-year revision process.

To request information or provide comments regarding this plan, please contact Bedford County Planning Commission. Contact information is provided below:

Mailing Address:	Hazard Mitigation Planning Team c/o Bedford County Planning Commission 200 South Juliana Street Bedford, PA 15522
Contact Name:	Donald Schwartz, Director, Bedford County Planning Commission
E-mail Address:	dschwartz@bedfordcountypa.org
Telephone:	(814) 623-4827

CERTIFICATION OF ANNUAL REVIEW MEETINGS

The Bedford County Hazard Mitigation Planning Team has reviewed this Hazard Mitigation Plan (HMP). See Section 7 of this document for further details regarding this certification section. The Bedford County Planning Commission HMP Coordinator hereby certifies the review.

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED?*	SIGNATURE
2012	10/11/12	Yes	Donald Schwartz
2013	10/30/13	Yes	Donald Schwartz
2014	11/6/14	Yes	Donald Schwartz
2015	11/5/15	Yes	Donald Schwartz
2016	10/19/16 – five-year update process began	Yes	Donald Schwartz
2017	09/21/17 – five-year update process ended		
2018			
2019			
2020			

* Confirm yes 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)
7/8/17	Reviewed HMP and noted changes to plan since 2012 approval		
7/8/17	Reviewed and updated HMP to incorporate information from previous 5 years; added new hazard profiles including radon exposure; reprioritized mitigation actions based on PA-STEEL evaluation; revised mitigation action plans; completed other revisions required by the Federal Emergency Management Agency (FEMA) for plan approval.		
09/21/7	FEMA notified Bedford County HMP Coordinator that the County received Approval Pending Adoption (APA) designation for its 2017 HMP update.		
09/29/17	Finalized 2017 HMP update with APA designation and update to month of approval.		

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SECTION 1 INTRODUCTION

This section presents background information, describes the purpose, and defines the scope of the 2017 update of the Bedford County Hazard Mitigation Plan (HMP).

1.1 BACKGROUND

Across the United States, natural and human-caused disasters have led to increasing numbers of instances of deaths, injuries, property damage, and interruptions of business and government services. The time, money, and effort spent to recover from these disasters exhausts resources, diverting attention from important public programs and private agendas.

Bedford County, Pennsylvania, has experienced a significant number of statewide or County-specific gubernatorial and presidential disaster declarations since 1954. The emergency management community, citizens, elected officials, and other stakeholders in Bedford County recognize the impact of disasters on their community and concluded that proactive efforts need to be taken to reduce the impact of natural and human-caused hazards.

"Hazard mitigation" describes actions taken to prevent or reduce the long-term risks to life and property caused by a hazard event. Pre-disaster mitigation actions are taken in advance of a hazard event and are essential to breaking the typical disaster cycle of damage, reconstruction, and repeated damage. With careful selection, mitigation actions can be long-term, cost-effective means of reducing the risk of loss.

The Bedford County Hazard Mitigation Planning Team (Planning Team)—composed of Bedford County officials, municipal representatives, emergency responders, and business leaders—has updated this HMP. Through an open-bid process, Bedford County contracted Tetra Tech, Inc. (Tetra Tech), to update the 2011 County HMP.

The HMP update is the result of months of collaboration between the citizens and officials of Bedford County and representatives from Tetra Tech to develop a pre-disaster, multi-hazard mitigation plan that will guide the County toward greater disaster resistance, while respecting the character and needs of the community.

1.2 PURPOSE

The purpose of this HMP is to minimize the effects that natural, technological, and man-made hazards have on the people, property, environment, and business operations within Bedford County. This document exists to provide the background information and rationale for the mitigation actions that the Planning Team and municipal representatives have chosen to implement across the County.

The document is governed by the Disaster Mitigation Act of 2000 (DMA 2000) and its implementing regulations (Title 44 Code of Federal Regulations [CFR] §201.6, published February 26, 2002). Local jurisdictions must comply with DMA 2000 and these regulations to remain eligible for funding and technical assistance from State and federal hazard mitigation programs.

1.3 SCOPE

The implementation actions within this HMP apply to Bedford County and any municipalities within the County that adopt this HMP as their own. However, only those municipalities that have participated in the plan update process will remain eligible for State and federal hazard mitigation funding through the HMP. For the purpose of this plan, municipal participation is defined as (1) completion and submission of a Risk Assessment Update Worksheet, Capability Assessment Survey, and Mitigation Strategy 5-Year Plan Review Worksheet; and (2) attendance by an official municipal representative at a planning or public meeting conducted as part of the planning process.

2 COUNTY PROFILE

This section discusses the geography and environment, community facts, population and demographics, land use and development, and critical facilities in Bedford County (County).

2.1 GEOGRAPHY AND ENVIRONMENT

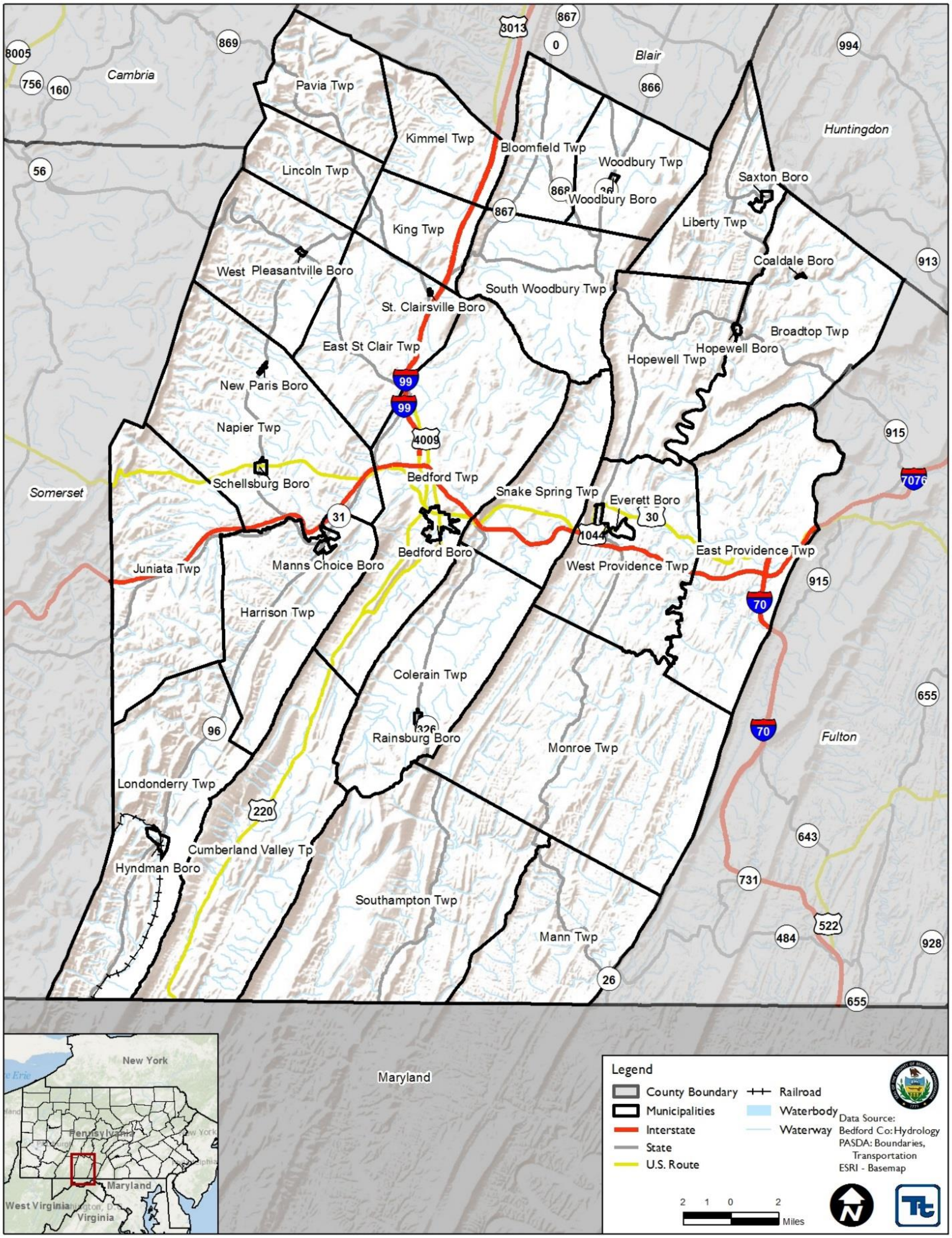
Bedford County is a rural county located in in the south-central portion of the Commonwealth of Pennsylvania, encompassing just over 1,000 square miles. It shares its southern border with the state of Maryland and is bordered to the east by Fulton County, to the northeast by Huntingdon County, to the north by Blair County, to the northwest by Cambria County, and to the west by Somerset County.

Bedford County's landscape is largely composed of aged mountain ridges and small valleys. These valleys are fertile and productive enough to support the primarily rural lifestyle of the County's residents. Approximately 67 percent of the County's land area is categorized as forested/woodland, and roughly 23 percent is categorized under various agricultural uses (Bedford County Comprehensive Plan Update, 2006). Less than 8 percent of the County's land area is classified as something other than agricultural or forest, and much of that area is composed of residential development in boroughs and along major roadways. The northern three-quarters of the County drain into the Susquehanna River Basin, while the southern quarter drains into the Potomac River Basin.

Bedford County has an extensive transportation network, including five highways: U.S. Route 30 (also known as the Lincoln Highway), U.S. Route 220, and Interstates 70, 76, and 99, which provide east-west access to Pittsburgh and Philadelphia via I-76, the Pennsylvania Turnpike, with interchanges in both Bedford and Breezewood. Additionally, I-70 offers access to Washington/Baltimore and other points east, while I-99 provides access north to Altoona, State College, and I-80. Bedford County is strategically located within 100 miles of Pittsburgh and Harrisburg, and 140 miles from the Baltimore and Washington, D.C. metropolitan areas (excerpted from the Bedford County Comprehensive Plan Update, 2006).

Figure 2-1 shows a base map of Bedford County.

Figure 2-1. Bedford County Base Map



Source: PASDA, Bedford County

2.2 COMMUNITY FACTS

Bedford County was created on March 9, 1771 from part of Cumberland County. It consists of 38 municipalities: 25 townships and 13 boroughs. Bedford County's seat is Bedford Borough, which has a population of 2,841.

Bedford County's economy and settlement patterns have historically been guided and supported by the rich natural resources in the region. Like many other American communities, settlement originally occurred along waterways, followed by rail lines and the interstate highway system in more recent history.

The construction of the Pennsylvania Turnpike through the County in October 1940 marked a turning point in the County's economy, ushering in a dramatic increase in commercial activity, particularly surrounding its interchanges at Breezewood and Bedford. Today, most Bedford County residents enjoy a predominantly rural landscape of forested hills and mountains and agricultural valleys, with most of the population residing in small towns and villages.

2.3 POPULATION AND DEMOGRAPHICS

Population and demographic data provide baseline information about residents. Changes in demographics or population may be used to identify higher-risk populations. Maintaining up-to-date data on demographics will allow the County to better assess magnitudes of hazards and develop more specific mitigation plans. Baseline demographic information for Bedford County is provided in Table 2-1.

Table 2-1. Demographics

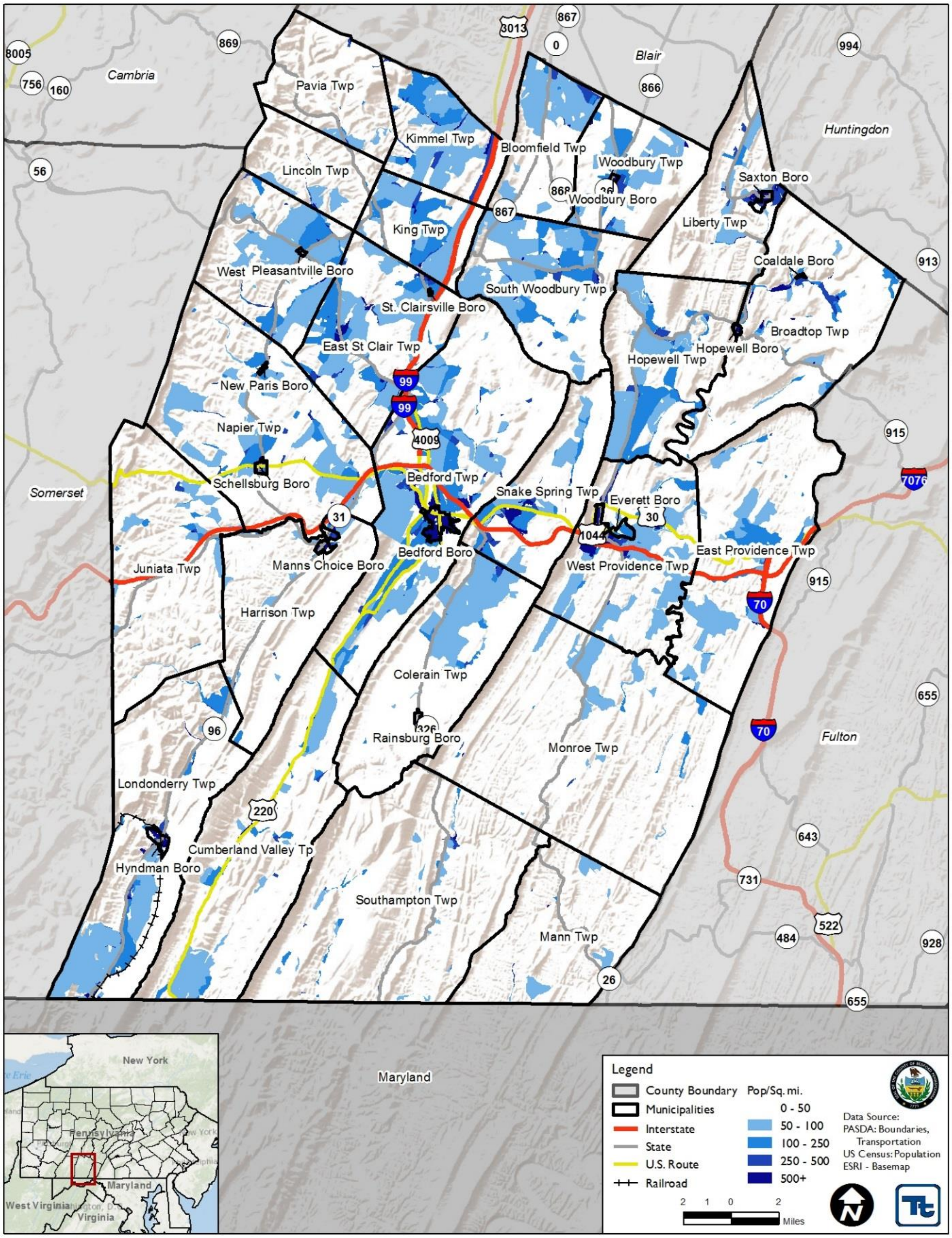
Demographics	2010 Census	2010 Census - Pennsylvania
Total population	49,762	12,702,379
Male	24,705	6,190,363
Female	25,057	6,512,016
Median age (years)	43.9	40.4
Under 5 years	2,627	719,941
18 years and over	39,023	9,910,224
65 years and over	9,476	1,959,307
Total households	20,233	5,018,904
Group quarters population	551	429,126

Source: U.S. Census Bureau 2010, General Population and Housing Characteristics, Bedford County

Bedford County has a smaller population than more than half of counties in the Commonwealth (49,762) and is ranked 57th of 67 counties)for its population density, with a density of only 49.2 people per square mile, as compared to 283.9 people per square mile in Pennsylvania as a whole (U.S. Census Bureau 2013). A low population density means that people are spread throughout the County rather than clustered in groups. Dispersing information, instructions, and resources to residents in low-density areas is more difficult than in more densely populated areas because individuals are not centralized.

While low-density areas provide challenges to disseminating hazard mitigation information, a low population density also helps prevent hazards from affecting as many people. For example, diseases may not spread as quickly because citizens are in contact with less people. Similarly, fires are less likely to spread to other structures because of the large distances between them. The magnitude of an event is typically smaller in a less populated area because each event affects fewer people and properties.

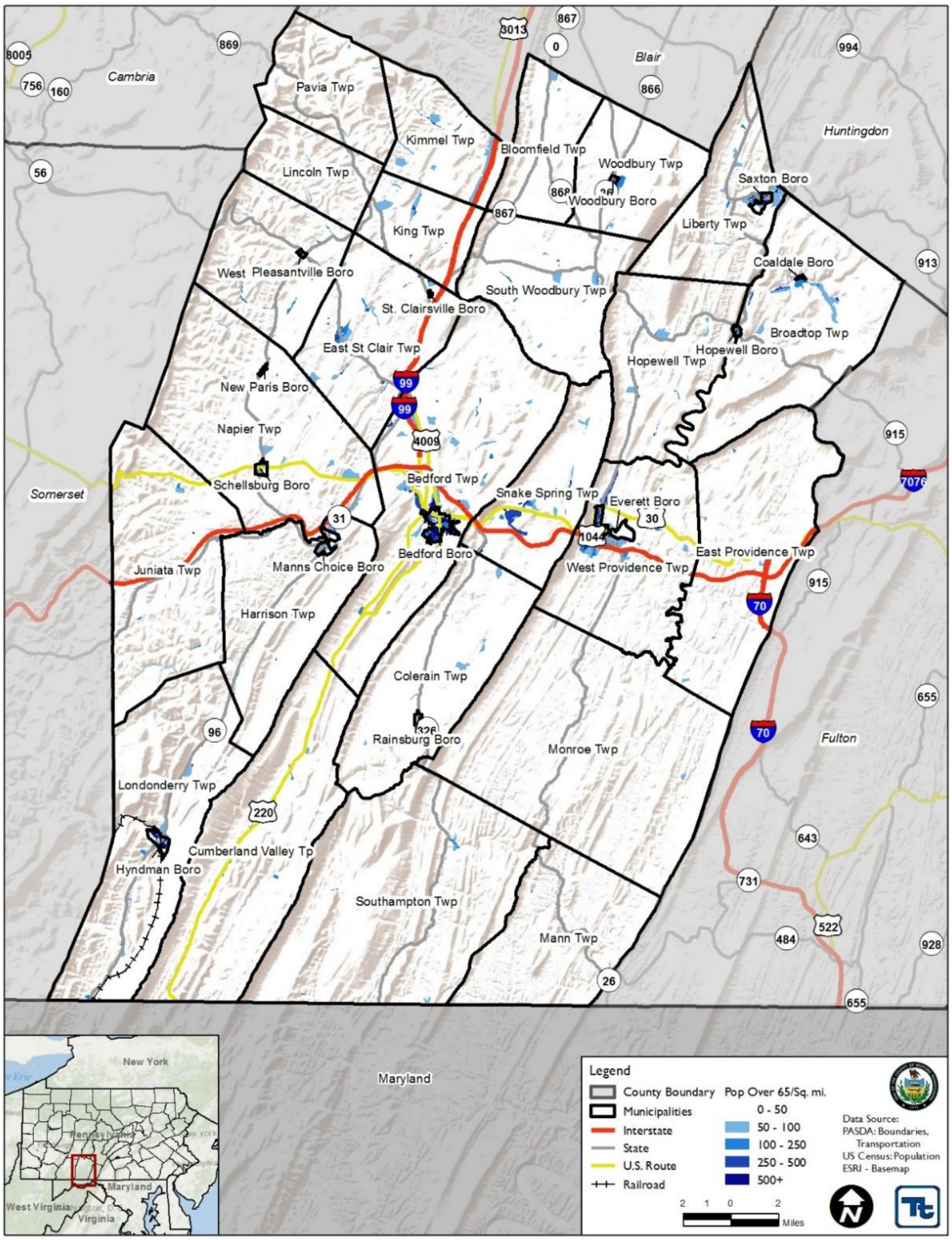
Figure 2-2. Bedford County 2010 Population Distribution



Source: U.S. Census Bureau 2010

Approximately 19 percent of Bedford's population is age 65 or older, compared with 15.4 percent across Pennsylvania. These residents may have special needs. For example, many residents in this age bracket may be unable to drive; therefore, special evacuation plans may need to be created for them. They may also have hearing or vision impairments that could make receiving emergency instructions difficult. Both older and younger populations have higher risks for contracting certain diseases. Bedford County's combined under-5-years-of-age and over-65 populations represent approximately 24.3 percent of its population. Figure 2-3 illustrates population distribution for residents age 65 and older.

Figure 2-3. Bedford County Population Over 65 Years



Source: US Census 2010

Only 1.1 percent of Bedford's population lives in group quarters, compared to 3.4 percent across Pennsylvania. The term *group quarters* refers to people living in communal settings, which can include inmates in a prison, students in a dorm, or elderly or mentally disabled individuals living in group care homes. Residents living in group quarters are often special needs populations. It is important to ensure that each group quarters facility has its own emergency plan to account for the unique needs of its residents during a hazard event.

Table 2-2 below provides population estimates for each municipality in Bedford County and for the County as a whole. The population of the entire County is estimated to be 48,779 by the year 2040, which represents a net population decrease of just over 950 people in a 30-year period. While the County will experience an overall population loss, some individual municipalities are expecting to experience a slight increase in population. Population loss typically means that some structures may become vacant and infrastructure will age, as little new development (and subsequent infrastructure updates) will be necessary. It is important for Bedford County to properly maintain its existing infrastructure and develop plans to manage or redevelop vacant properties.

Table 2-2. Population Estimates per Municipality in Bedford County

Municipality Name	2000 Census	2010 Census	2020 Projected	2030 Projected	2040 Projected
Bedford B	3,141	2,841	2,715	2,470	2,294
Bedford T	5,417	5,395	5,655	5,754	5,945
Bloomfield T	973	1,016	1,153	1,236	1,350
Broad Top T	1,827	1,687	1,575	1,447	1,328
Coaldale B	146	161	169	181	191
Colerain T	1,147	1,195	1,266	1,324	1,390
Cumberland Valley T	1,494	1,597	1,653	1,736	1,804
East Providence T	1,858	1,854	1,894	1,909	1,938
East Saint Clair T	3,123	3,048	3,220	3,251	3,363
Everett B	1,905	1,834	1,877	1,854	1,869
Harrison T	1,007	972	980	963	961
Hopewell B	222	230	249	262	279
Hopewell T	1,894	2,010	2,040	2,120	2,171
Hyndman B	1,005	910	861	784	723
Juniata T	1,016	954	1,014	1,004	1,034
Kimmel T	1,609	1,616	1,621	1,628	1,633
King T	1,264	1,238	1,249	1,238	1,240
Liberty T	1,477	1,368	1,321	1,238	1,176
Lincoln T	380	425	436	467	486
Londonderry T	1,760	1,856	1,821	1,861	1,858
Mann T	481	500	508	522	533
Manns Choice B	291	300	328	345	368
Monroe T	1,372	1,336	1,359	1,348	1,357
Napier T	2,145	2,198	2,273	2,335	2,404
New Paris B	214	186	169	154	138
Pavia T	325	295	299	283	279
Pleasantville B	211	198	190	179	170
Rainsburg B	146	133	121	110	99
Saint Clairsville B	86	78	73	67	61
Saxton B	803	736	687	625	571
Schellsburg B	316	338	388	422	465
Snake Spring T	1,482	1,639	1,690	1,801	1,878
South Woodbury T	2,000	2,155	2,313	2,470	2,627

Municipality Name	2000 Census	2010 Census	2020 Projected	2030 Projected	2040 Projected
Southampton T	1,010	976	1,013	1,009	1,029
West Providence T	3,323	3,210	3,213	3,150	3,124
West Saint Clair T	1,647	1,730	1,825	1,913	2,005
Woodbury B	269	284	308	326	348
Woodbury T	1,198	1,263	1,330	1,396	1,463

Source: Pennsylvania Department of Environmental Protection (PA DEP) 2012
Notes: B: Borough T: Township

According to the 2010–2014 American Community Survey, less than 1 percent of Bedford's population speaks English less than "very well." While currently a low percentage, future hazard mitigation strategies should consider addressing language barriers to ensure that all residents can receive emergency instructions. Table 2-3 summarizes race and ethnicity population information for Bedford County.

Table 2-3. Race and Ethnicity

Race and Ethnicity	2010 Census	2010 Census - Pennsylvania
One race	49,361	12,498,971
White	48,782	10,449,680
Black or African American	238	1,395,718
American Indian and Alaska Native	75	22,951
Asian	101	377,735
Pacific Islander	14	3,740
Other	151	249,147
Two or more races	401	259,758
Hispanic or Latino	450	784,562

Source: U.S. Census Bureau 2010, Race and Hispanic or Latino Origin Summary File 1 (SF 1)

According to the 2010–2014 American Community Survey 5-Year Estimates, Bedford County has 7,122 residential properties. These properties may be vulnerable to various natural hazards, in particular, flooding and windstorms. Damage to residential properties is not only expensive to repair or rebuild but also devastating to the displaced residents.

Approximately 16 percent of the County's residential properties are vacant, compared to 11.1 percent across Pennsylvania. Vacant buildings are particularly vulnerable to arson and criminal activity. Because vacant properties have not been maintained, many are structurally deficient and at risk of collapsing.

Approximately 18 percent of the County's population rents their home, compared to 26.5 percent across Pennsylvania. Renters are more transient than homeowners; therefore, communicating with renters may be more difficult than communicating with homeowners. Similarly, tourists would be a harder population to communicate with during an emergency event. Communication strategies should be developed to ensure that these populations could be given proper notification.

Table 2-4 summarizes housing characters of the residential properties in Bedford County.

Table 2-4. Housing Characteristics

Housing Characteristics	2014 Census Estimate	2014 Census Estimate - Pennsylvania
Total housing units	23,984	5,578,393
Owner-occupied housing units	16,076	3,446,230
Renter-occupied housing units	4,069	1,511,506
Vacant housing units	3,839	620,657
Median value (dollars)	120,100	164,900
Housing units with a mortgage	7,997	2,131,805
Housing units without a mortgage	8,079	1,314,425

Source: U.S. Census Bureau, General Housing Characteristics, 2010-2014 American Community Survey 5-Year Estimates

In 2014, the median household income in the County was $44,692, which was lower than the Commonwealth of Pennsylvania's estimated median household income ($53,115). Bedford County's 2014 estimated per capita income of $23,075 was also lower than the Commonwealth's 2014 estimated per capita income of $28,912. Approximately 10.3 percent of families' incomes in Bedford County were below poverty level, and 13.5 percent of its individuals' incomes were below poverty level. Emergency responders may experience challenges in connecting with individuals within this economic bracket for several reasons, including less access to the Internet within these communities. Additionally, many low-income families and individuals may not own vehicles, and therefore could be a more vulnerable population during an evacuation. Table 2-5 summarizes economic characteristics of Bedford County's population.

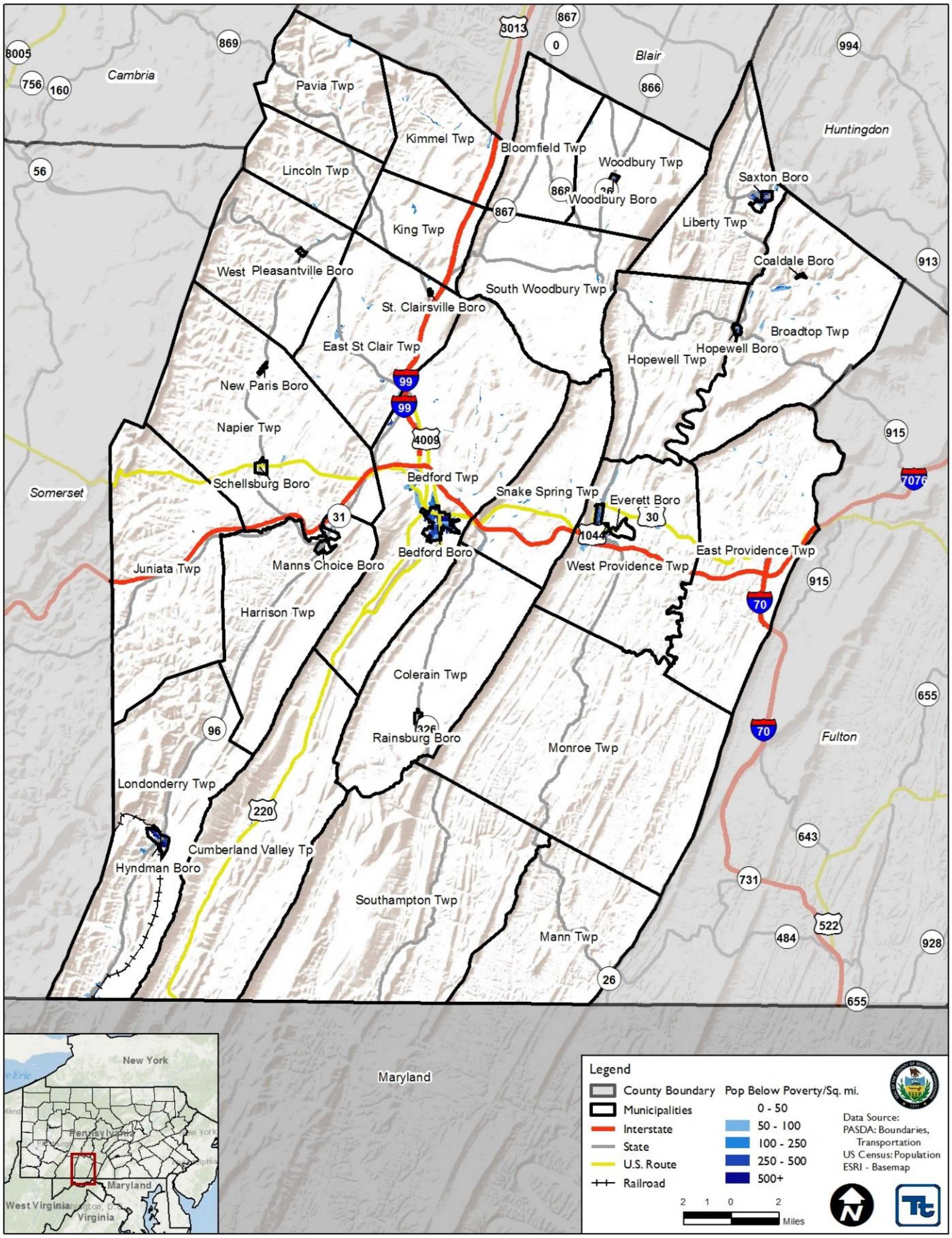
Table 2-5. Economic Characteristics

Economic Characteristics	2014 Census Estimate	2014 Census Estimate - Pennsylvania
Median household income in 2014	$44,692	53,115
Median family income in 2014	$54,425	67,521
Per capita income in 2014	$23,075	28,912
Families below poverty level (%)	10.3	9.3
Individuals below poverty level (%)	13.5	13.5

Source: U.S. Census Bureau 2014, Selected Economic Characteristics 2014 American Community Survey 5-Year Estimates, Bedford County

Figure 2-4 illustrates population distribution for residents with incomes below the poverty level.

Figure 2-4. Bedford County Population below the Poverty Level



Source: US Census 2010

2.4 LAND USE AND DEVELOPMENT

Bedford County's existing land use patterns are greatly influenced and shaped by surrounding natural features, such as mountain ranges, valleys, and waterways. These features have largely determined the location of transportation corridors and development activities as well as agricultural practices.

A network of high-capacity transportation systems traverses Bedford County. These systems include the U.S. Route 30 (also known as the Lincoln Highway), U.S. Route 220, and Interstates 70, 76 (the Pennsylvania Turnpike) and 99. These transportation systems have greatly contributed to Bedford County's accessibility and land development patterns. Of the County's total land area of 1,017 square miles, approximately 90 percent is categorized as forest or some agricultural use and less than 8 percent is considered developed. There is a significant concentration of woodlands in the southern and eastern part of the county, specifically along the ridgelines. Agricultural land is scattered throughout the county as well, with a noticeable concentration in the north central region. Developed, non-farm areas are primarily located in and around the boroughs and along major roadways (US 30 and Interstate 76). Typically, these areas make up most of Bedford County's commercial and institutional land uses.

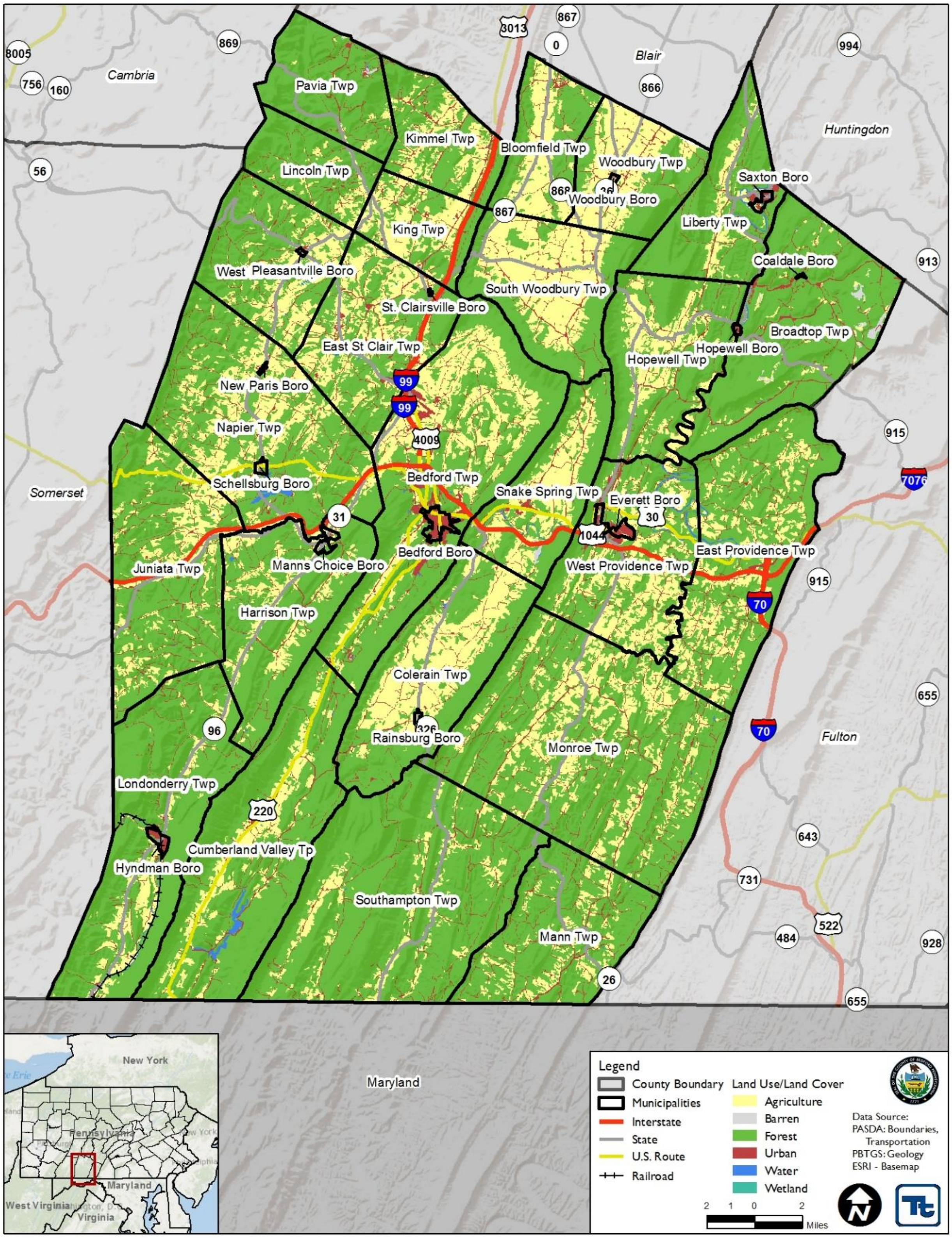
Over the last century, the county continued to grow; however, recently that growth has become stagnant and projects suggest impending population declines in the County. Most of the development has occurred in the townships and along highway corridors in those townships but not usually adjacent to boroughs or villages with water and sewer infrastructure. Growth corridors are defined by Bedford County businesses, with significant clusters of activity in Bedford and Everett Boroughs. This corridor is oriented east-west through the County (excerpted from 2006 Comprehensive Plan).

Bedford County's future population growth and land use development patterns will be largely influenced by in-migration patterns of people from the south. Data gathered from the Internal Revenue Service reveal that Bedford County's greatest population inflows originated in Blair County, Pennsylvania.

Land use regulations are not prevalent in Bedford County. As of 2017, 31 of the County's municipalities (and a majority of County residents) are not guided by a local municipal Comprehensive Plan. Municipalities that have local Comprehensive Plans include Bedford and Everett Boroughs and Mann, Monroe, Southampton, South Woodbury, and Woodbury Townships. Only Bedford Borough has adopted a Zoning Ordinance. Bedford County adopted its own Comprehensive Plan in 2006.

Agricultural use of land is in long-term decline, and Bedford County lost 174,189 acres of farmland between 1982 and 2006. That decline has slowed in recent years; however, according to the U.S. Department of Agriculture, the County only lost 1 percent of its farmland acres between 2012 and 2007. During that same time period, the number of farms in the County grew by three. This change is evidenced by the change in the average size of farms in the County, from 180 acres in 2007 to 173 acres in 2012. In 1982, Bedford County began to assist municipalities with forming Agricultural Security Areas. Presently, nearly all municipalities in the county have formed Agricultural Security Areas, totaling more than 110,000 acres. These locally formed areas encourage farming to continue and exclude farmers from ordinances that would restrict normal farming practices. In 2006, 113,625 acres (more than 50 percent) of the County's total farmland is enrolled in its agricultural security program.

Figure 2-5. Bedford County Land Use and Land Cover



Source: USGS 2011

2.5 CRITICAL FACILITIES

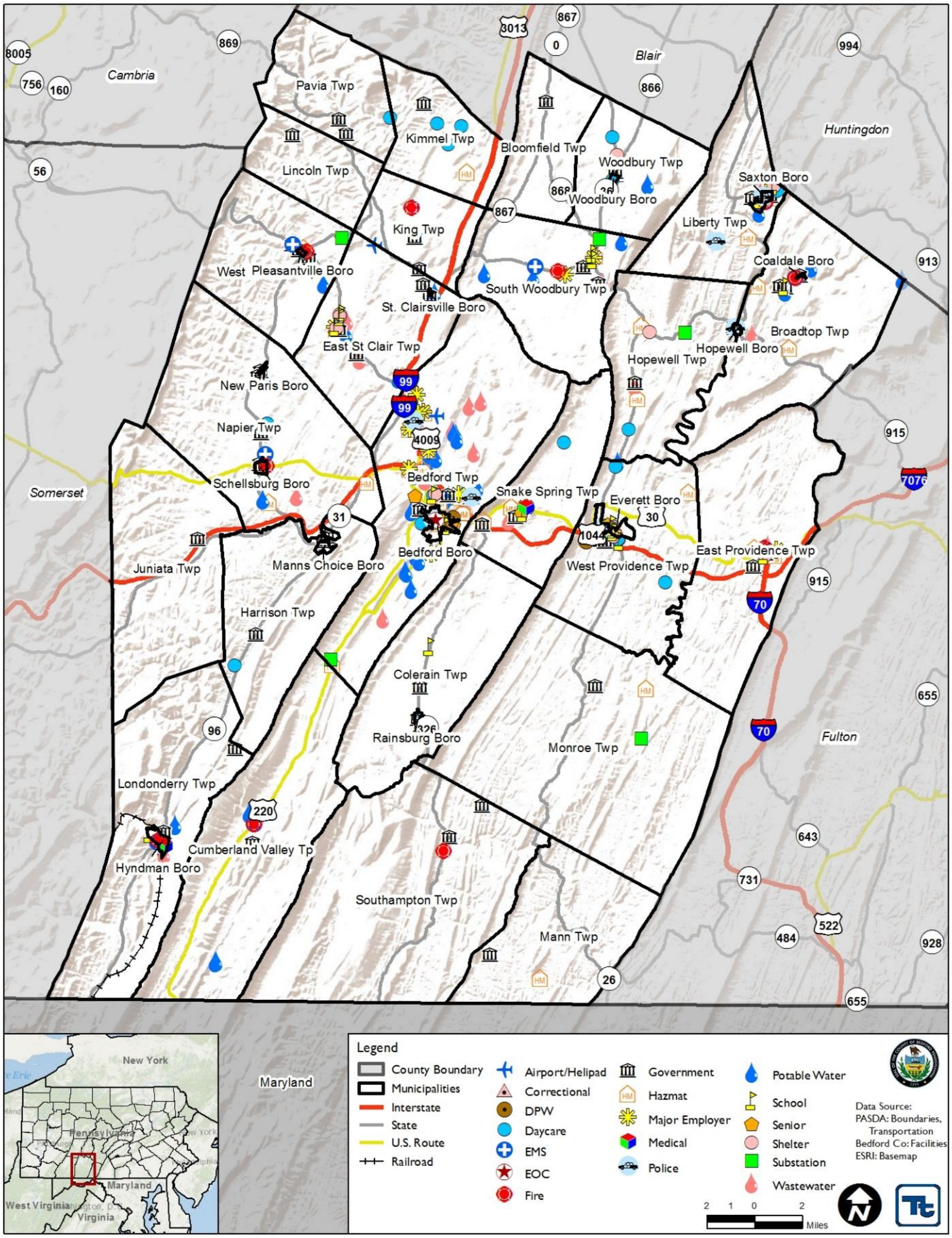
This section describes the critical facilities in Bedford County, including essential facilities, transportation systems, lifeline utility systems, and high-potential loss facilities. Transportation systems include roadways, bridges, tunnels, airways, and waterways. Lifeline utility systems include potable water, wastewater, oil, natural gas, electric power facilities, and emergency communication systems.

A comprehensive inventory of critical facilities in the County was developed from various sources, including input from representatives of the Steering Committee, Bedford County, participating municipal departments, and utility companies as well as HAZUS-MH-provided data. The inventory of critical facilities presented in this section represents the current state of the effort at the time of publication of this HMP and was used for the risk assessment presented in Section 4. Figure 2-6 identifies the critical facilities and their locations within Bedford County

Critical facilities are facilities that are considered critical to the health and welfare of the population and that are especially important following a hazard. As defined for this hazard mitigation plan (HMP), critical facilities include essential facilities, transportation systems, lifeline utility systems, and high-potential loss facilities.

Essential facilities are a subset of critical facilities that include those facilities that are important to ensure a full recovery following the occurrence of a hazard event. For the County risk assessment, this category was defined to include police, fire, emergency medical services (EMS), schools, shelters, senior accommodations, and medical facilities.

Figure 2-6. Critical Facilities in Bedford County



Source: Bedford County

2.5.1 Essential Facilities

This section provides information on emergency facilities, hospital and medical facilities, shelters, schools, and senior care and living facilities.

2.5.1.1 Emergency Facilities

For the purposes of this plan, emergency facilities include police, fire, emergency medical services (EMS), and emergency operation centers (EOC). Police protection at the local level is limited in Bedford County. Only four municipalities in Bedford County have local police departments. The majority of Bedford County is served by the Pennsylvania State Police, Troop G. An additional State Police station, located near Everett, is part of Troop T and is assigned to patrolling the Pennsylvania Turnpike. Emergency medical services can be divided into two general types. The first, emergency ambulance service, involves the transportation of patients from the scene of a medical emergency to a local medical care facility for treatment. The second, routine transports, provides transportation to patients from one medical care facility to another. There are 13 volunteer fire departments throughout Bedford County (2006 Comprehensive Plan).

Table I-1 in Appendix I provides an inventory of these emergency facilities in Bedford County.

2.5.1.2 Hospital and Medical Centers

Bedford County residents are served by one community hospital. UPMC Bedford Memorial is a 59-bed acute care general hospital with units for medical, surgical, obstetrical, intensive care, coronary care, telemetry, and palliative care services. The emergency facilities include 24-hour, in-house coverage by emergency medicine physicians, a licensed heliport for emergency transport, and trauma center affiliation. Several other hospital facilities in adjacent counties are within 35 miles of Bedford Borough, including Altoona Hospital and Bon Secours-Holy Family Hospital in Altoona as well as Memorial Medical Center and UPMC Lee Regional Hospitals in Johnstown (2006 Comprehensive Plan).

Table I-2 in Appendix I provides an inventory of hospitals and major medical facilities in Bedford County.

2.5.1.3 Shelters

Bedford County uses a variety of facilities for shelter locations, including schools and churches. Bedford County relies on the American Red Cross to identify and operate shelters.

Table I-3 in Appendix I provides an inventory of shelters in Bedford County.

2.5.1.4 Senior Care and Senior Living Facilities

Bedford County is served by 24 community centers that assist residents by providing a place to congregate, recreate, and receive services. Many of these centers are gathering spaces for local senior citizens. Table I-4 in Appendix I lists the senior facilities in Bedford County.

2.5.2 Transportation Systems

This section presents available inventory data for roadways, airports, railways, and other public transportation systems in Bedford County.

2.5.2.1 Highway, Roadways, and Associated Systems

Bedford County is home to several major roadways, most notably I-70, the Pennsylvania Turnpike I-76, I-81, and I-99. Overall, the County has over 1,780.8 linear miles of roadway. Of the total roadway miles in Bedford County, 53.2 are interstate highways, 54.6 are principal arterials, 73.5 are minor arterials, 173.0 are major collectors, 189.7 are minor collectors, and 1,232.9 are local roads (PennDOT Pennsylvania

Highway Statistics 2015). Bedford County's bridge infrastructure consists of 458 bridges on State roads and 88 on local roads.

2.5.2.2 Airports

Airports can fall into two categories: public airports and private airports. Public airports include large commercial airports for major airplane carriers that are open to the public. Private airports are often used for small charter flights and private jets and airplanes. Military airports and restricted land zones are also identified as private airports. Bedford County is home to one public airport, listed in Table I-5 in Appendix I. Bedford County Airport is owned by the Bedford County Airport Authority and is located four nautical miles (7.4 km) north of the central business district of the borough of Bedford, Pennsylvania. There are also two private airports in the County, along with one private (PennDOT Bureau of Aviation, online at www.tollfreeairline.com). Bedford County also identified three helipads located at UPMC Bedford Memorial Hospital, Breezewood Fire Company, and Imler Area Fire Company.

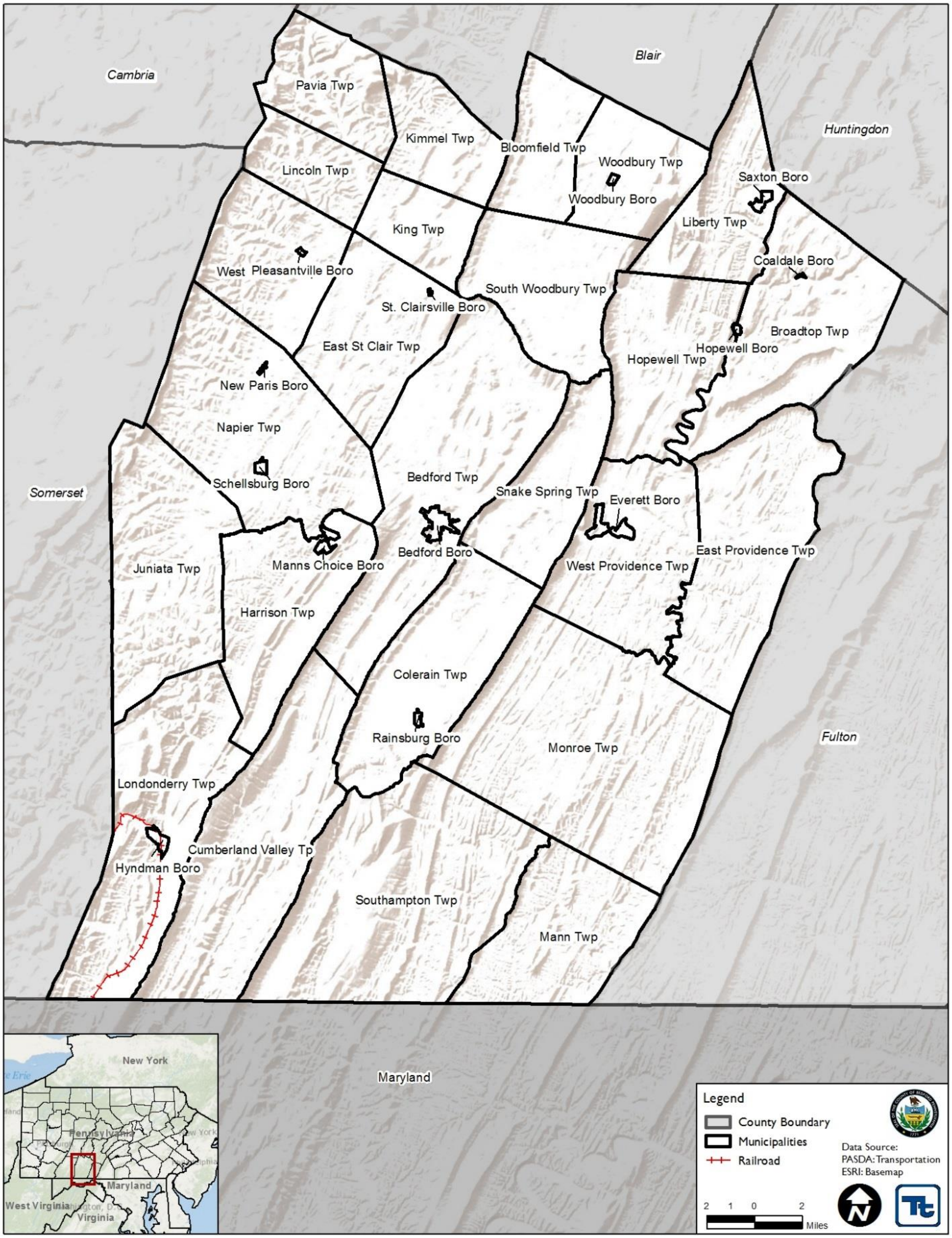
Regional airports within the vicinity of Bedford County include the Altoona-Blair County Airport, Franklin County Regional Airport, and the John Murtha Johnstown-Cambria County Airport. Slightly farther away but with still relevant airspace are the Gettysburg Airport, the Hanover Airport, the Mid-Atlantic Soaring Airport, and the Southern Adams County Heliport in Adams County; the Carlisle Airport and the Shippensburg Airport in Cumberland County; the Blue Knob Valley Airport and the Cove Valley Airport in Blair County; Harrisburg International Airport in Dauphin County; and the Somerset County Airport in Somerset County (PennDOT Bureau of Aviation 2014).

2.5.2.3 Railway

The rail line that runs through Hyndman Borough in the southwest corner of the county carries passenger and freight traffic. Amtrak provides its Capitol Limited service on CSX's Keystone Subdivision, with a station in Cumberland, MD. The Three Rivers service is a daily long-distance train with stops in Altoona (Blair County) and Johnstown (Cambria County). These stations have been experiencing increases in ridership while providing passenger rail services to major urban centers along the East Coast and to the Midwest (PennDOT Bureau of Rail Freight, Ports, and Waterways 2015).

Bedford County and Hyndman Borough have experienced problems with trains breaking down in Hyndman Borough, blocking all three crossings and cutting off the areas south of Hyndman from the rest of the County. This results in long travel times to bypass the borough, which could have a serious impact if emergency response vehicles were blocked from responding to emergency incidents. The County, Hyndman Borough, and CSX have had discussions about the problem. It is also detailed further in Section 4.3.19.

Figure 2-7. Active Rail Lines in Bedford County



Source: PennDOT 2015

2.5.2.4 Public Transportation

The Huntingdon-Bedford-Fulton Area Agency on Aging (HBFAAA) maintains a shared ride program, administered by PennDOT and funded by the Pennsylvania Lottery. As implied by the name, HBFAAA provides a public transit service for Huntingdon County, Bedford County, and Fulton County. This program offers a full-fare option to the general public through its demand responsive transit program. Reduced rates are offered to those aged 65 and older and to persons with disabilities. Residents eligible for the Medical Assistance Transportation Program receive free fares, and alternative rates are available for persons aged 60 to 64 or for low-income residents. The service does not offer any fixed routes and only operates on weekdays, not on holidays or weekends (HBFAAA 2014).

County residents may also elect to travel by personal car, taxi, or limousine service. These private companies share their information online and in phone books for interested residents to access.

2.5.3 Lifeline Utility Systems

This section presents potable water, wastewater, and energy resource utility system data. Because of heightened security concerns, local utility lifeline data sufficient to complete the analysis have only partially been obtained. Utility data are included in HAZUS-MH but are not sufficient to support detailed analyses for the County.

2.5.3.1 Potable Water Supply

Public water service is available in all County boroughs and townships. There are 18 public water providers in the County, many of them serving multiple jurisdictions. Many residents also use well water, and there are over 6,100 domestic wells in Bedford County (Pennsylvania Groundwater Information System [PaGWIS] 2016). Potable water supply resources in Bedford County are identified in Table I-6 in Appendix I.

2.5.3.2 Wastewater Facilities

Public sewer service is available to all local population centers and travel corridors in the County. Bedford County and its municipalities own and operate many of the wastewater collection systems and treatment plants in the County, and there are 23 public sewer entities in the County (2006 Comprehensive Plan). However, a portion of wastewater generated in Bedford County may be treated by non-County-owned facilities, including those operated by neighboring counties.

Wastewater facilities in Bedford County are identified in Table I-7 in Appendix I.

2.5.3.3 Energy Resources

Electric and gas utilities are deregulated whereby local delivery and supply are purchased separately. Electric services in Bedford County are provided by the following electric companies: PENELEC, New Enterprise Rural Electric Cooperative, Inc., Bedford Rural Electric Cooperative, Inc., and Allegheny Energy Company. Two companies provide gas services to Bedford County residents: PPL and Columbia Gas of Pennsylvania, Inc.

Table I-8 in Appendix I lists the electric power generating facilities and electric substations in Bedford County.

2.5.3.4 Communication Resources

CenturyLink (formerly Embarq) is the incumbent local exchange carrier for the majority of Bedford County. They are a provider of local telephone, data, and Internet services for the business community. Residents may also choose to use Sprint of Pennsylvania, Frontier Communications, EZ Talk, Satcom, Cat Communications International, Reconex, or other phone carriers for their needs. Comcast is the predominant cable provider. In addition, satellite service is readily available.

There are a number of radio stations licensed in the County, including WAYC-FM (100.9 FM) and WBVE (107.5 FM), both licensed in Bedford under Cessna Communications.

2.5.4 High-Potential Loss Facilities

High-potential loss facilities include military installations, dams, levees, nuclear power plants, and hazardous materials (HAZMAT) facilities. No levees, nuclear power plants, or military installations were identified in the County. County HAZMAT facilities and dams are described below.

2.5.4.1 HAZMAT Facilities

Bedford County is home to 38 identified facilities that utilize, ship, or house chemicals considered hazardous. These facilities have been identified under the Superfund Amendment and Reauthorization Act (SARA) as exceeding the quantity threshold for reporting. These facilities are required to comply with regulations set forth by the federal SARA and follow reporting requirements identified in the Pennsylvania Hazardous Materials Emergency Planning and Response Act (Act 165). Bedford County monitors these reporting requirements, as necessary, to ensure facility safety.

2.5.4.2 Dams

According to the Pennsylvania Department of Environmental Protection (PA DEP), Bedford County has 28 dams. A dam is included in the NID if (1) it is a "high" or "significant" hazard potential class dam, (2) it is a "low" hazard potential class dam that exceeds 25 feet in height and 15 acre-feet of storage, or (3) it is a "low" hazard potential class dam that exceeds 50 acre-feet storage and 6 feet height. The NID identifies 12 dams in the County. PADEP also tracks dams that do not fall into these categories. Of the 27 dams identified in the County, five have an Emergency Action Plan. Five dams are classified as having high hazard potential; three dams are classified as having significant hazard potential; and 19 dams are classified as having low damage potential.

Table 2-6 defines the hazard potential classifications, as accepted by the NID Interagency Committee on Dam Safety. PA DEP also designates dams based on potential risk level; this classification is slightly more detailed than that of the NID and is presented in Table 2-7. Table I-9 in Appendix I lists the dams in Bedford County and identifies their hazard classifications.

Table 2-6. NID Dam Hazard Potential Classifications

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, and Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable; one or more expected	Yes (but not necessary for this classification)

Table 2-7. Pennsylvania Dam Classification Definitions

Size Category		
Category	**Impoundment Storage (Acre-feet)**	**Dam Height**
A	Equal to or greater than 50,000	Equal to or greater than 100
B	Less than 50,000 but greater than 1,000	Less than 100 but greater than 40
C	Equal to or less than 1,000	Equal to or less than 40
Hazard Potential Category		
Category	**Population at Risk**	**Economic Loss**
1	Substantial (Numerous homes or small businesses or a large business or school)	Excessive such as extensive residential, commercial, or agricultural damage, or substantial public inconvenience
2	Few (A small number of homes or small businesses)	Appreciable such as limited residential, commercial, or agricultural damage, or moderate public inconvenience
3	None expected (no permanent structures for human habitation or employment)	Significant damage to private or public property and short duration public inconvenience such as damage to storage facilities or loss of critical stream crossings
4	None expected (no permanent structures for human habitation or employment)	Minimal damage to private or public property and no significant public inconvenience

2.5.4.3 Levees

Bedford County has two levee systems, one located in Everett Borough and one located in Hyndman Borough. They are detailed in Section 4.3.17.

2.5.5 Other Facilities

Table I-10 in Appendix I lists other critical facilities identified by the County.

SECTION 3 PLANNING PROCESS

A successful planning process builds partnerships and brings together members representing government agencies, the public, and other stakeholders to reach consensus on ways the community will prepare for and respond to those hazards most likely to occur. Applying a comprehensive and transparent process adds validity to the hazard mitigation Plan (HMP). Participants involved in the HMP planning process gained better understanding of problems and issues, and helped devise solutions and actions for the community—resulting in a revised set of common community values and widespread support for directing financial, technical, and human resources to agreed-upon actions.

The planning process was an integral part of updating the Bedford County HMP. This section describes the planning process used to update the HMP, with participation from 38 of the County's municipalities. This section also lists members of the hazard mitigation Planning Team; and provides descriptions of meetings and documentation, public and stakeholder participation, multi-jurisdictional planning, and existing planning mechanisms implemented during the HMP update process. Additional details about the process of updating each section of this HMP appear at the beginnings of those sections.

3.1 UPDATE PROCESS AND PARTICIPATION SUMMARY

In accordance with Disaster Mitigation Act of 2000 (DMA 2000) requirements, this plan documents the following topics:

- Planning process
- Hazard identification
- Risk assessment
- Mitigation strategy: goals, actions, and projects
- Formal adoption by the participating jurisdictions
- Pennsylvania Emergency Management Agency (PEMA) and Federal Emergency Management Agency (FEMA) approval

The PEMA All-Hazard Mitigation Planning Standard Operating Guide lays out the standard planning process in Pennsylvania to create and update HMPs (including this HMP), and is cited in Appendix A, under Authorities and References. Hazard vulnerabilities and the risk assessment are described in Section 4 (Risk Assessment), and the mitigation strategy is described in Section 6 (Mitigation Strategy) of this HMP.

Public participation and planning meetings served as the main forums for gathering information to update the HMP. The Planning Team and Tetra Tech, Inc. (Tetra Tech) were afforded access to information in relevant and approved plans, policies, and procedures for Bedford County. Opportunities for public participation included attending public meetings, completing written surveys, and reviewing and commenting on the existing plan and other documents. To develop all sections of the HMP, meetings, surveys, e-mail correspondence, and teleconferences were used to solicit input from County, municipal, and other stakeholders, including members of the general public; most information received for this update came from the County, its municipalities, and the Bedford County Conservation District. Through this planning process, the County established a comprehensive approach to reduce effects of hazards on the County and its municipalities.

3.2 THE HAZARD MITIGATION PLANNING TEAM

The County's Planning Team consisted of the members listed in Table 3-1 below.

Table 3-1. Bedford County Planning Team

Name, Title	Department / Agency	Name, Title	Department / Agency
Mark Pennabaker	Bedford Area School District	Gary Lochner, EMC	Lincoln Township
Jay Speicher, EMC	Bedford Borough	Velma Ickes, Secretary	Lincoln Township Supervisors
Barbara Diehl, Secretary	Bedford Borough Council	Steve L. Stouffer, Secretary	Londonderry Township
Jennifer Lentz Kovacs	Bedford County Conservation District	Ronald Scritchfield, Secretary	Londonderry Township Supervisors
Brooke Leppert, EMC	Bedford Township	Melissa Singleton, EMC	Mann Township
Janie McMillen, Secretary	Bedford Township Supervisors	Melissa Singleton, Secretary	Mann Township Supervisors
Charlene O'Dellick, Secretary	Bloomfield Township Supervisors	Christie Barefoot, Secretary	Manns Choice Borough Council
David Thomas, Secretary	Broad Top Township Supervisors	Bryon Mearkle, EMC	Monroe Township
John T. Black	Chestnut Ridge School District	Shellie Hood, Secretary	Monroe Township Supervisors
Kenneth R. Elder, EMC	Coaldale Borough	Lesley Kennedy, Secretary	Napier Township Supervisors
Melissa Wright, Secretary	Coaldale Borough Council	Tom Wertz, EMC	Napier Township/ New Paris Borough
Madelyn Fix, Secretary	Colerain Township Supervisors	Christa Morton, Secretary	New Paris Borough Council
Fred Myers, Secretary	Cumberland Valley Township Supervisors	Kelly Sparks	Northern Bedford County School District
John Hollis, EMC	Cumberland Vly. Township	Shane Corle, EMC	Pavia Township
Mark Diehl	Cycling Sports Group, Inc.	Pamela Feathers, Secretary	Pavia Township Supervisors
Donna Bryant, EMC	East Providence Township	Cindy J. Byers, Secretary	Pleasantville Borough Council
Allen Millen	East Providence Township Supervisors	Jim Dull, EMC	Pleasantville Borough/ West St. Clair Township
Fred Temke	East Providence Township Supervisors	Wayne Koontz, EMC	Rainsburg Borough
Julia Hillenbrand, Secretary	East Providence Township Supervisors	Wayne Koontz, Secretary	Rainsburg Borough Council
Charles S. Pensyl, Jr., EMC	East St. Clair Township	Jamie Foster, Secretary	Saxton Borough Council
Dorothy Oldham, Secretary	East St. Clair Township Supervisors	Wayne Felix, EMC	Schellsburg Borough
Chuck Stone, EMC	Everett Borough	Dorothy Wolfhope, Secretary	Schellsburg Borough Council
Eileen L. Reyan, Secretary	Everett Borough Council	Rose R. Diehl, EMC	Snake Spring Township
Nicole Kimmel, Secretary	Harrison Township Supervisors	Rose Diehl, Secretary	Snake Spring Township Supervisors
Dave Hershberger, EMC	Harrison Township/ Manns Choice Borough	Tina M. Walter, EMC	South Woodbury Township
Vicki Smith, Secretary	Hopewell Borough Council	Genevieve Zebroski, Secretary	South Woodbury Township Supervisors
Melissa Douglas, EMC	Hopewell Township	Karen Creggar, Deputy EMC	Southampton Township
Melissa J. Douglas, Secretary	Hopewell Township Supervisors	Lawrence A. Winters, EMC	Southampton Township
Robert Walls, EMC	Hyndman Borough	Karen Cregger, Secretary	Southampton Township Supervisors
Karen Ringler, Secretary	Hyndman Borough Council	Sean Whitmer, Secretary	St. Clairsville Borough Council
Dana LeGros, EMC	Juniata Township	Brandon Chamberlain, EMC	West Providence Township

Name, Title	Department / Agency	Name, Title	Department / Agency
Mary Grace Imgrund, Secretary	Juniata Township Supervisors	Patricia Foor, Secretary	West Providence Township Supervisors
Cathy Cox, Secretary	Kimmel Township Supervisors	Barbara Hammer, Secretary	West St. Clair Township Supervisors
Jim Claycomb, Secretary	King Township Supervisors	Barbara Wilt, Secretary	Woodbury Borough Council
John Fulton, EMC	King Township/ St. Clairsville Borough	Kevin D. Brumbaugh, EMC	Woodbury Borough/ Woodbury Township
Dwight L. Klinepeter, EMC	Liberty Township	Denise Ott, Secretary	Woodbury Township Supervisors
Vicky Smith, Secretary	Liberty Township Supervisors		

EMC Emergency Management Coordinator

Mr. Donald Schwartz, Director of Bedford County Planning Commission, served as chair of the Planning Team. He was supported by Mr. David Cubbison, Director of Bedford County Emergency Management Agency.

The Planning Team acknowledged that important steps in developing a comprehensive HMP included identifying hazards that specifically affect Bedford County, and assessing their likelihood of occurrence, along with potential damage to the people, property, and environment of the County. The Planning Team chose to focus on an all-hazards approach, rather than a narrow focus on natural disasters only.

3.3 MEETINGS AND DOCUMENTATION

Table 3-2 lists meetings held by the County Planning Team as part of the process of updating the Bedford County HMP and provides descriptions.

Table 3-2. Public and Planning Meetings

Date	Description of Meeting
September 27, 2016	Kickoff meeting with Steering Committee
October 19, 2016	First kickoff meeting with Planning Team members, including 5-year plan review and plan update process
February 8, 2017	Planning Team meeting to review capabilities assessment results, hazard profiles, and risk assessment results
March 2, 2017	Mitigation Solutions Workshop to identify potential mitigation goals, objectives, and actions
April 13, 2017	Mitigation Strategy Review Planning Team and public meeting to review mitigation goals, objectives, actions, and current plan status with municipal representatives, stakeholders, and residents.
Various, October 2016 through June 2017	Direct outreach to municipalities by phone and in person to explain HMP update process, worksheet and participation requirements, and mitigation project selection.
July 7, 2017	Approve draft HMP for public review
August 8, 2017	Public and Planning Team meeting to review the draft
To be determined – upon receipt of APA designation	HMP adoption at meeting of the County Commissioners

Notes:
APA Approval Pending Adoption
HMP Hazard Mitigation Plan
PEMA Pennsylvania Emergency Management Agency

Bedford County's contractor, Tetra Tech, followed up each meeting with meeting notes that documented all discussions, decisions, and unmet needs identified during the meetings. The meeting minutes were shared among the Planning Team and attendees of the meeting. Documentation from all meetings is provided in Appendix C. County residents were informed of public meetings through various sources, including newspaper public notices and announcements on the County HMP website (http://www.bedfordhmp.com/). Although the HMP meetings were publicly advertised, only one County resident (who did not represent a municipality or other stakeholder agency) attended HMP meetings or provided feedback for development of the plan. Any subsequent supporting documentation provided by County residents will be included in Appendix E (Public and Stakeholder Documentation).

The Planning Team partnered with Tetra Tech to aid in the HMP update. Tetra Tech assisted the County in drafting planning documents, preparing meeting materials, and facilitating meetings. The Planning Team reviewed any documentation produced by Tetra Tech, provided validation, and acted as an advocate for the HMP update.

3.4 PUBLIC AND STAKEHOLDER PARTICIPATION

To maximize effectiveness of the HMP, the Planning Team fostered continual public and stakeholder engagement. Input was encouraged and collected through a variety of methods. Three worksheets/surveys were sent to each municipality in Bedford County: the Hazard/Risk Identification Survey, the Capabilities Assessment Survey, and the Mitigation Strategy 5-Year Plan Review Worksheet (Mitigation Review Worksheet) . All of the 38 municipalities surveyed in Bedford County returned at least one completed worksheet/survey; their input was reviewed and their information was incorporated into the updated HMP.

The following entities with vested interest in development of the updated HMP were given the opportunity to participate in the planning process by attending a Planning Team or public meeting, or by offering comments on the project website: local, state, and federal agencies; neighboring jurisdictions (i.e., Somerset, Cambria, Blair, Huntingdon, and Fulton in Pennsylvania; and Alleghany County in Maryland); local businesses; community leaders; educators; and other relevant private and nonprofit groups. Invitations to participate in meetings were sent to adjacent counties, major industries, and other relevant stakeholders identified by the County. Appendix E includes copies of invitation letters and lists of individuals to whom invitation letters were sent. Meeting invitations were also sent to all municipalities. Additionally, direct outreach by phone or one-on-one meetings was conducted with municipalities who were unable to attend other meetings or who had questions about worksheets, participation requirements, the planning process, or mitigation project selection. Of the 38 municipalities in Bedford County, 26 had representatives attending at least one meeting.

Through public notices published in the local newspaper, the groups listed above, as well as members of the general public, were invited to review the County HMP and to send comments to the Bedford County Planning Commission or to Tetra Tech. In addition, general public meetings were held during the planning process as listed in Table 3-2 in Section 3.3, “Meetings and Documentation.” Preceding each of these meetings was a public notice inviting the general public to review and comment on the HMP, as well as to attend the meeting. Copies of the public notices are provided in Appendix E. Copies of newspaper articles for public meetings and opening of the public comment period are shown on Figure 3-1 through Figure 3-3. These notices were published on October 18, 2016, October 20, 2016, and March 3, 2017.

Figure 3-1. Bedford Gazette, October 18, 2016

6 — Tuesday, October 18, 2016 — Bedford Gazette, Bedford, Pa.

Public meeting to address hazard mitigation plan

By Erin Thompson
Gazette Staff Writer

Bedford County Planning Commission is looking at ways to lessen the likelihood of hazards such as CSX railroad stoppages in Hyndman, flooding and protecting historic structures, but are seeking community input to address other areas residents may have concerns.

The county's hazard mitigation plan, which is updated every five years, will identify potential natural and man-made hazards and find ways to lessen their impact on residents.

A public meeting at 7 p.m. Oct. 19 will allow individuals to voice concerns within their own municipalities. The meeting will be held at Bedford Elementary School.

The state-mandated plan is required by all municipalities nationwide so they may receive funding to eliminate or lessen the risk of future disasters, said Don Schwartz, director of the Bedford County Planning Commission.

The plan will look at issues such as flooding, winter storms and droughts, as well as potential manmade hazards like heavy-traffic intersections throughout the county's 38 municipalities, Schwartz said.

Schwartz said public involvement in the development of the plan is crucial because residents are generally more aware of specific hazards within their own communities.

"What we hear from the community forms the basis for the plan," said Schwartz, who added that the outcome of the plan could affect future funding efforts to lessen hazards in the future.

"This seems like a distant issue to people, but this is a pocketbook issue for residents," he said.

According to Tony Subbio, emergency management specialist for Tetra Tech, the company that is completing the plan, results of a hazard mitigation plan typically range from updating municipal ordinances, zoning regulations and emergency plans to upgrading infrastructure, looking at issues related to power outages, telecommunications and water/sewer.

"Generally we see stormwater management infrastructure upgrades, a lot of culverts and roadway upgrades to prevent washouts," Subbio said. "We also work on education programs and to update community regulations."

Aside from Wednesday's meeting, Subbio said there will be a series of upcoming meeting to address the plan so that planners can gain a better understand what potential hazards Bedford County residents are faced with.

"It's better for us to get information from people who witness what happens," he said. "Knowing that there's a section of roadway that floods is important because we can incorporate that into a plan, whereas data sources we use may not reflect that as a problem area. It makes the plan more effective and if we can implement hazard mitigation throughout the county."

Subbio, who conducts hazard mitigation plans throughout Pennsylvania and New York said they "help to reduce the vulnerability of the community to natural and manmade hazards. When you can't prevent problems, the plan will make them so they're not as bad. . . it makes the community more resilient."

Schwartz outlined rail train stoppages in Hyndman, which split the town in two as an example of a man-made hazard the community of Hyndman faces that he said the county was not aware of until it was brought to his attention earlier this year.

"Maybe there can be some nonostructructual solution to this problem. Maybe CSX can do something with the scheduling of these trains so it's not such a big issue for the people in Hyndman," Schwartz said.

Subbio said dealing with rail lines can be tricky because "you're getting beyond the scope of what the local jurisdiction can do to solve the problem," he said. "Changing operations requires an act of congress, which requires coordination."

To address this issue, Subbio said a result of the plan will be contacting local rail operators to find a potential solution.

Also included in the plan, for the first time, will be a separate study by the Pennsylvania Historic Museum Commission, that will highlight potential impacts to historic structures throughout the county.

Schwartz said the study of historic structures will be the largest one of its kind in Bedford County in the last 30 years.

The study will then be used as a pilot project to determine the best methods of protecting historic buildings nationwide, Schwartz said.

"In Bedford County, history is very important to tourism and to the resident. Bedford County is known far and wide for its history and it's important to the county on an economic basis to look at these structures and determine their vulnerability and determining any ways to mitigate hazards is important," Schwartz said.

Contact Erin Thompson at ethompson@bedfordgazette.com; 623-1151, ext. 150.

Figure 3-2. Bedford Gazette, October 20, 2016

Community leaders gather to discuss hazard mitigation plan

By Erin Thompson
Gazette Staff Writer

About 25 municipal, business and school district leaders were asked to identify natural and manmade hazards, as a first step in developing a plan that will be used to minimize the likelihood of mishaps occurring in the future.

The public meeting Wednesday night at Bedford Elementary School was the first of several meetings that will develop the county's hazard mitigation plan — a Federal Emergency Management Agency-mandated plan that is updated every five years.

According to Tony Subbio, emergency management specialist for Tetra Tech, the company that is working with Bedford County Planning Commission and Bedford County Emergency Medical Agency to complete the plan, a hazard mitigation plan is required by each municipality so they may receive funding to prevent or lessen the effects of future hazards.

Subbio, who led the meeting, said when the plan is complete, it will identify areas of potential hazards and look at the county's capabilities of mitigating them.

—Continued on Page 6

Hazard mitigation plan. . .

—Continued from Page 1

Dave Cubbison, director of emergency management in Bedford County, who was present at the meeting, said the plan will "try to look ahead for possibilities that surround the places where we live and work, and lessen, or at least acknowledge what can happen — either naturally or manmade — and see if there are ways that, if we can't prevent (hazards), we can lessen the effects and bring about the restoration or recovery process in a more plentiful and meaningful way to get our lives back to normal."

Subbio said the plan will help reduce the vulnerability of disasters within each municipality.

The plan "either prevents bad things from happening or makes them less bad when they do happen."

"If you have a culvert that was washed out, you can repair it, or you can repair it to a higher capacity to make it better so it's less likely to happen again," he said. "If you don't have a mitigation plan in place, you're not going to be eligible for that funding to help make it better."

Subbio said the plan can also address issues such as power outages and particular intersections that are known to have a lot of crashes.

In other cases, the plan will look at potential natural disasters that could occur and how their impact could be lessened.

"We're not going to prevent a winter storm. We're not going to prevent flooding or droughts, but we can take measures to make them not as bad," said Subbio.

Subbio identified a number of natural disasters that are common within Bedford County that will be identified in the plan, such as floods, winter storms, lightning strikes and wildfires.

Subbio also asked local stakeholders like business leaders, school leaders and residents to notify them of any hazards they may be aware of so they can be incorporated in the plan.

"If you know there are sections of roadway that floods every time there are a couple inches of rain because you have to drive around it, make sure you are working with local officials so we can incorporate that into the full analysis of the plan," said Subbio. "If you know of a bridge that needs to be looked at...or you see the bank of a stream eroding under some houses, share your ideas with local official so they can incorporate them."

Bedford County Planning Director Don Schwartz said the plan will also include an assessment of historic structures by the Pennsylvania Historic Museum Commission that will highlight potential impacts to historic structures throughout the county.

The study will then be used as a pilot project to determine the best methods of protecting historic buildings nationwide, Schwartz said.

Jim Wehling, a Bedford Borough council member said within Bedford Borough, he hopes to address a number of areas within the plan, namely flooding.

"Much of the borough is in a flood plane, including the (Bedford) middle school. We are dependent on local businesses to keep us viable and this plan could have a big impact on local businesses," he said. "Looking to the future is something I do regularly . . . we need to manage change and I'd like to try to see how we can influence some of that."

Schwartz said he expects the plan to take between six and nine months to complete. When complete, it will be submitted to the Pennsylvania Emergency Management Agency and FEMA for approval.

Contact Erin Thompson at ethompson@bedfordgazette.com; 623-1151, ext. 150.

Figure 3-3. Bedford Gazette, March 3, 2017

Levees, trains, meth are new, old county hazard concerns

By Elizabeth Coyle
Gazette managing Editor

Addressing Bedford County's high-profile hazards — uncertified and decertified levees in Hyndman and Everett and a possible new peril of meth labs — will be no easy task but officials are being asked to take the first step by updating the county's hazardous mitigation plan.

Some countywide and local officials representing UPMC Bedford Memorial Hospital, Chestnut Ridge School District, West Providence Township, and county government met for a workshop Thursday to identify hazards in their municipalities or areas of interest as part of the five-year update of the plan.

Tony Subbio, project manager from Tetra Tech's state office in Harrisburg, said the hazard mitigation plan is required to be completed if the county and its municipalities wish to receive federal monies to help remove or lessen the impact of hazards in their communities.

Subbio said the hazardous mitigation plan is typically focused on flood-reduction efforts because flooding is the number one hazard in the state.

"There's is a big flood focus and the majority of the grant programs are flood focused," Subbio said.

Any project for which a municipality or agency wishes to receive federal help must be identified on the county's approved hazardous mitigation plan.

For now, that isn't helping two communities that are dealing with the complications of their unapproved levees.

—Continued on Page 6

Hazard mitigation plan. . .

—Continued from Page 1

Hyndman is still in the early stages of the already long process of certifying a $3.3 million levee that was completed about six years ago. Since then, borough council has struggled to find a way to obtain the levee's certification and give its property owners relief from high flood insurance rates. These premiums are preventing some home purchases because homeowners will be required to get flood insurance, officials have said.

As it stands, Subbio said, the federal flood program doesn't recognize officially that the levee exists.

Subbio said Hyndman is in a better position than Everett because it is moving toward certification however slowly.

Everett is in a harder spot because it has only two options currently. A third choice is doing nothing, which will results in the same high-flood insurance premiums Hyndman grapples with now.

The Federal Emergency Management Agency determined the levee's embankments, designed and built about 50 years ago, aren't sufficient anymore.

About 160 buildings and 300 residents are located in an area that would be affected by the uncertified levee. And without certification, the federal government will consider those properties as falling in zone AE. The National Flood Insurance Program considers these areas to be at a high risk for flooding — a 26 percent chance of flooding during the course of a 30-year mortgage, according to FEMA.

Council also could conduct a conduct a freeboard deficiency analysis — a set of procedures for analyzing and mapping flood hazards on the landward side of non-accredited levee systems. And that could result in a properties having a Zone D designation, wherein residents probably would be encouraged to purchase flood insurance, but it might not be mandatory. Zone D designation is used in areas where there are possible, but undetermined flood hazards.

But Subbio said in Zone D, the federal flood insurance program doesn't set flood insurance rates, as it does across the country, instead it's the banks and those premiums could be even higher than the feds'.

Subbio said Everett could join a National Flood Insurance Program Community Rating System to help ease rates in the future. It's a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Bedford Township is part of the program, Subbio said.

But going the full measure of building the levee to the height FEMA wants will take millions of dollars, officials have said.

A second major hazard for Hyndman is the periodic blockage of intersections in town by long CSX trains that break down.

"There are some complicating factors there," Subbio said. Officials have discussed alternate roads further south or west of town that would help motorists get around the blocked intersections of Schellsburg, Center and Market streets. When CSX trains sometimes break down, they in effect cut off the north side of town from the south, a worry for emergency responders.

Subbio said one idea has been to pave a road near the sewer plant on the south side of town, though it lies in the flood plain. The other idea is for a bypass that would connect with Hogback near Schellsburg Street, though that idea is likely out of any realm of possibility because of the cost.

Bedford County Emergency Services Director David Cubbison said his office has conducted "very aggressive alerting of services" as well as the emergency management coordinators both north and south of Hyndman.

Emergency services crews could come up from Maryland, if needed, he said. "We've thought that through," Cubbison said of his discussions with emergency crews in the area, "and have had very good participation."

"Unfortunately, these trains are two miles long," in some instances, Cubbison said.

There is one new danger emerging in communities along roadsides and in woods, Beth Hullihen, director of operations at UPMC Bedford Memorial, said. The prevalence of meth labs and the dump sites that addicts have created around the county are a new hazard for residents.

West Providence Township Supervisor Tom Brady said there have been meth dump sides along his municipality's roads. The concern is they look like trash but their toxic ingredients and equipment are so much worse.

"A lot of our residents don't know what they're looking at," when they find the items, he said.

Hullihen said the hospital worries about the impact on the hospital and the possible contamination meth addicts may bring.

Trains and meth labs are not typical dangers listed on hazardous mitigation plans. Subbio said one of the goals of the plan is to identify these hazards or potential hazards and find a way to either remove the threats or make them less of a danger.

Projects identified on county plans may be eligible for state reimbursement of 85 percent and possible federal help as well.

Unfortunately, 23 boroughs and townships in the county have not filled out a mitigation worksheet that identifies hazards.

Subbio said municipalities that include school districts and agencies, such as the hospital, are encouraged to submit a worksheet as the county moves toward submitting the plan to FEMA.

A completed draft is set for mid-April, Subbio said. There will be time for public input ahead of a draft review in late May. It's hoped an updated plan will be sent to Pennsylvania Emergency Management Agency by early June and then FEMA in late June.

For information, contact Donald Schwartz, Bedford County Planning, 623-4827, or dcubbison@bedfordcounty,org; David Cubbison, 623-9117, or dcubbison@bedfordcountypa.org; Tony Subbio, 717-545-3580, or tonysubbio@tetratech.com.

The Planning Team felt that jurisdictional and stakeholder participation was critical to the process. The Planning Team met regularly to review the status of the planning process, the HMP document, and strategies to involve the public. Because this particular HMP was an update, the Planning Team felt that it was critical to allow adequate time for stakeholders to review each section individually. The Planning Team also individually contacted several municipalities to elicit feedback on various sections of the HMP.

In addition, the Pennsylvania Historic & Museum Commission (PHMC) sponsored a project to collect detailed survey data about historic structures and areas in Bedford County to protect these from hazard impacts. At the time of this HMP update, the data was not available to include in the risk assessment or development of the mitigation strategy. However, available information will be incorporated into the next update of this HMP.

3.5 MULTI-JURISDICTIONAL PLANNING

Bedford County took a multi-jurisdictional approach to preparing its HMP, so that the HMP would apply to the County and all participating municipalities. The County was able to provide resources (such as funding, specific data, geographic information system [GIS] programs, etc.) to prepare the HMP. Certain municipalities may not have had access to such resources. The County did, however, depend on municipal buy-in because the municipalities have the legal authority to enforce compliance with land use planning and development directives. The County, together with Tetra Tech, undertook an intensive effort to involve all 38 municipalities in the update process, although only 26 municipalities participated in meeting attendance and information sharing.

Each municipality was given the opportunity to participate in this process. Municipal officials and representatives were invited to attend Planning Team and public meetings, were sent a copy of the existing HMP for comment, and were asked to review and prioritize the mitigation actions listed in the plan. Municipal participation culminated in formal adoption of the HMP; copies of municipal adoption resolutions are provided in Appendix F. Table 3-3 indicates how each municipality participated in the planning process.

Table 3-3. Planning Participation

Municipality	Risk Assessment Survey Received	Capabilities Assessment Survey Received	Mitigation Review Worksheet Received	Attended Meeting(s)	Individual Contact by County	Adopted 2017 Plan	2017 Plan Adoption Date
Bedford County	x	x	x	x			
Bedford Borough	x	x	x	x			
Bedford Township	x	x	x	x			
Bloomfield Township	x	x	x	x			
Broad Top Township	x	x			x		
Coaldale Borough	x						
Colerain Township	x	x	x	x			
Cumberland Valley Township	x	x	x				
East Providence Township	x	x	x	x			
East St. Clair Township	x	x	x	x			
Everett Borough	x	x	x	x			
Harrison Township	x	x	x	x			
Hopewell Borough	x			x			
Hopewell Township	x	x	x		x		
Hyndman Borough	x	x		x			
Juniata Township	x	x	x	x			
Kimmel Township	x						

Municipality	Risk Assessment Survey Received	Capabilities Assessment Survey Received	Mitigation Review Worksheet Received	Attended Meeting(s)	Individual Contact by County	Adopted 2017 Plan	2017 Plan Adoption Date
King Township	x						
Liberty Township	x			x			
Lincoln Township	x	x	x	x			
Londonderry Township	x	x		x			
Mann Township	x	x	x	x			
Manns Choice Borough	x						
Monroe Township	x	x	x	x			
Napier Township	x	x		x			
New Paris Borough	x	x	x				
Pavia Township	x						
Pleasantville Borough	x						
Rainsburg Borough	x	x		x			
Saxton Borough	x	x	x	x			
Schellsburg Borough	x	x		x			
Snake Spring Township	x	x		x			
South Woodbury Township	x	x	x				
Southampton Township	x	x	x	x			
St. Clairsville Borough	x						
West Providence Township	x	x	x	x			
West Saint Clair Township	x	x	x	x			
Woodbury Borough	x	x	x	x			
Woodbury Township	x	x	x	x			

3.6 EXISTING PLANNING MECHANISMS

The HMP planning process also allowed for review and incorporation, if appropriate, of existing plans, studies, reports, and other information that would aid in mitigation of hazards across the County. Sections 5 and 7 of this HMP provide additional information regarding integration of existing and future County and municipal processes with hazard mitigation, specifically as these concern administrative, budgetary, and regulatory processes and plans; funding sources; and partnerships. Bedford County will implement existing plans and programs to carry out decided-upon hazard mitigation actions. Based on capability assessments of the participating municipalities, the County will continue to plan and implement programs to reduce effects of hazards on people, places, and the environment. This updated HMP builds upon momentum developed through previous related planning efforts and mitigation programs, and recommends implementing actions, where possible.

4.1 Methodology and Tools

This section describes the methodology and tools used to support the risk assessment process.

4.1.1 Methodology

The risk assessment process applied for this Hazard Mitigation Plan (HMP) update is consistent with the process and steps presented in the Federal Emergency Management Agency (FEMA) 386-2, State and Local Mitigation Planning How-to-Guide, Understanding Your Risks – Identifying Hazards and Estimating Losses (FEMA 2001). This process identifies and profiles hazards of concern and assesses vulnerability of assets (population, structures, critical facilities, and the economy) at risk in a community. A risk assessment provides the foundation for a community's decision makers to evaluate mitigation measures that can help reduce impacts of a hazard (mitigation measures are described in Section 6). The risk assessment process consists of the following steps:

Step 1: Identify the hazards of concern. FEMA's current regulations require an evaluation of only natural hazards. Natural hazards are natural events that threaten lives, property, and other assets. Natural hazards often can be predicted to reoccur at the same geographical locations because these are related to weather patterns or physical characteristics of an area. Bedford County elected to include non-natural hazards as well in this HMP.

Step 2: Prepare a profile of each hazard of concern to assist communities in evaluating and comparing hazards that can impact their areas. Each type of hazard has unique characteristics that vary from event to event. That is, impacts associated with a specific hazard can vary depending on magnitude and location of each event (a hazard event is a specific, uninterrupted occurrence of a particular type of hazard). Further, probability of occurrence of a hazard at a given location affects the priority assigned to that hazard. Finally, each hazard impacts different communities in different ways based on geography, local development, population distribution, age of buildings, and mitigation measures already implemented.

Steps 3 and 4: Community evaluates its assets (Step 3) and identifies assets exposed or vulnerable to the identified hazards of concern (Step 4). Hazard profile information—combined with data regarding population, demographics, general building stock, and critical facilities at risk—prepares the community to develop risk scenarios and estimate potential damages and losses from each hazard. Critical facilities in Bedford County are identified in Section 2.5 and Appendix I to this HMP.

4.1.2 Tools

To address Disaster Mitigation Act of 2000 (DMA 2000) requirements and better understand potential vulnerability and losses associated with hazards of concern, Bedford County used standardized tools combined with local, state, and federal data and expertise to conduct the risk assessment. Tools used by the County to support the risk assessment are described in the sections below.

Hazards U.S. – Multi-Hazard (HAZUS-MH)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes known as Hazards U.S. (HAZUS). HAZUS was developed in response to need for more effective national-, state-, and community-level planning, and need to identify areas facing highest risk and potential for loss. HAZUS was expanded into a multi-hazard methodology (HAZUS-MH) with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a geographic information system (GIS)-based software tool that applies engineering and scientific risk calculations developed by hazard and information technology experts to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports evaluations of hazards, as well as assessments of inventory and loss estimates from these hazards.

HAZUS-MH uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems, and utilities. To generate this information, HAZUS-MH uses default HAZUS-MH-provided data for inventory, vulnerability, and hazards. These default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (such as inundation, fire, and threats posed by hazardous materials and debris) and direct economic and social losses (such as casualties, shelter requirements, and economic impact), depending on the hazard and available local data. HAZUS-MH's open data architecture can be applied to manage community GIS data at a central location. Use of this software also promotes consistency of current and future data output, and standardization of data collection and storage. Those applying HAZUS-MH to this risk assessment and plan relied on guidance from "Using HAZUS-MH for Risk Assessment: How-to Guide" (FEMA 433) (FEMA 2015).

In general, probabilistic analyses were performed to develop estimates of long-term average losses (annualized losses) from earthquake and tornado/windstorm hazards, as well as an expected or estimated distribution of losses (mean return period losses) from an earthquake; flood, flash flood, and ice jam; and tornado and windstorm hazards. Probabilistic hazard analyses generate estimates of damage and loss within specified return periods. For determination of annualized losses, HAZUS-MH 3.1 calculates maximum potential annual dollar loss resulting from various return periods averaged on a per-year basis. The analysis consists of summation of all HAZUS-supplied return periods (e.g., 10, 50, 100, 200, 500) multiplied by the return period probability (as a weighted calculation). In summary, estimated cost of a hazard (earthquake, flood, and tornado and windstorm hazards) is calculated for each year.

The following custom methodologies in HAZUS-MH 3.1 were applied to assess potential exposure and losses associated with hazards of concern for Bedford County:

- <u>Inventory</u>: Default demographic data in HAZUS-MH 3.1, based on the 2010 U.S. Census, were used for the potential loss analysis (such as for sheltering and injuries) for each hazard model.

  Default building inventory in HAZUS-MH 3.1 was used for Bedford County. Occupancy classes available in HAZUS-MH 3.1 were condensed into categories (residential, commercial, industrial, agricultural, religious, government, and educational) to facilitate the analysis and presentation of results. Residential loss estimates address both multi-family and single-family dwellings. Building replacement cost values are based on 2015 RS Means Company, Inc. (RS Means) valuations. The County provided a building footprint layer that was used to calculate exposure to each hazard.

  An updated critical facility inventory was also developed and incorporated into HAZUS-MH, replacing the default essential facility (police, fire, schools, etc.), transportation, and utility inventories for the earthquake, flood, and tornado/windstorm hazard models. This comprehensive inventory was developed by gathering input from numerous sources including Bedford County GIS, participating municipalities, and the Planning Committee.

  The "user-defined facilities" category includes all assets that Bedford County plan participants deemed critical to include in the inventory, and that do not fit within a pre-defined HAZUS-MH facility category. These facilities include County buildings, senior care facilities, and municipality-owned buildings.

HAZUS-MH 3.1 incorporates two types of census block-based data, homogenous and dasymetric. Homogenous census blocks display the full extent of each block, while the dasymetric census blocks have had homogenous undeveloped areas (bodies of area, forests, etc.) removed. The dasymetric blocks were developed to provide more accurate loss estimates by excluding uninhabited and undeveloped areas of a census block.

- Earthquake: A probabilistic assessment was conducted for Bedford County of the 500-year mean return periods (MRP) through a Level 2 analysis in HAZUS-MH 3.1 to analyze the earthquake hazard and provide a range of loss estimates for Bedford County. The probabilistic method uses information from historical earthquakes and inferred faults, locations, and magnitudes to compute, by Census tract, probable ground-shaking levels that may be experienced during a recurrence period.

  As noted in the HAZUS-MH Earthquake User Manual:

  > "Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. These factors can result in a range of uncertainly in loss estimates produced by the HAZUS Earthquake Model, possibly at best a factor of two or more." (FEMA 2015f).

  However, HAZUS' potential loss estimates are acceptable for the purposes of this HMP.

  Ground shaking is the primary cause of earthquake damage to manmade structures, and soft soils amplify ground shaking. One contributor to site amplification is velocity at which rock or soil transmits shear waves (S-waves). The National Earthquake Hazard Reduction Program (NEHRP) developed five soil classifications that impact severity of an earthquake, ranging from A to E. Soil classified as A represents hard rock that reduces ground motions from an earthquake, and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. NEHRP soil classifications were not available for Bedford County at the time of this analysis. Soils were estimated as NEHRP soil Type D across Bedford County as a conservative approach to this risk assessment. Groundwater was set at depth of 5 feet (default setting). Damages and losses due to liquefaction, landslide, or surface fault rupture were not included in this analysis.

- Flood, Flash Flood, and Ice Jam: The FEMA Digital Flood Insurance Rate Map (DFIRM) dated March 2012 was used to evaluate exposure to 1-percent annual chance flood events, and to determine potential future losses from the 1-percent annual chance event in Bedford County; this flood event is generally considered by planners and evaluated under federal programs such as the National Flood Insurance Program (NFIP). The FEMA-generated, 1-percent annual chance flood depth grid obtained from the Pennsylvania Spatial Data Clearinghouse was incorporated into HAZUS-MH to estimate potential losses to the County (Pennsylvania Spatial Data Clearinghouse 2010). According to FEMA Region III, the 2010 depth grid was based on data used to develop 2010 DFIRMs. The depth grid was integrated into HAZUS-MH 3.1, and the model was run to estimate potential losses at the census block level using HAZUS-MH default building inventory.

- Tornado and Windstorm: After review of historical data occurred a HAZUS-MH 3.1 probabilistic analysis of the 100- and 500-year MRP events to analyze wind hazard losses in Bedford County. The probabilistic hurricane hazard model includes data regarding historical hurricane events and wind speeds; the model activates a database of thousands of potential storms with tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886, and then identifies those storms with tracks associated with the County. It also includes surface roughness and vegetation (tree coverage) maps of the County. Surface roughness and vegetation data support modeling of wind force across various types of land surfaces. Default demographic and building stock data from HAZUS-MH 3.0 and updated critical facility inventories were used for the analysis.

- Other Hazards: GIS tools including HAZUS-MH were used to evaluate other hazards (such as landslide, environmental hazards, etc.), as feasible. For evaluation of many hazards in this risk assessment, historical data are not adequate to model future losses at this time. Therefore, regarding these hazards of concern, areas and inventory susceptible to specific hazards were mapped, and exposure was evaluated to help guide mitigation efforts (mitigation efforts are discussed further in Section 6). Regarding hazards for which GIS data were not available, a qualitative analysis was conducted using the best available data and professional judgment.

For this risk assessment, loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on best available data and methodologies. Uncertainties are inherent in any loss estimation methodology, and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct such a study
- Incomplete or dated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed by the participating municipalities and the amount of advance notice residents have to prepare for a specific hazard event.

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of 2 or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results, and should be used to understand relative risk. Over the long term, Bedford County will collect additional data to assist in developing refined estimates of vulnerabilities to natural and non-natural hazards.

4.2 Hazard Identification

In identifying hazards that pose significant risk to Bedford County, the Planning Team reviewed additional information and historical records from a wide range of sources, and identified the following hazards for consideration and profiling from the original 2012 plan:

Natural Hazards

- Drought
- Earthquakes
- Extreme Temperatures (Hot or Cold)
- Floods, Flash Floods, and Ice Jam
- Hailstorms
- Landslide
- Lightning Strike
- Pandemic Disease
- Subsidence and Sinkholes
- Tornadoes and Windstorms
- Wildfires
- Winter Storms
- Invasive Species
- Radon Exposure

Non-Natural Hazards

- Dam Failures
- Environmental Hazards
- Levee Failure
- Terrorism
- Transportation Accidents
- Utility Interruption

As part of the plan update process, the Planning Team reviewed the hazards of concern detailed in the 2012 version of the plan, as well as those identified in the State HMP. The Planning Team also considered the history of hazard events in Bedford County, as well as events occurring after completion of the 2012 version of the plan. This review of historical events included an evaluation of all emergency and disaster declarations in the Commonwealth, focusing on those in which Bedford County was designated for federal assistance.

Further, all jurisdictions participating in the plan update process were provided a Hazard Identification/ Evaluation of Risk worksheet to help identify the hazards—natural and non-natural—that each community believed posed significant risk to Bedford County, including any that may not have been considered in either the 2012 version of the plan or the State HMP. Completed worksheets submitted by the municipalities are in Appendix D.

Based on all available information and input from the municipalities, the Planning Team elected to retain the above list of natural and non-natural hazards for consideration in this plan. These hazards have been profiled individually in Section 4.3 of this plan.

4.3.1 Drought

This section provides a profile and vulnerability assessment of the drought hazard in Bedford County. Drought is a period characterized by long durations of below-normal precipitation. Drought conditions occur in virtually all climatic zones, yet characteristics of drought vary significantly from one region to another, relative to normal precipitation within respective regions. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. Drought is a temporary irregularity in typical weather patterns and differs from aridity, which reflects low rainfall within a specific region and is a permanent feature of the climate of that area.

Drought can be defined or grouped into four categories:

- Meteorological drought is a measure of departure of precipitation from normal, defined solely by reference to relative degree of dryness. Because of climatic differences, dryness considered a drought at one location of the country may not be considered drought at another location.
- Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced groundwater or reservoir levels, and other parameters. Agricultural drought occurs when not enough water is available for a particular crop to grow at a particular time. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life, primarily crops.
- Hydrological drought is associated with below-normal surface or subsurface water supply resulting from periods of precipitation shortfalls (including snowfall). Hydrological drought is related to effects of precipitation shortfalls on stream flows and water levels in reservoirs, lakes, and groundwater.
- Socioeconomic drought is associated with supply and demand of an economic good, with elements of meteorological, hydrological, and agricultural drought categories. This differs from the aforementioned types of drought because its occurrence depends on supply and demand to identify or classify droughts. Supplies of many economic goods such as water, silage, food grains, fish, and hydroelectric power depend on weather. Socioeconomic drought occurs when demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply (National Drought Mitigation Center ([NDMC] 2012).

Drought can affect many sectors of an economy and can reach beyond an area undergoing physical drought. Because water is essential for producing goods and providing services, drought can reduce crop yield, increase fire hazard, lower water levels, and damage wildlife and fish habitats. Further consequences include: reductions in crop yields, rangeland, and forest productivity that may lower incomes of farmers and agribusinesses; increase in prices of food and timber; increase in unemployment; reduction of tax revenues as expenditures decline; increase in crime, foreclosures, and migration; and depletion of disaster relief funds. The many impacts of drought can be categorized as economic, environmental, or social.

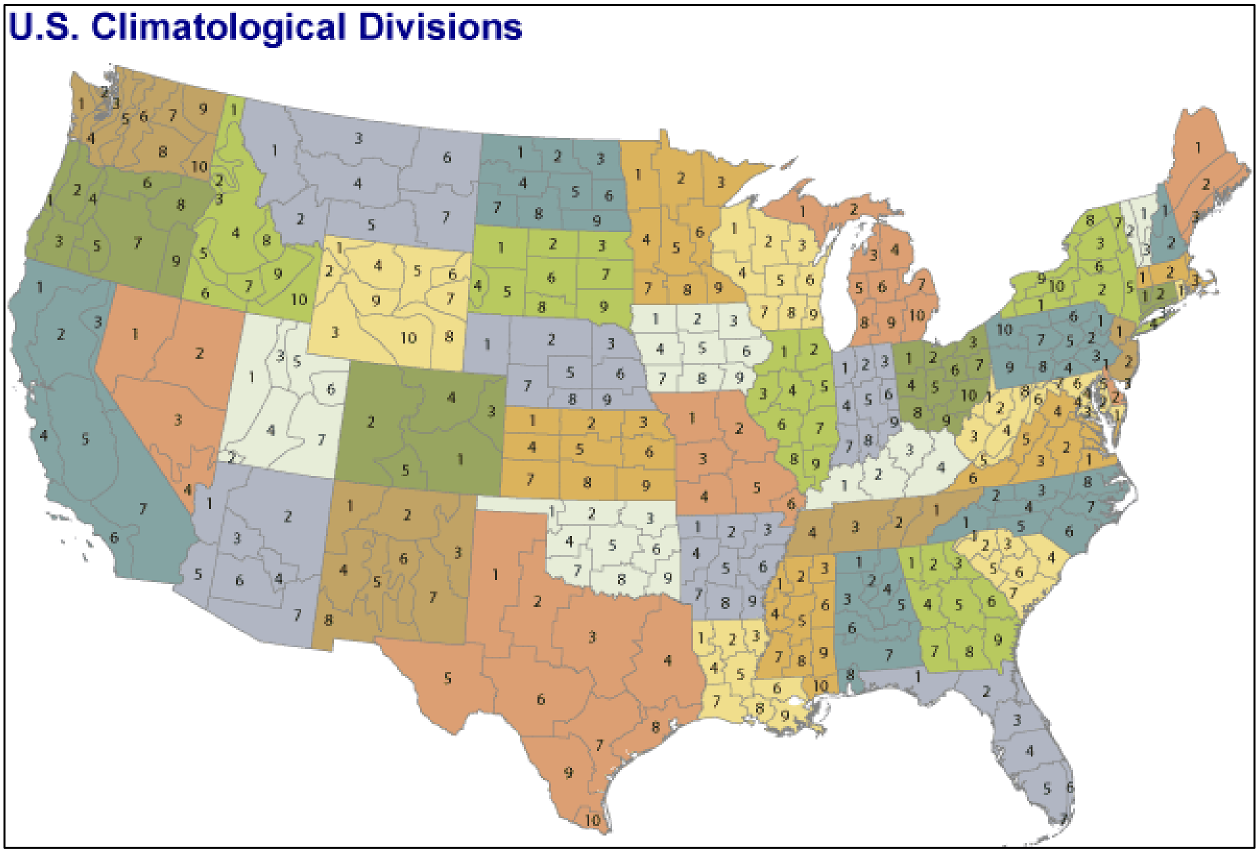
4.3.1.1 Location and Extent

Droughts are regional in scope and may affect the entirety of Bedford County rather than only individual municipalities within the county. Droughts may also concurrently affect counties near Bedford County, or even the entire Commonwealth. Generally, areas along waterways will reveal drought conditions later than areas away from waterways.

Climate divisions are regions within a state that are climatically homogenous. The National Oceanic and Atmospheric Administration (NOAA) has divided the United States into 359 climate divisions. The boundaries of these divisions typically coincide with county boundaries, except in the western United States where they are based largely on drainage basins (CPC 2005).

According to NOAA, Pennsylvania includes 10 climate divisions: Pocono Mountains, East Central Mountains, Southeastern Piedmont, Lower Susquehanna, Middle Susquehanna, Upper Susquehanna, Central Mountains, South Central Mountains, Southwest Plateau, and Northwest Plateau Climate Division (National Climatic Data Center [NCDC] 2012). Figure 4.3.1-1 shows the climate divisions throughout the United States, and Figure 4.3.1-2 shows the climate divisions of Pennsylvania. Bedford County is within the South Central Mountains climate division.

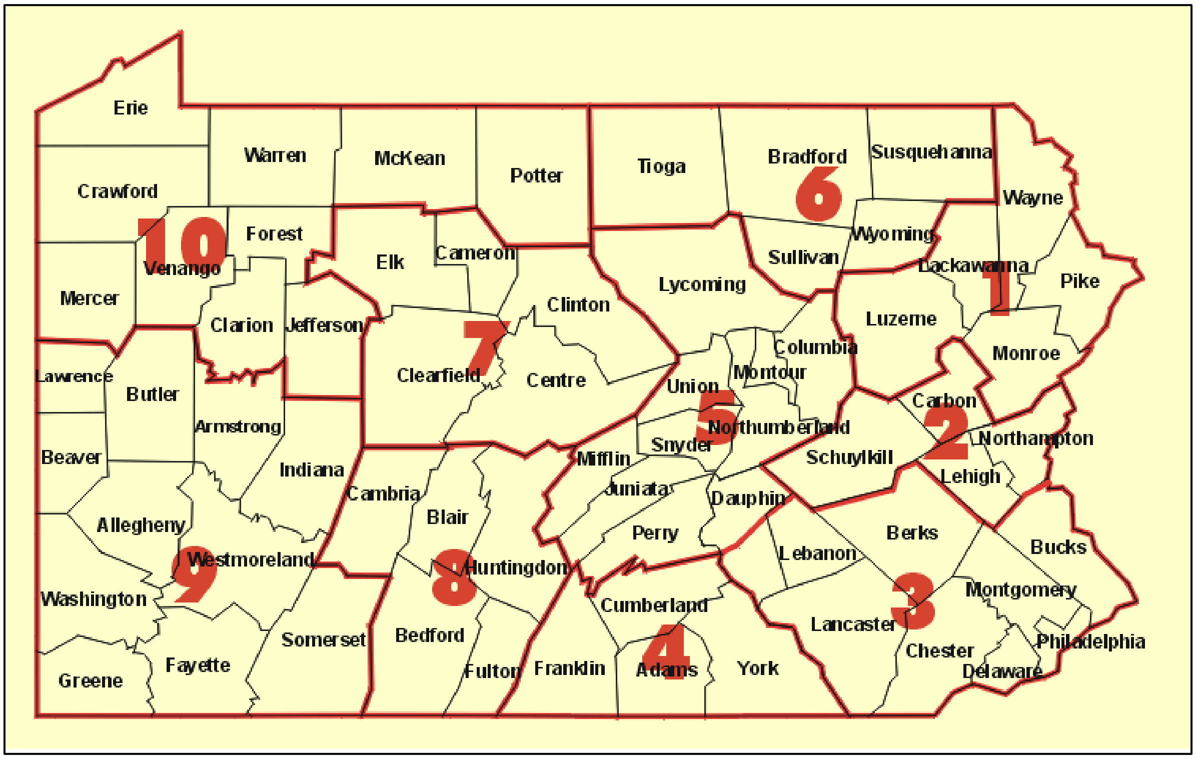
Figure 4.3.1-1. Climate Divisions in the United States



Source: NCDC n.d.

Note: Climate division names vary from state to state. The climate divisions for Pennsylvania are: 1 = Pocono Mountains; 2 = East Central Mountains; 3 = Southeastern Piedmont; 4 = Lower Susquehanna; 5 = Middle Susquehanna; 6 = Upper Susquehanna; 7 = Central Mountains; 8 = South Central Mountains; 9 = Southwest Plateau; 10 = Northwest Plateau

Figure 4.3.1-2 Climate Divisions of Pennsylvania



Source: CPC 2005
Note: Highlight added.
The climate divisions for Pennsylvania are:
1 = Pocono Mountains; 2 = East Central Mountains; 3 = Southeastern Piedmont; 4 = Lower Susquehanna; 5 = Middle Susquehanna; 6 = Upper Susquehanna; 7 = Central Mountains; 8 = South Central Mountains; 9 = Southwest Plateau; 10 = Northwest Plateau

Particularly at locations where citizens rely on wells for drinking water, water supplies are vulnerable to effects of drought and thus can impact the severity of a drought. Residents depending on well water can more easily handle short-term droughts without major inconveniences than can populations that rely on surface water. However, longer-term droughts inhibit groundwater aquifers from recharging and can thus extend the problems of well owners for an indeterminate amount of time. Bedford County residents who depend on private domestic wells have this greater "hidden vulnerability" to droughts. According to the USGS National Water Information System, the average daily domestic self-supplied groundwater withdrawals of fresh water in Bedford County was 1.98 million gallons (Mgal) per day in 2010, serving roughly 32,972 residents for a total of roughly 60 gallons per person (dependent on well water) per day (USGS 2014).

Table 4.3.1-1 lists the number of reported domestic wells within each municipality of Bedford County. The well data were obtained from the Pennsylvania Groundwater Information System (PaGWIS). PaGWIS is maintained by PA DCNR and relies on voluntary submissions of well record data by well drillers; as a result, it is not a complete database of all domestic wells in the county. It is, however, the most complete dataset of domestic wells available.

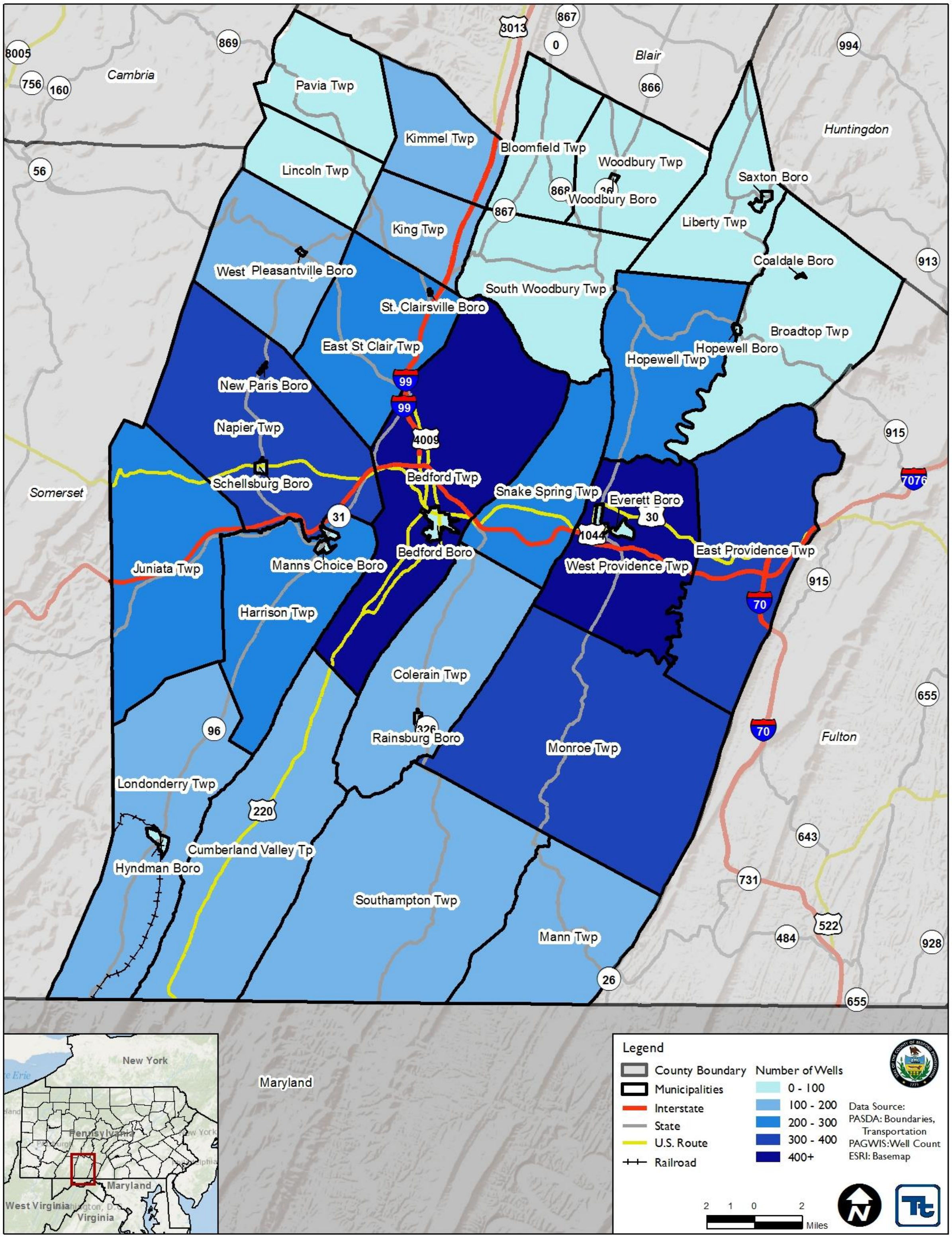
Table 4.3.1-1. Domestic Wells in Bedford County

Municipality	Number of Reported Domestic Wells	Municipality	Number of Reported Domestic Wells
Bedford Borough	7	Londonderry Township	126
Bedford Township	468	Mann Township	178
Bloomfield Township	81	Manns Choice Borough	17
Broad Top Township	98	Monroe Township	331
Coaldale Borough	1	Napier Township	383
Colerain Township	193	New Paris Borough	8
Cumberland Valley Township	158	Pleasantville Borough	11
Darlington Township	1	Saxton Borough	1
East Providence Township	305	Schellsburg Borough	12
East St Clair Township	296	Snake Spring Township	214
Everett Borough	32	South Woodbury Township	70
Harrison Township	241	Southampton Township	129
Hopewell Borough	12	St Clairsville Borough	8
Hopewell Township	265	Union Township	15
Hyndman Borough	11	West Providence Township	569
Juniata Township	208	West St Clair Township	197
Kimmell Township	105	Woodbury Township	87
King Township	113	Unknown	50
Liberty Township	52	**Bedford County**	**5,092**
Lincoln Township	39		

Source: PAGWIS 2016

Figure 4.3.2-3 shows well counts by municipality within Bedford County.

Figure 4.3.1-3 Bedford County Domestic Well Counts by Municipality



Source: PA DCNR 2016

In addition to domestic wells in the county, residents may also receive their water from municipal water providers. According to the 2006 Bedford County Comprehensive Plan, there are 18 public water providers in the County. Public water systems, for the most part, are located in the northern half of the County (Bedford County Comprehensive Plan 2006).

Jurisdictions that are designated for agricultural use are particularly vulnerable to drought. In Bedford County, the following municipalities have large portions zoned for agricultural use: Kimmel Township, King Township, West St. Clair Township, East St. Clair Township, Napier Township, Juniata Township, Colerain Township, Cumberland Valley Township, Snake Spring Township, South Woodbury, Bloomfield, Woodbury, West Providence, and East Providence. Areas designated for agricultural use are illustrated in Figure 2-5 in Section 2.

4.3.1.2 Range of Magnitude

Effects of droughts vary depending on their severity, timing, duration, and location. Some droughts may exert their greatest impact on agriculture, while others may have stronger effects on water supply or recreational activities. Droughts can adversely affect the following significantly:

- 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
- Water for forests and for fighting forest fires
- Water for navigation and recreation.

Pennsylvania Department of Environmental Protection (PADEP) and Pennsylvania Emergency Management Agency (PEMA) manage water supply droughts according to the following four conditions of drought, as defined in the Commonwealth of Pennsylvania 2013 Standard Hazard Mitigation Plan (PA HMP):

- Drought Watch: A period to alert government agencies, public water suppliers, water users, and the public regarding potential for future drought-related problems. The focus is on increased monitoring, awareness, and preparation for response in the event that conditions worsen. A request for voluntary water conservation is issued. The objective of voluntary water conservation measures during a drought watch is to reduce water use by 5 percent within the affected areas. Because of varying conditions, individual water suppliers or municipalities may propose more stringent conservation actions.
- Drought Warning: This is a drought stage involving a coordinated response to imminent drought conditions and potential water supply shortages through concerted voluntary conservation measures to avoid or reduce shortages, relieve stressed sources, develop new sources, and, if possible, forestall the need to impose mandatory water use restrictions. The objective of voluntary water conservation measures during a drought warning is to reduce overall water use by 10 to 15 percent within the affected areas. Because of varying conditions, individual water suppliers or municipalities may propose more stringent conservation actions.
- Drought Emergency: During this drought stage, water management entities assemble all available resources to respond to actual emergency conditions, avoid depletion of water sources, ensure at least minimum water supplies to protect public health and safety, support essential and high-priority water uses, and avoid unnecessary economic upsets. If deemed necessary and if ordered by the Governor during this stage, imposition of mandatory restrictions on nonessential water usage could occur as provided for in 4 *Pa. Code* Chapter 119. Objectives of water use restrictions (mandatory or voluntary) and other conservation measures during a drought emergency are to reduce consumptive water use within the affected areas by 15 percent, and to reduce total use to the extent necessary to preserve public

water system supplies, avoid or mitigate local or area shortages, and ensure equitable sharing of limited supplies.

- Local Water Rationing: This fourth condition of drought is not defined as a drought stage. Local municipalities may, with the approval of the PEMA Council, implement local water rationing to share a rapidly dwindling or severely depleted water supply within designated water supply service areas. These individual water rationing plans, authorized through provisions of 4 *Pa. Code* Chapter 120, require specific limits on individual water consumption to achieve significant reductions in use. Under both mandatory restrictions imposed by the commonwealth and local water rationing practices, procedures are specified for granting variances in consideration of individual hardships and economic dislocations (PEMA 2013).

Pennsylvania uses five parameters to assess drought conditions: precipitation deficits, stream flows, reservoir storage levels, groundwater levels, and a measure of soil moisture. These are described in detail below.

- Precipitation Deficits: As rainfall provides the basis for both groundwater and surface water resources, precipitation deficits are the earliest indicators of a potential drought. The National Weather Service (NWS) records "normal" monthly precipitation data for each county in Pennsylvania. These figures are generated from long-term monthly and decennial averages of precipitation, and are updated at the end of each decade based on the most recent 30 years. Monthly totals with less than normal values represent precipitation deficits, which are then converted to percentages of the normal values. Table 4.3.1-3 lists the drought conditions (defined in the PA HMP and noted above) that are indicated by various precipitation deficit percentages (PEMA 2013).

Table 4.3.1-2 Precipitation Deficit Drought Indicators for Pennsylvania

Duration of Deficit Accumulation (months)	Drought Watch (deficit as percent of normal precipitation)	Drought Warning (deficit as percent of normal precipitation)	Drought Emergency (deficit as percent of normal precipitation)
3	25	35	45
4	20	30	40
5	20	30	40
6	20	30	40
7	18.5	28.5	38.5
8	17.5	27.5	37.5
9	16.5	26.5	36.5
10	15	25	35
11	15	25	35
12	15	25	35

Source: PEMA 2010

Table 4.3.1-4 lists normal monthly and annual precipitation from 1981 to 2010 at the two NOAA weather stations in Bedford County. Data from the NOAA weather stations are available through the National Climatic Data Center (NCDC), which compiles monthly and annual normal total precipitation (inches) data retrieved from both National Weather Service Cooperative Network (COOP) and Principal Observation (First-Order) locations throughout the United States.

Table 4.3.1-3 Normal Monthly and Annual Precipitation (total in inches) from 1981 to 2010 at NOAA Weather Stations in Bedford County

Station Name	January	February	March	April	May	June	July	August	September	October	November	December	ANNUAL
Everett	2.58	2.39	3.22	3.81	4.01	3.61	3.54	3.11	3.41	2.94	3.20	2.80	38.62
Saxton 1 W	2.61	2.46	3.40	3.48	4.00	3.60	3.86	3.13	3.45	3.03	3.46	2.88	39.36

Source: NCDC 2014

- Stream Flows: Stream flows, which typically lag up to 2 months behind normal precipitation amounts in signaling a drought, offer the second earliest indication of drought conditions. PADEP uses 73 U.S. Geological Survey (USGS)-maintained stream gauges throughout the State as its drought monitoring network, computing 30-day average stream flow values for each stream gauge based on the entire period of record for each gauge. For example, the Raystown Branch Juniata River gauge at Saxton has data records as far back as September 1911 from which the long-term, 30-day average, or normal, flows are now determined. Drought status is determined from stream flows based on exceedances rather than percentages. The various stages of drought watch, warning, and emergency conditions are indicated, respectively, by 75-, 90-, and 95-percent exceedances of 30-day average flows (PEMA 2013). Detailed descriptions of these data collection methods appear in the PA HMP.
- Reservoir Storage Levels: Water levels in several large public water supply reservoirs are another indicator that PADEP uses for drought monitoring. Depending on total quantity of storage and length of the refill period for the various reservoirs, PADEP uses varying percentages of storage drawdown to indicate the three drought stages for each reservoir (PEMA 2013).
- Groundwater Levels: Groundwater levels can be an indicator of a developing drought, although low readings may lag up to 3 months behind drought-indicative precipitation readings. This lag occurs because storage of nearly 80 trillion gallons of groundwater throughout the Commonwealth disguises precipitation deficits for many months before significant lack of groundwater recharge becomes noticeable (PEMA 2013).

  USGS also maintains groundwater monitoring wells in each county throughout the Commonwealth. Groundwater measurements taken from these wells at exceedances of 75, 90, and 95 percent are used to indicate drought watch, warning, and emergency statuses, respectively. Within the USGS well network, the 30-day average depth-to-groundwater readings are analyzed in relation to long-term, 30-day averages based on the period of record for each county well (PEMA 2013).

- Soil Moisture: NOAA's Palmer Drought Severity Index (PDSI) provides soil moisture information for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. The index tool is frequently used to indicate availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and forest fire potential. Although notably ineffective for monitoring short-term drought, the PDSI is effective for determining long-term droughts, and as such is most frequently used to delineate disaster areas (CPC 2005).

Table 4.3.1-5 lists PDSI classifications. The PDSI uses 0 to reflect normal status, and negative numbers indicate droughts. For example, 0 is no drought, -2 is moderate drought, and -4 is extreme drought. Positive numbers signify excess precipitation (NDMC 2013).

Table 4.3.1-4. Palmer Drought Severity Index (PDSI) Classifications

Severity Category	PDSI Value	Drought Status
Extremely wet	4.0 or more	None
Very wet	3.0 to 3.99	None
Moderately wet	2.0 to 2.99	None
Slightly wet	1.0 to 1.99	None
Incipient wet spell	0.5 to 0.99	None
Near normal	0.49 to -0.49	None
Incipient dry spell	-0.5 to -0.99	None
Mild drought	-1.0 to -1.99	None
Moderate drought	-2.0 to -2.99	Watch
Severe drought	-3.0 to -3.99	Warning
Extreme drought	-4.0 or less	Emergency

Source: NDMC 2013; PEMA 2013

Availability and management of water supply are discussed in the 2009 Pennsylvania State Water Plan, a joint effort by the Statewide Water Resources Committee and PADEP. In 2009, the PADEP Secretary approved an updated State Water Plan to guide management of Pennsylvania's water resources over a 15-year planning horizon. As a functional planning tool for all Pennsylvania municipalities, counties, and regional planning partnerships, the State Water Plan profiles drought and resource constraints and encourages implementation of new technology and use policies to facilitate reduced water uses and resource demands at critical peak times. The Plan provides inventories of water availability, as well as an assessment of current and future water use demands and trends. It also offers strategies for improving management of water resources and waterway corridors that aim to reduce damages from extreme drought and flooding conditions (PADEP 2009).

4.3.1.3 Past Occurrence

Historical information has been drawn from many sources regarding previous occurrences and losses associated with drought events throughout Pennsylvania and Bedford County. Because so many sources were reviewed for the purpose of developing this plan, loss and impact information pertaining to many events could vary depending on the source. Therefore, accuracy of cited monetary values is based only on the available information identified during research for this plan.

According to NOAA's NCDC storm events database, Bedford County underwent four drought events between January 1, 1950, and July 31, 2016—October 1997, December 1998, July 1999, and August 1999. No state-wide crop or property losses were reported because of the droughts; statewide losses would have included damages in other counties.

Since 1930, the Commonwealth of Pennsylvania has undergone 10 significant droughts. Since 1955, the Commonwealth has undergone 12 drought events that resulted in a Governor's proclamation or a Federal Emergency Management Agency (FEMA)-declared disaster or emergency. Bedford County was included in three of these events, and full details are available in PEMA's Pennsylvania Disaster History list. In addition to these events, between 1980 and 2013 PADEP indicated that Bedford County has undergone 22 drought-watch declarations, 13 drought-warning declarations, and 14 drought-emergency declarations (PEMA 2013).

According to FEMA, between 1954 and 2016, Pennsylvania underwent one drought-related disaster (DR) or emergency (EM) classified as one or a combination of the following disaster types: drought or water shortage. Because these disaster types generally cover a wide region of the Commonwealth, this single disaster may have impacted many counties. However, not all counties were included in the disaster declaration. FEMA, PEMA, and other sources indicate that Bedford County has not been declared a disaster area as a result of a drought-related event (FEMA 2016).

Based on all sources researched, drought events between 1895 and 2015 that have affected Bedford County are identified in Table 4.3.1-6. However, not all sources have been identified or researched, and therefore Table 4.3.1-6 may not include all events that have occurred throughout the county.

Table 4.3.1-5 Past Occurrences of Drought Events from 1895 to 2015

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts / PDSI Value
July – September 1965	Drought	DR-206	N/A	-3.68 in 8/1965
November 1980 – April 1982	Drought Emergency	N/A	Yes	Not listed
April – December 1985	Drought Watch	N/A	Yes	Not listed
July – August 1988	Drought Watch	N/A	Yes	Not listed
August – December 1988	Drought Warning	N/A	Yes	Not listed
March – May 1989	Drought Watch	N/A	Yes	Not listed
June – July 1991	Drought Warning	N/A	Yes	Not listed
July 1991	Drought	N/A	Yes	Governor Robert P. Casey – Governor's Proclamation
July 1991 – April 1992	Drought Emergency	N/A	Yes	Not listed
April – September 1992	Drought Warning	N/A	Yes	Not listed
September – December 1995	Drought Watch	N/A	Yes	Not listed
July – November 1997	Drought Watch	N/A	Yes	Not listed
October 1997	Drought	N/A	N/A	No losses identified.
December 1998	Drought	N/A	N/A	No losses identified.
December 1998	Drought Warning	N/A	Yes	Not listed
December 1998 – March 1999	Drought Emergency	N/A	Yes	Not listed
March – June 1999	Drought Watch	N/A	Yes	Not listed
June – July 1999	Drought Warning	N/A	Yes	Not listed
July 1999	Drought	N/A	Yes	Governor Tom Ridge – Governor's Proclamation, Individual Assistance, Hazard Mitigation Grant Program – Amended to include all 67 counties for an agricultural disaster
July – September 1999	Drought Emergency	N/A	Yes	Not listed

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts / PDSI Value
July 1999	Drought	N/A	Yes	No losses identified.
August 1999	Drought	N/A	Yes	No losses identified.
September 1999 – February 2000	Drought Warning	N/A	Yes	Not listed
February – May 2000	Drought Watch	N/A	Yes	Not listed
August – December 2001	Drought Watch	N/A	Yes	Not listed
December 2001 – February 2002	Drought Warning	N/A	Yes	Not listed
February 2002	Drought and Water Shortage	N/A	Yes	Governor Mark S. Schweiker – Governor's Proclamation
February – November 2002	Drought Emergency	N/A	Yes	Not listed
November – December 2002	Drought Watch	N/A	Yes	Not listed
April – June 2006	Drought Watch	N/A	Yes	Not listed
August 2007 – January 2008	Drought Watch	N/A	Yes	Not listed
September – November 2010	Drought Warning	N/A	Yes	Not listed
August – September 2011	Drought Watch	N/A	Yes	Not listed
July - August 2012	Drought Watch	N/A	No	Not listed
March – July 2015	Drought Watch	N/A	Yes	Not listed

Sources: NRCC 2012, PEMA 2014, NCDC 2016, PADEP 2016.

Notes:

FEMA	Federal Emergency Management Agency
N/A	Not applicable
NCDC	National Climatic Data Center
NRCC	Northeast Regional Climate Center
PADEP	Pennsylvania Department of Environmental Protection
PDSI	Palmer Drought Severity Index
PEMA	Pennsylvania Emergency Management Agency

Table 4.3.1-7 lists the crop loss insurance payments on claims from Bedford County caused by drought events since 1948.

Table 4.3.1-6. Crop Loss Insurance Claims Due to Drought, 1948 to 2015

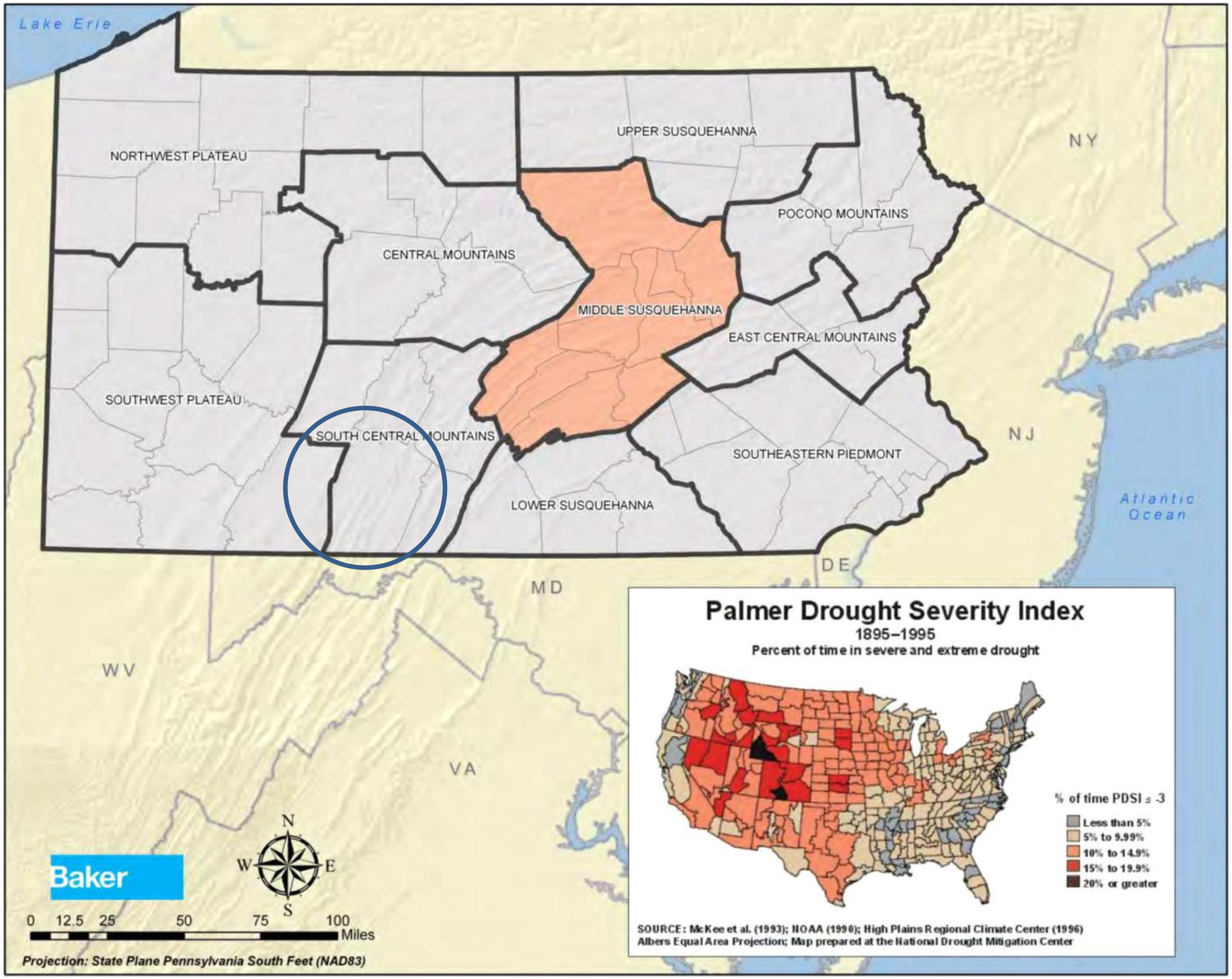
Crop Year	Total Claims	Crop Year	Total Claims
1948 - 1988	$349,241	2002	$1,256,485
1989	$334	2003	$16,982
1990	$11,469	2004	$142
1991	$517,770	2005	$892,250
1992	$0	2006	$300,457
1993	$214,578	2007	$351,680
1994	$48,173	2008	$557,440
1995	$34,293	2009	$252,732
1996	$0	2010	$117,398
1997	$669,650	2011	$1,576,148
1998	$88,682	2012	$96,321
1999	$835,058	2013	$36,794
2000	$0	2014	$328,544
2001	$718,840	2015	$108,398

Source: U.S. Department of Agriculture (USDA) 2016

4.3.1.4 Future Occurrence

Frequency of droughts is difficult to forecast. Based on national annual data from 1895 to 1995, Bedford County underwent severe or extreme drought conditions less than 5 percent of the time (illustrated on Figure 4.3.1-4). Based on national annual data from 1895 to July 2013, the South Central Mountains (climate division 8), in which Bedford County is located, had its lowest PDSI when it reached -7.13 in January 1931. This climate division has been in severe or extreme drought during approximately 7.7 percent of the 119 years on record (NRCC 2013). Future occurrences of drought events are considered possible, as defined by the Risk Factor Methodology probability criteria (described in Section 4.4).

Figure 4.3.1-4. Palmer Drought Severity Index for Pennsylvania (1895 to 1995)



Source: PEMA 2013 (highlight added)

4.3.1.5 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the drought hazard, all of Bedford County has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines) described in the County Profile (Section 2) are potentially vulnerable to a drought. This section evaluates and estimates potential impacts of the drought hazard on Bedford County in the following subsections:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) economy; and (5) future growth and development
- Effects of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time.

Overview of Vulnerability

Bedford County is vulnerable to drought. Assets at particular risk include any open land or structures along the wildland/urban interface (WUI) that could become vulnerable to the wildfire hazard caused by extended periods of low rain and high heat, usually associated with drought. In addition, water supply resources could be impacted by extended periods of low rain. Finally, vulnerable populations could be particularly susceptible to the drought hazard and cascading impacts because of age, health conditions, and limited ability to mobilize to shelter, cooling, and medical resources.

Data and Methodology

At the time this Plan was updated, insufficient data were available to model long-term potential impacts of a drought on Bedford County. Over time, additional data will be collected to allow better analysis of this hazard. Preliminary assessments based on available data are provided below.

Impact on Life, Health, and Safety

Drought conditions can cause a shortage of water available for human consumption and can reduce local firefighting capabilities. Social impacts of a drought include mental and physical stress, public safety threats (increased threat from forest/grass fires), health threats, conflicts among water users, reduced quality of life, and inequities in distribution of impacts and disaster relief. The infirm, young, and elderly are particularly susceptible to drought and extreme temperatures, sometimes associated with drought conditions, due to their age, health conditions, and limited ability to mobilize to shelters, cooling, and medical resources. Impacts on the economy and environment may have social implications as well (New York State Disaster Preparedness Commission [NYSDPC] 2011). For the purposes of this Plan, the entire population of the county is considered vulnerable to drought events.

Impact on General Building Stock and Critical Facilities

A drought is not expected to directly affect any structures, and all are expected to be operational during a drought event. However, droughts contribute to conditions conducive to wildfires. Risk to life and property is greatest in regions where forested areas adjoin urbanized areas (high-density residential, commercial, and industrial), also known as the WUI. Therefore, all assets in and adjacent to the WUI zone, including population, structures, critical facilities, lifelines, and businesses, are considered vulnerable to wildfire. Section 4.3.13 of this HMP addresses the wildfire hazard in Bedford County.

Impact on the Economy

A prolonged drought can exert serious direct and indirect economic impacts on a community or across the County. A summary of impacts on the economy is presented in Table 4.3.1-8.

Table 4.3.1-7. Impacts on the Economy

Losses to Agricultural Producers	Losses to Livestock Producers	Losses of Timber Production
Annual and perennial crop losses	Reduced productivity of rangeland	Wildland fires
Damage to crop quality	Reduced milk production	Tree disease
Income loss for farmers due to reduced crop yields	Forced reduction of foundation stock	Insect infestation
Reduced productivity of cropland (wind erosion, long-term loss of organic matter, etc.)	High cost/unavailability of water for livestock	Impaired productivity of forest land
Insect infestation	Cost of new or supplemental water resource development (wells, dams, pipelines)	Direct loss of trees, especially young ones
Plant disease	High cost/unavailability of feed for livestock	**Losses to Transportation Industry**
Wildlife damage to crops	Increased feed transportation costs	Loss from impaired navigability of streams, rivers, and canals
Increased irrigation costs	High livestock mortality rates	**Decline in food production/disrupted food supply**
Cost of new or supplemental water resource development (wells, dams, pipelines)	Disruption of reproduction cycles (delayed breeding, more miscarriages)	Increase in food prices
Losses of Fishery Production	Decreased stock weights	Increased importation of food (higher costs)
Damage to fish habitat	Increased predation	**Losses to Water Suppliers**
Loss of fish and other aquatic organisms due to decreased flows	Grass fires	Revenue shortfalls and/or windfall profits
Losses to Recreation and Tourism Industry	**Energy-related Effects**	Cost of water transport or transfer
Loss to manufacturers and sellers of recreational equipment	Increased energy demand and reduced supply because of drought-related power curtailments	Cost of new or supplemental water resource development
Losses related to curtailed activities: hunting and fishing, bird watching, boating, etc.	Costs to energy industry and consumers associated with substituting more expensive fuels (oil) for hydroelectric power	

Source: NYSDPC 2011

Loss estimates are based on lost agricultural revenues statewide. Table 4.3.1-8 below enumerates the county's farmland acreage exposure to the drought hazard, as well as the annual market value of all agricultural products sold, as documented in the 2012 USDA Census of Agriculture. If the county would lose its agricultural yield due to drought, total losses could amount to nearly $123 million. Table 4.3.1-10 details the potential losses associated with County livestock by providing livestock totals for the county and their associated market value. Livestock, poultry, and associated products have a potential loss value of more than $86.3 million (USDA 2012).

Table 4.3.1-8. Estimated County Losses Relating to Agricultural Production

Impacted Farmland Acreage	Market Value Of All Agricultural Products
209,795	$122,820,000

Source: USDA 2012

Table 4.3.1-9. Estimated County Losses Relating to Agricultural Production

Livestock and Poultry	Inventory	Market Value Of All Livestock, Poultry, and Their Products
Layers	364,934	**$86,347,000**
Cattle and Calves	47,427	
Hogs and Pigs	11,274	
Sheep and Lambs	2,927	
Total	**426,562**	

Source: USDA 2012
Note: Market value of livestock and poultry is only provided by total value and not available by category.

Impact on the Environment

As summarized in the PA HMP (2013), 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, such as dust and pollutants
- Loss of quality in landscape through loss in plants and plant diversity
- Increase in nitrate levels, which can negatively affect health of pregnant women and children.

Future Growth and Development

Areas targeted for potential future growth and development within the next 5 to 10 years have been identified across the county (further discussed in Section 2.4 of this HMP). Exposure of any new development and new residents to the drought hazard is anticipated.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by type, frequency, and intensity of weather events. Both globally and at the local level, climate change can alter prevalence and severity of weather extremes such as droughts. While predicting changes in drought events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating effects of future climate change on human health, society, and the environment (U.S. Environmental Protection Agency [EPA] 2006).

PADEP was directed by the Climate Change Act (Act 70 of 2008) to initiate a study of potential impacts of global climate change on the commonwealth. The June 2009 Pennsylvania Climate Impact Assessment's main findings indicated that Pennsylvania is very likely to undergo increased temperatures in the 21st century. Increases in temperature will likely lead to increased evapotranspiration, and thus an increase in soil-moisture-related droughts throughout late spring and early fall. Pennsylvania's precipitation climate is projected to become more extreme in the future, with longer dry periods and greater intensity of precipitation. Most models project an increase in the maximum number of consecutive dry days in a year, a drought indicator (Shortle et al. 2009).

Future improvements in modeling smaller-scale climatic processes can be expected and will lead to improved understanding of how the changing climate will alter temperature, precipitation, storm frequency, and intensity in Pennsylvania. Understanding this information can help provide better indications of future drought events (Shortle et al. 2009).

4.3.2 Earthquake

An earthquake is the sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge of the earth's tectonic plates, a volcanic eruption, or by a manmade explosion (Federal Emergency Management Agency [FEMA] 2001; Shedlock and Pakiser 1997). Most earthquakes occur at the boundaries where the earth's tectonic plates meet (faults); less than 10 percent of earthquakes occur within plate interiors. As plates continue to move and plate boundaries change geologically over time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes, which are a response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser 1997).

According to the U.S. Geological Survey (USGS) Earthquake Hazards Program, an earthquake hazard is any disruption associated with an earthquake that may affect residents' normal activities. This category includes surface faulting, ground motion (shaking), landslides, liquefaction, tectonic deformation, tsunamis, and seiches. Each of these terms is defined below:

- Surface faulting: Displacement that reaches the earth's surface during a slip along a fault. This commonly occurs with shallow earthquakes — those with an epicenter of less than 20 kilometers.
- Ground motion (shaking): The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by a sudden slip on a fault or sudden pressure at the explosive source and that travel through the Earth and along its surface.
- Landslide: A movement of surface material down a slope.
- Liquefaction: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like the wet sand near the water at the beach. Earthquake shaking can cause this effect.
- Tectonic Deformation: A change in the original shape of the earth's material caused by stress and strain.
- Tsunami: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major sub-marine slides, or exploding volcanic islands.
- Seiche: The sloshing of a closed body of water, such as a lake or bay, from earthquake shaking (USGS 2012a).

Ground shaking is the primary cause of earthquake damage to manmade structures. Damage can be increased when soft soils amplify ground shaking. Soils influence damage in different ways. One way is that soft soils amplify the motion of earthquake waves, producing greater ground shaking and increasing the stresses on built structures on the land surface. Another way that soil can cause damage is that loose, wet, sandy soils may lose strength and flow as a fluid when shaken, causing foundations and underground structures to shift and break (Stanford 2003).

The National Earthquake Hazard Reduction Program (NEHRP) developed five soil classifications defined by their shear-wave velocity that alters the severity of an earthquake. The soil classification system categories soil ranging from A to E; each class is presented in Table 4.3.2-1. Class A soils represent hard rock that reduces ground motion from an earthquake, and Class E soils represent soft soils that amplify and magnify ground shaking and increase building damage and losses.

Table 4.3.2-1. NEHRP Soil Classifications

Soil Classification	Description
A	Hard rock
B	Rock
C	Very dense soil and soft rock
D	Stiff soils
E	Soft soils

Source: FEMA 2013

The following sections discuss the location and extent, range of magnitude, previous occurrence, future occurrence, and vulnerability assessment associated with the earthquake hazard for Bedford County.

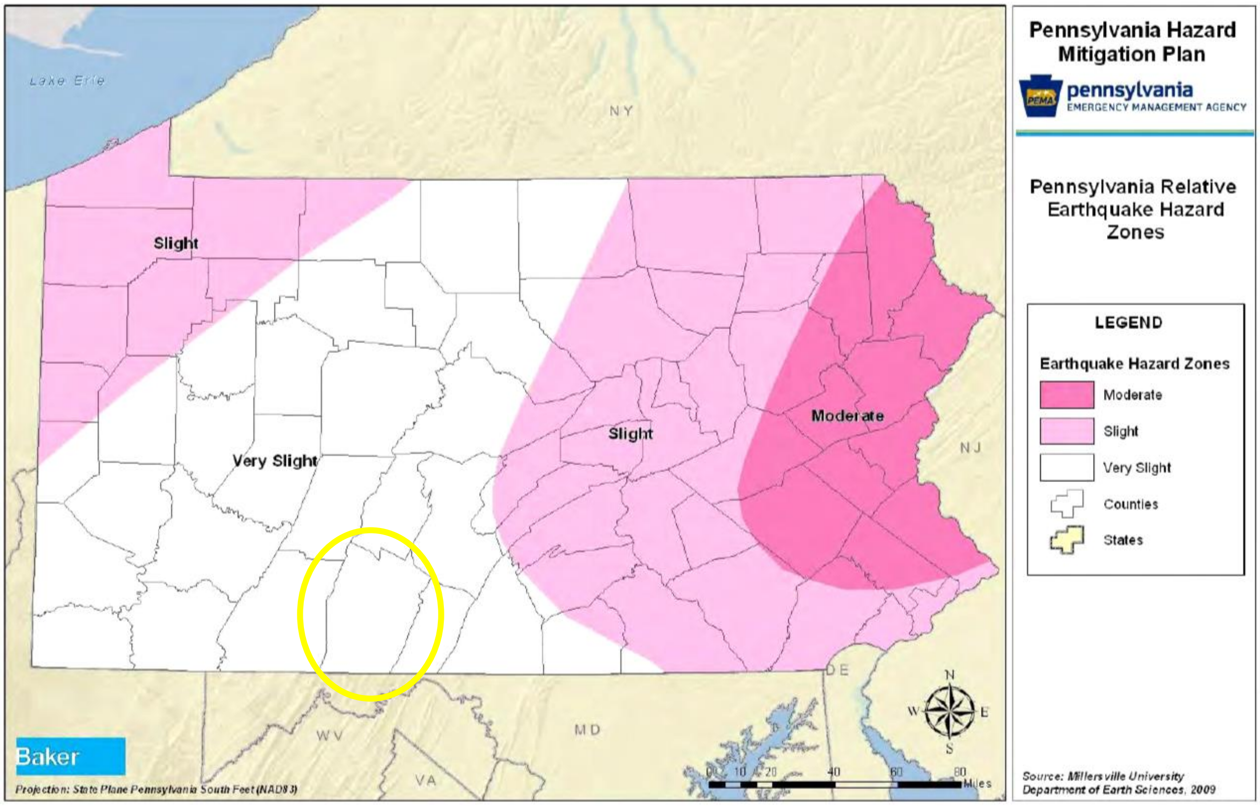
4.3.2.1 Location and Extent

The focal depth and the geographic position of the epicenter of an earthquake commonly determines its location. The focal depth of an earthquake is the depth from the earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the earth's surface directly above the hypocenter. Earthquakes usually occur without warning, and their effects can be felt in areas at great distances from the epicenter.

According to the Pennsylvania Bureau of Topographic and Geologic Survey, when events occur in the commonwealth, their impact area is very small (less than 100 kilometers [km] in diameter). The most seismically active region is located in southeastern Pennsylvania in the area of Lancaster County (Pennsylvania Emergency Management Agency [PEMA] 2013). Areas of Pennsylvania, including Bedford County, may be subject to the effects of earthquakes with epicenters outside the commonwealth.

Pennsylvania has three earthquake hazard area zones: very slight, slight, and moderate (shown in Figure 4.3.2-1) (PEMA 2013). Bedford County falls into the "very slight" zone, along with other municipalities and counties located within 100 km from a historical epicenter. Minor earthquake damage is expected in this zone.

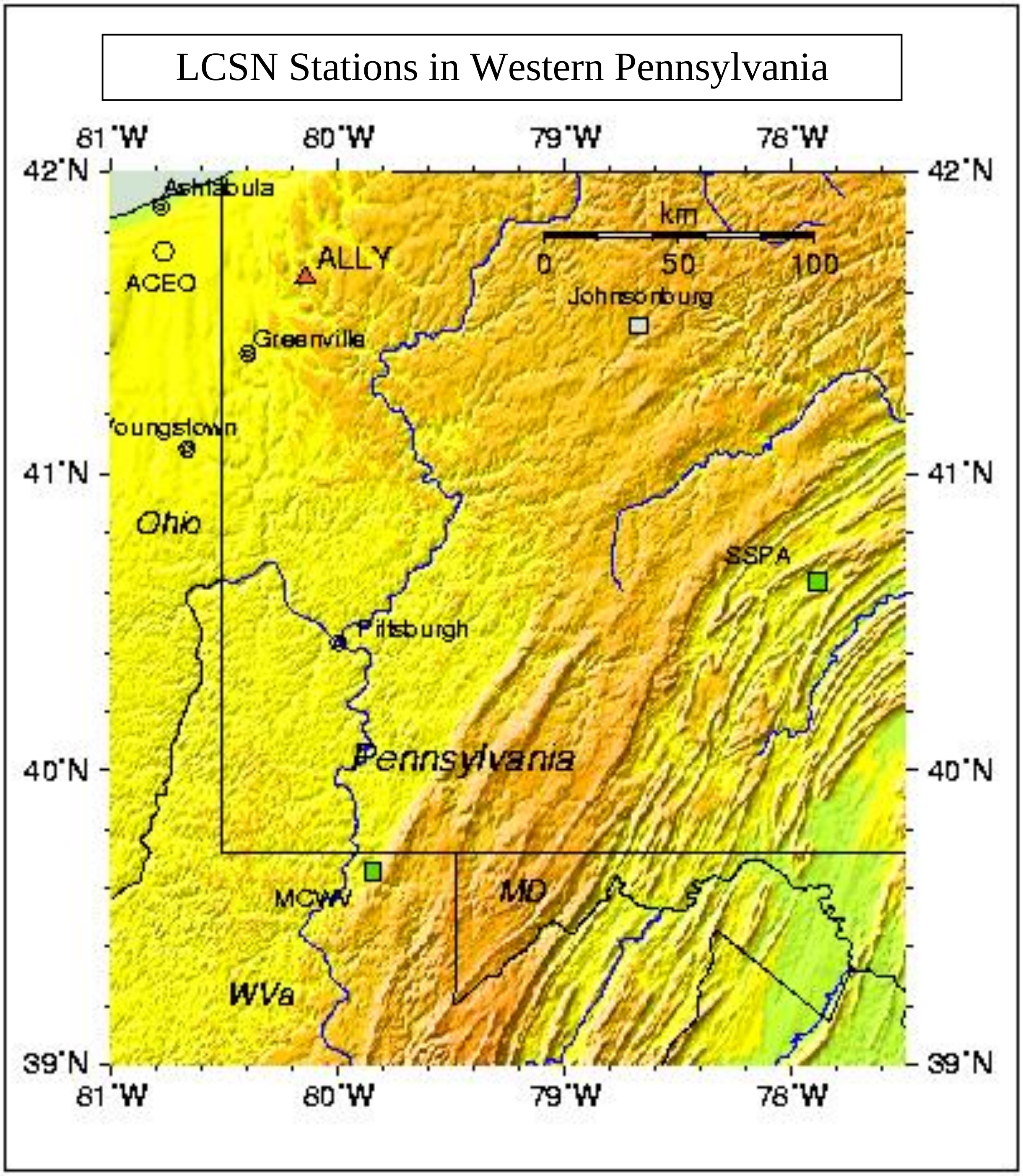
Figure 4.3.2-1. Pennsylvania Earthquake Hazard Zones



Source: PEMA 2013
Note: The yellow oval on the map illustrates the location of Bedford County.

The Lamont-Doherty Cooperative Seismographic Network (LCSN) monitors earthquakes that occur primarily in the northeastern United States. The goal of the project is to compile a complete earthquake catalog for this region, to assess the earthquake hazards, and to study the causes of the earthquakes in the region. The LCSN operates 40 seismographic stations in the following seven states: Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, and Vermont. Figure 4.3.2-2 shows the locations of seismographic stations in western Pennsylvania. The network is composed of broadband and short-period seismographic stations (LCSN 2012).

Figure 4.3.2-2. Lamont-Doherty Seismic Stations Locations in Western Pennsylvania



Source: LCSN 2006

In addition to the Lamont-Doherty seismic stations, USGS operates a global network of seismic stations to monitor seismic activity. While no seismic stations are located in Bedford County, nearby stations are positioned in State College, Pennsylvania. Figure 4.3.2-3 shows its location.

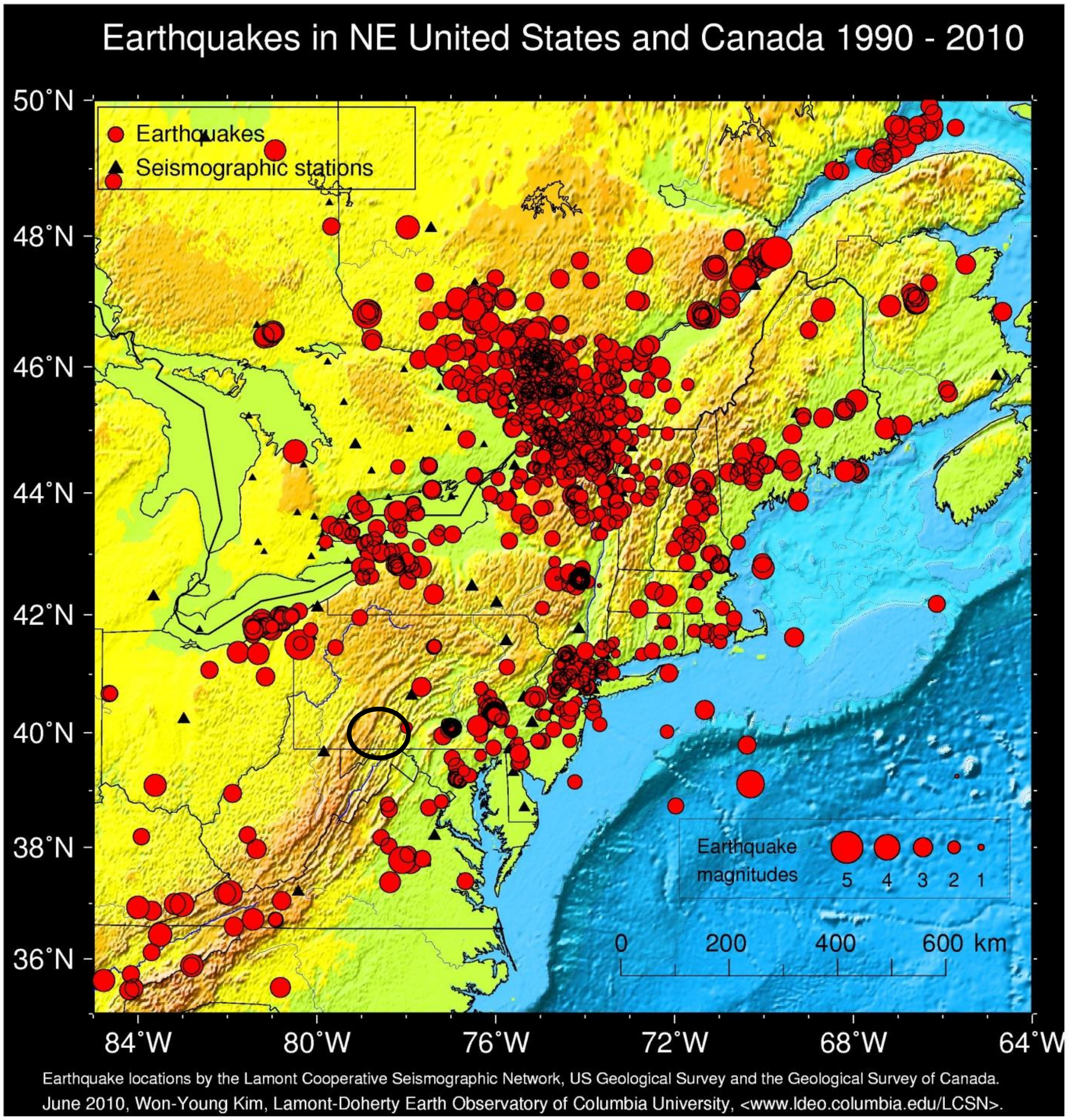
Figure 4.3.2-3. USGS Seismic Stations

Source: USGS 2012
Note: Seismic station locations are indicated by the green triangles.

USGS has developed the website *Did You Feel It?* (http://earthquake.usgs.gov/earthquakes/dyfi/) for citizens to report earthquake experiences and to share information regarding the earthquake and its effects. The website is intended to gather citizens' experiences during an earthquake and incorporate the information into detailed maps for illustrating shaking intensity and damage assessments (USGS 2014).

Earthquakes above a magnitude 5.0 have the potential to cause damage near their epicenters, and larger-magnitude earthquakes have the potential to cause damage over larger, wider areas. Earthquakes in Pennsylvania appear to be centered in the southeastern portion and northwestern corner of the commonwealth. Figure 4.3.2-4 illustrates earthquake activity in the northeast United States from 1990 to 2010, with Bedford County circled in black. A discussion of previous occurrences of earthquakes in Bedford County is presented in Section 4.3.2.3, Previous Occurrence, of this profile.

Figure 4.3.2-4. Earthquake Epicenters in the Northeast 1990 – 2010



Source: LCSN 2010

4.3.2.2 Range of Magnitude

Seismic waves are the vibrations from earthquakes that travel through the earth and are recorded on instruments called seismographs. The magnitude, or extent of an earthquake, is given a value of the earthquake size, or amplitude of the seismic waves, as measured by a seismograph. The Richter magnitude scale (Richter scale) was developed in 1932 as a mathematical device to compare the sizes of earthquakes. The Richter scale is the most widely known scale that measures the magnitude of earthquakes. It has no upper limit and is not used to express damage. An earthquake in a densely populated area that results in many deaths and considerable damage may have the same magnitude and shock in a remote area that did not experience any damage. Table 4.3.2-2 shows the Richter scale magnitudes and the corresponding earthquake effects for each magnitude. The worst-case earthquake in Bedford County would likely result in trees swaying, objects falling off walls, cracked walls, and falling plaster.

Table 4.3.2-2. Richter Scale Magnitudes

Richter Magnitude	Earthquake Effects
2.5 or less	Usually not felt, but can be recorded by seismograph
2.5 to 5.4	Often felt, but causes only minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can destroy communities near the epicenter

Source: PEMA 2013

The intensity of an earthquake is based on the observed effects of ground shaking on people, buildings, and natural features, and varies with location. The Modified Mercalli Intensity (MMI) scale expresses the intensity of an earthquake and is a subjective measure that describes the strength of a shock felt at a particular location. The MMI scale expresses the intensity of an earthquake's effects in a given locality in values ranging from I to XII. A detailed description of the MMI scale is shown in Table 4.3.2-3. The earthquakes that occur in Pennsylvania originate deep within the earth's crust, and not on an active fault. No injury or severe damage from earthquake events has been reported in Bedford County.

Table 4.3.2-3. Modified Mercalli Intensity Scale with Associated Impacts

Scale	Intensity	Description Of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	<4.2
II	Feeble	Some people feel it	
III	Slight	Felt by people resting; feels like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves	<5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures; poorly constructed buildings are damaged	<6.9
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	
X	Disastrous	Ground cracks profusely; many buildings are destroyed; liquefaction and landslides are widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes, and cables are destroyed; general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>8.1

Source: PEMA 2013

Environmental impacts of earthquakes can be numerous, widespread, and devastating, particularly if indirect impacts are taken into account. The examples listed below are unlikely to occur in Bedford County:

- Induced tsunamis and flooding or landslides and avalanches
- Poor water quality
- Damage to vegetation
- Breakage in sewage or toxic material containments
- Secondary impacts, including train derailments and spillage of hazardous materials and utility interruption.

Seismic hazards are often expressed in terms of Peak Ground Acceleration (PGA) and Spectral Acceleration (SA). USGS defines PGA and SA as the following: "PGA is what is experienced by a particle on the ground. Spectral Acceleration (SA) is approximately what is experienced by a building, as modeled by a particle mass on a massless vertical rod having the same natural period of vibration as the building" (USGS 2012). Both PGA and SA can be measured in *g* (the acceleration caused by gravity) or expressed as a percent acceleration force of gravity (%g). PGA and SA hazard maps provide insight into location-specific vulnerabilities (New York State Disaster Preparedness Commission [NYSDPC] 2011).

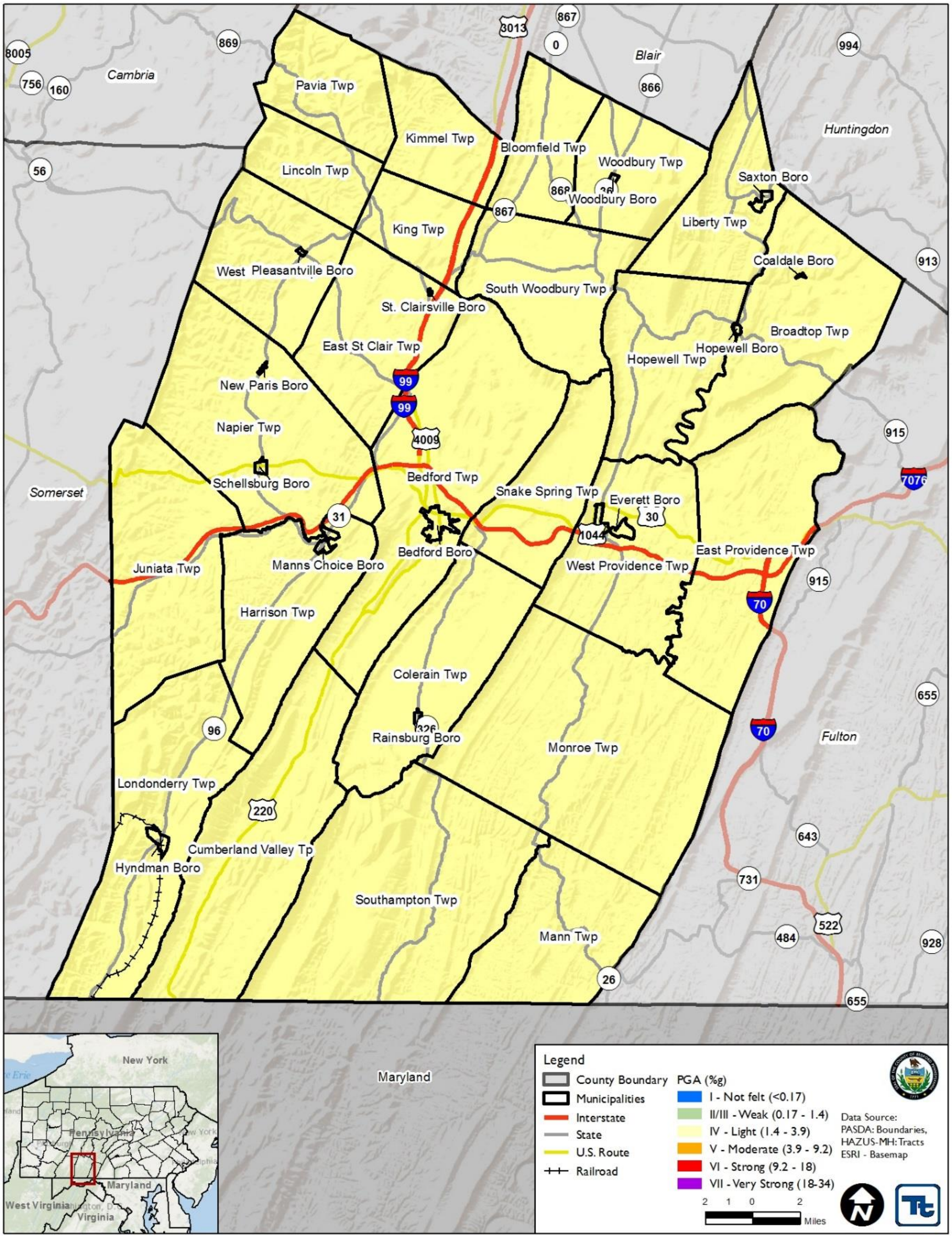
PGA is a common earthquake measurement that shows three things: (1) the geographic area affected, (2) the probability of an earthquake of each given level of severity, and (3) the strength of ground movement (severity) expressed in terms of percent of acceleration force of gravity (%g). In other words, PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes (or accelerates) in a given geographic area (NYSDPC 2011).

National maps of earthquake shaking hazards have been produced since 1948. These maps provide information essential to creating and updating the seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning used in the United States. Scientists frequently revise these maps to reflect new information and knowledge. Buildings, bridges, highways, and utilities built to meet modern seismic design requirements are typically able to withstand earthquakes better, with less damage and disruption. After thoroughly reviewing the studies, professional engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown and others 2001).

A probabilistic assessment was conducted for the 500-year mean return period (MRP) using a Level 1 analysis in FEMA's Hazards U.S. Multi-Hazard (HAZUS-MH), Version 2.1, to analyze the earthquake hazard for Bedford County. The HAZUS analysis evaluates the statistical likelihood that a specific event will occur and the consequences of that event. A 500-year MRP event is an earthquake with a 0.2 percent chance that the mapped ground motion levels (PGA) will be exceeded in any given year. Communities with higher earthquake risks can also choose to run a 100-year MRP or a 2,500-year MRP; however, these analyses were not run for Bedford County due to the low likelihood of such an event. A 100-year MRP event is an earthquake with a 1-percent chance that the mapped ground motion levels (PGA) will be exceeded in any given year. For a 2,500-year MRP (the worst-case scenario), there is a 0.04-percent chance the mapped PGA will be exceeded in any given year.

Figure 4.3.2-5 illustrates the geographic distribution of PGA (%*g*) across Bedford County for the 500-year MRP event. The estimated potential losses estimated by HAZUS-MH for the MRP and the associated PGA are discussed in the Section 4.3.2.5, Vulnerability Assessment, of this profile.

Figure 4.3.2-5. Peak Ground Acceleration Modified Mercalli Scale in Bedford County for a 500-Year MRP Earthquake Event

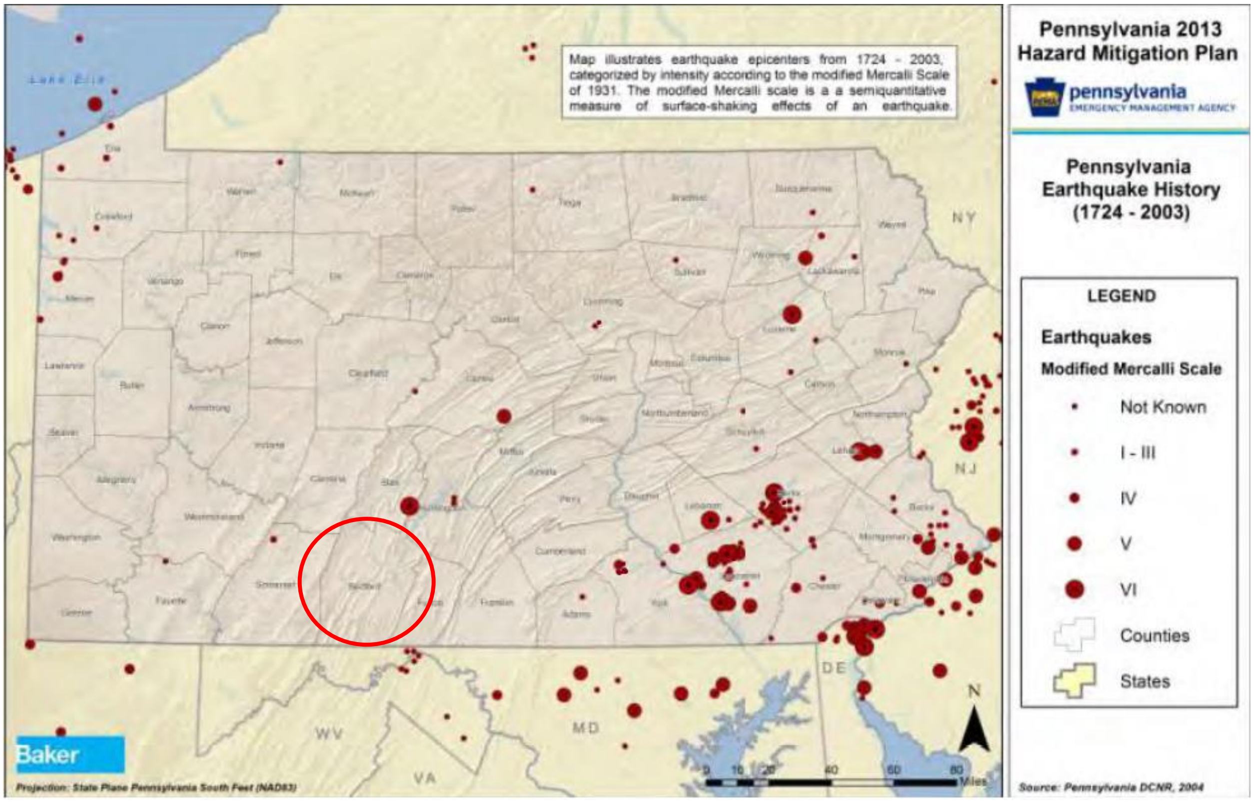


Source: HAZUS-MH 3.1
Note: The peak ground acceleration for the 500-year MRP is 2.82%*g*-3.02%*g*.

4.3.2.3 Past Occurrence

The historical record for earthquakes goes back approximately 200 years. In Pennsylvania, about 48 earthquakes have caused light damage since the colonial period. Nearly half of these events had out-of-state epicenters (PEMA 2013; USGS 2014). A map of earthquake epicenters in Pennsylvania from 1724 to 2003 is shown in Figure 4.3.2-6, updated with events from 2003 to January 2014. No damage was reported in Bedford County.

Figure 4.3.2-6. Earthquake Epicenters in Pennsylvania



Source: PEMA 2013
Note: Red oval has been added to the map to indicate the location of Bedford County.

The Pennsylvania Department of Conservation and Natural Resources (PA DCNR) indicated that there have been no recorded earthquake epicenters in Bedford County between 1724 and December 1, 2014. However, there were epicenters in Blair, Huntingdon, Somerset, and Adams Counties. On July 15, 1938, the epicenter of a 3.3 magnitude earthquake was located in Blair County. On February 13, 1964, Huntingdon County experienced three earthquake events with a 3.3 magnitude. On February 3, 1982, a 2.6 magnitude earthquake was recorded from Jennerstown in Somerset County. Adams County also experienced a more recent 2.8- magnitude earthquake on May 26, 1994 (PA DCNR 2014).

Earthquakes whose epicenters fall outside of Pennsylvania can also affect Bedford County. Historically, large earthquakes in eastern North America have occurred in three regions: (1) Mississippi Valley near the Town of New Madrid, Missouri; (2) St. Lawrence Valley region of Quebec, Canada; and (3) Charleston, South Carolina. In February 1925, one of the region's largest earthquakes on record occurred, with its epicenter located in a region of Quebec, with a magnitude near 7.0. If a similar-magnitude earthquake were to occur in the western part of the Quebec region, some moderate damage might be expected in one or more counties of Pennsylvania's northern tier. An earthquake with an estimated magnitude of about 7.5 occurred on August 31, 1886, in Charleston, South Carolina. The earthquake was felt in most of Pennsylvania. Since then, an earthquake with a magnitude of 5.8 occurred in Louisa County, Virginia; it was felt throughout Pennsylvania, causing evacuations, minor damage, and emergency infrastructure inspections (PEMA 2013). Additionally, in August 2011, shaking was felt from a 5.9 magnitude earthquake located near Richmond, Virginia.

Other earthquakes have occurred in east coast areas, including eastern Massachusetts, southeastern New York, and northern New Jersey. Moderate earthquakes were experienced in southeastern New York and northern New Jersey and were felt in eastern Pennsylvania. If an earthquake with a magnitude 6.0 or greater were to occur in this area, damage would likely result in easternmost counties of Pennsylvania, but not in Bedford County.

4.3.2.4 Future Occurrence

An earthquake's severity can be expressed by considering the rate in change of motion of the earth's surface during a seismic event as a percent of the normal rate of acceleration caused by gravity (*g*), which is called the Peak Horizontal Ground Acceleration (PHGA). In general, ground acceleration must exceed 15 percent of *g* for significant damage to occur, although soil conditions at local sites are extremely important in controlling how much damage will occur as a consequence of a given amount of ground acceleration. According to PEMA, the highest seismic hazard in is located in southeastern Pennsylvania, where PHGA values range from 10 to 14 percent and there is a 90-percent probability that maximum horizontal acceleration in rock of 10 percent of gravity will not be exceeded in a 50-year period (PEMA 2010).

Based on available historical data, the future occurrence of earthquake events can be considered *unlikely* as defined by the Risk Factor Methodology probability criteria (refer to Section 4.4 of this plan).

4.3.2.5 Vulnerability Assessment

To understand risk, a community must evaluate which assets are exposed or vulnerable in the identified hazard area. The entire county is exposed to the earthquake hazard. Therefore, all assets in Bedford County (population, structures, critical facilities, and lifelines) described in the County Profile (Section 2), are potentially vulnerable. The following section provides an evaluation and estimation of the potential impact of the earthquake hazard on Bedford County, including the following:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety, and health of residents; (2) general building stock; (3) critical facilities; (4) economy; (5) environment; and (6) future growth and development
- Effect of climate change on vulnerability
- Further data collections that will assist understanding of this hazard over time

Overview of Vulnerability

Earthquakes usually occur without warning and can be felt in areas a great distance from their point of origin. The extent of damage depends on the density of the population and construction of buildings and infrastructure in the area shaken by the quake. Some areas may be more vulnerable than others based on soil type, the age of the buildings, and building codes in place. Compounding the potential for damage, the Building Officials Code Administration (BOCA) was developed in the northeastern United States to address local concerns including heavy snow loads and wind; seismic requirements for design criteria are not as stringent as those of the west coast of the country, which rely on the more seismically focused Uniform Building Code. As such, a smaller earthquake in the northeast can cause more structural damage than if it occurred out west.

The entire population and general building stock inventory of the county are at risk of being damaged or experiencing losses as a result of impacts of an earthquake. Potential losses associated with earth shaking were calculated for Bedford County for the 500-year MRP. A summary of the data and methodology used for this assessment is presented below, followed by the impacts on population, existing structures, critical facilities, and the economy within Bedford County.

Data and Methodology

A probabilistic assessment was conducted for the 500-year MRP in HAZUS-MH 3.1 to analyze the earthquake hazard. The probabilistic method used historical earthquake information from historical earthquakes and inferred faults, locations, and magnitudes, and computed the probable ground-shaking levels that may be experienced during a recurrence period by Census tract. According to the New York City Area Consortium for Earthquake Loss Mitigation (NYCEM), probabilistic estimates are best for urban planning, land use, zoning, and seismic building code regulations (NYCEM 2003). The default assumption is a magnitude-7.0 earthquake for all return periods.

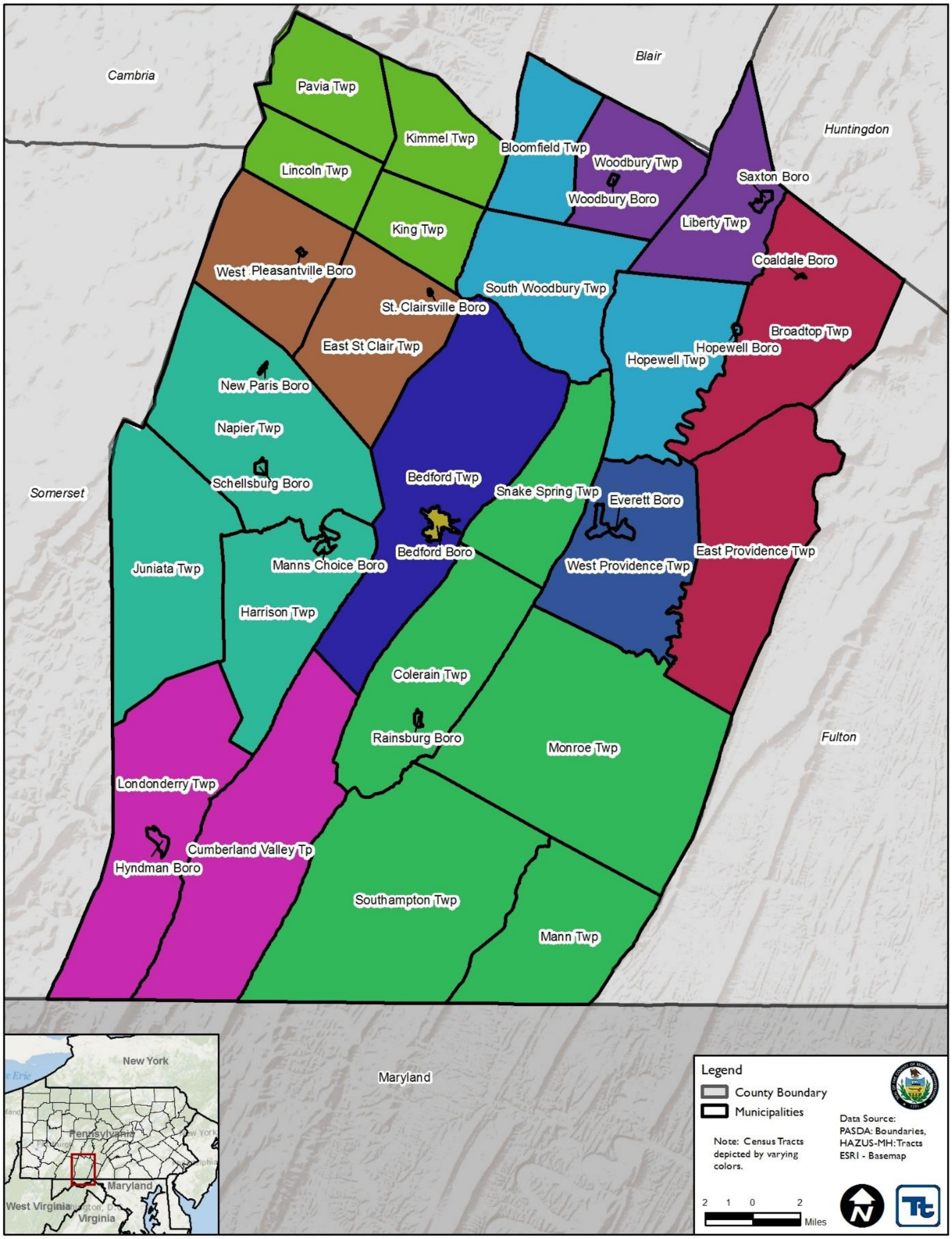
In addition to the probabilistic scenarios mentioned, an annualized loss run was conducted in HAZUS 3.1 to estimate the annualized general building stock dollar losses for Bedford County. The annualized loss methodology combines the estimated losses associated with ground shaking for eight return periods, which are based on values from the USGS seismic probabilistic curves. Annualized losses are useful for mitigation planning because they provide a baseline that can be used to compare (1) the risk of one hazard across multiple jurisdictions, and (2) the degree of risk of all hazards for each participating jurisdiction.

As noted in the HAZUS-MH Earthquake User Manual, "Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning earthquakes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics, and economic parameters add to the uncertainty. These factors can result in a range of uncertainly in loss estimates produced by the HAZUS Earthquake Model, possibly at best a factor of two or more." However, HAZUS potential loss estimates are acceptable for the purposes of this Hazard Mitigation Plan (HMP).

The occupancy classes available in HAZUS-MH 3.1 were condensed into the following categories to facilitate the analysis and the presentation of results: residential, commercial, industrial, agricultural, religious, government, and educational. Residential loss estimates address both multi-family and single-family dwellings. Impacts to critical facilities and utilities were also evaluated.

All exposure and loss estimates discussed in the assessment below are for Bedford County. HAZUS-MH v2.1 generates results at the Census-tract level. The boundaries of the Census tracts do not always coincide with the town and village boundaries in Bedford County. The results in the tables below are presented for the Census tracts with the associated towns and villages listed for each tract. Figure 4.3.2-7 shows the spatial relationship between the Census tracts and the town and borough boundaries.

Figure 4.3.2-7. HAZUS-MH Census Tracts in Bedford County



Source: HAZUS-MH 3.1

Impact on Life, Health, and Safety

Overall, the entire population of Bedford County is exposed to the earthquake hazard. According to the 2010 U.S. Census, Bedford County had a population of 48,586 people. The impacts of an earthquake on life, health, and safety depend on the severity of the event. Risks to public safety and loss of life from an earthquake in Bedford County are minimal, with higher risk occurring in buildings as a result of damage to the structure, or people walking below building ornamentation and chimneys that may be shaken loose and fall as a result of the quake.

Populations considered most vulnerable are located in the built environment, particularly near unreinforced masonry construction. In addition, the vulnerable population includes the elderly (persons over the age of 65) and individuals living below the Census poverty threshold. These socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard, and the location and construction quality of their housing.

Residents may be displaced or require temporary to long-term sheltering as a result of the event. The number of people requiring shelter is generally less than the number displaced, as some displaced persons use hotels or stay with family or friends after a disaster event. HAZUS-MH 3.1 does not estimate any displaced persons or population that may require short-term sheltering as a result of the 500-year event.

There is a strong correlation between structural building damage and the number of injuries and casualties from an earthquake event (NYCEM 2003). Furthermore, the time of day also exposes different sectors of the community to the hazard. For example, HAZUS considers the residential occupancy at its maximum at 2:00 a.m.; educational, commercial, and industrial sectors maximum occupancy to be 2:00 p.m.; and peak commute time to be 5:00 p.m. Whether affected directly or indirectly, the entire population will have to cope with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could affect populations that suffered no direct damage from an event itself. HAZUS-MH 3.1 estimates there will be two injuries at 2:00 a.m. and one injury at both 2:00 p.m. and 5:00 p.m. in Bedford County as a result of the 500-year event.

Impact on General Building Stock

After the population exposed to the earthquake hazard has been considered, the value of general building stock exposed to and damaged by the 500-year MRP earthquake events was evaluated. In addition, annualized losses were calculated using HAZUS-MH 3.1. The entire study area's general building stock is considered at risk and exposed to this hazard.

The HAZUS-MH 3.1 model estimates the value of the exposed building stock and the loss (in terms of damage to the exposed stock). Section 2, County Profile, presents statistics on the replacement value for general building stock data (structure and contents).

A probabilistic model was run for this plan to estimate annualized dollar losses for Bedford County using HAZUS-MH 3.1. Annualized losses are useful for mitigation planning because they provide a baseline that can be used to compare (1) the risk of one hazard across multiple jurisdictions, and (2) the degree of risk of all hazards for each participating jurisdiction. Please note that annualized loss does not predict what losses will occur in any particular year. The estimated annualized losses are approximately $20K per year (building and contents) for the county.

According to NYCEM, where earthquake risks and mitigation were evaluated in the New York, New Jersey, and Connecticut region, most damage and loss caused by an earthquake are directly or indirectly the result of ground shaking (NYCEM 2003). NYCEM indicates there is a strong correlation between PGA and the damage a building might experience. The HAZUS-MH model is based on the best available earthquake science and aligns with these statements. HAZUS-MH 3.1 methodology and model were used to analyze the earthquake hazard for the general building stock for Bedford County. Figure 4.3.2-5, presented earlier in this profile, illustrates the geographic distribution of PGA (*g*) across the County for the 500-year MRP events.

In addition, according to NYCEM (NYCEM 2003), a building's construction determines how well it can withstand the force of an earthquake. The NYCEM report indicates that un-reinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy. Additional attributes that contribute to a building's capability to withstand an earthquake's force include its age, number of stories, and quality of construction. HAZUS-MH considers building construction and the age of buildings as part of the analysis. The default building ages and building types already incorporated into the inventory were used because the default general building stock was used for this HAZUS-MH analysis.

Potential building damage was evaluated by HAZUS-MH 3.1 across the following damage categories: none, slight, moderate, extensive, and complete. Table 4.3.2-4 provides definitions of these categories of damage for a light wood-framed building; definitions for other building types are included in the HAZUS-MH technical manual documentation.

Table 4.3.2-4 Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Slight	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates or slippage of structure over foundations; partial collapse of room-over-garage or other soft-story configurations.
Complete	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse because of the cripple wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

Source: FEMA 2012

Table 4.3.2-5 summarizes the damage estimated for 500-year MRP earthquake event. Damage loss estimates include structural and non-structural damage to the building, as well as loss of contents.

Table 4.3.2-5. Estimated Building Value (Building and Contents) Damaged by the 500-Year MRP Earthquake Event

Municipality	Estimated Total Damages*		Percent of Total Building and Contents RV**	Estimated Residential Damage	Estimated Commercial Damage
	Annualized Loss	500-Year			
Bedford Boro	$1,702	$168,092	<1%	$95,028	$50,549
Bedford Twp	$2,855	$284,736	<1%	$181,900	$52,522
Bloomfied Twp-Hopewell Boro-Hopewell Twp-South Woodbury Twp	$1,592	$173,952	<1%	$141,159	$17,716
Broadtop Twp-Coaldale Boro-East Providence Twp	$1,486	$156,148	<1%	$131,704	$14,733
Colerain Twp-Mann Twp-Monroe Twp-Snake Spring Twp-Southampton Twp-Rainsburg Boro	$2,728	$290,296	<1%	$234,272	$38,930
Cumberland Valley Twp-Hyndman Boro-Londonderry Twp	$1,425	$160,099	<1%	$137,385	$11,348
East St. Clair Twp-Pleasantville Boro-St. Clairsville Boro-West St. Clair Twp	$1,529	$173,278	<1%	$145,721	$17,024
Everett Boro-West Providence Twp	$2,997	$293,223	<1%	$181,571	$70,229
Harrison Twp-Juniata Twp-Manns Choice Boro-Napier Twp-New Paris Boro-Schellsburg Boro	$1,762	$197,249	<1%	$166,340	$14,299
Liberty Twp-Saxton Boro-Woodbury Boro-Woodbury Twp	$1,551	$157,438	<1%	$101,278	$25,585
Licoln Twp-Kimmel Twp-King Twp-Pavia Twp	$1,056	$117,842	<1%	$100,719	$7,730
Bedford County (Total)	**$20,682**	**$2,172,355**	**<1%**	**$1,617,076**	**$320,665**

Source: HAZUS-MH 3.1
Notes:
Boro Borough
RV Replacement Value
Twp Township
*Total amount is sum of damages for all occupancy classes (residential, commercial, industrial, agricultural, educational, religious, and government).
**Total replacement value (building and contents) for the County is greater than $7.5 billion.

It is estimated that there would be approximately $2.1 million in damage to buildings in the county during a 500-year earthquake event. This amount includes structural damage, non-structural damage, and loss of contents, representing less than 1 percent of the total replacement value for general building stock in Bedford County (Total replacement value is greater than $7.5 billion for the county.) Residential and commercial buildings account for most of the damage for earthquake events. Earthquakes can cause secondary hazard events such as fires. According to HAZUS-MH, no fires are anticipated as a result of the 500-year MRP event.

Impact on Critical Facilities

After considering the general building stock exposed to, and damaged by, a 500-year MRP earthquake event, critical facilities were evaluated. All critical facilities (essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and user-defined facilities) in Bedford County are considered exposed and potentially vulnerable to the earthquake hazard. The Critical Facilities subsection in Section 2 (County Profile) includes a complete inventory of critical facilities in Bedford County.

HAZUS-MH 3.1 estimates the probability that critical facilities may sustain damage as a result of 500-year MRP earthquake event. Additionally, HAZUS-MH estimates percent functionality for each facility during periods of days after the event. Table 4.3.2-6 lists the percent probability of critical facilities sustaining the damage category, as defined by the column heading and percent functionality after the event for the 500-year MRP earthquake events. As noted, during and following a 500-year MRP event, HAZUS-MH estimates nearly 100-percent functionality of critical facilities identified by the County.

Table 4.3.2-6. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Bedford County for the 500-Year MRP Earthquake Event

Name	Percent Probability of Sustaining Damage					Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Critical Facilities									
Medical	98.3-98.4	1.3	<1	0	0	98	100	100	100
Police	99.8	0.02	0	0	0	98	100	100	100
Fire	98.3-98.5	1.2-1.3	<1	0	0	98	100	100	100
EOC	98.4	1.3	<1	0	0	98	100	100	100
School	98.3-98.4	1..2-1.3	<1	0	0	98	100	100	100

Source: HAZUS-MH 3.1

Impact on Economy

Earthquakes also have impacts on the economy, affecting loss of business function, damage to inventory, relocation costs, wage loss, and rental loss caused by the repair or replacement of buildings. A HAZUS-MH analysis estimates the total economic loss associated with each earthquake scenario, which includes building- and lifeline-related losses (such as transportation and utility losses) based on the available inventory (facility or geographic information system [GIS] point data only). Direct building losses are the estimated costs to repair or replace the damage caused to the building. These losses are reported in the Impact on General Building Stock section discussed earlier. Lifeline-related losses include the direct repair cost to transportation and utility systems and are reported in terms of the probability of reaching or exceeding a specified level of damage when subjected to a given level of ground motion. Additionally, economic loss includes business interruption losses associated with the inability to operate a business as a result of the damage sustained during the earthquake as well as temporary living expenses for those displaced. These losses are discussed below.

For the 500-year event, HAZUS-MH 3.1 estimates Bedford County will incur approximately $1.07 million in income losses (wage, rental, relocation, and capital-related losses) in addition to the 500–year event structural, non-structural, and content building stock losses ($2.18 million).

Utility damage results are not considered to be significant as a result of the 500-year event. All utilities evaluated in the risk assessment will be nearly 100-percent functional by Day 1 after the event.

The HAZUS-MH analysis conducted did not compute any damage estimates for roadway segments. However, it is assumed these features may experience damage as a result of ground failure and regional transportation and distribution of these materials will be interrupted as a result of an earthquake event. According to HAZUS-MH 3.1 Earthquake User Manual, losses to the community that result from damages to lifelines can be much greater than the cost of repair (FEMA 2016).

Earthquake events can significantly damage road bridges. These bridges are important because they often provide the only access to certain neighborhoods. Because softer soils can generally follow floodplain boundaries, bridges that cross watercourses should be considered vulnerable. A key factor in the degree of vulnerability will be the age of the facility, which will help indicate the standards the facility was built to achieve.

HAZUS-MH 3.1 Earthquake User's Manual also estimates the volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare and rapidly and efficiently manage debris removal and disposal. Debris estimates are divided into two categories: (1) reinforced concrete and steel that require special equipment to break up before it can be transported; and (2) brick, wood, and other debris that can be loaded directly onto trucks with bulldozers (FEMA 2016).

HAZUS-MH 3.1 estimates greater than 2,000 tons of debris will be generated for the 500-year MRP event. Table 4.3.2-7 summaries the estimated debris generated by the 500-year MRP earthquake event.

Table 4.3.2-7. Estimated Debris Generated by the 500-year MRP Earthquake Event

Municipality	500-Year	
	Brick/Wood (tons)	Concrete/Steel (tons)
Bedford Boro	148.5	37.6
Bedford Twp	241.0	63.9
Bloomfied Twp-Hopewell Boro-Hopewell Twp-South Woodbury Twp	165.1	32.9
Broadtop Twp-Coaldale Boro-East Providence Twp	140.7	29.2
Colerain Twp-Mann Twp-Monroe Twp-Snake Spring Twp-Southampton Twp-Rainsburg Boro	251.4	52.0
Cumberland Valley Twp-Hyndman Boro-Londonderry Twp	154.5	29.2
East St. Clair Twp-Pleasantville Boro-St. Clairsville Boro-West St. Clair Twp	156.7	31.2
Everett Boro-West Providence Twp	236.2	55.2
Harrison Twp-Juniata Twp-Manns Choice Boro-Napier Twp-New Paris Boro-Schellsburg Boro	190.7	37.6
Liberty Twp-Saxton Boro-Woodbury Boro-Woodbury Twp	140.0	33.3
Licoln Twp-Kimmel Twp-King Twp-Pavia Twp	113.1	22.1
Bedford County (Total)	**1,938.2**	**424.0**

Source: HAZUS-MH 3.1
Notes:
Boro Borough
Twp Township

Impact on the Environment

Earthquakes can lead to numerous, widespread, and devastating environmental impacts. These impacts may include but are not limited to:

- Induced flooding or landslides
- Poor water quality
- Damage to vegetation
- Breakage in sewage or toxic material containments

Secondary impacts can include train derailments, roadway damage, spillage of hazardous materials, and utility interruption.

Future Growth and Development

As discussed in Section 2.4 of this HMP, areas targeted for future growth and development have been identified across Bedford County. It is anticipated that the human exposure and vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the county. Current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing construction that may have been built to lower construction standards.

Effect of Climate Change on Vulnerability

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. National Aeronautics and Space Administration (NASA) and USGS scientists found that retreating glaciers in southern Alaska might be opening the way for future earthquakes (NASA 2004).

Secondary impacts of earthquakes could also be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity as a result of the increased saturation. Dams storing increased volumes of water, as a result of changes in the hydrograph, could fail during seismic events. Currently, no models are available to estimate these impacts.

Additional Data and Next Steps

Ground shaking is the primary cause of earthquake damage to manmade structures, and soft soils amplify ground shaking. One contributor to the site amplification is the velocity the rock or soil transmits, shear waves (S-waves). The National Earthquake Hazards Reduction Program (NEHRP) developed five soil classifications defined by their shear-wave velocity that alter the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. When this soil information becomes available, it may be incorporated into HAZUS-MH to further refine the county's vulnerability assessment.

Additional data to further refine the county's vulnerability assessment include (1) updated demographic data to replace the default data in HAZUS-MH; and (2) updated building data to update the replace data in HAZUS-MH. The County can identify non-reinforced masonry critical facilities and privately owned buildings (residences) using local knowledge and pictometry and orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response/recovery efforts for these properties can be set in place. Further mitigation actions include training of county and municipal personnel to provide post-hazard-event rapid visual damage assessments, increase of county and local debris management and logistic capabilities, and revised regulations to prevent additional construction of non-reinforced masonry buildings.

4.3.3 Extreme Temperatures

Extreme heat and extreme cold can have a significant impact to human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (such as burst pipes and power failure). Defining features of "extreme cold" or "extreme heat" can vary across different areas of the country, based on the population's experience. Extreme heat can generally be described as temperatures that hover 10°F or more above the average high temperature for a region during the summer months. Parameters for extreme cold temperature events vary across different regions of the United States, but in Bedford County and other areas accustomed to winter weather, below 0° temperatures may be considered extreme cold (National Weather Service [NWS] n.d.). Cold temperatures may be classified as extreme when they drop well below what is considered normal for an area during the winter months, and often when they are accompanied by winter storm events. Combined with increases in wind speed, extreme cold temperatures in Pennsylvania (including Bedford County) can be life threatening to those exposed for extended periods of time.

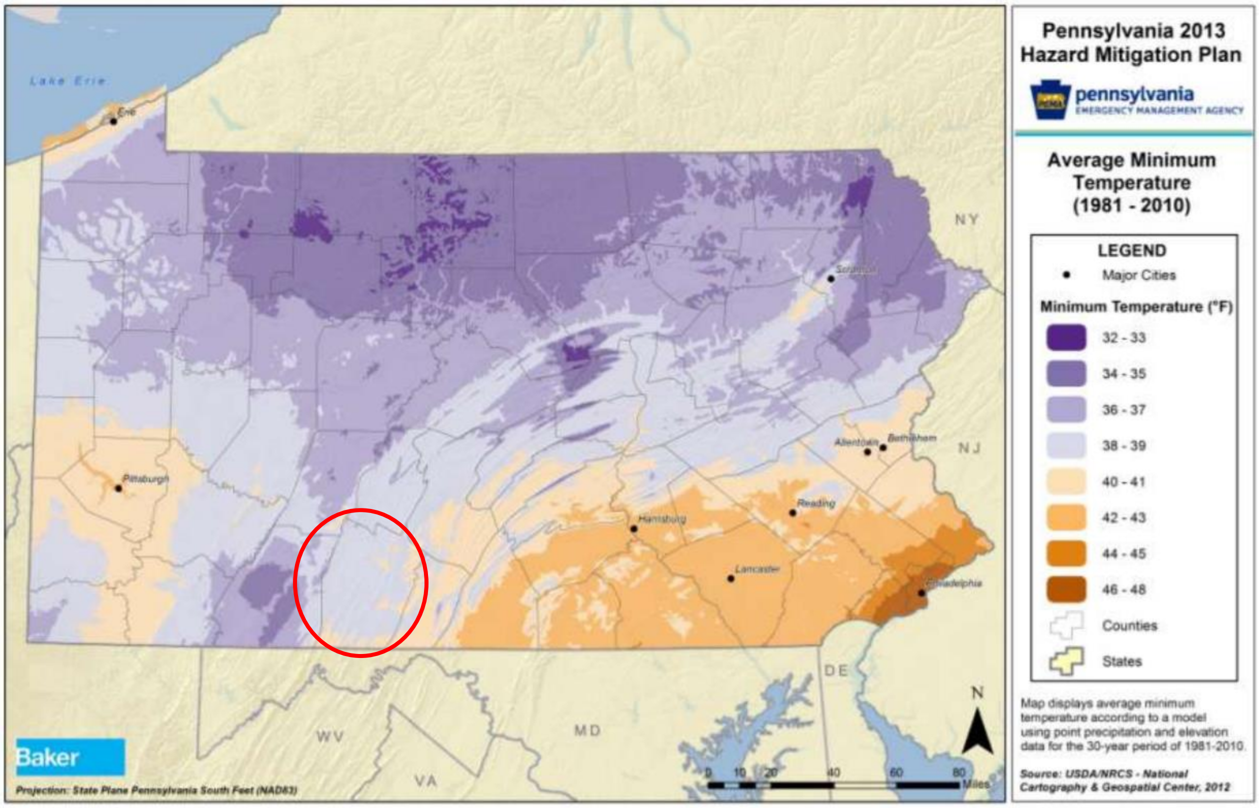
This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the extreme temperatures hazard for the Bedford County Hazard Mitigation Plan (HMP).

4.3.3.1 Location and Extent

Bedford County can experience many different temperature extremes in the summer and winter seasons. Areas most susceptible to extreme heat include urban environments, which tend to retain the heat well into the night, leaving little opportunity for dwellings to cool.

Figures 4.3.3-1 and 4.3.3-2 show mean minimum and maximum temperatures (respectively) throughout Pennsylvania according to county. During the colder months, most of Bedford County experiences low temperature averages ranging from 23°F in Hyndman to as low as 17.7°F in Everett. Throughout July, the warmest month, high temperatures in Bedford County normally range from the low 80s in Everett to the mid- to upper-80s in Hyndman.

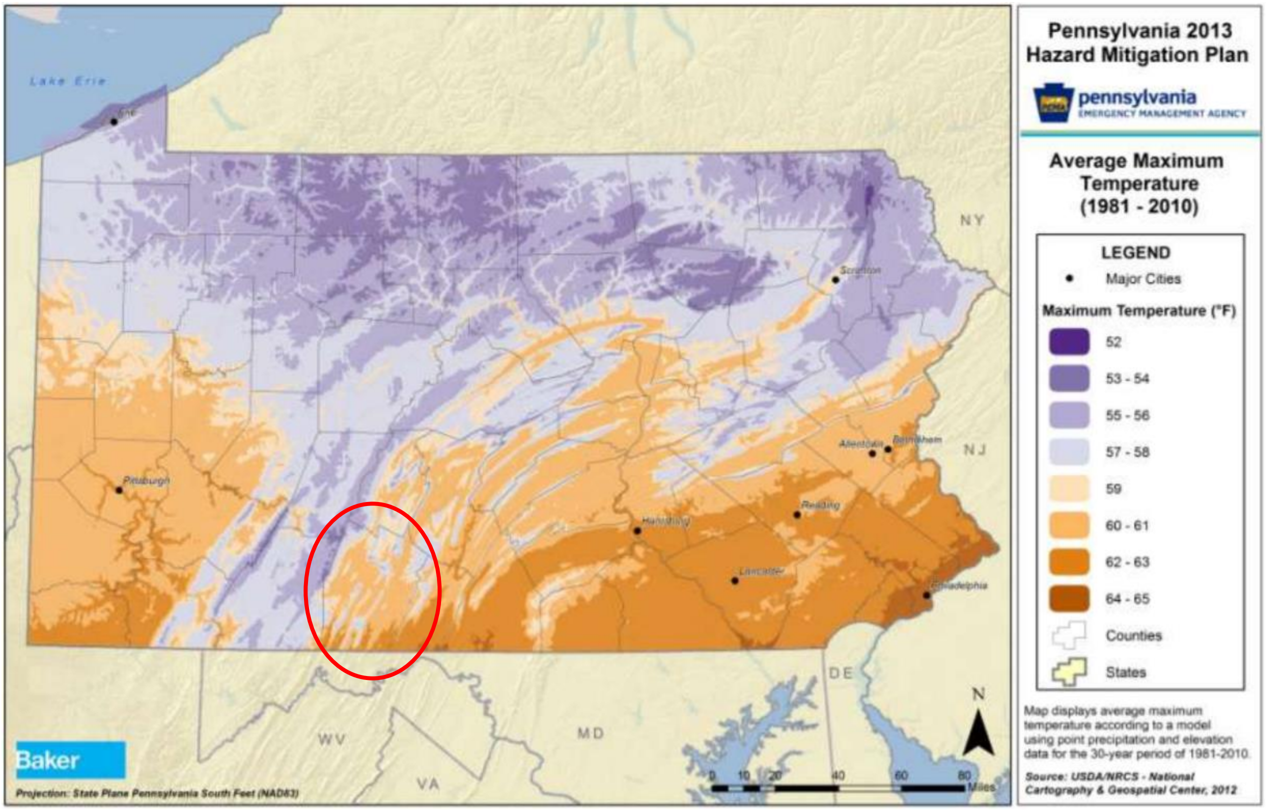
Figure 4.3.3-1. Average Minimum Temperature throughout Pennsylvania (1981 and 2010)



Source: Pennsylvania Emergency Management Agency (PEMA) 2013
Note: Highlight added. Circled area indicates Bedford County's location within the State of Pennsylvania.

Because of its geographic location in the northeast of the United States, Bedford County is more likely to experience extreme cold temperatures in the winter.

Figure 4.3.3-2. Average Maximum Temperature throughout Pennsylvania (1981 and 2010)



Source: PEMA 2013
Note: Highlight added. Circled area indicates Bedford County's location within the State of Pennsylvania.

June, July, and August are typically the warmest months in Bedford County and an extreme heat event could be considered any temperature that hovers around 10°F higher than the average high temperature. Given this definition and the average high temperatures for the County's hottest months, extreme heat can vary from mid to high 90s.

4.3.3.2 Range of Magnitude

The National Oceanic and Atmospheric Administration (NOAA)'s heat alert procedures are based mainly on heat index values. The heat index, given in degrees Fahrenheit, is a measure of perceived temperature when relative humidity is factored in with the actual air temperature. The heat index temperature is determined based on the temperature measured and relative humidity. Once both values are known, the heat index will correspond with both values (Figure 4.3.3-3 illustrates NWS's heat index chart). The heat index indicates the temperature the body feels. It is important to note that heat index values are devised for shady, light-wind conditions. Exposure to full sunshine can increase heat index values by up to 15°F. Strong winds, particularly with very hot dry air, can also be extremely hazardous (NWS n.d.).

Figure 4.3.3-3. NWS Heat Index Chart

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution   Extreme Caution   Danger   Extreme Danger

Source: NWS n.d.
Notes:
°F degrees Fahrenheit
% Percent

Exposure to heat can cause health problems indirectly, such as through the increased workload on the heart. Extreme heat can be especially dangerous to individuals with pre-existing medical conditions, typically the elderly. Extremely high temperatures cause heat stress, which can be divided into the four categories outlined in Table 4.3.3-1). 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 listed in Table 4.3.3-1 serve as a guide for various danger categories, the impacts of high temperatures will vary from person to person based on an individual's age, health, and other factors.

Table 4.3.3-1. Four Categories of Heat Stress

Danger Category	Heat Disorders	Apparent Temperature (°F)
I (Caution)	Fatigue is possible with prolonged exposure and physical activity.	80 to 90
II (Extreme Caution)	Sunstroke, heat cramps, and heat exhaustion are possible with prolonged exposure and physical activity.	90 to 105
III (Danger)	Sunstroke, heat cramps, or heat exhaustion are likely; heat stroke is possible with prolonged exposure and physical activity.	105 to 130
IV (Extreme Danger)	Heatstroke or sunstroke are imminent.	>130

Source: PEMA 2013

The extent (severity or magnitude) of extreme cold temperatures are generally measured through the wind chill temperature (WCT) index. WCT is the temperature that people and animals feel when outside. It is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop (NWS n.d.).

On November 1, 2001, NWS implemented a new process for determining the WCT index that was designed to more accurately calculate how cold air feels on human skin. Figure 4.3.3-4 shows the WCT index. The WCT index includes a frostbite indicator, showing points where temperature, wind speed, and exposure time will produce frostbite in humans. Figure 4.3.3-4 shows three shaded areas of frostbite danger. Each shaded area indicates the amount of time a person can be exposed before frostbite develops (NWS n.d.).

Figure 4.3.3-4. NWS Wind Chill Index

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill } (^\circ F) = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Source: NWS n.d.
Notes:
°F degrees Fahrenheit
mph Miles per hour

The following impacts can be observed following an extreme temperature event:

- Health Impacts – Extreme cold events result in more deaths than extreme heat over a prolonged period. Extreme heat waves, however, can prove more deadly over a shorter duration. Urban-dwelling elderly without access to an air-conditioned environment for at least part of the day are at the greatest risk of death during a heat wave..

- Transportation – Cold weather can impact automotive engines (possibly stranding motorists) and stress metal bridge structures. Highways and railroad tracks can become distorted in high heat. Disruptions to the transportation network and accidents caused by 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. Residents are placed in extreme danger when any fuel shortages or utility failures prevent the heating of a dwelling. Extreme heat can also result in utility interruptions, and transmission lines sagging from the heat can lead to shorting out.

The range of impacts of an extreme temperature event, especially health impacts, can be mitigated through improved forecasts, warnings, community preparedness, and appropriate community-based responses.

A worst-case event is predicted to include extreme cold temperatures, with injuries resulting from direct exposure (as a result of an interruption of energy supplies) and lack of access to medical care caused by associated snow or ice impacting travel. This scenario is estimated to require medical care for 1 percent of Bedford County's population over 65 years of age, and cause 10 percent mortality of those impacted. With an approximate population of 8,594 persons who are 65 and older, this would result in 86 injuries and 9 deaths from a worst-case scenario. Medical afflictions would be a result of direct influence on the coronary circulation system and via the respiratory system. Influenza and other infectious diseases would be secondary impacts. The overall risk and magnitude of such an event anticipated for the County has been determined by the Planning Team to be moderate (further discussed in Section 4.4.2).

Bedford County's worst occurrence was the extreme cold spell that hit the state in January 1994. Record low temperatures were reported in numerous locations across the state, including a wind chill of -70 in nearby Johnstown, Cambria County, on January 18th. Three deaths and 129 injuries were reported statewide. Damages were estimated at $5 million. More recently in January 2014, the western region of Pennsylvania, including Bedford County, experienced extreme cold. In the early morning of January 7, 2014, temperatures in Bedford County generally varied between -0 and -10F with wind chills around -30F.

Bedford County's worst-case extreme heat scenario would be an excessive heat spell occurring during a summer holiday weekend, such as Independence Day weekend. Summer holiday weekends bring people out of their air-conditioned work environments and into the outdoors, often despite dangerous heat and humidity levels.

4.3.3.3 Past Occurrence

The Commonwealth of Pennsylvania 2013 Standard Hazard Mitigation Plan (PA HMP) noted over 300 extreme temperature events throughout the Commonwealth. Table 4.3.3-2 summaries the extreme cold and wind chill events that occurred around western Pennsylvania and the Bedford County region. The temperatures indicated in Table 4.3.3-2 do not necessarily represent temperatures reached in Bedford County; extreme heat events often occurred in the eastern portion of the State. Based on research and review of relevant records and the PA HMP, no excessive heat events have occurred in Bedford County or the surrounding area.

The NOAA-National Climatic Data Center (NCDC) Storm Events database contains references to extreme temperature events in Bedford County from 1950 to July 2016, as shown in Table 4.3.3-2 below. The database indicated that 10 separate, extreme events occurred throughout the County from 1950 to July 2016.

Table 4.3.3-2. Extreme Temperature Events in Bedford County, 1950 to 2016

Date	Type	Temperature (Approximate °F)	Deaths	Injuries	Property Damage
January 14-21, 1994	Extreme Cold	-70	3	129	$5.0 M
July 17, /2006	Heat	96 to 101	0	0	0
August 1, 2006	Heat	97 to 102	0	0	0
February 5, 2007	Extreme Cold/ Wind Chill	-10 to -15	0	0	0
February 10, 2008	Extreme Cold/ Wind Chill	-10 to -20	0	0	0
December 21, 2008	Extreme Cold/ Wind Chill	-15 to -20	0	0	0
January 16, 2009	Extreme Cold/ Wind Chill	-15 to -25	0	0	0
January 6, 2014	Extreme Cold/ Wind Chill	-30	0	0	0
February 15, 2015	Extreme Cold/ Wind Chill	-25 to -35	0	0	0
February 19, 2015	Extreme Cold/ Wind Chill	-25 to -35	0	0	0

Sources: NOAA-NCDC 2016

4.3.3.4 Future Occurrence

Because of its location and geography, Bedford County is more likely to encounter extreme cold than excessively hot weather. Topography and vegetation can impact temperature differentials across Bedford County.

The 2013 PA HMP provides information on the probability of extreme maximum and minimum temperatures using data from 30 recording stations throughout the State. These stations produce location-specific data that are more precise than the broader geographic area averages referenced under the Location and Extent section of this chapter. According to these data, high temperatures of 90°F or above occur on the average of 10 to 15 days per year in Bedford County. On average, temperatures exceed 95°F on 1 to 2.5 days per year in Bedford County. For temperatures greater than 100°F, the number of years between occurrences ranges between 30 and 50. Extreme cold temperatures less than 0°F occur on the average of 3 to 6 days annually with the greatest number of occurrences in the northwest areas of the County, and the shortest occurrences in the southeastern portion. For temperatures lower than -10°F, the number of years between occurrences ranges between 0 and 10, and the number of years between occurrences for temperatures lower than -20°F ranges between 60 and 100.

The future occurrence of extreme temperatures can be considered possible as defined by the Risk Factor Methodology probability criteria (described in Section 4.4).

4.3.3.5 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable within the identified hazard area. Most extreme temperature events involve a large region; therefore, all of Bedford County has been identified as the hazard area. This section evaluates and estimates the potential impact of extreme temperature events on the County in the following sections:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on life, health, and safety; general building stock; critical facilities; economy; and future growth and development
- Effect of climate change on vulnerability
- Further data collections that will assist understanding of this hazard over time

Overview of Vulnerability

Extreme temperatures generally occur for a short period of time but can cause a range of impacts, particularly to vulnerable populations that may not have access to adequate cooling or heating in their residences. This natural hazard can also cause impacts to agriculture (crops and animals), infrastructure (e.g., through pipe bursts associated with freezing, power failure), and the economy.

Data and Methodology

At the time of this plan update, insufficient data are available to model the long-term potential impacts of extreme temperatures on the Bedford County. Over time, additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety

For the purposes of this plan update, the entire population of Bedford County is considered vulnerable to extreme temperature events. Extreme temperature events have potential health impacts including injury and death.

According to the Centers for Disease Control and Prevention (CDC), populations most at risk to extreme cold and heat events include the following: (1) the elderly, who are less able to withstand temperature extremes because of their age, health conditions, and limited mobility to access shelters; (2) infants and children up to 4 years of age; (3) individuals who are physically ill (e.g., heart disease or high blood pressure); (4) low-income persons that cannot afford proper heating and cooling resources; and (5) the general public who may physically overexert themselves while working or exercising during extreme heat events, or may experience hypothermia during extreme cold events.

Table 4.3.3-3 shows the demographic change in children under 5 years old, and in individuals below the poverty level, from 2000 through 2014. Fewer children in the County are vulnerable to extreme temperatures than in recent years, but more families in the County live below the poverty level. Data on other vulnerable groups listed above was not available.

Table 4.3.3-3: Demographic Trends for Vulnerable Populations

Vulnerable Population	2000 Census	2010 Census	2014 Census Estimate	2000 to 2014 Change
Children under 5 years	3,004	2,627	2,515	-489
Families below the poverty level (%)	7.7	9.1	10.3	+2.6

Source: U.S. Census Bureau

Meteorologists can accurately forecast extreme heat event development and the severity of the associated conditions with several days lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions, and focus surveillance and relief efforts on those at greatest risk. Adhering to extreme temperature warnings can significantly reduce the risk of temperature-related deaths.

Section 2 of this HMP describes the population in Bedford County over the age of 65, and population with an annual income below the poverty threshold.

Impact on General Building Stock

All of the building stock in Bedford County is exposed to the extreme temperature hazard. Section 2 of this HMP summarizes the building inventory in the County. Extreme heat generally does not impact buildings. Losses may be associated with the overheating of heating, ventilation, and air-conditioning (HVAC) systems. Extreme cold temperature events can damage buildings in the event of freezing or bursting pipes and during the associated freeze/thaw cycles. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities may have inadequate capabilities to withstand extreme temperatures.

Impact on Critical Facilities

All critical facilities in Bedford County are exposed to the extreme temperature hazard. Impacts to critical facilities are the same as those described for general building stock (above). Additionally, critical facilities must remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failure commonly referred to as "brown-outs," caused by increased usage from air conditioners and appliances. Similarly, heavy snowfall and ice storms associated with extreme cold temperature events can cause power interruption as well. Backup power is recommended for critical facilities and infrastructure.

Impact on the Economy

Extreme temperature events impact the economy in several ways, including loss of business function and damage or loss of inventory. Business owners may be faced with increased financial burdens caused by unexpected repairs the building (e.g., pipes bursting), higher-than-normal utility bills, or business interruption due to power failure (i.e., loss of electricity, telecommunications).

The agricultural industry is most at risk in terms of economic impact and damage caused by extreme temperature events. Extreme heat events can result in drought and dry conditions and directly impact livestock and crop production.

Future Growth and Development

Areas targeted for potential future growth and development in the next 5 years have been identified across Bedford County and are described in Section 4.4 of this HMP. Any new development and new residents are anticipated to be exposed to the extreme temperature hazard.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local level, climate change has the potential to alter the prevalence and severity of weather extremes such as extreme temperature events. While predicting changes in extreme temperature events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (U.S. Environmental Protection Agency [EPA] 2006).

As directed by the Climate Change Act (Act 70 of 2008), Pennsylvania's Department of Environmental Protection (PA DEP) initiated a study of the potential impacts of global climate change on the Commonwealth. The June 2009 Pennsylvania Climate Impact Assessment's main findings indicate that Pennsylvania is very likely to experience increased temperatures in the 21st century. Higher summer temperatures will result in higher ozone concentrations in urban areas, which can negatively impact the respiratory health of members of the vulnerable populations. Increased winter temperatures will mean fewer cold-related deaths (Shortle et al. 2009).

With 1 to 3-degree increases in temperature, Pennsylvania farmers' yields of hay, corn, and soybeans may increase, while yields of cool temperature-adapted fruits such as apples and potatoes may decrease. However, changes in these crop yields will greatly depend on the exact temperature change. Dairy producers may experience the greatest challenges because they rely on their own crop production, their animals may experience heat stress, and productivity may be impacted (Shortle et al. 2009). It is clear that temperature changes will impact the agricultural industry, which is part of Bedford County's economy.

Additional Data and Next Steps

For future updates to the Bedford County HMP, Bedford County can track data on extreme temperature events, and obtain additional County- and jurisdiction-specific information on past and future events, particularly in terms of any injuries, deaths, shelter needs, instances of freezing pipes, agricultural losses, and other impacts. This information will help to identify any concerns or trends for which mitigation measures should be developed or refined. In time, quantitative modeling of estimated extreme heat and cold events may be feasible as data are gathered and improved.

4.3.4 Flood, Flash Flood, Ice Jam

This section provides a profile and vulnerability assessment for the flood hazard for Bedford County. Floods are one of the most common natural hazards in the United States and are the most prevalent type of natural disaster occurring in Pennsylvania. Pennsylvania has more miles of streams than any other state and leads the United States in flood-related losses. Over 94 percent of Pennsylvania's municipalities have been designated as flood-prone areas. Both seasonal and flash floods have caused millions of dollars in annual property damage, loss of lives, and disruption of economic activities (Pennsylvania Emergency Management Agency [PEMA] 2013).

The Federal Emergency Management Agency's (FEMA) definition of flooding is "a general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of two or more properties from the overflow of inland or tidal waters or the rapid accumulation of runoff of surface waters from any source" (FEMA 2008).

Most floods fall into three categories: riverine, coastal, and shallow (FEMA 2005). Other types of floods may include ice-jam floods, flash floods, stormwater floods, alluvial fan floods, dam failure floods, and floods associated with local drainage or high groundwater (as indicated in the previous flood definition). For the purpose of this Plan and as deemed appropriate by the Steering Committee, riverine, flash, ice-jam, and stormwater flooding are the main flood types of concern for Bedford County. These types of floods are further discussed below. Dam failures are discussed in Section 4.3.15.

Riverine Floods

Riverine floods are the most common flood type and occur along a channel. Channels are defined features on the ground that carry water through and out of a watershed. They may also be referred to as rivers, creeks, streams, or ditches. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas. These floods usually occur after heavy rains, heavy thunderstorms, or snowmelt, and can be slow or fast-rising, and develop over a period of hours to a few days (FEMA 2005, FEMA 2008, Illinois Association for Floodplain and Stormwater Management 2006).

Flash Floods

According to the National Weather Service (NWS), flash floods are a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within 6 hours of the causative event (e.g., intense rainfall, dam failure, or ice jam) (NWS 2009).

Flash floods can occur very quickly and with very little warning. This type of flood can be deadly because it produces rapid rises in water levels and has devastating flow velocities. Urban areas are more susceptible to flash floods because a high percentage of the surface area is impervious (PEMA 2013).

The actual time may vary in different parts of the country. Ongoing flooding can intensify to flash flooding in cases where extreme rainfall results in a rapid surge of rising flood waters (NWS 2009). A flash flood can have a dangerous wall of roaring water that carries rocks, mud, and other debris, and can sweep away most things in its path. Flash floods usually result from intense storms dropping large amounts of rain within a brief period with little or no warning, and can reach their peak within only a few minutes. They normally occur in the summer during the thunderstorm season. The most severe flooding conditions usually occur when direct rainfall is augmented by snowmelt. If the soil is saturated or frozen, stream flow may increase because of inability of the soil to absorb additional precipitation (FEMA 2008).

Ice-Jam Floods

An ice jam is an accumulation of ice that acts as a natural dam and restricts flow of a body of water. Ice jams occur when warm temperatures and heavy rains cause rapid snowmelt. The melting snow, combined with the heavy rain, causes frozen rivers to swell. The rising water breaks the ice layers into large chunks, which float downstream and often pile up near narrow passages and obstructions (bridges and dams). Ice jams may build up to a thickness great enough to raise the water level and cause flooding (NESEC Date Unknown, U.S. Army Corps of Engineers [USACE] 2002).

Ice jams are of two different types: freeze-up and break-up. Freeze-up jams occur in the early to mid-winter when floating ice may slow or stop due to a change in water slope as it reaches an obstruction. Break-up jams occur during periods of thaw, generally in late winter and early spring. The ice cover break-up is usually associated with a rapid increase in runoff and corresponding river discharge caused by a heavy rainfall, snowmelt, or warmer temperatures (USACE 2002).

4.3.4.1 Location and Extent

Flooding in Pennsylvania is typically associated with abnormally high and intense rainfall amounts. It can also be caused by sudden snowmelt, landslides, or dam failures. In Pennsylvania, flooding usually occurs in the summer; however, flooding has occurred during the winter months as well.

Floodplains are found in lowland areas adjacent to rivers, streams, creeks, lakes, or other bodies of water that become inundated during a flood. The size of a floodplain is described by the recurrence interval of a given flood. A 1-percent annual chance floodplain is smaller than the floodplain associated with a flood that has a 0.2-percent annual chance of occurring (PEMA 2013). Floodplain maps for each Bedford County jurisdiction are available at the end of this profile. These maps show the location of both the 1-percent chance annual floodplain and the 0.2-percent chance annual floodplain.

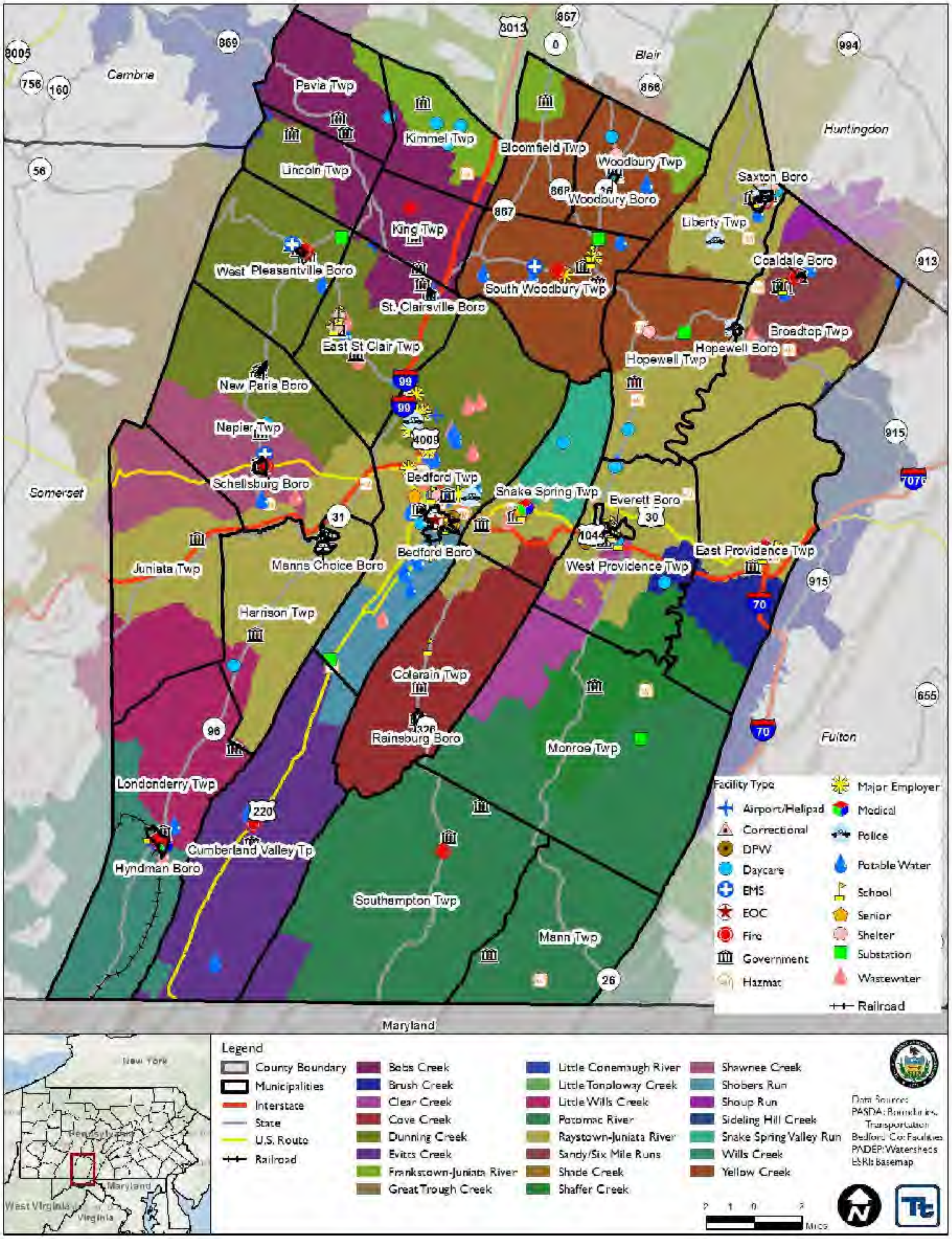
Of particular concern in Bedford County is flooding along the Juniata River at the Raystown Branch. This river serves as a major conduit for flood drainage for the northern three-quarters of Bedford County. The Juniata River impacts a significant portion of the county and runs through numerous jurisdictions. Additionally, critical transportation routes (such as Route 26, Route 30, and Interstate 76) are located adjacent to the Juniata River.

The Juniata sub-basin encompasses a 3,406-square-mile area and includes Huntingdon and Blair Counties, and portions of Somerset, Franklin, Perry, Juniata, Snyder, Mifflin, Centre, Cambria, and Bedford Counties. The other one-quarter of Bedford County drains into the Potomac River Basin. The Potomac drainage area includes 14,679 square miles within the states of Maryland, Pennsylvania, Virginia, and West Virginia, as well as in the District of Columbia. Figure 4.3.4-1 shows the watersheds in Bedford County.

In accordance with the 1978 Pennsylvania Stormwater Management Act (Act 167), counties are required to prepare stormwater management plans on a watershed-by-watershed basis that provide for improved management of stormwater impacts associated with development of land. In June 2003, Bedford County developed the Bobs Creek and Dunning Creek Watersheds Stormwater Management Plan (Bedford County Planning Commission 2003). These two watersheds cover an area of nearly 200 square miles in the following Bedford County municipalities, as well as others in Blair and Cambria Counties:

- Bedford Township
- East Saint Clair Township
- Kimmel Township
- King Township
- Lincoln Township
- Napier Township
- New Paris Borough
- Pavia Township
- Pleasantville Borough
- St. Clairsville Borough
- West St. Clair Township

Figure 4.3.4-1. PADEP-Designated Watersheds with Critical Facilities



Source: PADEP, Bedford County

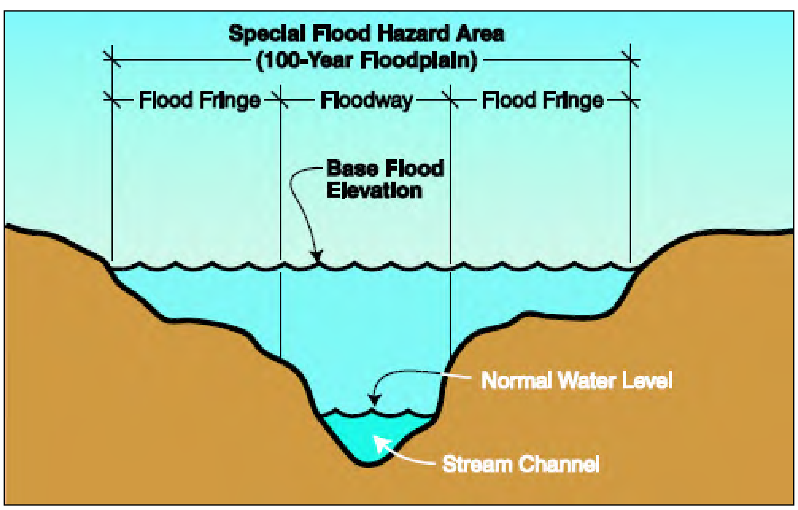
FEMA Regulatory Flood Zones

According to FEMA, flood hazard areas are defined as areas on a map shown to be inundated by a flood of a given magnitude. These areas are determined by use of statistical analyses of records detailing river flow, storm tides, and rainfall; information obtained through consultation with the community; floodplain topographic surveys; and hydrologic and hydraulic analyses. Flood hazard areas are delineated on FEMA's Flood Insurance Rate Maps (FIRM), which are official maps of a community on which the Federal Insurance and Mitigation Administration has delineated both Special Flood Hazard Areas (SFHA) and the risk premium zones applicable to the community. These maps identify the SFHAs, the location of a specific property in relation to the SFHA, the base flood elevation (BFE) (1-percent annual chance) at a specific site, the magnitude of a flood hazard within a specific area, undeveloped coastal barriers where flood insurance is not available, and regulatory floodways and floodplain boundaries (1-percent and 0.2-percent annual chance floodplain boundaries) (FEMA 2012). Bedford County's FIRMs can be accessed via the FEMA Flood Map Service Center online (https://msc.fema.gov/portal).

The land area covered by the floodwaters of the base flood is the SFHA shown on a FIRM. It is the area where the National Flood Insurance Program's (NFIP) floodplain management regulations must be enforced and the area where flood insurance is mandatory for federally-backed mortgages. This regulatory boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities because many communities have maps showing the extent of the base flood and likely depths that will occur.

The 1-percent annual chance flood is referred to as the base flood. As defined by NFIP, the BFE on a FIRM is the elevation of a base flood event, or a flood which has a 1-percent chance of occurring in any given year. The BFE describes the exact elevation of the water that will result from a given discharge level, which is one of the most important factors used in estimating potential damage within a given area. A structure within a 1-percent annual chance floodplain has a 26-percent chance of undergoing flood damage during the term of a 30-year mortgage. The 1-percent annual chance flood is a regulatory standard used by federal agencies and most states to administer floodplain management programs. The 1-percent annual chance flood is used by NFIP as the basis for insurance requirements nationwide. FIRMs also depict 0.2-percent annual chance flood designations (FEMA 2003). Figure 4.3.4-2 depicts the special flood hazard area, the base flood elevation, the flood fringe, and the floodway areas of a floodplain for the 1-percent annual chance flood.

Figure 4.3.4-2. Floodplain Illustration



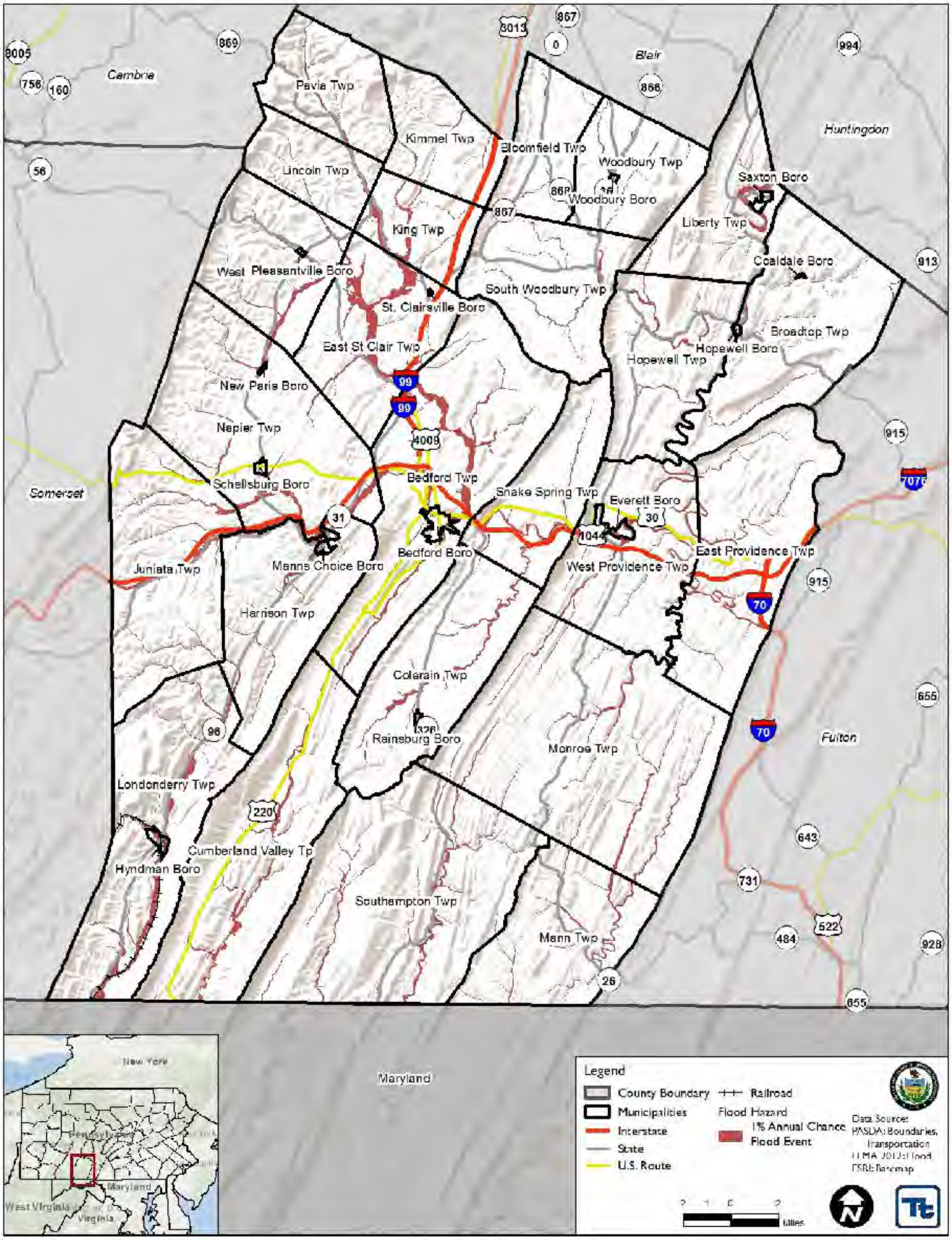
Source: PEMA 2013

The SFHA serves as the primary regulatory boundary used by FEMA and Pennsylvania. Digitized Flood Insurance Rate Maps (DFIRM), FIRMs, and other flood hazard information can be referenced to identify the expected spatial extent of flooding from a 1-percent annual chance event and 0.2-percent annual chance event.

At the time this Plan was written, the March 2012 DFIRMs were considered the best available, and were used for the risk analysis. Figure 4.3.4-3 illustrates the NFIP flood zones in Bedford County.

While the DFIRMs provide a creditable source to document extent and location of the flood hazard, accuracy of data reflected on these maps has limitations. Notably, DFIRMs are based on existing hydrological conditions at the time of map preparation. DFIRMs are not set up to account for possible changes in hydrology over time.

Figure 4.3.4-3. NFIP Floodplains in Bedford County



Source: FEMA 2012

Flood Insurance Study

In addition to FIRM and DFIRMs, FEMA also provides Flood Insurance Studies (FIS) of entire counties and individual jurisdictions. These studies aid in administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. They are narrative reports of county-wide flood hazards, which include descriptions of flood areas studied and engineered methods used, principal flood problems, flood protection measures, and graphic profiles of flood sources (FEMA 2008). The county-wide FIS for Bedford County was last completed in March 2012, at the same time as the DFIRM revisions.

Ice-Jam Hazard Areas

Ice jams are common in northeastern United States, and the Commonwealth of Pennsylvania is not an exception. The Ice Jam Database, maintained by the Ice Engineering Group at the USACE Cold Regions Research and Engineering Laboratory (CRREL), currently consists of over 18,000 records from across the United States. According to the USACE-CRREL, the 9th Congressional District (which includes Bedford County) underwent 149 historical ice-jam events between 1780 and 2013. This district ranks as one of the districts with the highest number of ice-jam events in Pennsylvania, second only to 5th Congressional District, which has undergone 414 ice jam events (USACE 2016).

Table 4.3.4-1 shows the number of recorded ice jams at the U.S. Geological Survey (USGS) stream gages in the County.

Table 4.3.4-1. Ice Jams by Stream Gage in Bedford County

Gage (Gage Number)	Number of Ice Jams
Dunning Creek in Belden (01560000)	4
Raystown Branch Juniata River in Saxton (01562000)	7

Source: USACE 2016

Historical events are further mentioned in the "Past Occurrence" section of this hazard profile.

4.3.4.2 Range of Magnitude

Both localized and widespread 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 period of time can result in flash floods. Small amounts of rain can cause flooding in areas with frozen soil or saturated soils from a previous event, or if the rain is concentrated in areas with impervious surfaces (PEMA 2013).

Several factors determine severity of floods, including 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. Many areas in Pennsylvania have relatively steep slopes that promote quick surface water runoff. Most storms track from west to east; however, some storms originate in the Great Lakes or the Atlantic Ocean (PEMA 2013).

Rainfall in Pennsylvania is about average for the eastern United States. Amounts of precipitation can be divided into the following six categories:

- Very light rain – precipitation rate of <0.01 inch per hour
- Light rain – precipitation rate between 0.01 inch and 0.04 inch per hour
- Moderate rain – precipitation rate between 0.04 inch and 0.16 inch per hour
- Heavy rain – precipitation rate between 0.16 inch and 0.63 inch per hour
- Very heavy rain – precipitation rate between 0.63 inch and 2 inches per hour
- Extreme rain – precipitation rate greater than 2 inches per hour (PEMA 2013).

Severity of a flood depends not only on the amount of water that accumulates within a period of time, but also on the land's ability to manage this water. The size of rivers and streams in an area also affect flood severity; but an equally important factor is the land's absorbency. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration into the ground slows, and any more water that accumulates must flow as runoff (Harris 2008).

In the case of riverine or flash flooding, once a river reaches flood stage, the flood extent or severity categories used by the National Weather Service (NWS) include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat:

- Minor Flooding – minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding – some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding – extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations are necessary (NWS 2011).

Bedford County's worst flood occurred on September 17, 2004. The remnants of Hurricane Ivan interacted with a cold front, leading to excessive rainfall across Central Pennsylvania. Rainfall amounts of 3 to 6 inches were common, with some localities reporting as much as 8 inches within a 12-hour period. The flooding was responsible for two deaths and caused property damage of $50 million.

4.3.4.3 Past Occurrence

Many sources provided historical information regarding previous occurrences and losses associated with flooding events throughout the Commonwealth of Pennsylvania and specifically, Bedford County. With so many sources reviewed for the purpose of this Hazard Mitigation Plan (HMP), loss and impact information regarding many events could vary depending on the source. Therefore, accuracy of monetary figures discussed is based only on available information identified during research for this HMP.

According to the National Oceanic and Atmospheric Administration's National Climatic Data Center (NOAA NCDC) storm event database, Bedford County underwent 42 flood events between January 1, 1993, and September 30, 2016 (the dates for which data are provided).

Between 1954 and 2016, the State of Pennsylvania underwent 49 FEMA-declared flood-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: severe storms, mudslides, flash flooding, tropical storms, tropical depressions, high winds, and rains. Typically, these disasters cover a wide region of Pennsylvania; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations (FEMA 2016). Bedford County was included in 12 of the 49 declarations, as listed in Table 4.3.4-2.

Based on all sources researched, known flooding events that have affected Bedford County and its municipalities, resulting in property damages, are listed in Table 4.3.4-2. Total property damage also includes damage in other counties. Four fatalities caused by flooding have been recorded in Bedford County. With flood documentation for Pennsylvania being so extensive, not all sources have been identified or researched. Therefore, Table 4.3.4-2 may not include all events that have occurred throughout the county.

Table 4.3.4-2. Major Flooding Events between 1993 and 2016 in Bedford County

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
April 10, 1993	Flood/Flash Flood	N/A	N/A	$5,000 in property damages
April 16, 1993	Flood/Flash Flood	N/A	N/A	$1,000 in property damages
November 27, 1993	Flood/Flash Flood	N/A	N/A	$5,000 in property damages
March 22, 1994	Flood/Flash Flood	N/A	N/A	$5,000 in property damages
July 6, 1994	Flash Flood	N/A	N/A	$5,000 in property damages
January 19, 1996	Flash Flood	DR-1093	Yes	1 fatality
June 18, 1996	Flash Flood	DR-1120	Yes	$8,000,000 in property damages
July 19, 1996	Flash Flood	DR-1130	No	1 fatality
January 23, 1999	Flash Flood	N/A	N/A	$5,000 in property damages
September 17, 2004	Hurricane Ivan	DR-1557	Yes	2 fatalities; $50,000,000 in property damages across the County
September 9, 2011	Tropical Storm Lee	DR-4030 EM-3340	Yes	Water was reported in homes and covering parts of Main Street in Coledale. A preliminary total of 20 structures reported minor damage with a total of 42 structures impacted. Damage was estimated at $197,460 for public facilities.

Sources: NOAA-NCDC 2016; NOAA-NCDC 2011; PEMA 2013; FEMA 2016
Notes:
Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of increased U.S. Inflation Rates.

DR	Federal Disaster Declaration
EM	Federal Emergency Declaration
FEMA	Federal Emergency Management Agency
NCDC	National Climate Data Center
NOAA	National Oceanic Atmospheric Administration
SHELDUS	Spatial Hazard Events and Losses Database for the U.S.

Based on review of the CRREL database, Table 4.3.4-3 lists the ice-jam events that have occurred in or near the Bedford County between 1780 and 2016. Information regarding losses associated with these reported ice jams was limited.

Table 4.3.4-3. Ice-Jam Events in Bedford County between 1936 and 2016

City (Additional Geographic Identifier)	River	Jam Date	Water Year	Gage Number	Impact
Saxton	Raystown Branch Juniata River	February 28, 1936	1936	01562000	USGS recorded a gage height of 12.75 ft due to backwater from ice.
Belden	Dunning Creek	January 8, 1954	1954	01560000	Minimum gage height for period of record 1939-1989 of 0.92 feet as a result of freeze-up
Belden	Dunning Creek	January 22, 1959	1959	01560000	Maximum annual gage height of 8.4 feet, affected by backwater from ice
Saxton	Raystown Branch Juniata River	February 10-11, 1959	1959	01562000	Maximum annual gage height of 9.23 feet, affected by backwater from ice. Discharge 7,740 cfs. Bank-full stage 11 ft. -
Belden	Dunning Creek	February 7, 1965	1965	01560000	Maximum annual gage height of 7.80 due to ice jam
Saxton	Raystown Branch Juniata River	February 8, 1965	1965	01562000	Maximum annual gage height of 9.12 feet due to ice jam. Average daily discharge 4,100 cfs (prior day 1,070 cfs).
Belden	Dunning Creek	February 14, 1966	1966	01560000	Maximum annual gage height of 10.45 feet due to ice jam
Saxton	Raystown Branch Juniata River	February 14, 1966	1966	01562000	Maximum annual gage height of 14.67 feet due to ice jam. Average daily discharge 13,000 cfs (2,800 cfs previous day).
Saxton	Raystown Branch Juniata River	January 31, 1968	1968	01562000	Maximum annual gage height of 9.01 feet due to ice jam. Average daily discharge of 4,500 cfs (previous day 1,500 cfs).
Saxton	Raystown Branch Juniata River	February 14, 1971	1971	01562000	The USGS reported an ice jam. The estimated water discharge was 7,000 cubic feet per inch. Maximum gage height was 11.21 feet.
Saxton	Raystown Branch Juniata River	February 17, 1982	1982	01562000	Maximum annual gage height of 13.25 feet due to ice jam. Average daily discharge 6,000 cfs (800 cfs previous day

Source: USACE 2016

Notes:

Although events were reported for Bedford County, information pertaining to every event was not easily ascertainable; therefore this table may not represent all ice jams in the county.

cfs Cubic feet per second
CRREL Cold Regions Research and Engineering Laboratory
USGS U.S. Geological Survey

National Flood Insurance Program

According to FEMA's 2002 National Flood Insurance Program (NFIP): Program Description, the U.S. Congress established the NFIP with passage of the National Flood Insurance Act of 1968. NFIP is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for compliance with state and community floodplain management regulations that reduce future flood damages. NFIP collects and stores a vast quantity of information regarding insured structures, including number and locations of flood insurance policies, number of claims per insured property, dollar value of each claim and aggregate value of claims, repetitive flood loss properties, etc. Use of NFIP claims data strongly indicates locations of flood events, along with use of other indicators (NYSDPC 2011).

Participation in the NFIP is based on an agreement between communities and the federal government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction and substantial improvements within floodplains, the FEMA will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an insurance alternative to disaster assistance to reduce escalating costs of repairing damage to buildings and their contents caused by floods (FEMA 2005).

The three components of the NFIP are flood insurance, floodplain management, and flood hazard mapping. Over 22,000 communities across the United States and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary. Flood damage is reduced by nearly $1 billion each year via implementation by communities of sound floodplain management requirements. Additionally, buildings constructed in compliance with NFIP building standards undergo approximately 80 percent less flood damage annually than those built not in compliance.

4.3.4.4 Future Occurrence

Given the history of flood events that have impacted Bedford County, future flooding events of varying degrees are likely to occur. The fact that the elements required for flooding exist and that major flooding has occurred throughout the county in the past suggests that many people and properties are at risk from the flood hazard in the future.

A structure within a 1-percent annual chance floodplain has a 26-percent chance of undergoing flood damage during the term of a 30-year mortgage. As noted, Figure 4.3.4-3 illustrates the FEMA DFIRM 1-percent annual chance flood zones for Bedford County.

In Section 4.4, the identified hazards of concern for Bedford County were ranked for relative risk. Probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records, NFIP data, and the Pennsylvania State Hazard Mitigation Plan, the probability of occurrence of flood events in Bedford County is considered highly likely (100-percent annual probability). Section 4.4 includes further information on PEMA's risk factor methodology.

Annual flooding is anticipated in Bedford County. Some of the flooding events may induce secondary hazards such as water quality and supply concerns; infrastructure damage, deterioration, and failure; utility failures; power outages; transportation delays/accidents/inconveniences; and public health and safety concerns.

4.3.4.5 Vulnerability Assessment

To understand risk, a community must evaluate the assets exposed or vulnerable within the identified hazard area. For the flood hazard, the 1-percent annual chance event (100-year) is examined. The following sections evaluate and estimate potential impact of flooding in Bedford County presenting specifically:

- Overview of vulnerability

- Data and methodology used for the evaluation
- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) the economy; and (5) future growth and development
- Effects of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time.

Overview of Vulnerability

Flood is a significant concern for Bedford County. To assess vulnerability, potential losses were calculated for the county for the 1-percent annual chance (100-year) mean return period (MRP) flood event. The flood hazard exposure and loss estimate analysis is presented below.

Data and Methodology

The 1-percent annual chance flood event was examined to evaluate Bedford County's risk from and vulnerability to the flood hazard. The polygons representing the 1-percent annual chance event from the FEMA Digital Flood Insurance Rate Map (DFIRM) dated March 2012 were used to estimate exposure. The 1-percent annual chance flood depth grid, dated August 2010, available from the Pennsylvania Spatial Data Clearinghouse, was incorporated into HAZUS-MH to estimate potential losses for the County. According to FEMA Region III, the 2010 depth grid is based on the data used to develop the 2010 DFIRM.

The version of the HAZUS-MH model (version 3.1) used for Bedford County's vulnerability assessment applied 2010 U.S. Census demographic data. The 2010 U.S. Census data was also used to estimate population exposure in order to provide the best available output. Figure 4.3.4-3 illustrates the flood boundaries used for this vulnerability assessment.

Impact on Life, Health, and Safety

Impacts of flooding on life, health, and safety depend on several factors including severity of the event and whether or not adequate warning time is provided to residents. The population living in or near floodplain areas would assumed to be exposed. However, exposure should not be limited only to those who reside within a defined hazard zone, but everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event). The degree of that impact varies and is not strictly measurable.

Table 4.3.4-4 lists the estimated population located within the 1-percent annual chance flood zone by municipality. To estimate the population exposed to the 1-percent flood event, the FEMA DFIRM floodplain boundaries were overlaid upon the 2010 U.S. Census population data in Geographic Information Systems (GIS) (U.S. Census 2010). The U.S. Census blocks do not follow the boundaries of the floodplain. Utilizing the centroid or intersect of the U.S. Census block and the floodplain can grossly overestimate or underestimate the population exposed. The limitations of these analyses are recognized, and as such the results are used only to provide a general estimate.

The 2010 U.S. Census blocks, with their centroids within the flood boundaries, were used to calculate the estimated population exposed to this hazard. Use of this approach resulted in an estimate of 3,641 people within the 1-percent annual chance floodplain, or 7.3 percent of the total county population.

Table 4.3.4-4. Estimated Bedford County Population Vulnerable to the 1-Percent Flood Hazard (2010 Census)

Municipality	Total Population	1-Percent Annual Chance Event	
		Population in SFHA	Percent Population in Boundary
Bedford Borough	2,841	320	11.3%
Bedford Township	5,395	395	7.3%
Bloomfield Township	1,016	13	1.3%
Broad Top Township	1,687	106	6.3%
Coaldale Borough	161	0	0.0%
Colerain Township	1,195	4	0.3%
Cumberland Valley Township	1,597	96	6.0%
East Providence Township	1,854	77	4.2%
East St. Clair Township	3,042	353	11.6%
Everett Borough	1,832	54	2.9%
Harrison Township	978	88	9.0%
Hopewell Borough	230	35	15.2%
Hopewell Township	2,010	94	4.7%
Hyndman Borough	910	684	75.2%
Juniata Township	954	77	8.1%
Kimmel Township	1,616	94	5.8%
King Township	1,238	105	8.5%
Liberty Township	1,418	89	6.3%
Lincoln Township	425	30	7.1%
Londonderry Township	1,856	201	10.8%
Mann Township	500	25	5.0%
Manns Choice Borough	294	58	19.7%
Monroe Township	1,336	27	2.0%
Napier Township	2,198	54	2.5%
New Paris Borough	186	0	0.0%
Pavia Township	295	14	4.7%
Pleasantville Borough	198	0	0.0%
Rainsburg Borough	133	0	0.0%
Saxton Borough	686	0	0.0%
Schellsburg Borough	338	0	0.0%
Snake Spring Township	1,639	90	5.5%
South Woodbury Township	2,155	207	9.6%
Southampton Township	976	56	5.7%
St. Clairsville Borough	78	0	0.0%
West Providence Township	3,212	84	2.6%
West Saint Clair Township	1,736	86	5.0%
Woodbury Borough	284	0	0.0%
Woodbury Township	1,263	25	2.0%
Bedford County (Total)	**49,762**	**3,641**	**7.3%**

Sources: U.S. Census 2010, FEMA 2012
Note:
SFHA Special Flood Hazard Area

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over the age of 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on the potential economic impact on their families. The population over the age of 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available because of isolation during a flood event, and they may have more difficulty evacuating.

Using 2010 U.S. Census data, HAZUS-MH 3.1 estimates potential sheltering needs based on a 1-percent chance flood event. For the 1-percent flood event, HAZUS-MH 3.1 estimates 4,705 households will be displaced, and 1,304 people will seek short-term sheltering, representing approximately 2.6 percent of the Bedford County population seeking short-term shelter. These statistics, by municipality, are listed in Table 4.3.4-5. The estimated displaced population and number of persons seeking short-term sheltering differs from the number of persons exposed to the 1-percent annual chance flood (Table 4.3.4-4), because the displaced population numbers take into consideration that not all residents will be significantly impacted enough to be displaced or to require short-term sheltering during a flood event.

Table 4.3.4-5. Estimated Population Displaced or Seeking Short-Term Shelter from the 1-Percent Annual Chance Flood Event

Municipality	Total Population (2010 U.S. Census)	1-Percent Annual Chance Event	
		Displaced Households	Persons Seeking Short-Term Sheltering
Bedford Borough	2,841	270	167
Bedford Township	5,395	518	178
Bloomfield Township	1,016	52	9
Broad Top Township	1,687	90	9
Coaldale Borough	161	2	0
Colerain Township	1,195	59	1
Cumberland Valley Township	1,597	103	4
East Providence Township	1,854	77	39
East St. Clair Township	3,042	426	96
Everett Borough	1,832	59	12
Harrison Township	978	115	11
Hopewell Borough	230	29	3
Hopewell Township	2,010	198	33
Hyndman Borough	910	689	306
Juniata Township	954	85	13
Kimmel Township	1,616	77	7
King Township	1,238	134	30
Liberty Township	1,418	102	18
Lincoln Township	425	81	6
Londonderry Township	1,856	331	109
Mann Township	500	29	1
Manns Choice Borough	294	33	10
Monroe Township	1,336	59	2
Napier Township	2,198	97	1
New Paris Borough	186	9	0
Pavia Township	295	34	7

Municipality	Total Population (2010 U.S. Census)	1-Percent Annual Chance Event	
		Displaced Households	Persons Seeking Short-Term Sheltering
Pleasantville Borough	198	8	1
Rainsburg Borough	133	3	0
Saxton Borough	686	4	0
Schellsburg Borough	338	0	0
Snake Spring Township	1,639	119	44
South Woodbury Township	2,155	262	94
Southampton Township	976	111	6
St. Clairsville Borough	78	0	0
West Providence Township	3,212	168	59
West Saint Clair Township	1,736	188	25
Woodbury Borough	284	5	0
Woodbury Township	1,263	79	3
Bedford County (Total)	**49,762**	**4,705**	**1,304**

Source: HAZUS-MH 3.1

Generally, the total number of injuries and casualties resulting from riverine flooding is limited because of advanced weather forecasting, blockades, and warnings. Therefore, injuries and deaths are not anticipated if proper warning occurs and precautions are in place. Warning time for flash flooding is often limited. Flash flood events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard. Populations without adequate warning of the event are highly vulnerable to this hazard. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which is persons trying to cross flooded roadways or channels. Mitigation action items addressing this issue are included in Section 6 (Mitigation Strategies) of this Plan.

Impact on General Building Stock

After consideration of the population exposed and vulnerable to the flood hazard, the built environment was evaluated. Exposure in the flood zone includes those buildings located within the flood zone. Potential damage is the modeled loss that could occur to the exposed inventory, including structural and content value.

Total land area within the 1-percent annual chance flood zones was calculated for each municipality, as listed in Tables 4.3.4-6 below.

Table 4.3.4-6. Total Land Area within the 1-Percent Annual Chance Flood Zone (Acres)

Municipality	Total Area (acres)	1% Flood Event Hazard Area	
		A-Zone Area Exposed (acres)	Percentage of Total Land in A-Zone
Bedford Borough	713.9	102.3	14.3%
Bedford Township	43,713.6	2,877.8	6.6%
Bloomfield Township	12,415.2	216.4	1.7%
Broad Top Township	31,022.4	898.4	2.9%
Coaldale Borough	23.5	0.4	1.7%
Colerain Township	26,878.7	1,068.7	4.0%
Cumberland Valley Township	38,549.5	1,495.6	3.9%

Municipality	Total Area (acres)	1% Flood Event Hazard Area	
		A-Zone Area Exposed (acres)	Percentage of Total Land in A-Zone
East Providence Township	32,510.8	1,242.2	3.8%
East St. Clair Township	21,678.8	2,604.0	12.0%
Everett Borough	677.7	165.8	24.5%
Harrison Township	23,784.8	1,119.3	4.7%
Hopewell Borough	71.8	12.6	17.5%
Hopewell Township	22,073.2	1,100.8	5.0%
Hyndman Borough	340.3	216.1	63.5%
Juniata Township	30,546.3	1,473.0	4.8%
Kimmel Township	12,785.8	256.4	2.0%
King Township	10,063.1	945.6	9.4%
Liberty Township	17,142.7	1,138.1	6.6%
Lincoln Township	10,403.2	359.7	3.5%
Londonderry Township	35,214.6	2,288.4	6.5%
Mann Township	22,881.5	994.7	4.3%
Manns Choice Borough	324.5	95.9	29.6%
Monroe Township	56,051.1	1,853.1	3.3%
Napier Township	37,256.4	2,350.2	6.3%
New Paris Borough	37.3	3.0	8.0%
Pavia Township	13,879.5	416.0	3.0%
Pleasantville Borough	45.3	4.7	10.4%
Rainsburg Borough	104.0	6.0	5.8%
Saxton Borough	241.7	18.6	7.7%
Schellsburg Borough	162.9	1.2	0.7%
Snake Spring Township	16,802.5	810.4	4.8%
South Woodbury Township	21,585.2	707.8	3.3%
Southampton Township	51,336.7	1,816.6	3.5%
St. Clairsville Borough	19.0	0	0.0%
West Providence Township	24,848.2	1,795.4	7.2%
West Saint Clair Township	19,211.9	888.2	4.6%
Woodbury Borough	85.1	9.0	10.6%
Woodbury Township	14,798.7	458.6	3.1%
Bedford County (Total)	**650,281.4**	**31,810.6**	**4.9%**

Source: FEMA 2012
Notes:
The area represented includes the area of inclusive water bodies.

Similar to the population, the building stock data are presented by U.S. Census block. To estimate the value of building stock exposed to the 1-percent flood event, the FEMA DFIRM floodplain boundaries were overlaid upon the HAZUS-MH building stock data in GIS. Using the default general building stock, the replacement cost values of the Census blocks with their centroids in the floodplain were totaled. Approximately $603 million worth of building/contents are exposed to the 1-percent annual chance flood in Bedford County. This represents approximately 8.0 percent of the County's total general building stock replacement value inventory ($7.5 billion).

To estimate the number of structures exposed to the FEMA DFIRM floodplain boundary, the county's spatial layer of structures was overlaid by the 1-percent flood event boundary. In total, 4,856 structures, or 8.2% of the building stock, are located in this hazard area. The building stock exposure per municipality is presented in Table 4.3.4-7.

Potential damage estimated to the general building stock inventory associated with the 1-percent annual chance flood exceeds $142 million. Building stock potential loss estimates per municipality are listed in Table 4.3.4-8.

Table 4.3.4-7. Estimated General Building Stock Exposure to the 1-Percent Annual Chance Flood Event

Municipality	Total Number of Buildings	Total RCV	1% Annual Chance Flood Boundary			
			Number of Buildings	% of Total	RCV	% of Total
Bedford Borough	1,892	$646,059,000	78	4.1%	$66,745,000	10.3%
Bedford Township	5,482	$1,064,751,000	554	10.1%	$89,115,000	8.4%
Bloomfield Township	1,053	$98,910,000	28	2.7%	$225,000	<1%
Broad Top Township	1,989	$210,095,000	125	6.3%	$21,888,000	10.4%
Coaldale Borough	101	$12,009,000	0	0.0%	$0	0.0%
Colerain Township	1,879	$124,874,000	59	3.1%	$9,477,000	7.6%
Cumberland Valley Township	2,167	$186,632,000	66	3.0%	$3,524,000	1.9%
East Providence Township	2,599	$278,118,000	111	4.3%	$8,625,000	3.1%
East St. Clair Township	3,216	$370,063,000	411	12.8%	$52,543,000	14.2%
Everett Borough	1,222	$438,564,000	51	4.2%	$18,506,000	4.2%
Harrison Township	1,664	$163,407,000	264	15.9%	$32,644,000	20.0%
Hopewell Borough	164	$24,173,000	19	11.6%	$3,710,000	15.3%
Hopewell Township	2,146	$222,875,000	210	9.8%	$10,625,000	4.8%
Hyndman Borough	778	$117,166,000	591	76.0%	$86,280,000	73.6%
Juniata Township	1,979	$125,361,000	114	5.8%	$7,651,000	6.1%
Kimmel Township	1,852	$207,126,000	55	3.0%	$4,452,000	2.1%
King Township	1,354	$128,234,000	185	13.7%	$14,723,000	11.5%
Liberty Township	1,764	$190,571,000	123	7.0%	$8,355,000	4.4%
Lincoln Township	462	$43,153,000	91	19.7%	$6,563,000	15.2%
Londonderry Township	2,507	$197,714,000	416	16.6%	$21,782,000	11.0%
Mann Township	1,125	$84,599,000	31	2.8%	$4,548,000	5.4%
Manns Choice Borough	269	$32,878,000	9	3.3%	$5,177,000	15.7%
Monroe Township	2,558	$164,383,000	28	1.1%	$2,400,000	1.5%
Napier Township	3,539	$277,952,000	227	6.4%	$15,229,000	5.5%
New Paris Borough	135	$21,772,000	0	0.0%	$76,000	<1%
Pavia Township	559	$46,739,000	49	8.8%	$2,241,000	4.8%
Pleasantville Borough	170	$22,172,000	10	5.9%	$0	0.0%
Rainsburg Borough	157	$14,504,000	0	0.0%	$0	0.0%

Municipality	Total Number of Buildings	Total RCV	1% Annual Chance Flood Boundary			
			Number of Buildings	% of Total	RCV	% of Total
Saxton Borough	504	$168,466,000	0	0.0%	$0	0.0%
Schellsburg Borough	266	$41,027,000	0	0.0%	$0	0.0%
Snake Spring Township	1,768	$383,646,000	178	10.1%	$58,500,000	15.2%
South Woodbury Township	2,245	$245,720,000	214	9.5%	$23,657,000	9.6%
Southampton Township	1,932	$133,937,000	90	4.7%	$6,850,000	5.1%
St. Clairsville Borough	73	$10,568,000	0	0.0%	$0	0.0%
West Providence Township	3,696	$618,794,000	245	6.6%	$8,128,000	1.3%
West Saint Clair Township	1,790	$179,339,000	143	8.0%	$6,503,000	3.6%
Woodbury Borough	238	$31,161,000	4	1.7%	$279,000	<1%
Woodbury Township	1,614	$198,967,000	77	4.8%	$1,950,000	1.0%
Bedford County (Total)	**58,908**	**$7,526,479,000**	**4,856**	**8.2%**	**$602,971,000**	**8.0%**

Source: HAZUS-MH 3.1; FEMA 2012, Bedford County 2016
Notes:
RCV Replacement cost value (structure and contents)

Table 4.3.4-8. Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event

Municipality	Total RCV	1% Annual Chance Flood Boundary	
		Loss	% of Total
Bedford Borough	$646,059,000	$10,114,000	1.6%
Bedford Township	$1,064,751,000	$32,233,000	3.0%
Bloomfield Township	$98,910,000	$291,000	<1%
Broad Top Township	$210,095,000	$4,233,000	2.0%
Coaldale Borough	$12,009,000	$18,000	<1%
Colerain Township	$124,874,000	$778,000	<1%
Cumberland Valley Township	$186,632,000	$1,068,000	<1%
East Providence Township	$278,118,000	$1,106,000	<1%
East St. Clair Township	$370,063,000	$9,967,000	2.7%
Everett Borough	$438,564,000	$4,019,000	<1%
Harrison Township	$163,407,000	$6,379,000	3.9%
Hopewell Borough	$24,173,000	$689,000	2.9%
Hopewell Township	$222,875,000	$4,481,000	2.0%
Hyndman Borough	$117,166,000	$10,909,000	9.3%
Juniata Township	$125,361,000	$885,000	<1%
Kimmel Township	$207,126,000	$837,000	<1%
King Township	$128,234,000	$1,794,000	1.4%
Liberty Township	$190,571,000	$8,382,000	4.4%
Lincoln Township	$43,153,000	$870,000	2.0%
Londonderry Township	$197,714,000	$4,358,000	2.2%

Municipality	Total RCV	1% Annual Chance Flood Boundary	
		Loss	% of Total
Mann Township	$84,599,000	$623,000	<1%
Manns Choice Borough	$32,878,000	$284,000	<1%
Monroe Township	$164,383,000	$609,000	<1%
Napier Township	$277,952,000	$3,500,000	1.3%
New Paris Borough	$21,772,000	$73,000	<1%
Pavia Township	$46,739,000	$244,000	<1%
Pleasantville Borough	$22,172,000	$56,000	<1%
Rainsburg Borough	$14,504,000	$10,000	<1%
Saxton Borough	$168,466,000	$229,000	<1%
Schellsburg Borough	$41,027,000	$0	0.0%
Snake Spring Township	$383,646,000	$12,807,000	3.3%
South Woodbury Township	$245,720,000	$8,000,000	3.3%
Southampton Township	$133,937,000	$2,051,000	1.5%
St. Clairsville Borough	$10,568,000	$0	0.0%
West Providence Township	$618,794,000	$8,478,000	1.4%
West Saint Clair Township	$179,339,000	$1,429,000	0.8%
Woodbury Borough	$31,161,000	$167,000	<1%
Woodbury Township	$198,967,000	$886,000	<1%
Bedford County (Total)	**$7,526,479,000**	**$142,857,000**	**1.9%**

Source: HAZUS-MH 3.1
Notes:
% Percent
RCV Replacement cost value

To further enhance the risk assessment, FEMA Region III provided data on the total exposure in the floodplain (TEIF) for Bedford County. This data utilizes best available data including the 2010 Census geography and 2012 RS Means valuations. This data is used in lieu of the average annualized loss study. This data indicates the total exposure in the floodplain for Bedford County is $573,841,741.00.

In addition to total building stock modeling, individual data available regarding flood policies, claims, repetitive loss (RL) properties, and severe repetitive loss (SRL) properties were analyzed. According to Section 1361A of the National Flood Insurance Act (NFIA), as amended, 42 *United States Code* (U.S.C.) 4102a, a SRL property is defined as a residential property covered by an NFIP flood insurance policy, and can claim at least one of the following:

- Has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000
- For which at least two separate claims payments (building payments only) have been made, with the cumulative amount of the building portion of such claims exceeding the market value of the building.

A RL property is defined by the NFIP as an NFIP-insured structure that incurred flood-related damage on two occasions, and for which the cost of repair equaled or exceeded $1,000 at the time of each flood. FEMA's Flood Mitigation Assistance program refers to an NFIP-insured structure that incurred flood-related damage on two occasions, and for which the cost of repair equaled or exceeded 25 percent of the market value of the structure at the time of each such flood.

For both of the above, at least two of the referenced claims must have occurred within a 10-year period, and minimally 10 days must have intervened between the two claims. Bedford County has 28 RL properties (whether residential or commercial/industrial), and 20 SRL properties, per FEMA documentation.

Table 4.3.4-9 summarizes the NFIP policies and claims for Bedford County.

Table 4.3.4-9. NFIP Policies, Claims, and Repetitive Loss Statistics

Municipality	# Policies (1)	# Claims (Losses) (1)	# Repetitive Loss Properties (1)	# Severe Repetitive Loss Properties (1)	Total Loss Payments (2)
Bedford Borough	17	31	-	-	$ 323,753.82
Bedford Township	62	442	17	15	$ 4,500,065.01
Bloomfield Township	5	0	-	-	$ -
Broad Top Township	18	25	1	-	$ 281,579.67
Colerain Township	3	1	-	-	$ 364.46
Cumberland Valley Township	8	5	-	-	$ 14,694.35
East Providence Township	7	6	-	-	$ 24,176.33
East St. Clair Township	37	193	2	1	$ 1,451,482.65
Everett Borough	14	12	-	-	$ 135,547.62
Harrison Township	7	5	-	-	$ 16,279.39
Hopewell Borough	6	21	-	-	$ 158,181.32
Hopewell Township	29	42	2	-	$ 660,877.57
Hyndman Borough	117	127	-	-	$ 1,064,776.94
Juniata Township	4	7	-	-	$ 51,623.83
Kimmel Township	3	1	-	-	$ 8,012.18
King Township	12	0	-	-	$ -
Liberty Township	14	21	1	-	$ 388,151.45
Lincoln Township	17	0	-	-	$ -
Londonderry Township	27	31	-	-	$ 242,275.84
Mann Township	-	1	-	-	$ 3,000.00
Manns Choice Borough	1	3	-	-	$ 6,525.32
Monroe Township	1	0	-	-	$ -
Napier Township	6	3	-	-	$ 33,511.53
New Paris Borough	1	6	-	-	$ 76,050.99
Pavia Township	3	0	-	-	$ -
Pleasantville Borough	1	4	-	-	$ 33,939.25
Saxton Borough	1	1	-	-	$ 883.00
Schellsburg Borough	1	5	-	-	$ 22,187.41
Snake Spring Township	20	140	3	2	$ 1,601,163.29

Municipality	# Policies (1)	# Claims (Losses) (1)	# Repetitive Loss Properties (1)	# Severe Repetitive Loss Properties (1)	Total Loss Payments (2)
South Woodbury Township	13	2	-	-	$ 20,192.66
West Providence Township	33	81	1	1	$ 977,678.00
West Saint Clair Township	29	46	1	1	$ 499,881.26
Woodbury Township	2	6	-	-	$ 155,831.41
Bedford County (Total)	**519**	**1,268**	**28**	**20**	**$ 12,752,686.55**

Source: FEMA 2016

Notes:
(1) Policies, claims, repetitive loss, and severe repetitive loss statistics provided by FEMA and PEMA, and are current as of 10/31/16. Total number of repetitive loss properties includes the severe repetitive loss properties. The number of claims represents claims closed by 10/31/16.
(2) Total building and content loss information was collected from the claims file provided by FEMA.

Impact on Critical Facilities

In addition to considering general building stock at risk, the risk of flood to critical facilities, utilities, and user-defined facilities was also evaluated. HAZUS-MH was used to estimate the flood loss potential to critical facilities exposed to the flood risk. Using depth/damage function curves, HAZUS estimates the percent of damage to the building and contents of critical facilities. Table 4.3.4-10 lists the number of critical facilities and utilities within the FEMA flood zones, for those municipalities with critical facilities in the flood zones.

In cases where short-term functionality is impacted by a hazard, other facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce impacts on critical facilities and ensure that sufficient emergency and school services remain functional when a significant event occurs. Actions addressing shared service agreements are included in Section 6 (Mitigation Strategy) of this Plan.

Table 4.3.4-10 Critical Facilities Within the 1-Percent Annual Chance Flood Boundary and Estimated Potential Damage

Municipality	Facility Types													
	DPW	EMS	Fire Station	Government	Hazmat	Helipad	Medical	Municipal Building	Potable Pump	Potable Facility	School	Substation	Wastewater Facility	Wastewater Pump
Bedford Borough	0	0	0	0	0	0	0	0	0	1	1	0	1	0
Bedford Township	1	0	0	0	2	0	0	0	2	0	0	0	0	0
Everett Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hyndman Borough	0	1	1	0	0	0	1	1	0	0	0	0	0	0
King Township	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Londonderry Township	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Snake Spring Township	0	0	0	0	0	0	0	0	0	1	0	0	1	1
South Woodbury Township	0	0	0	1	0	0	0	0	0	0	0	1	0	0
West Providence Township	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bedford County (Total)	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**4**

Sources: HAZUS-MH 3.1, Bedford County

Impact on the Economy

To consider the impact on the economy, estimated losses from a flood event are evaluated. Losses include but are not limited to general building stock damage, agricultural losses, business interruption, and tax base of Bedford County. Damage to general building stock can be quantified by use of HAZUS-MH as discussed above. Other economic components such as loss of facility use, functional downtime, and social economic factors are less susceptible to measurement with a high degree of certainty. For the purpose of this analysis, general building stock damage is further discussed in reference to impacts on the economy of Bedford County.

Flooding can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur, and drinking water and wastewater treatment facilities may be temporarily out of operation. Flooded streets and road blocks make it difficult for emergency vehicles to respond to calls for service. Floodwaters can wash out sections of roadway and bridges.

Direct building losses are the estimated costs to repair or replace damage caused to buildings. The potential damage estimated to the general building stock inventory associated with the 1-percent flood is approximately $143 million, which represents 1.9 percent of the county's overall total general building stock inventory. These dollar value losses to the county's total building inventory replacement value, in addition to damages to roadways and infrastructure, would greatly impact the local economy.

HAZUS-MH estimates the amount of debris generated from a 1-percent flood event. The model breaks down debris into three categories because of the different types of equipment needed to handle debris: (1) finishes (dry wall, insulation, etc.), (2) structural (wood, brick, etc.), and (3) foundations (concrete slab and block, rebar, etc.). Table 4.3.4-11 summarizes the debris HAZUS-MH 3.1 estimates to result from a 1-percent flood event.

Table 4.3.4-11. Estimated Debris Generated from the 1-Percent Flood Event

Municipality	1% Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Bedford Borough	693	454	133	106
Bedford Township	3,377	1,451	989	938
Bloomfield Township	13	10	1	2
Broad Top Township	708	275	228	205
Coaldale Borough	3	2	0	0
Colerain Township	71	47	9	15
Cumberland Valley Township	72	49	10	14
East Providence Township	153	80	29	44
East St. Clair Township	903	485	168	250
Everett Borough	607	136	288	183
Harrison Township	513	291	111	111
Hopewell Borough	93	48	24	21
Hopewell Township	555	270	141	144
Hyndman Borough	827	645	94	88
Juniata Township	56	38	8	11
Kimmel Township	21	15	2	4
King Township	110	78	11	21
Liberty Township	1,058	247	434	377

Municipality	1% Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Lincoln Township	55	38	6	11
Londonderry Township	458	292	68	98
Mann Township	33	19	5	8
Manns Choice Borough	25	16	3	6
Monroe Township	31	21	3	7
Napier Township	545	286	122	137
New Paris Borough	5	4	0	1
Pavia Township	15	11	1	3
Pleasantville Borough	5	3	1	1
Rainsburg Borough	1	0	0	0
Saxton Borough	22	4	10	9
Schellsburg Borough	0	0	0	0
Snake Spring Township	503	291	112	100
South Woodbury Township	636	271	183	182
Southampton Township	171	109	23	39
St. Clairsville Borough	0	0	0	0
West Providence Township	1,321	445	496	380
West Saint Clair Township	128	77	17	34
Woodbury Borough	3	3	0	1
Woodbury Township	50	34	5	10
Bedford County (Total)	**13,841**	**6,545**	**3,737**	**3,560**

Source: HAZUS-MH 3.1

Future Growth and Development

As discussed in Section 2.4, areas targeted for future growth and development have been identified across the county. Any areas of growth could be impacted by the flood hazard if construction occurs within identified hazard areas. The county intends to discourage development in vulnerable areas or to encourage higher regulatory standards on the local level.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change can alter the prevalence and severity of extremes such as flood events. While predicting flood events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (U.S. Environmental Protection Agency [EPA] 2006).

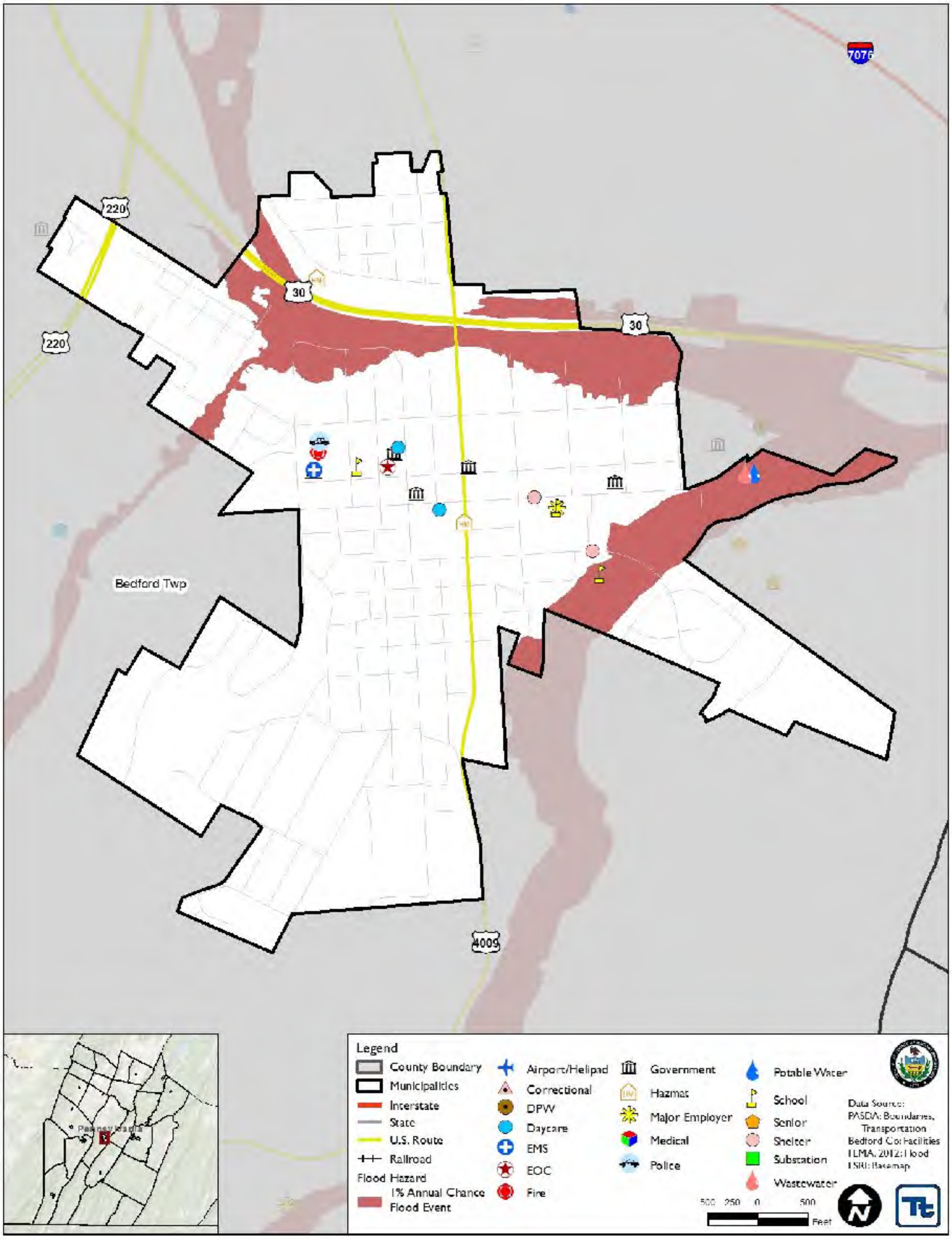
Pennsylvania's Department of Environmental Protection (PADEP) was directed by the Climate Change Act (Act 70 of 2008) to initiate a study of potential impacts of global climate change on the Commonwealth. The June 2009 Pennsylvania Climate Impact Assessment's main findings indicate that Pennsylvania is very likely to undergo increased temperatures in the 21st century. An increase in variability of temperature and precipitation may lead to increased frequency and/or severity of storm events. Summer floods and general stream flow variability are projected to increase due to increased variability in precipitation. Even with the anticipated increase in winter precipitation occurring as rain rather than snow, increased winter temperatures and a reduced snowpack may decrease rain-on-snow events and thus affect major flooding events in Pennsylvania. This conclusion, however, remains speculative until further studies can validate it. Future improvements in modeling smaller-scale climatic processes are expected, and will lead to improved understanding of how the changing climate will alter temperature, precipitation, storms, and flood events in Pennsylvania (Shortle et al. 2009).

Additional Data and Next Steps

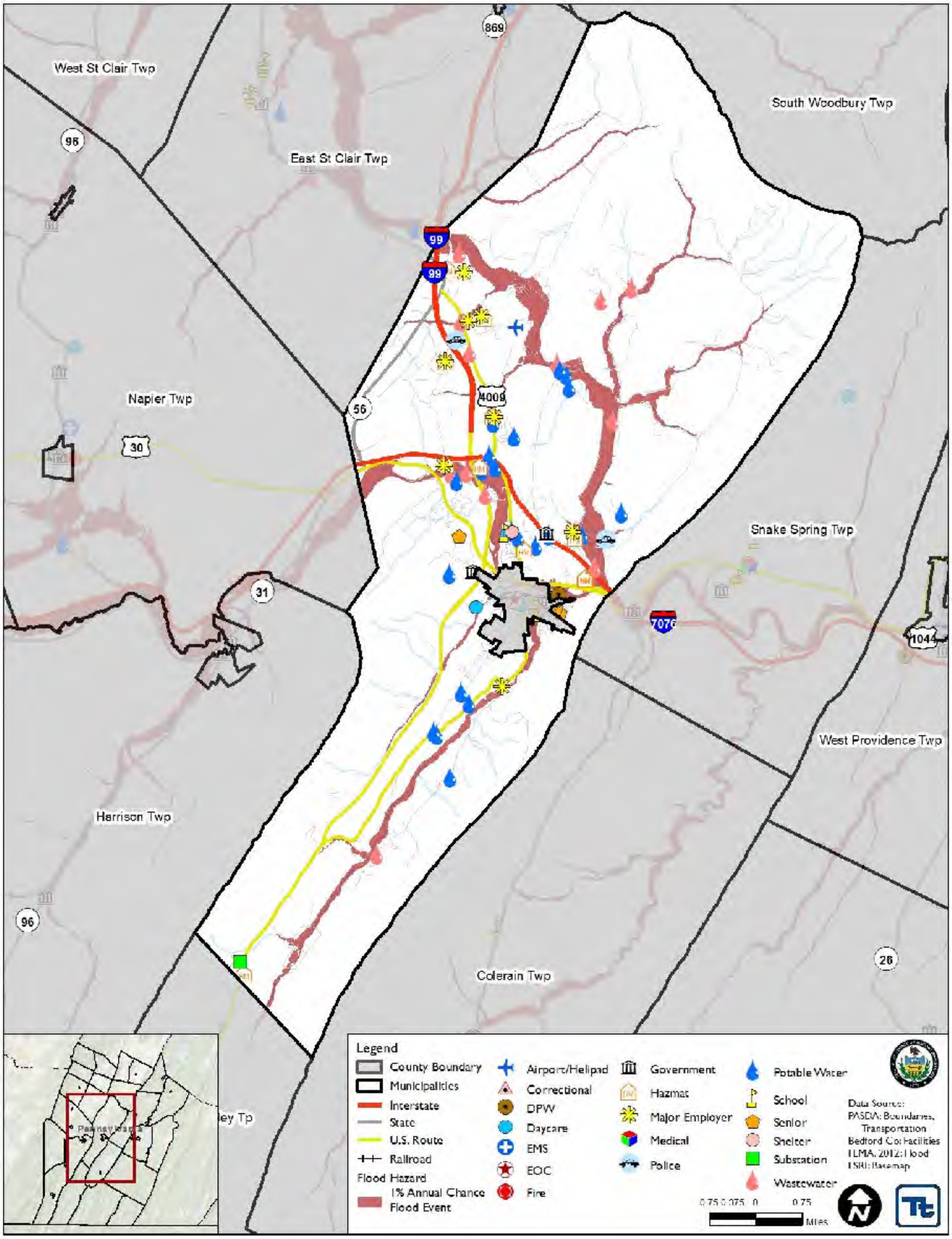
A HAZUS-MH riverine flood analysis for Bedford County was based on the most current and best available data, including critical facility inventories and FEMA DFIRM. For future plan updates, more accurate exposure and loss estimates can be produced by updating the default general building stock inventory in HAZUS-MH and conducting the loss estimates at the structure level.

Section 6 (Mitigation Strategy) of this Plan includes discussions of specific mitigation actions addressing improved data collection and further vulnerability analysis.

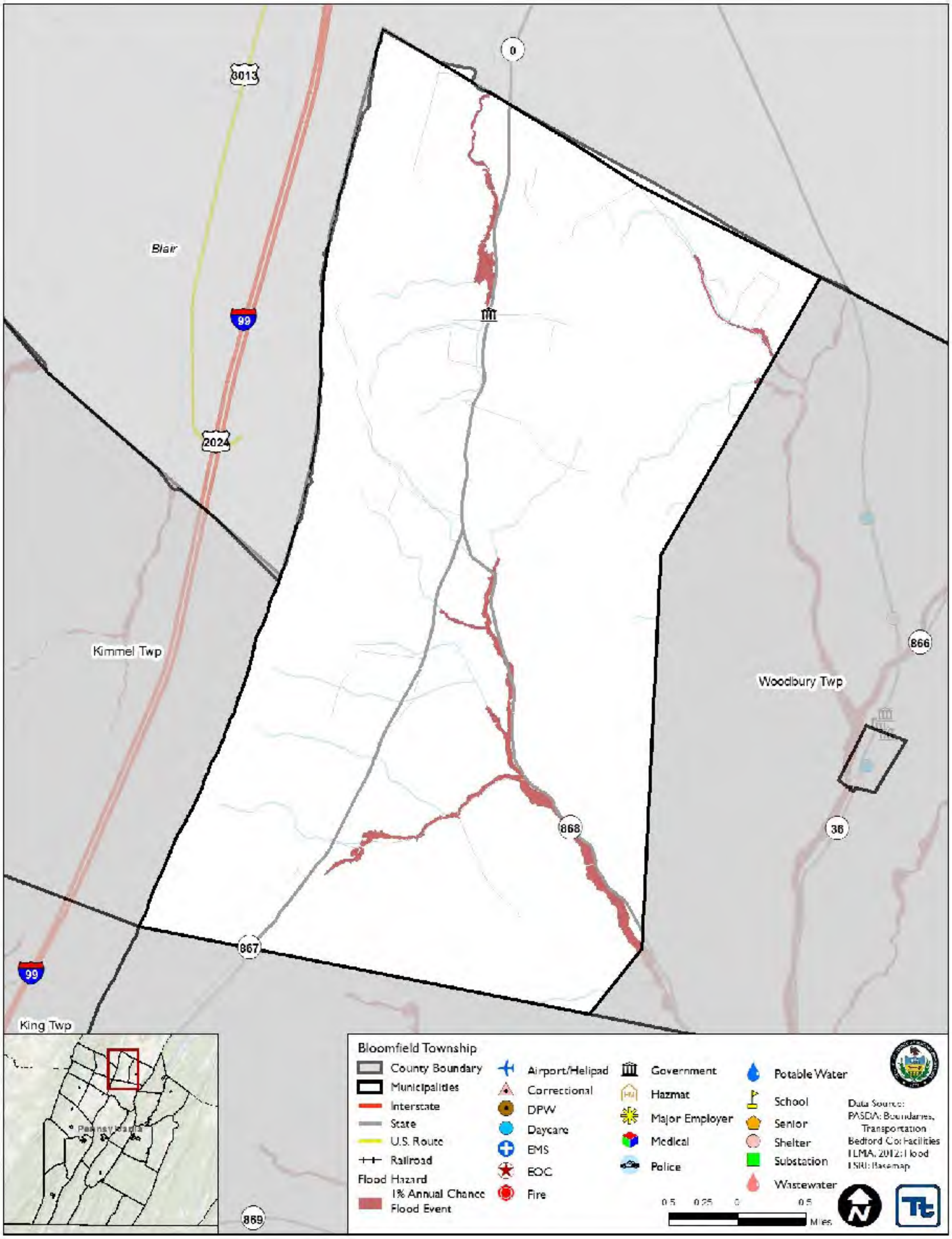
BEDFORD BOROUGH



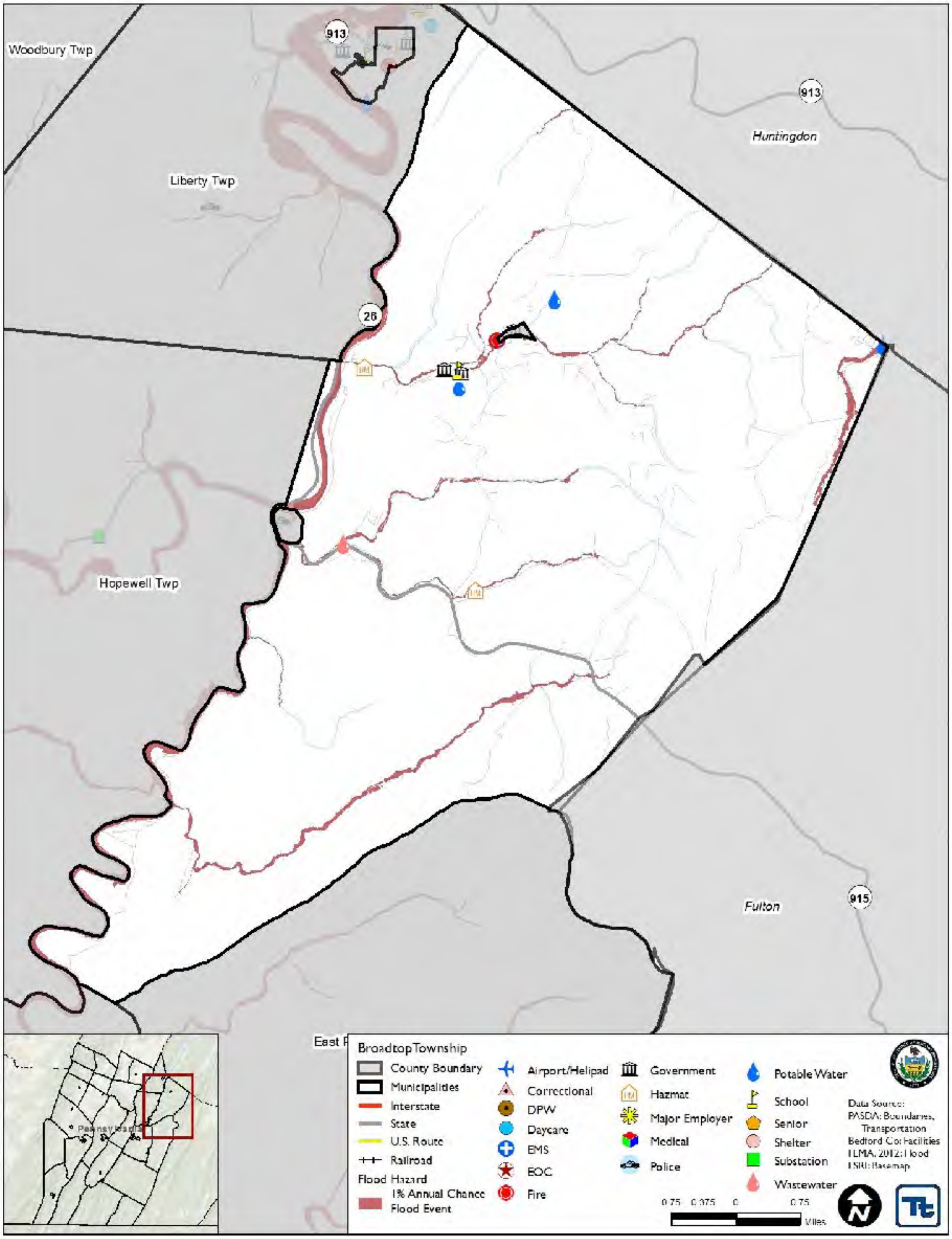
BEDFORD TOWNSHIP



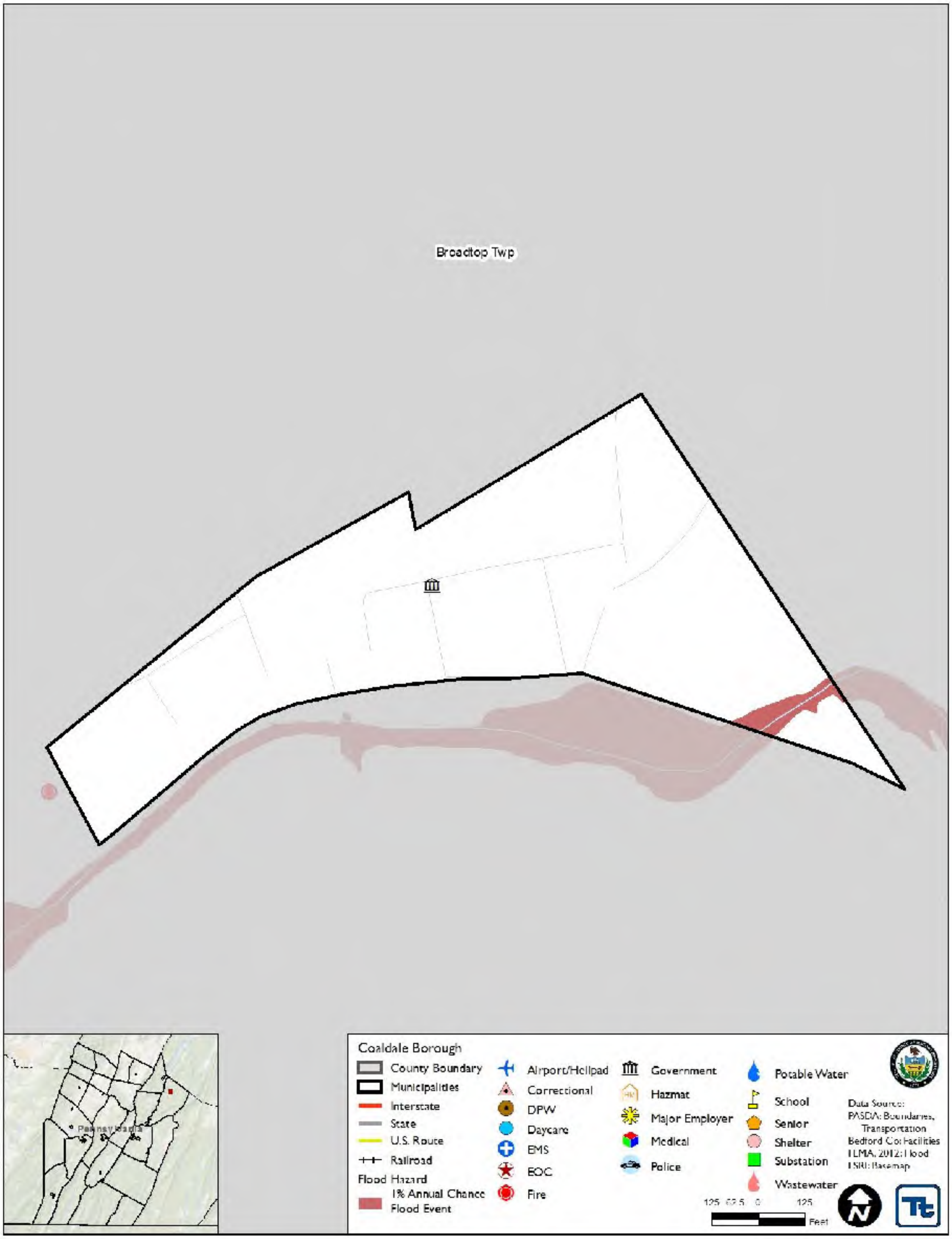
BLOOMFIELD TOWNSHIP



BROAD TOP TOWNSHIP



COALDALE BOROUGH



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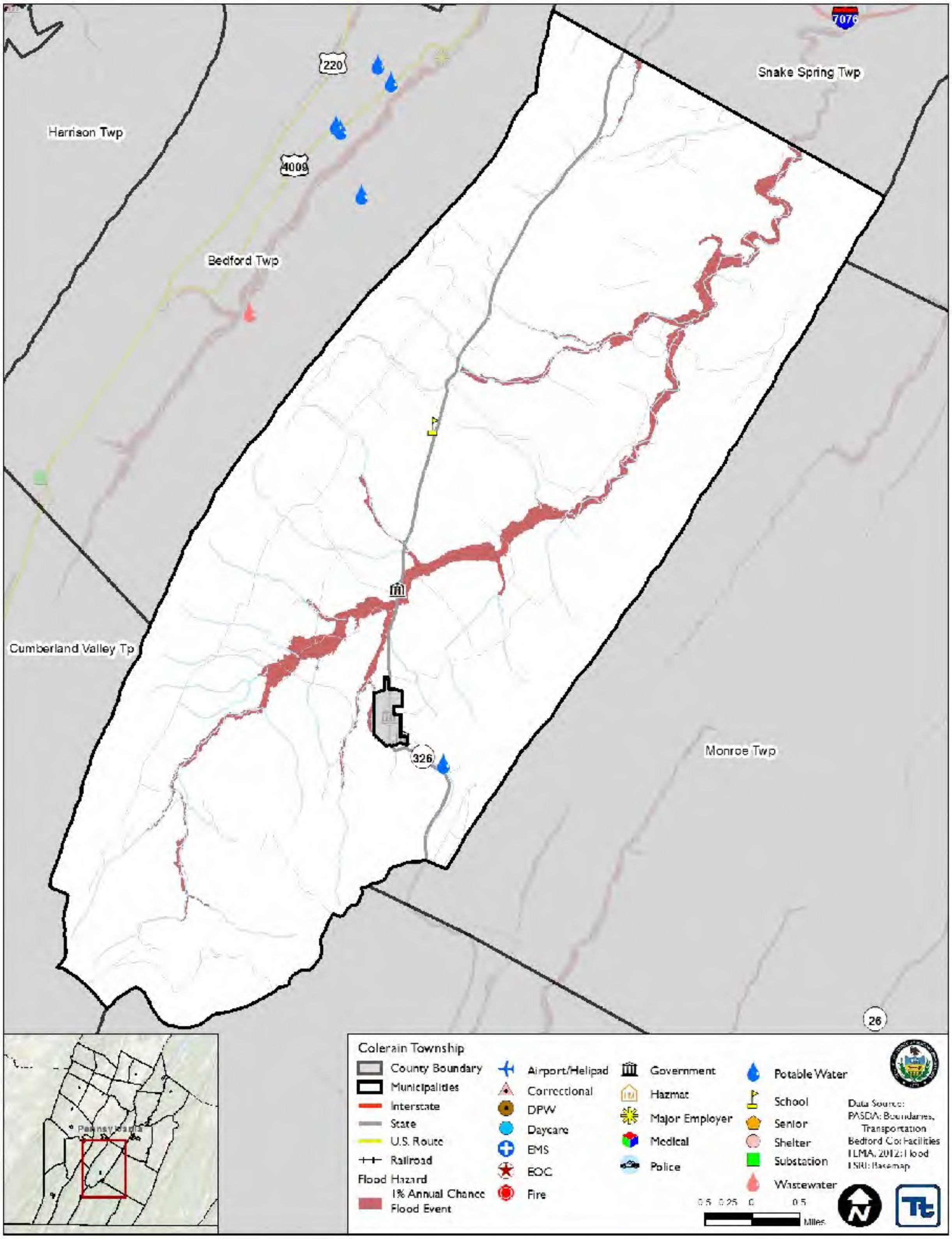

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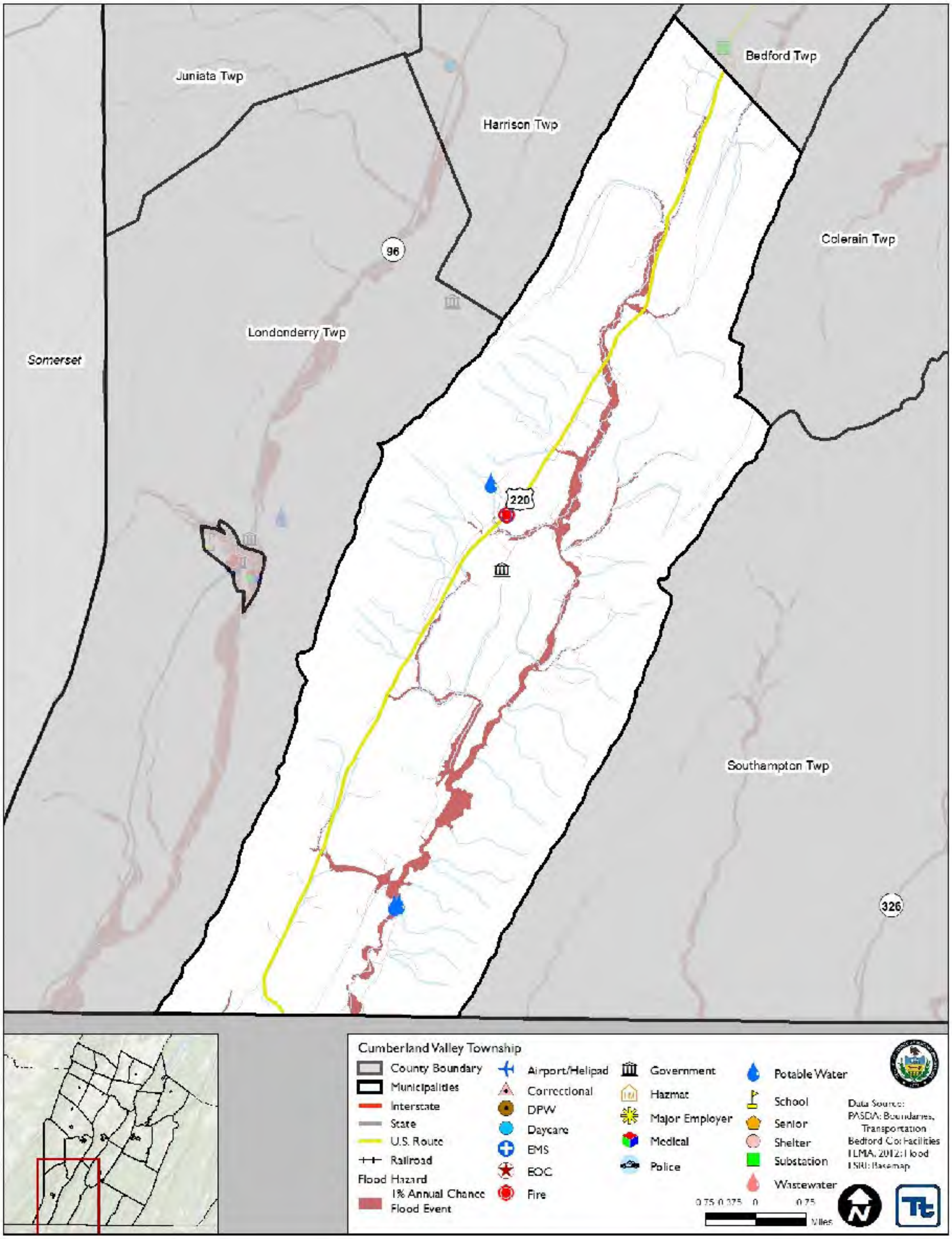

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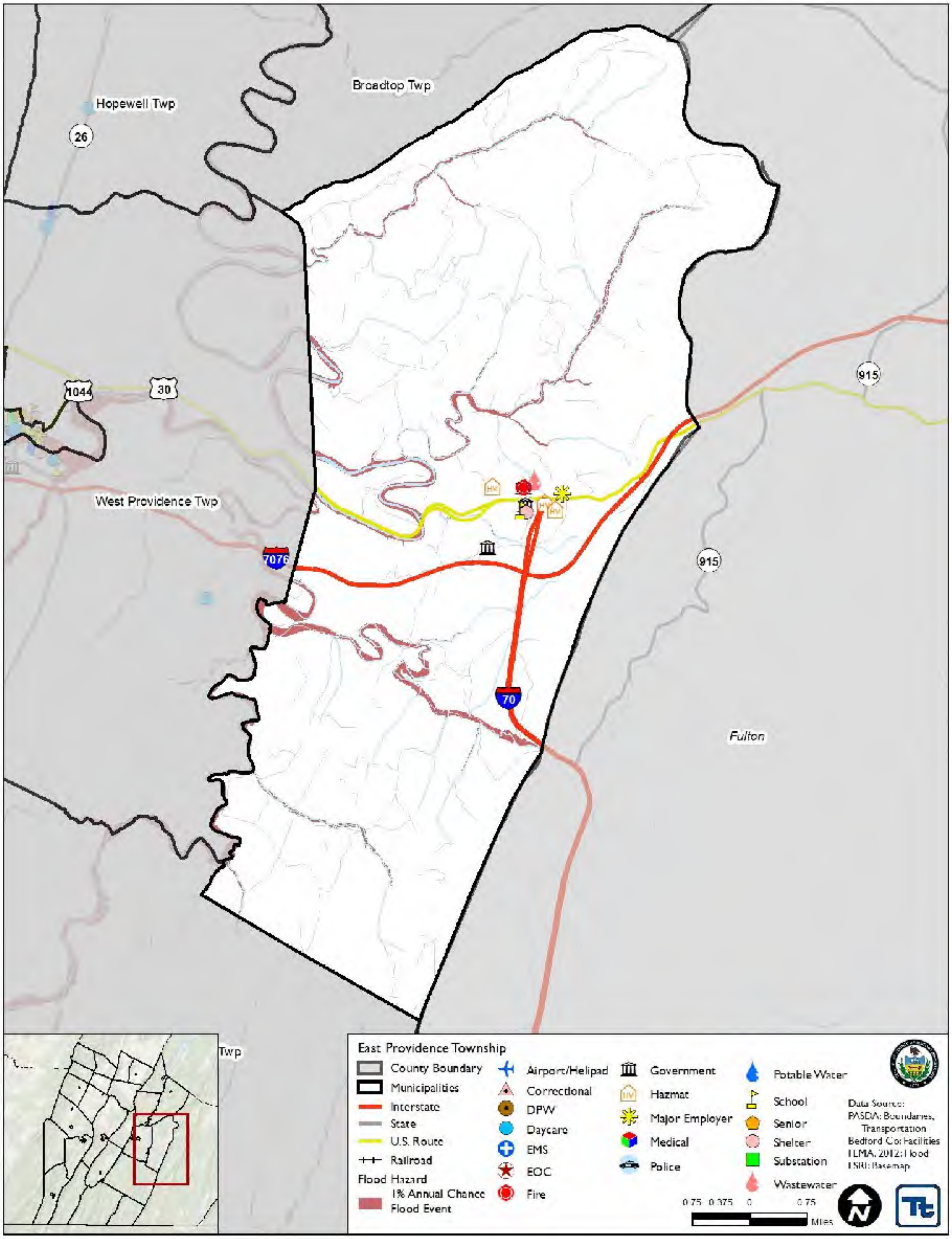

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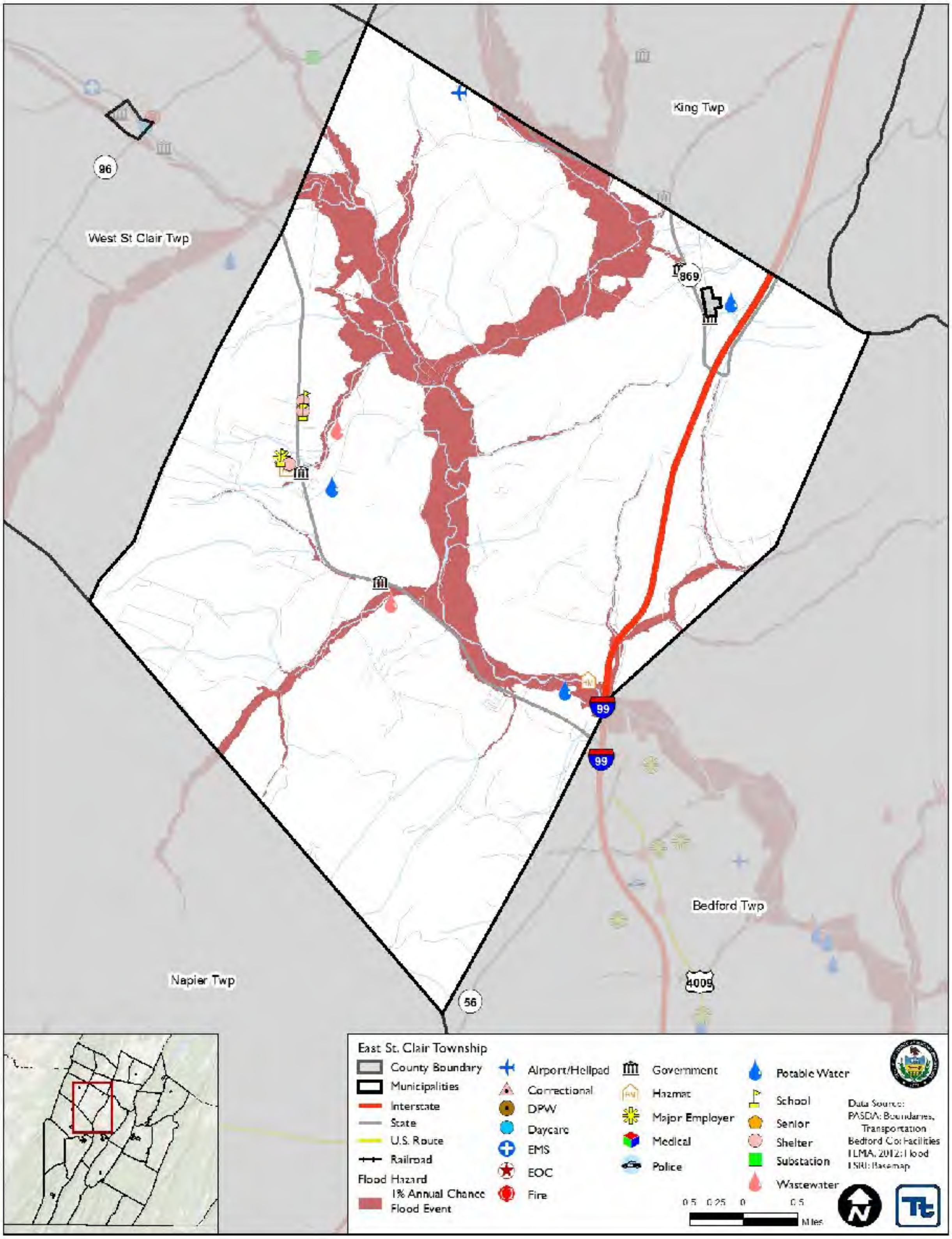

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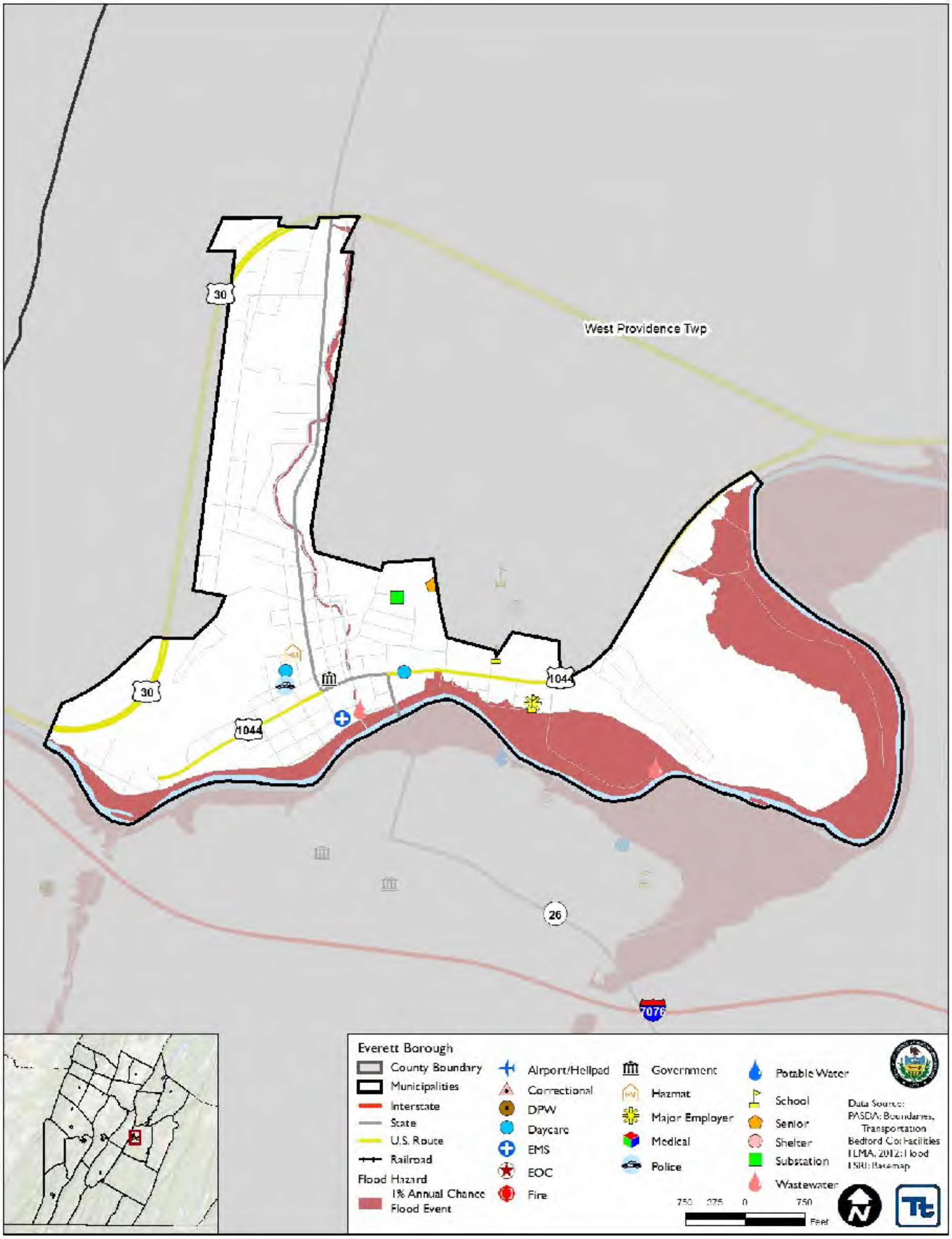

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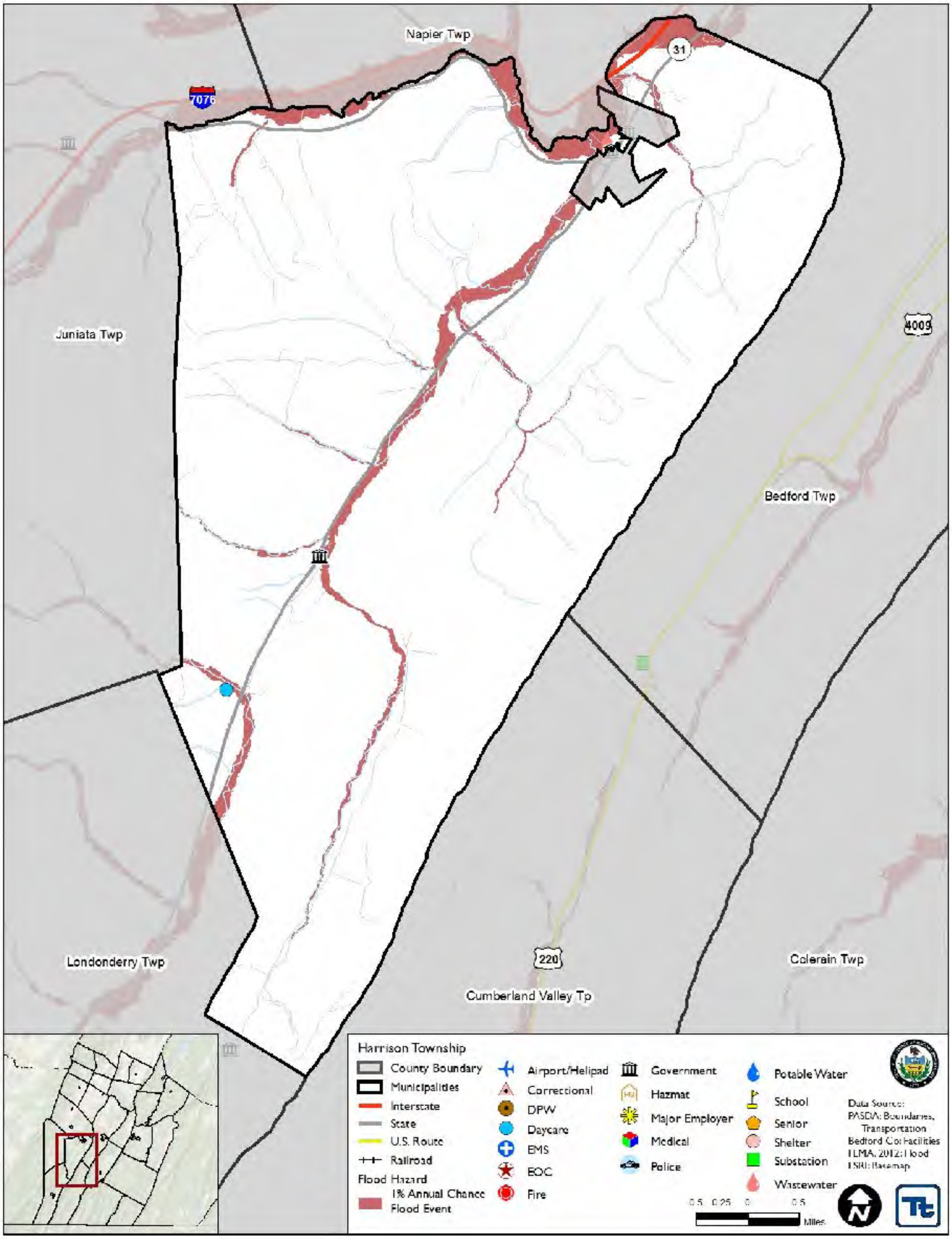

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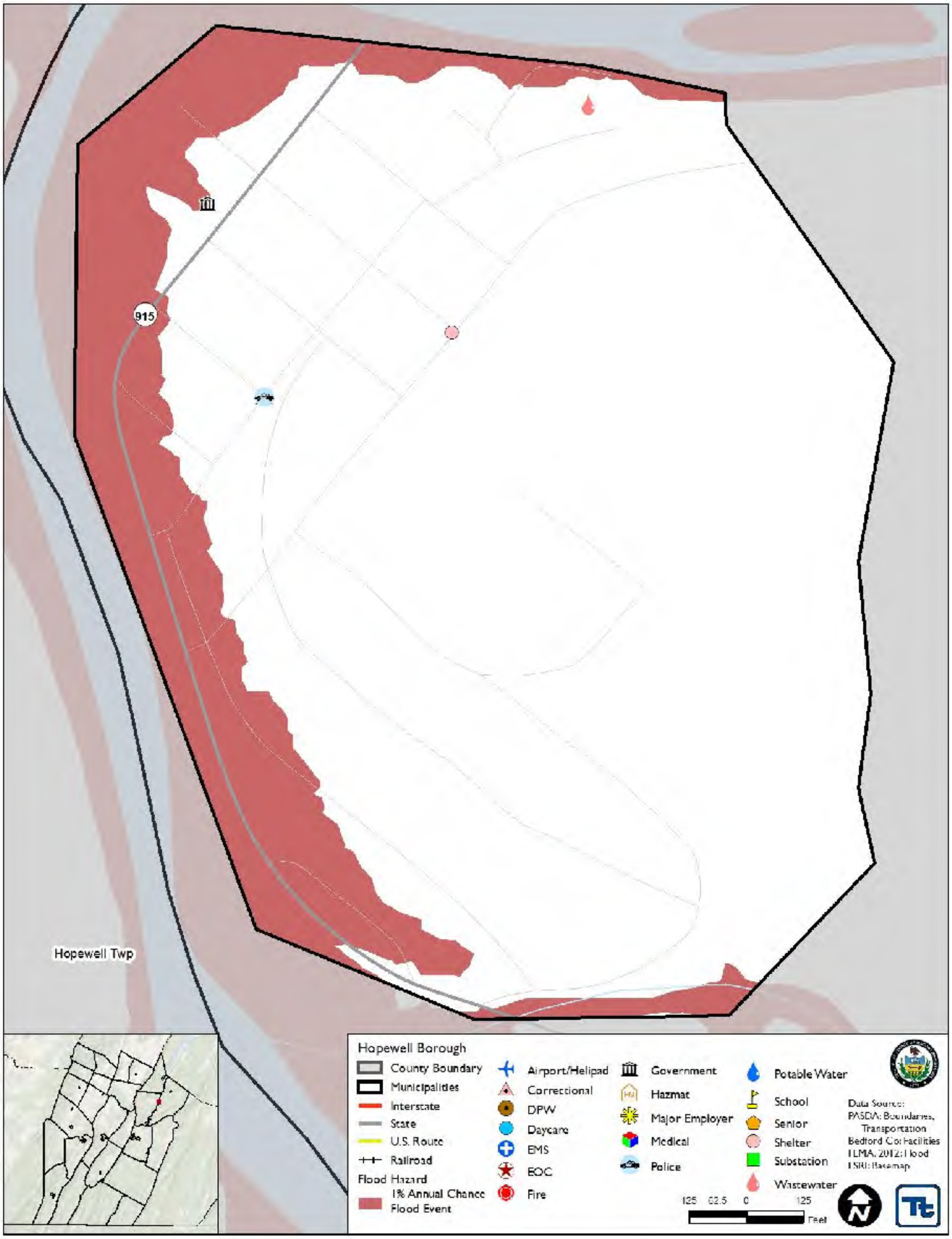

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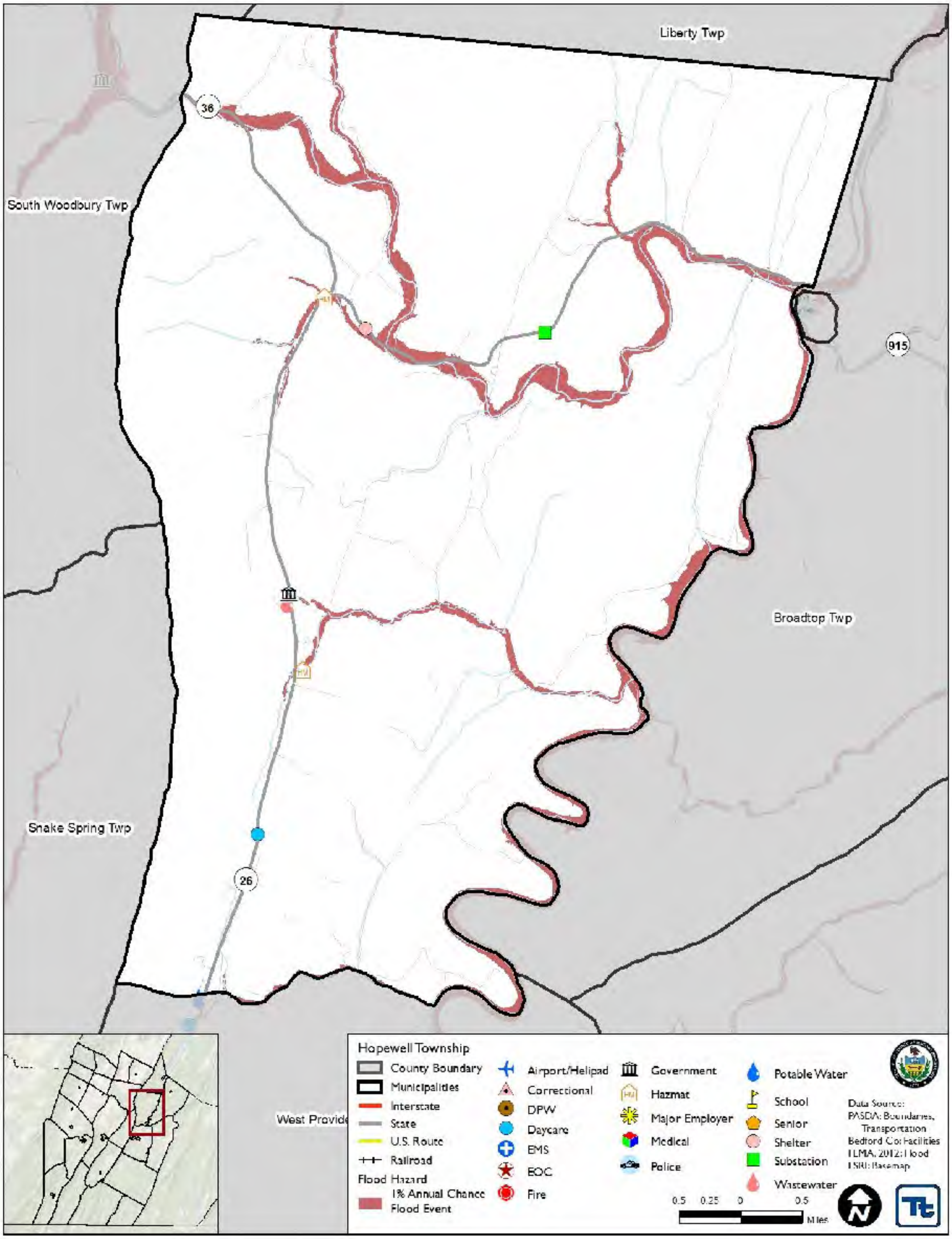
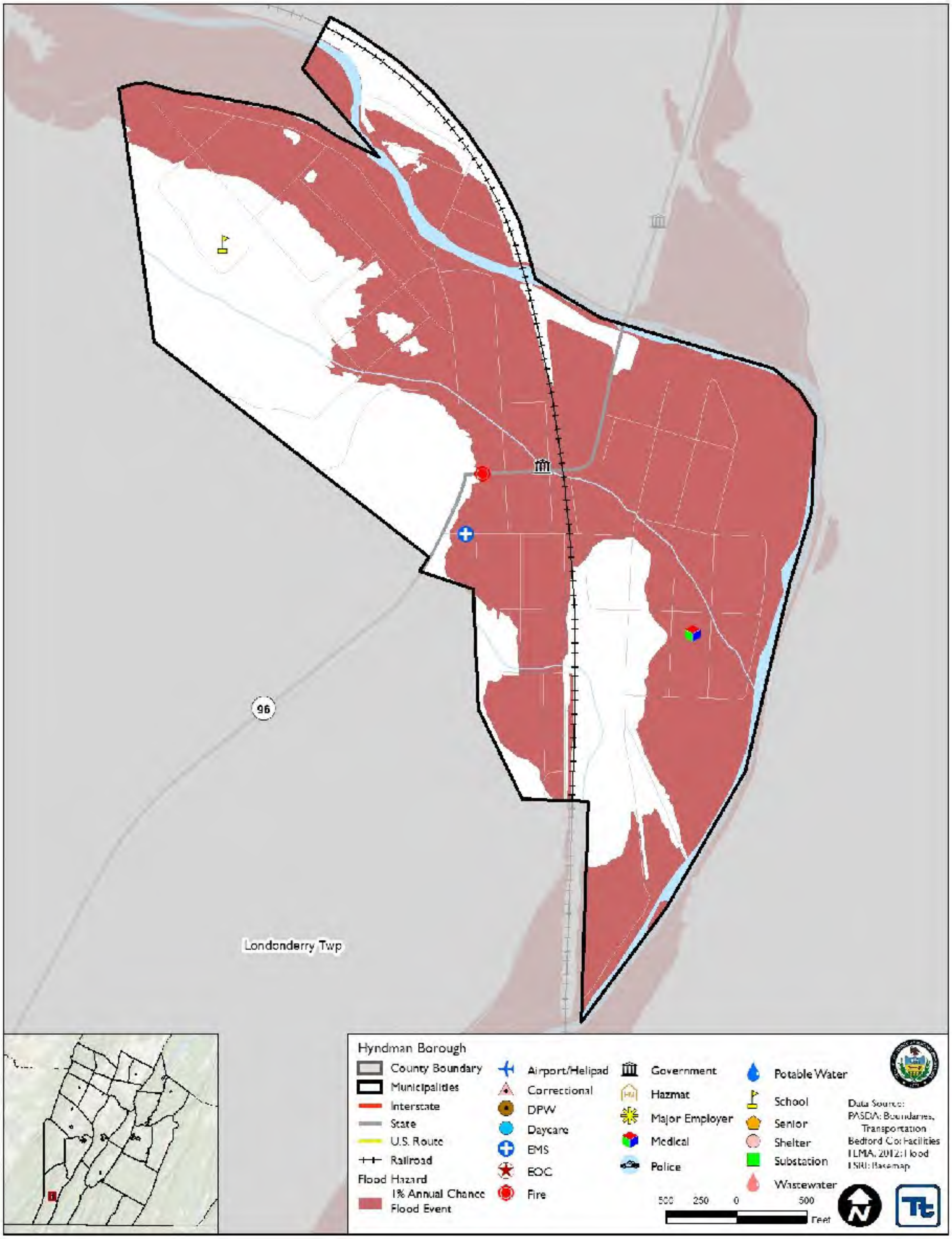


HYNDMAN BOROUGH



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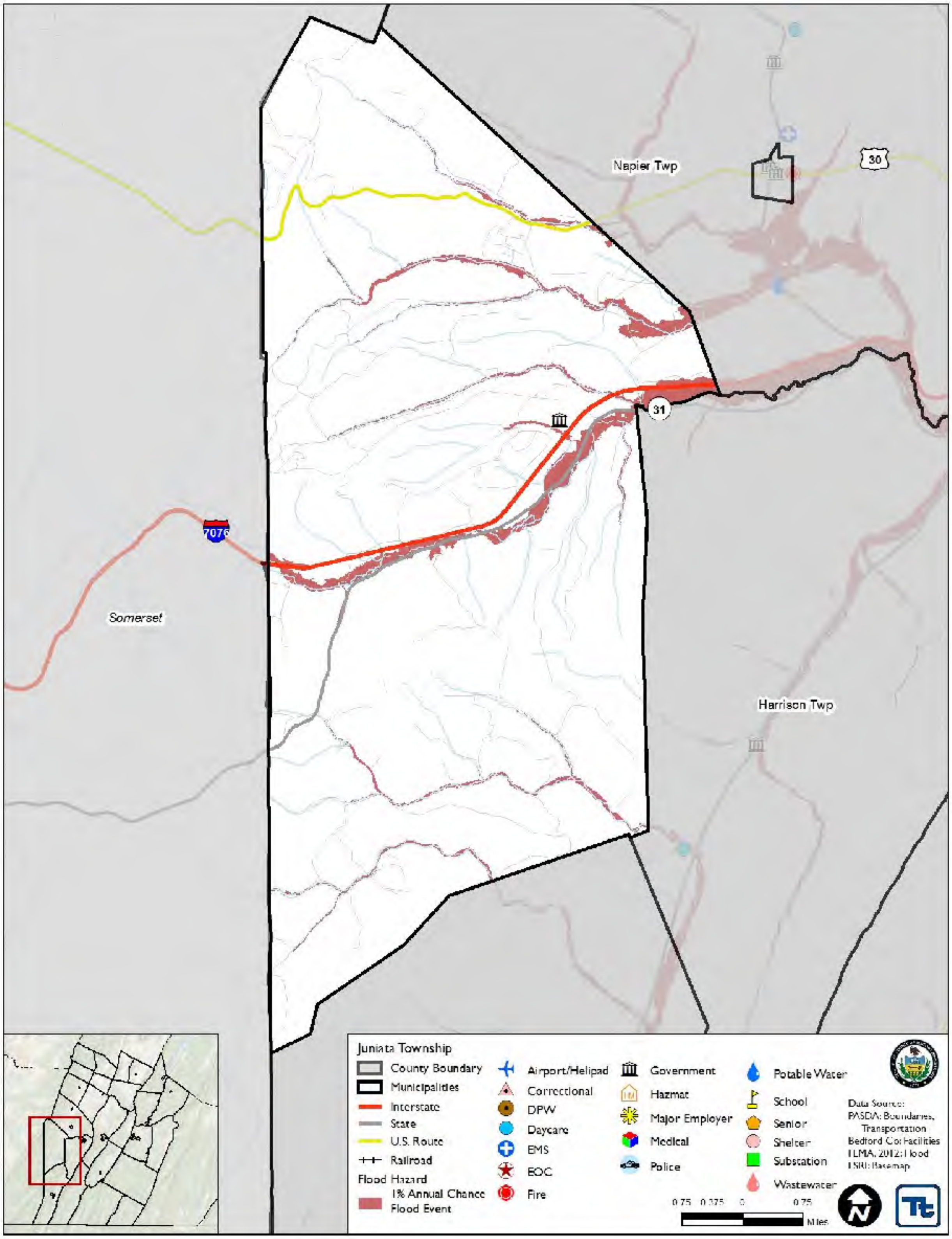

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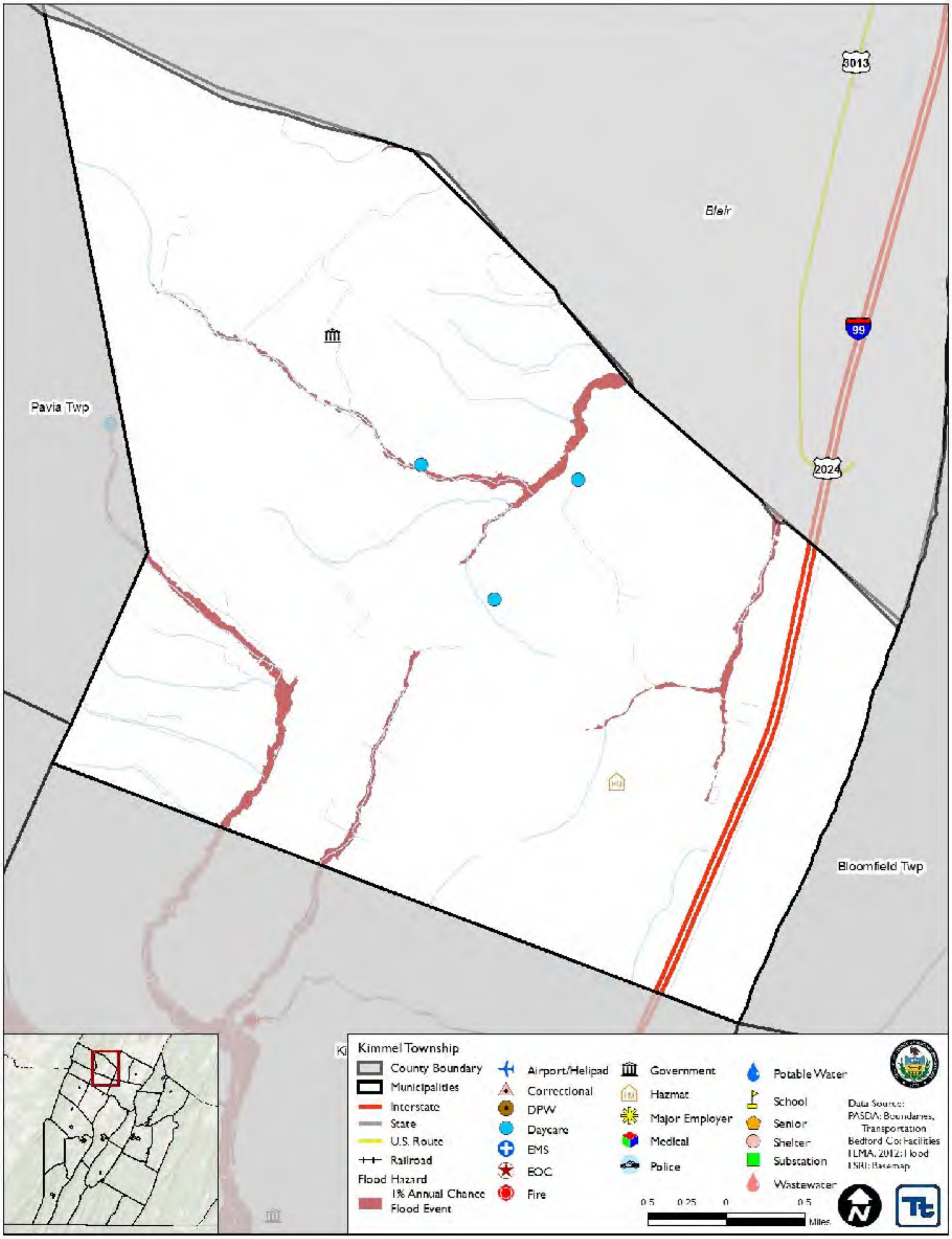

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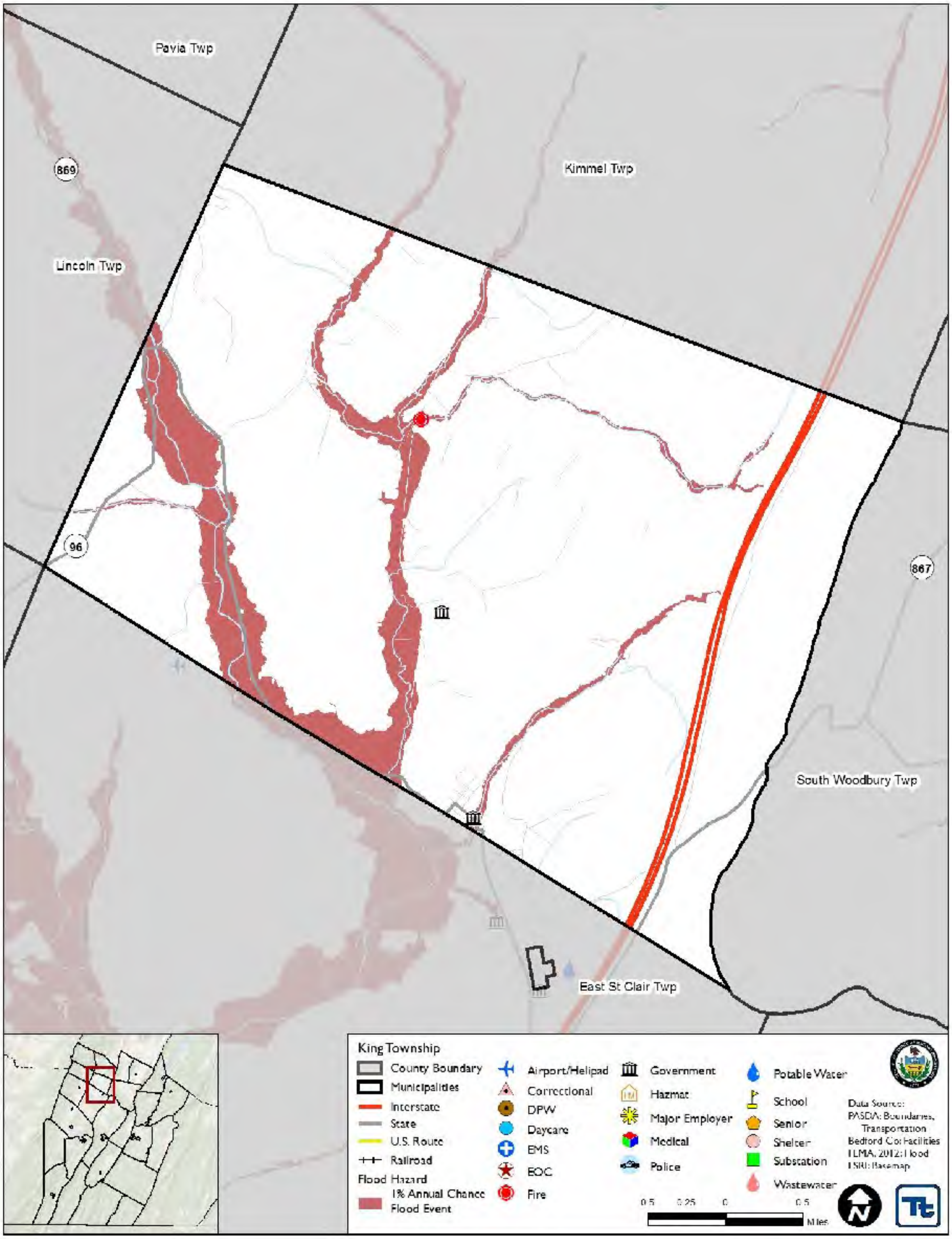

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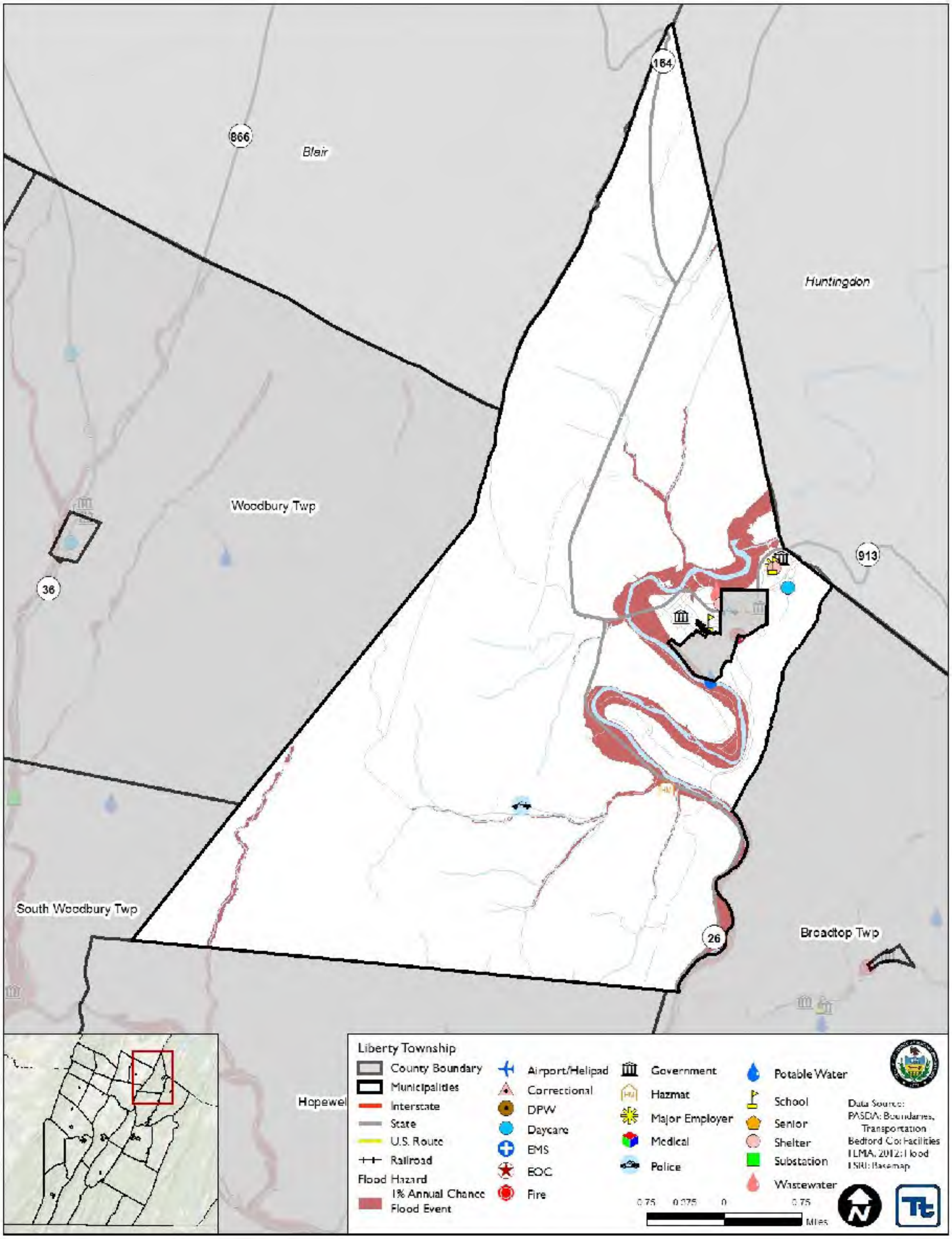

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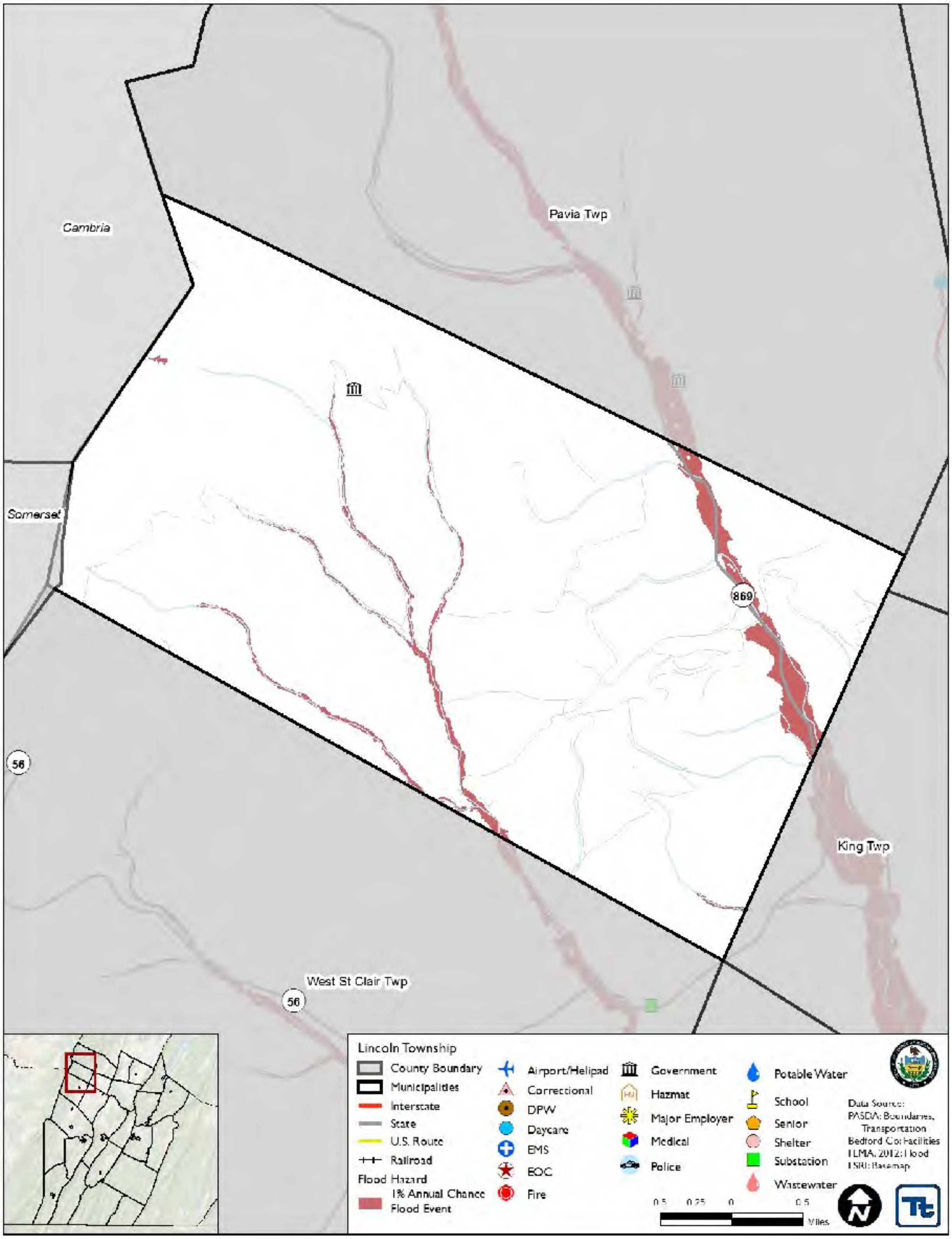

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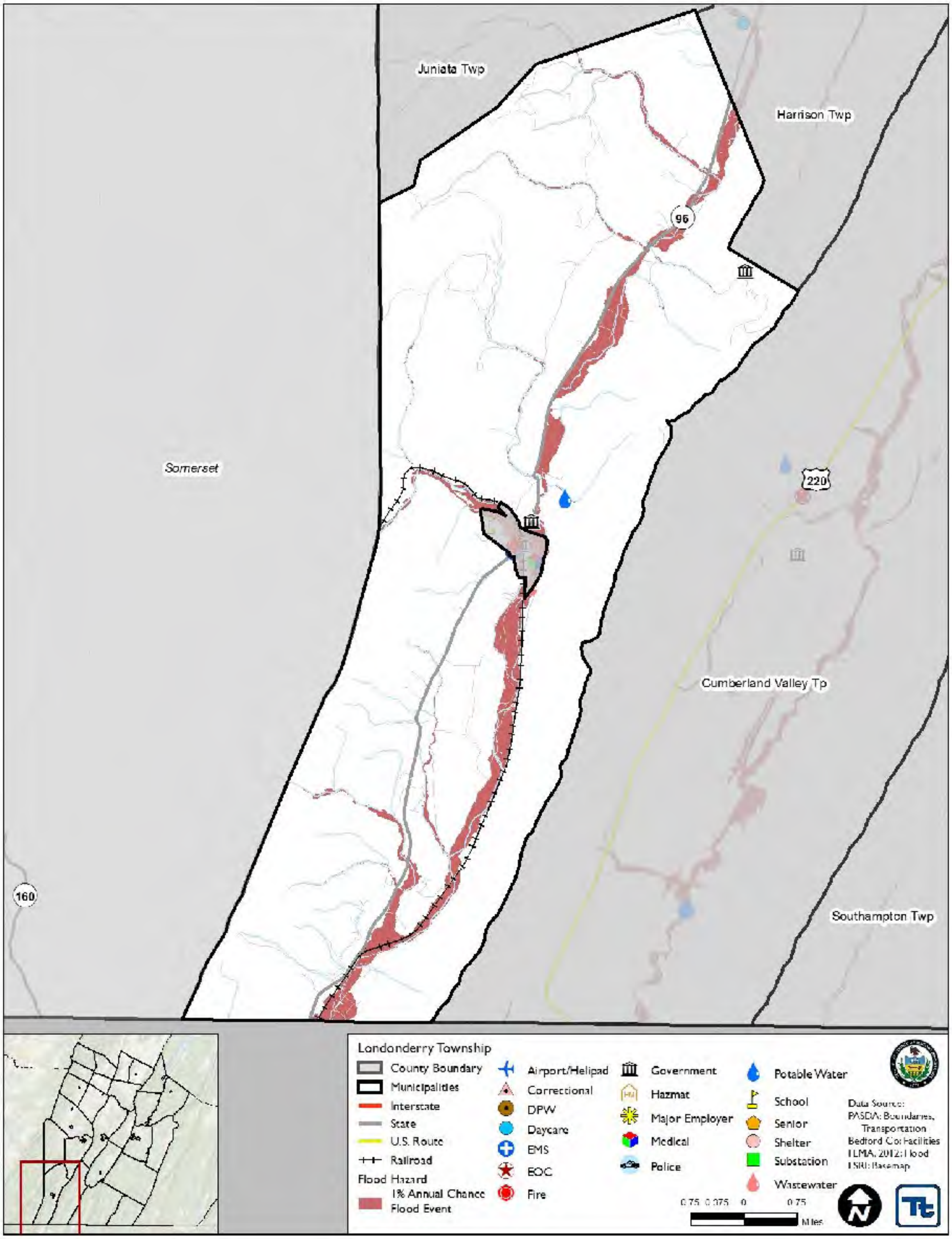

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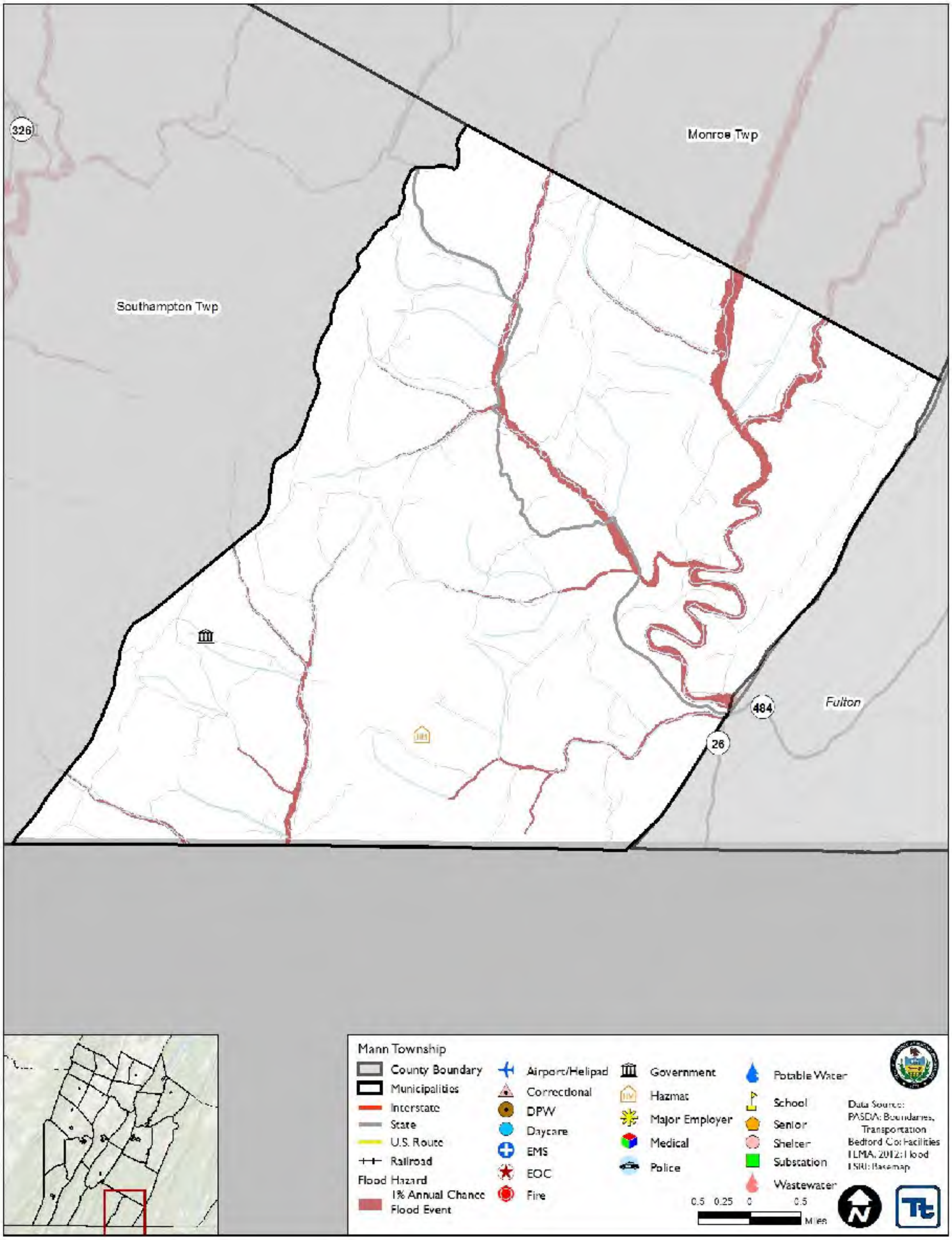
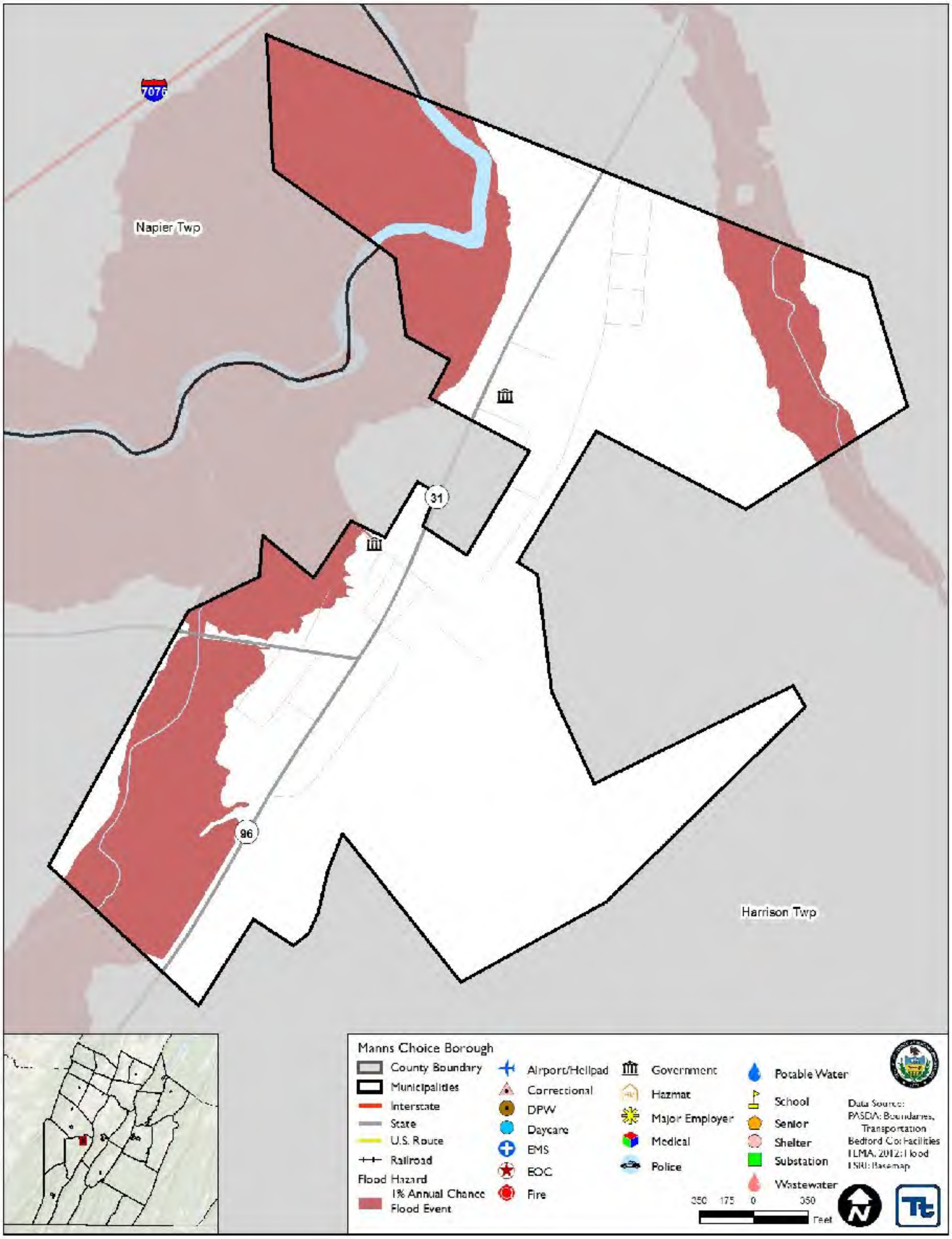


MANNS CHOICE BOROUGH



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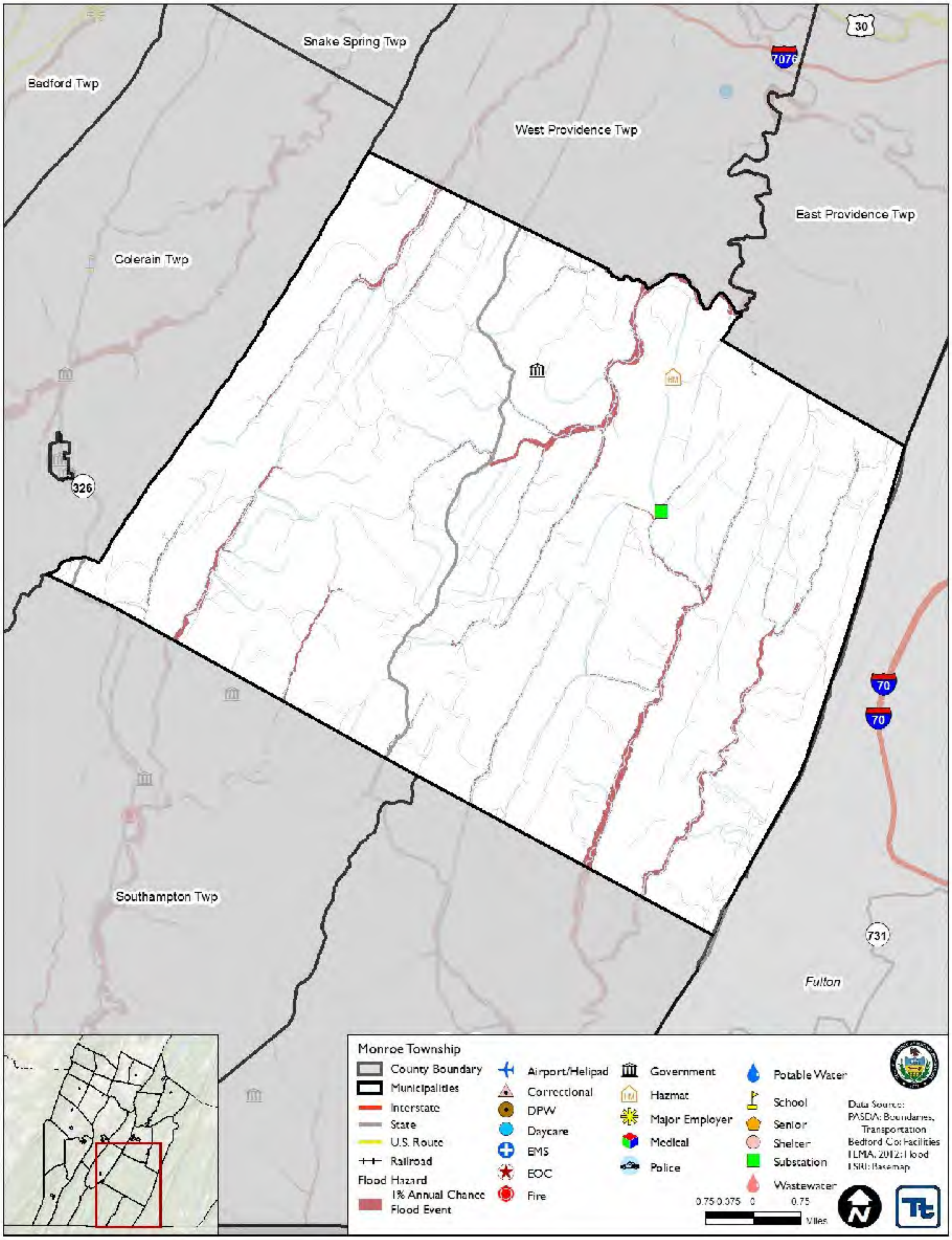
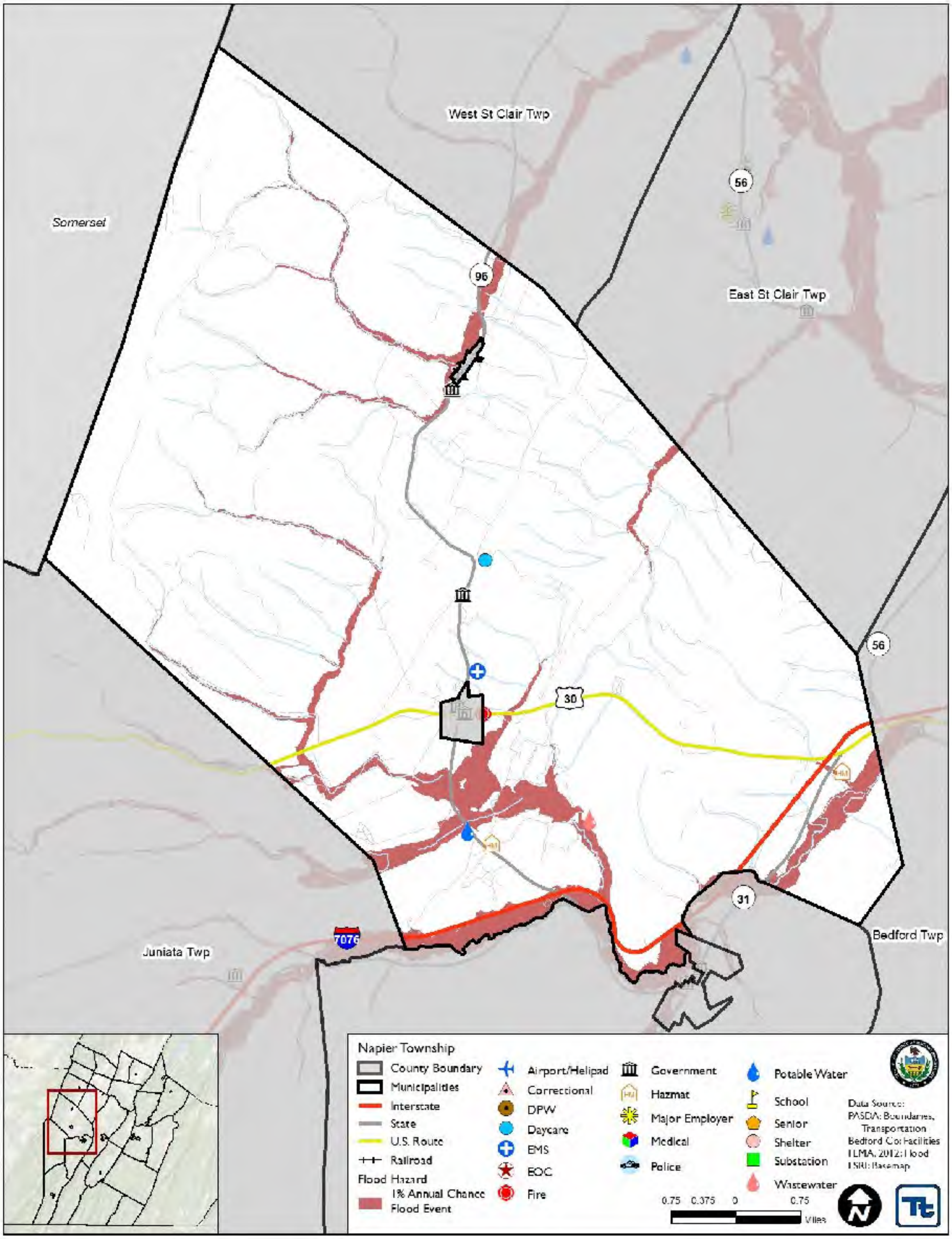


NAPIER TOWNSHIP



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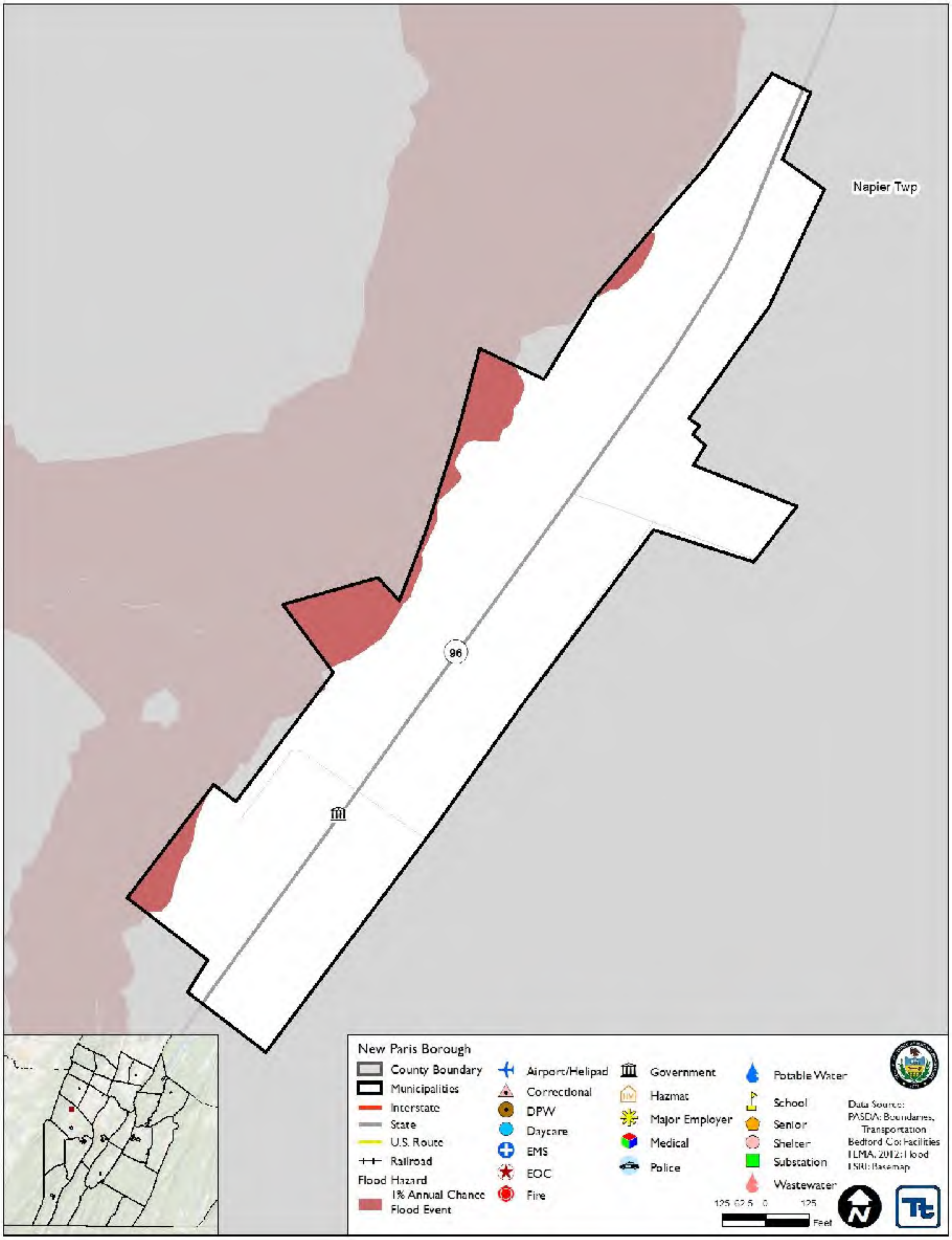

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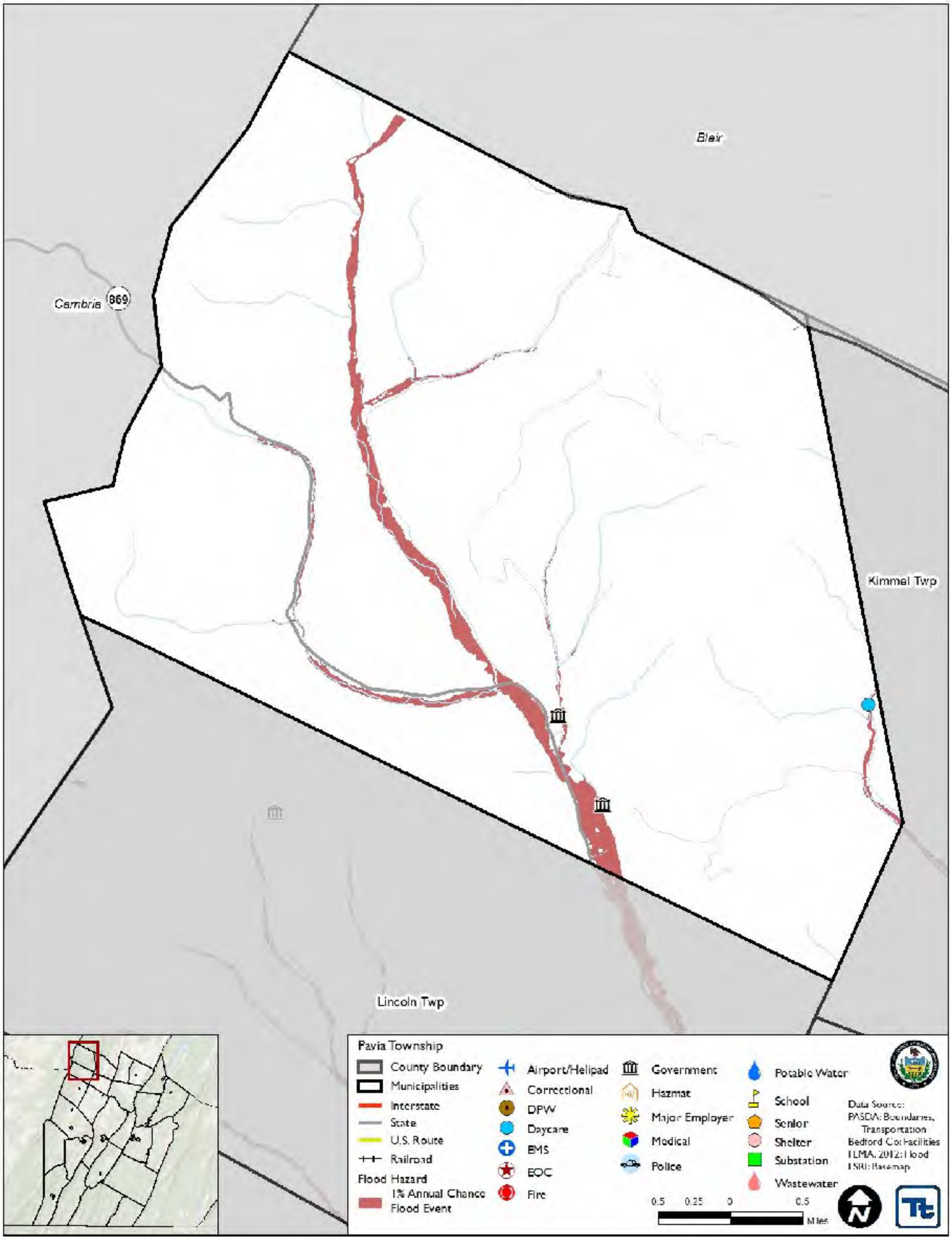
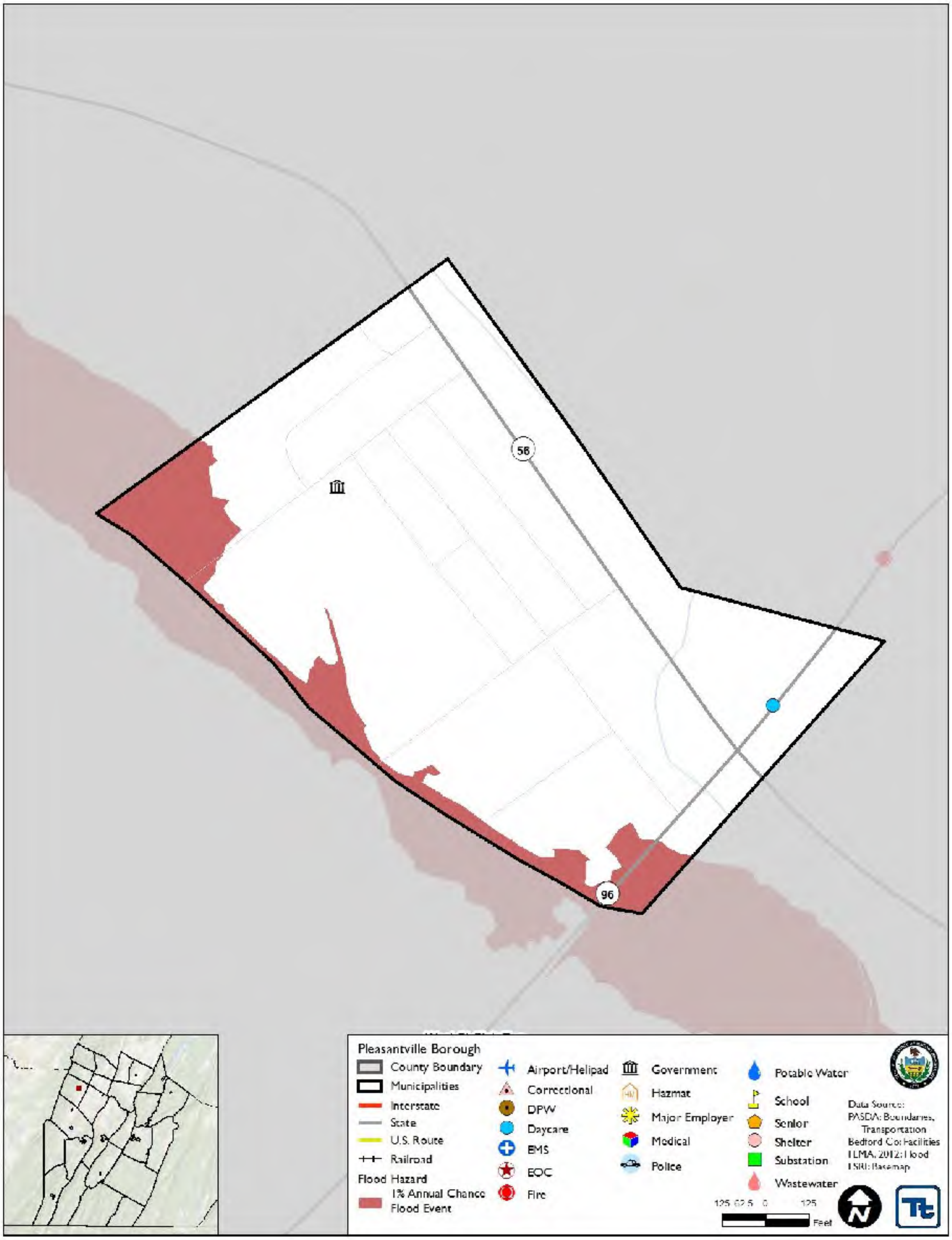
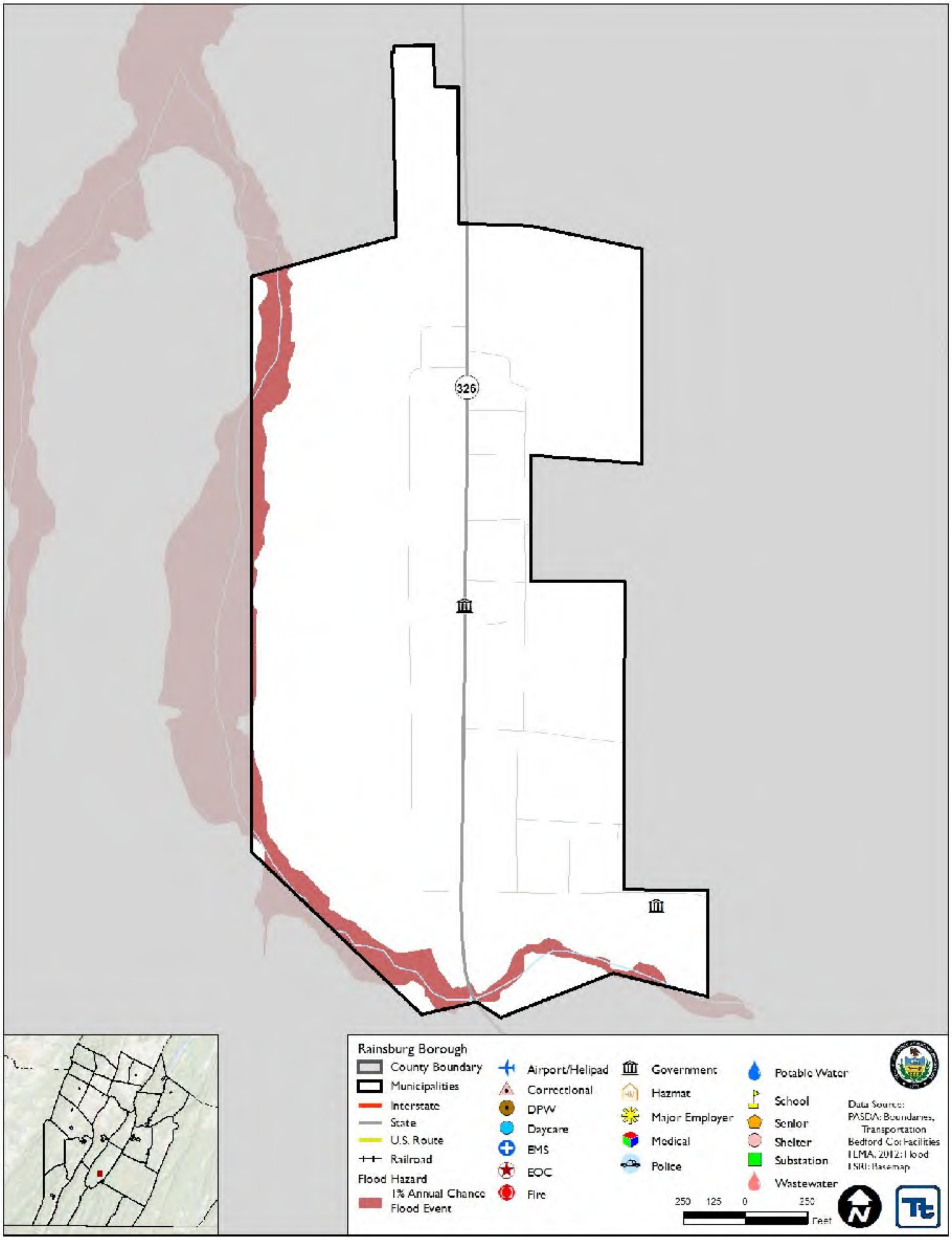


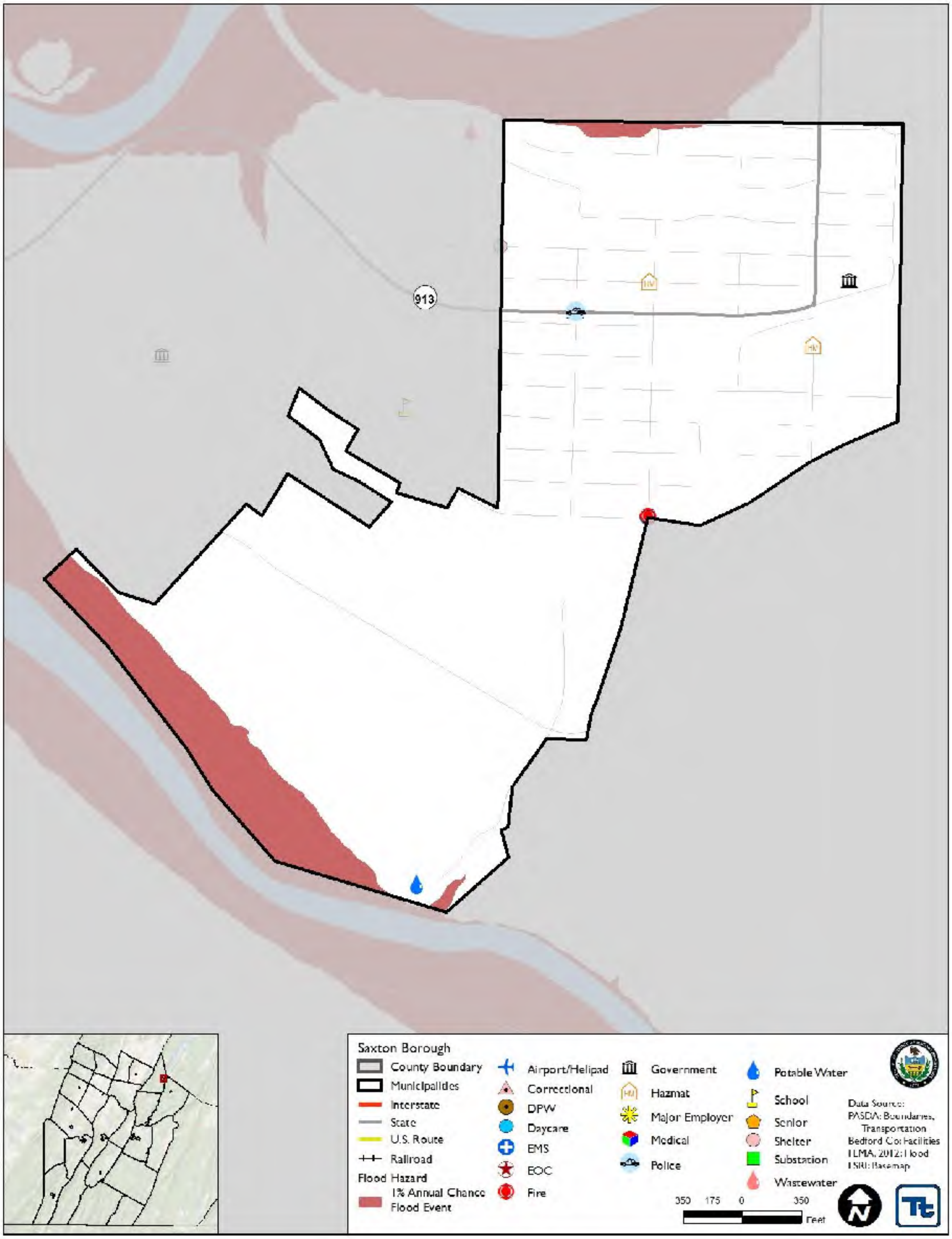
PLEASANTVILLE BOROUGH



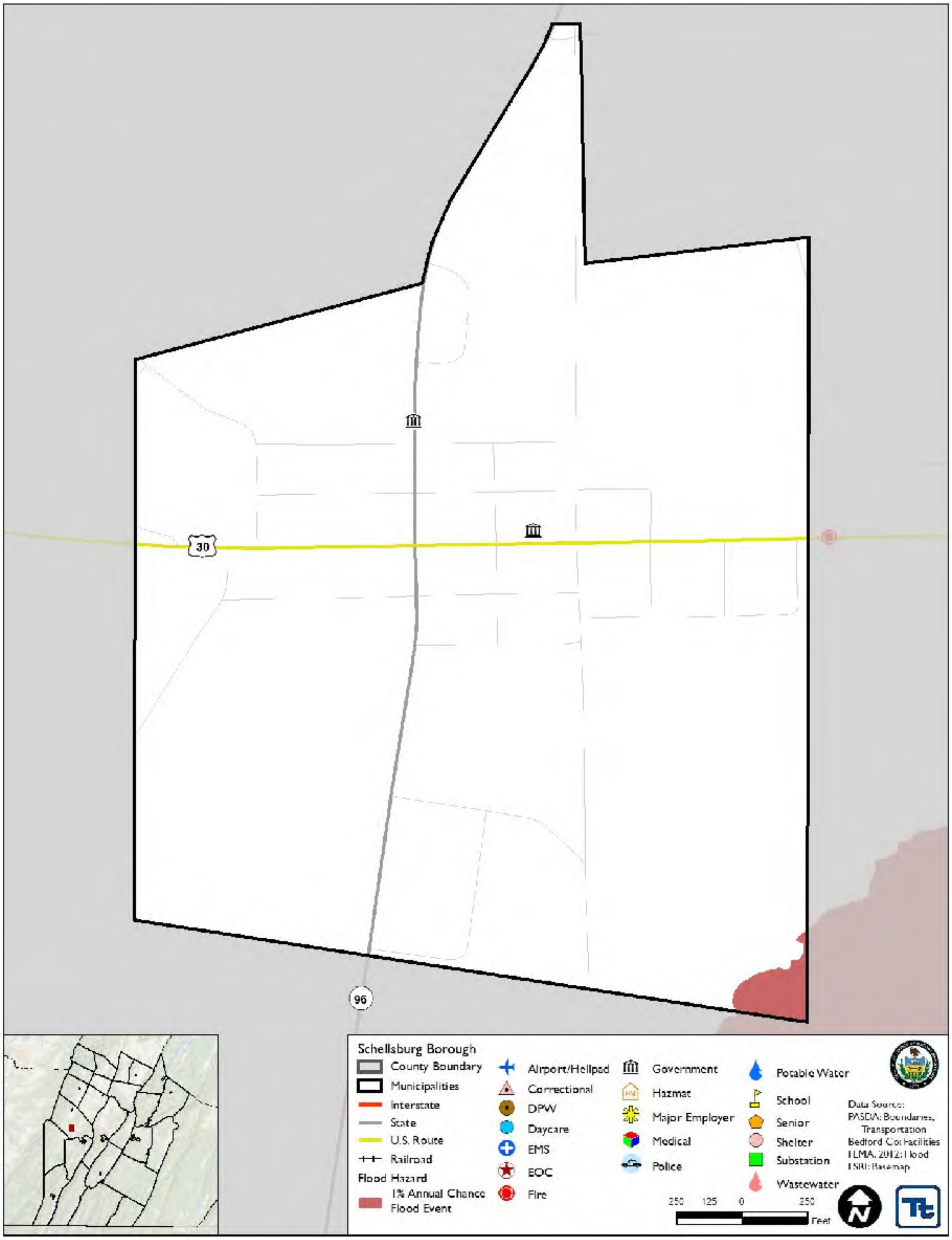
RAINSBURG BOROUGH



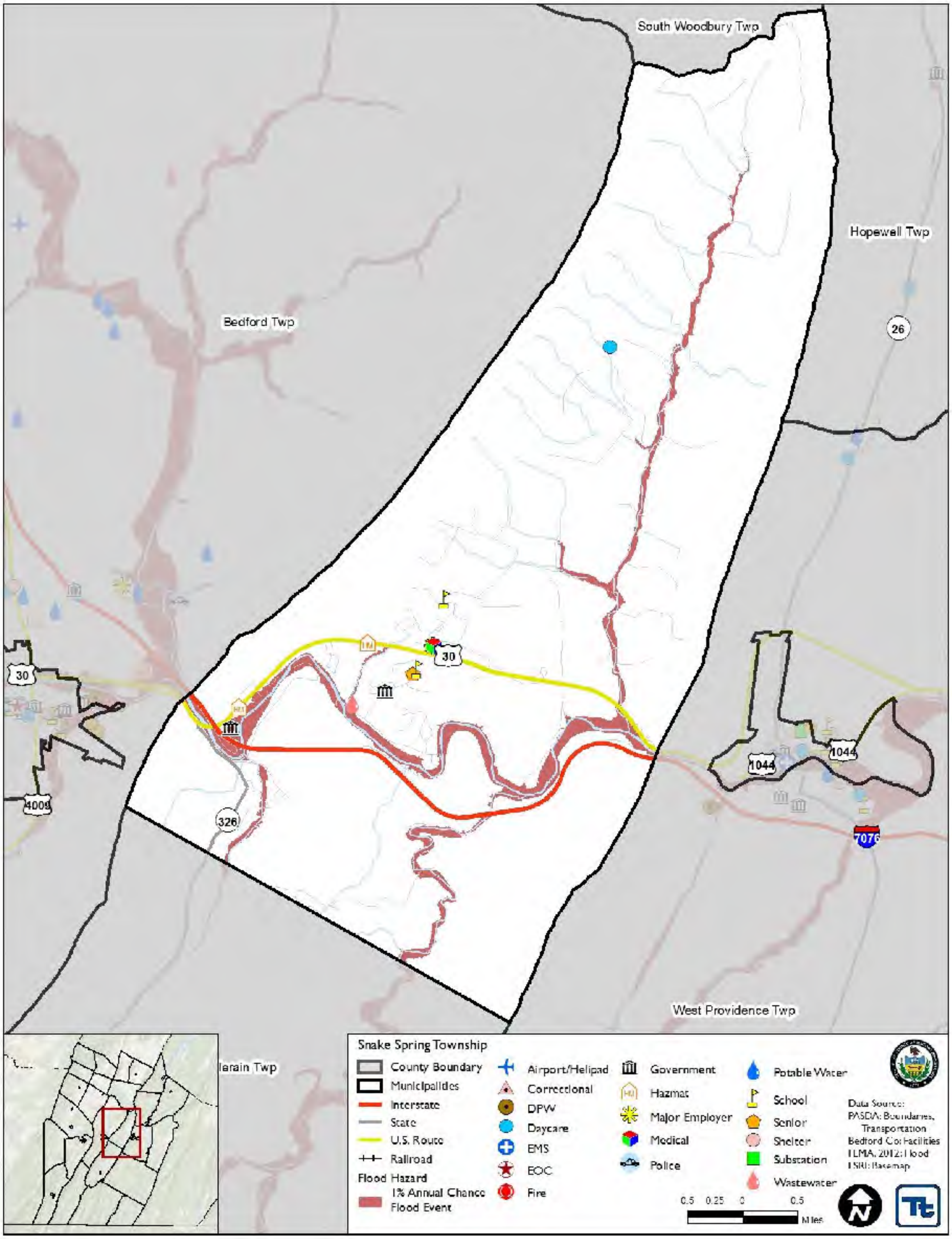
SAXTON BOROUGH



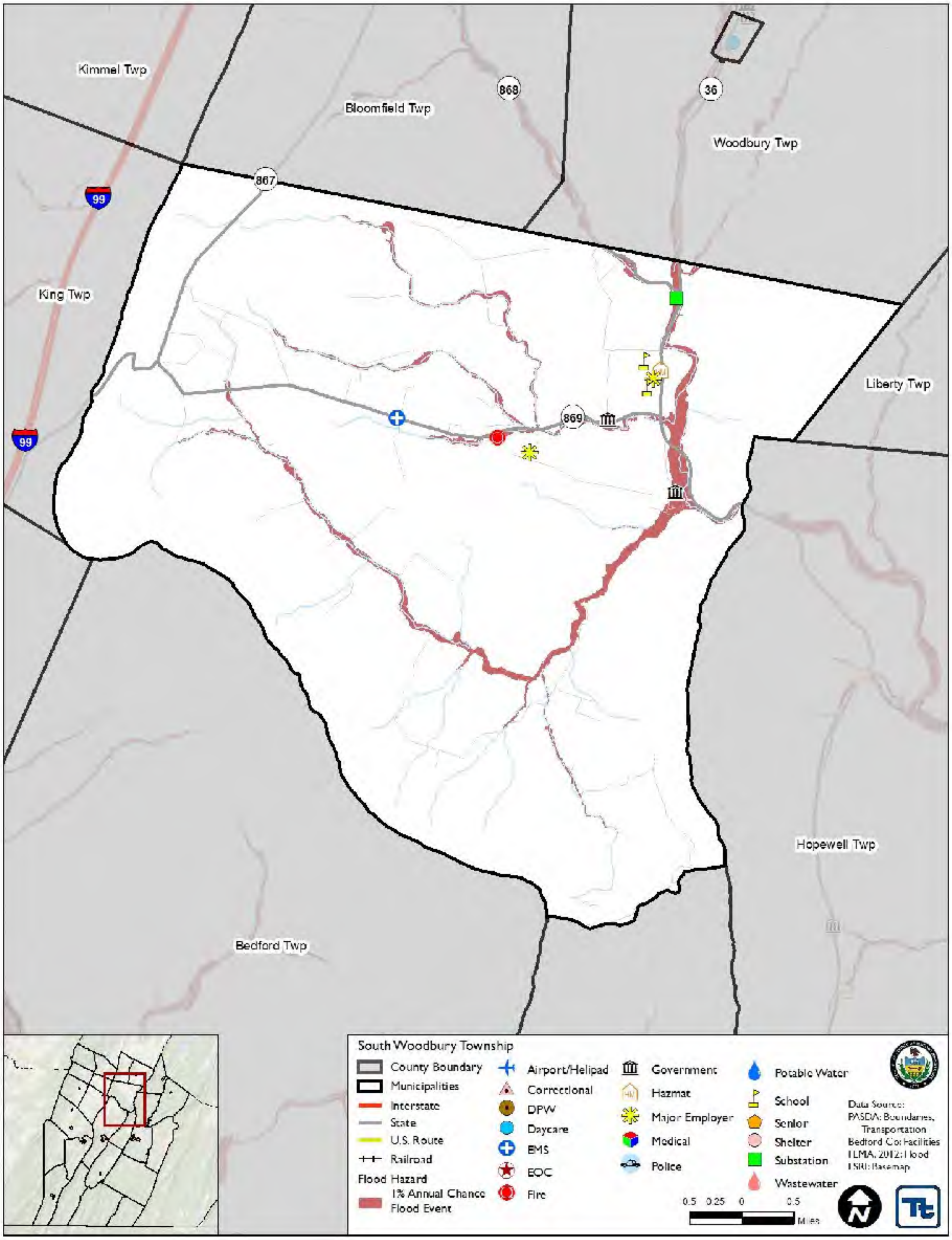
SCHELLSBURG BOROUGH



SNAKE SPRING TOWNSHIP



SOUTH WOODBURY TOWNSHIP



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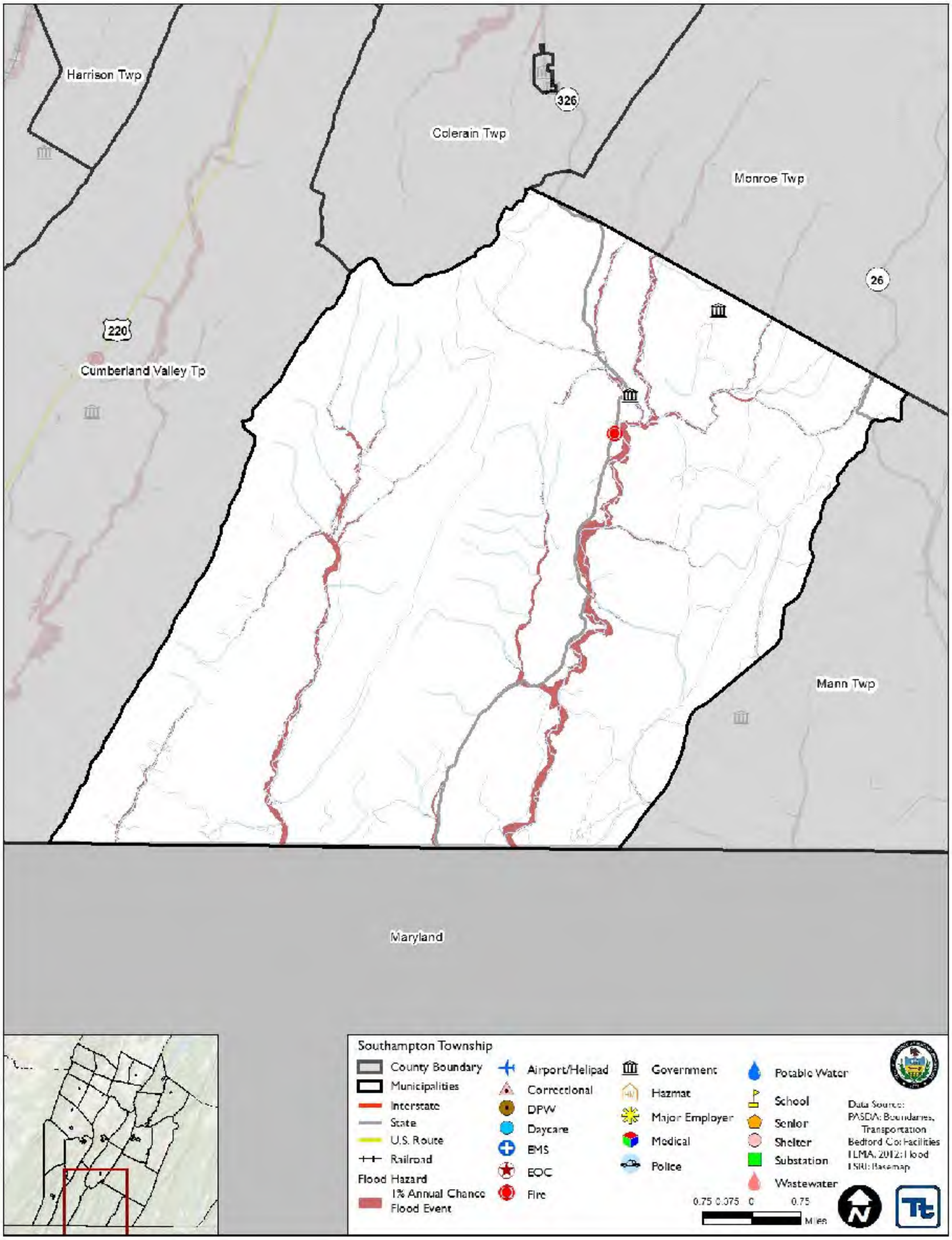
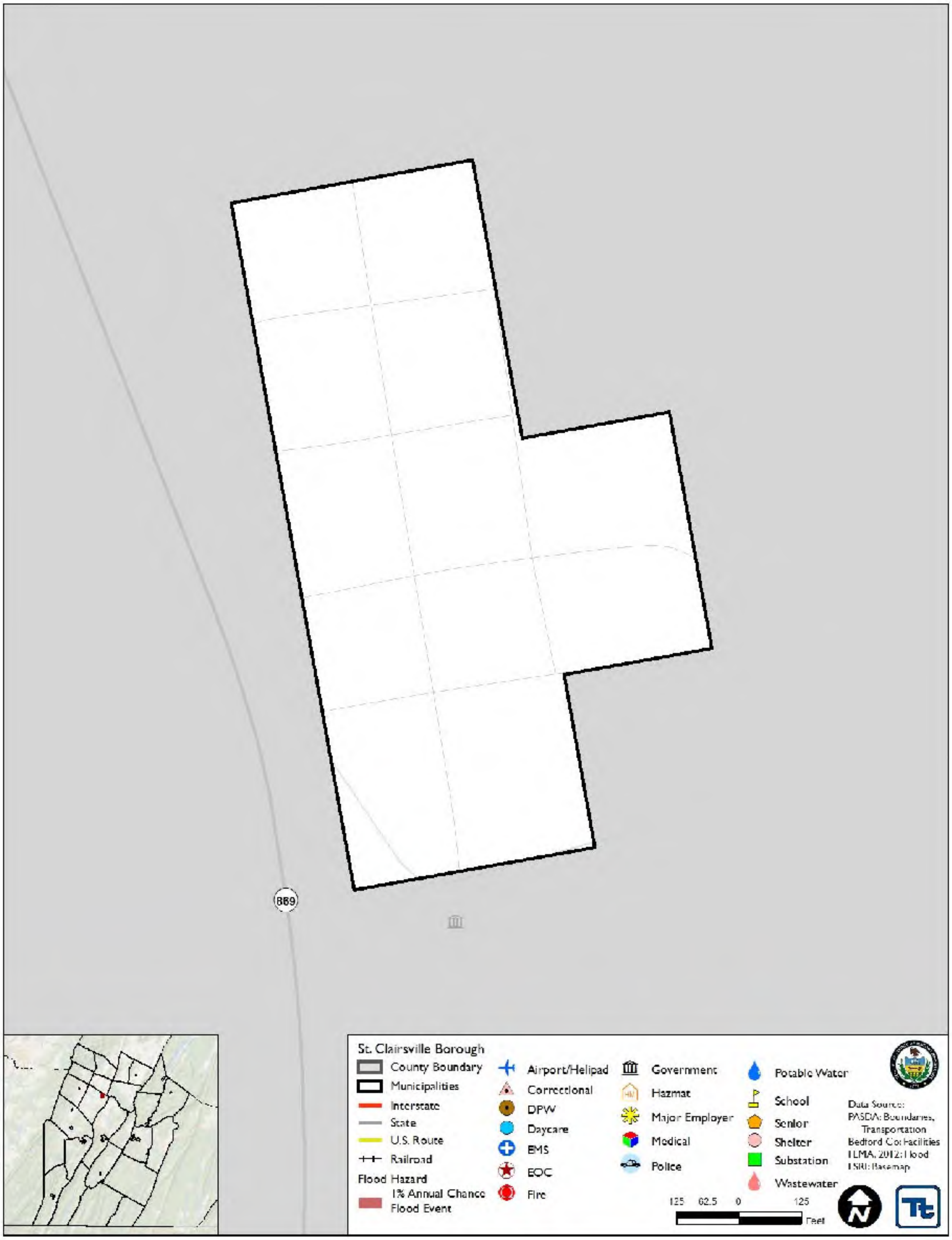
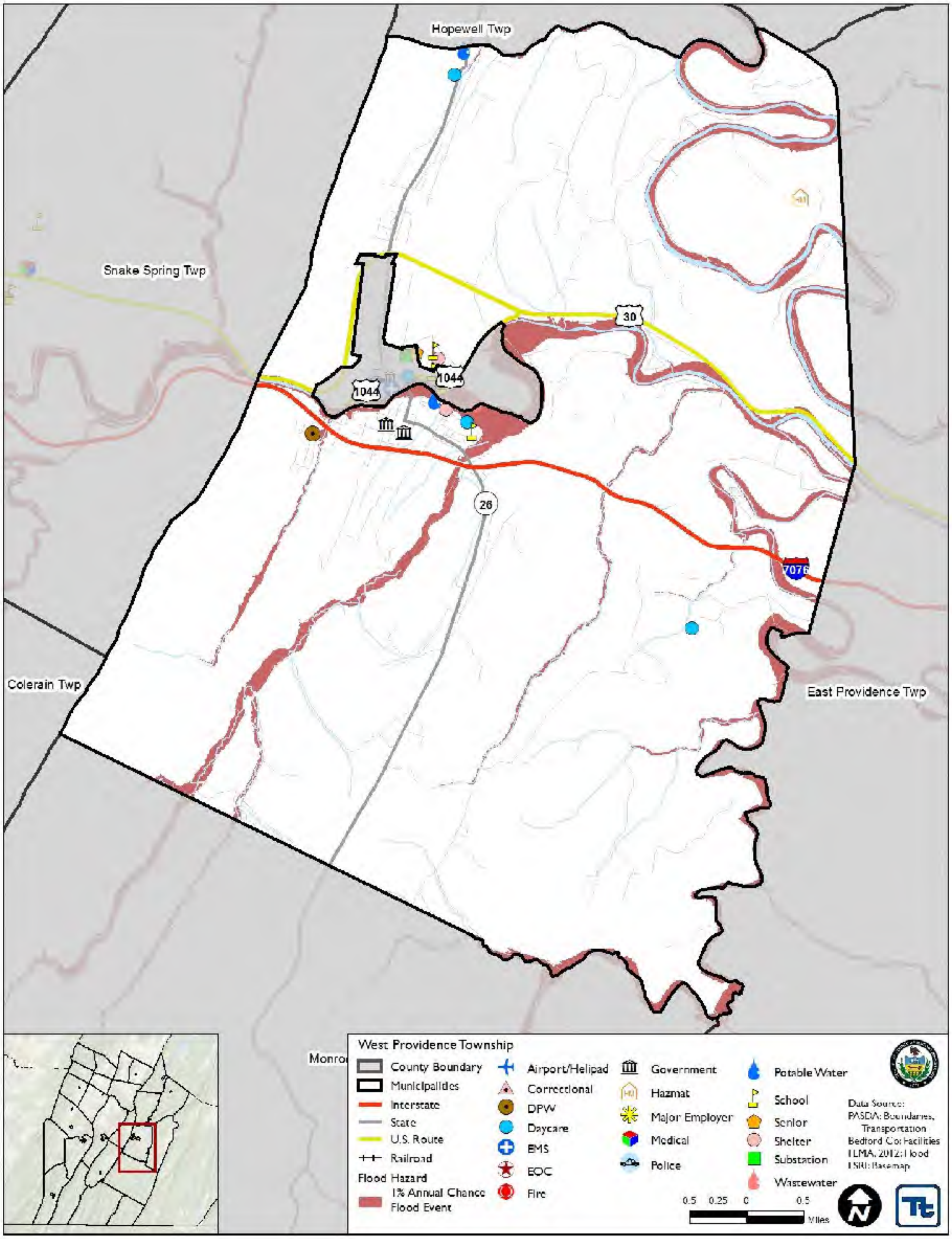


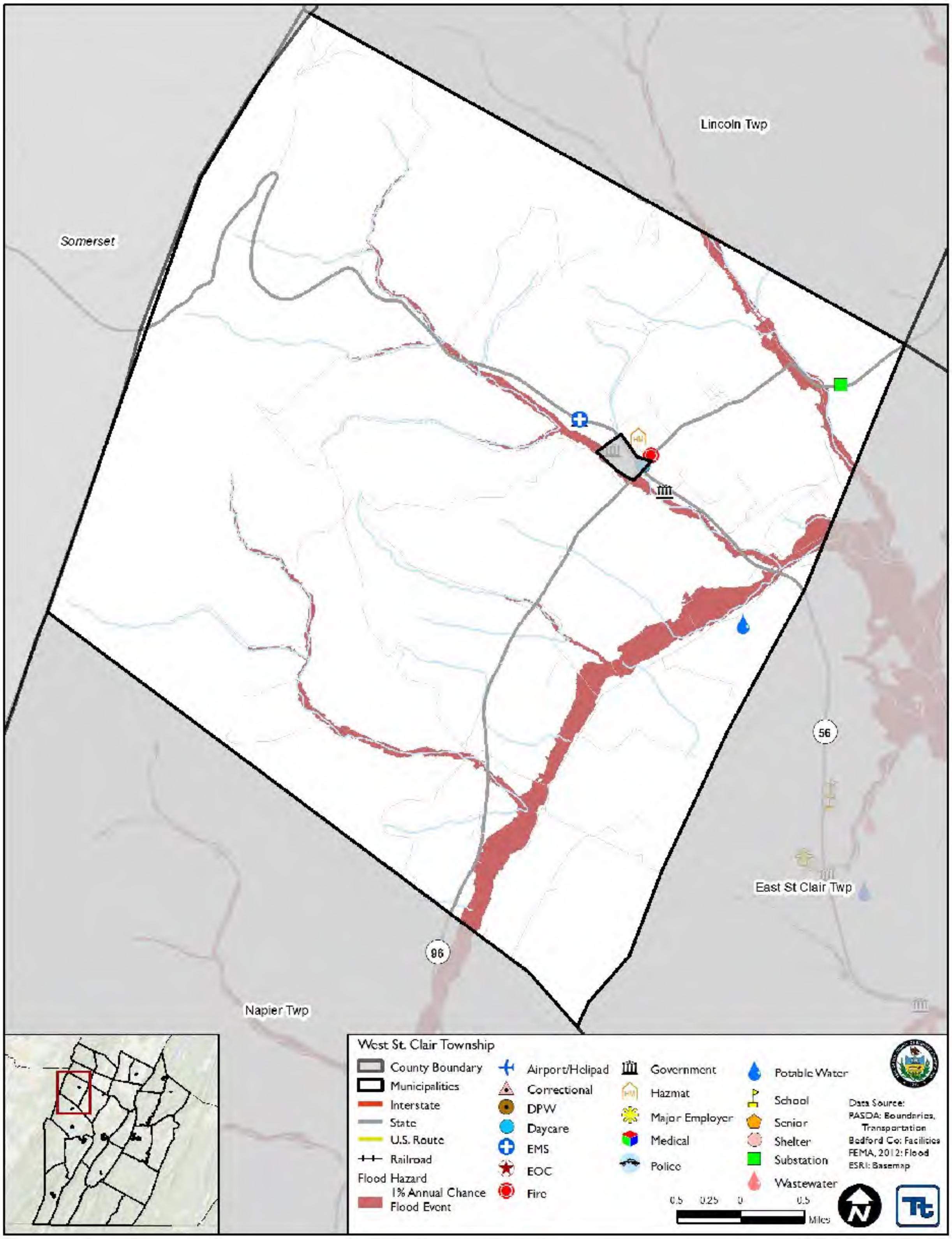
ST. CLAIRSVILLE BOROUGH



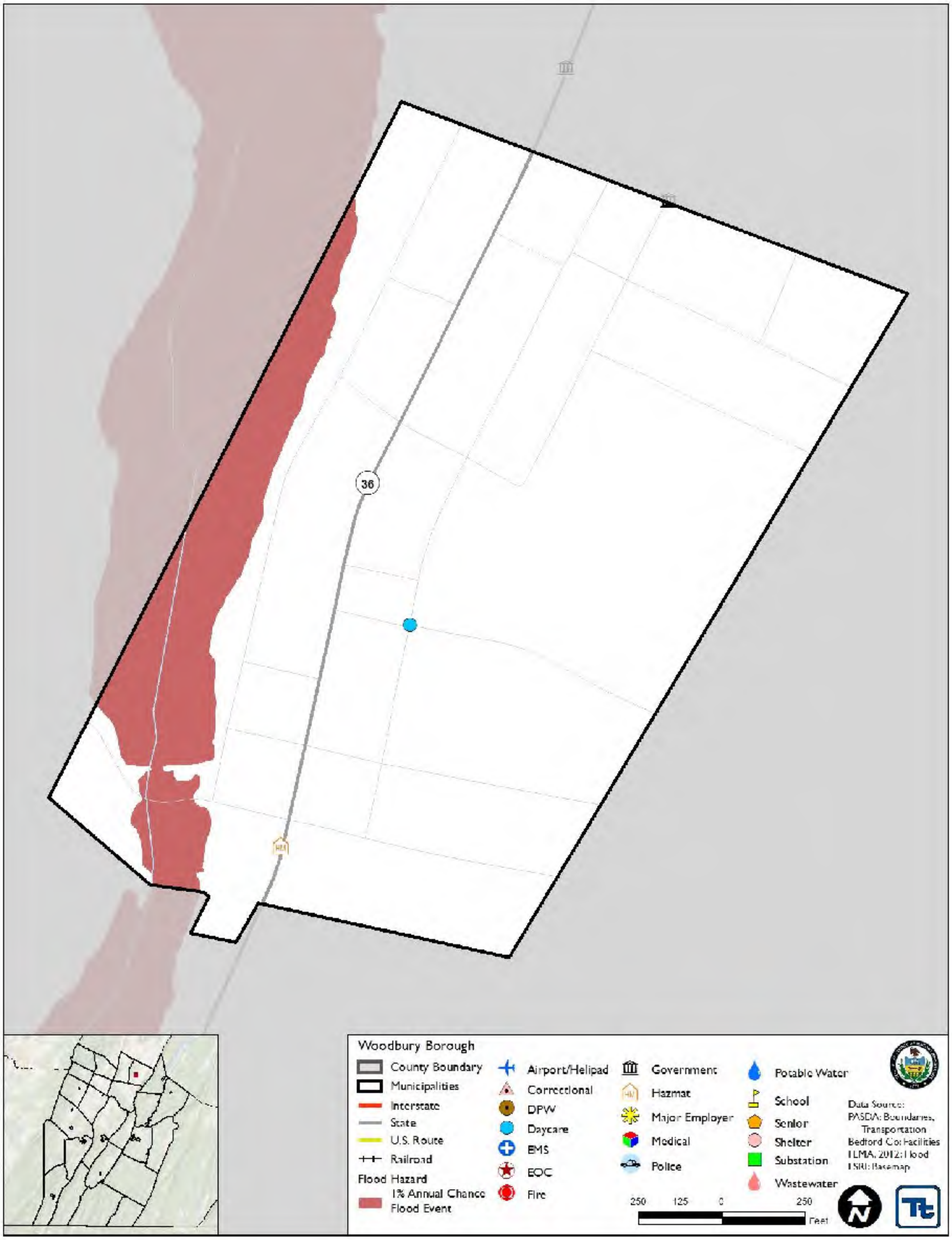
WEST PROVIDENCE TOWNSHIP



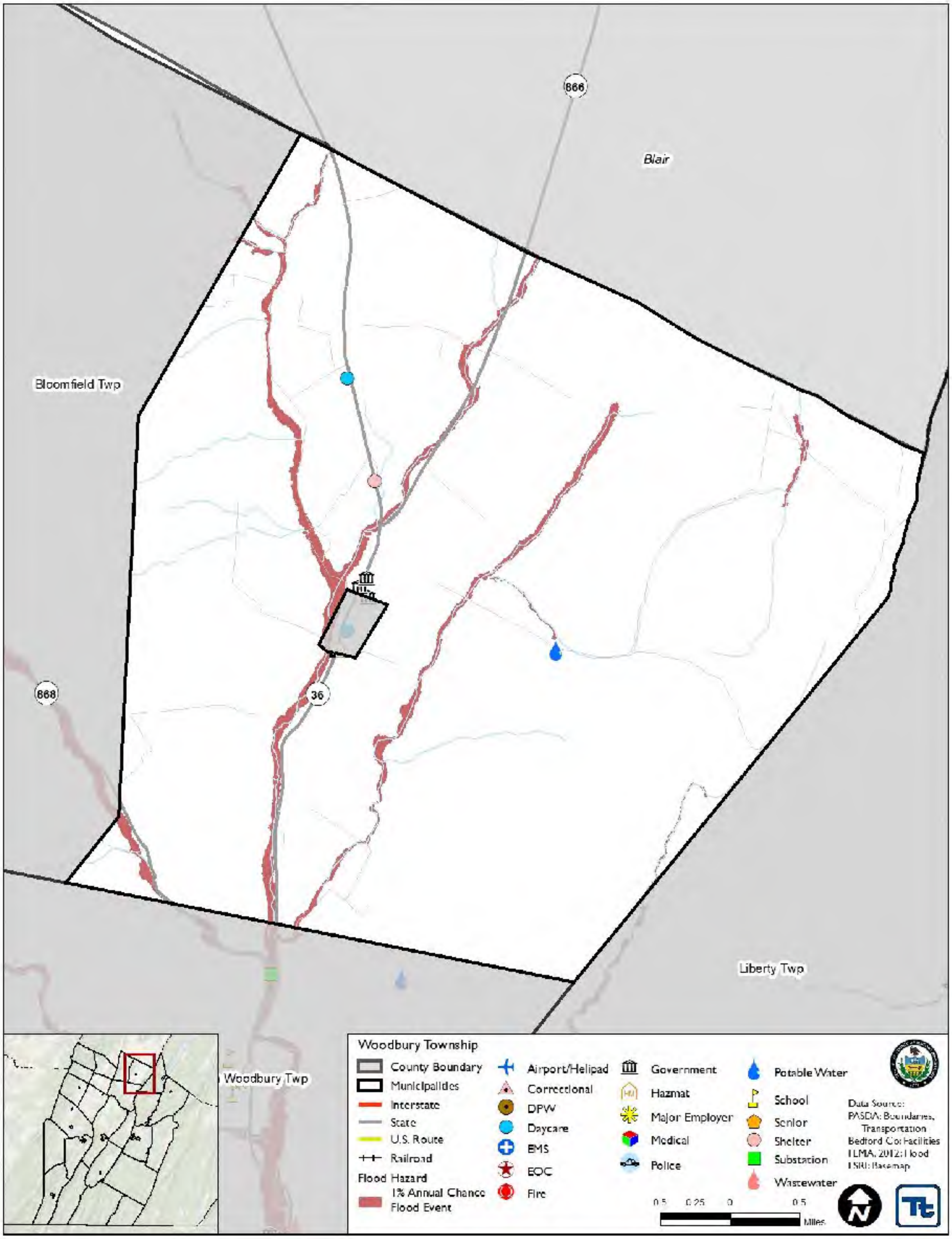
WEST SAINT CLAIR TOWNSHIP



WOODBURY BOROUGH



WOODBURY TOWNSHIP

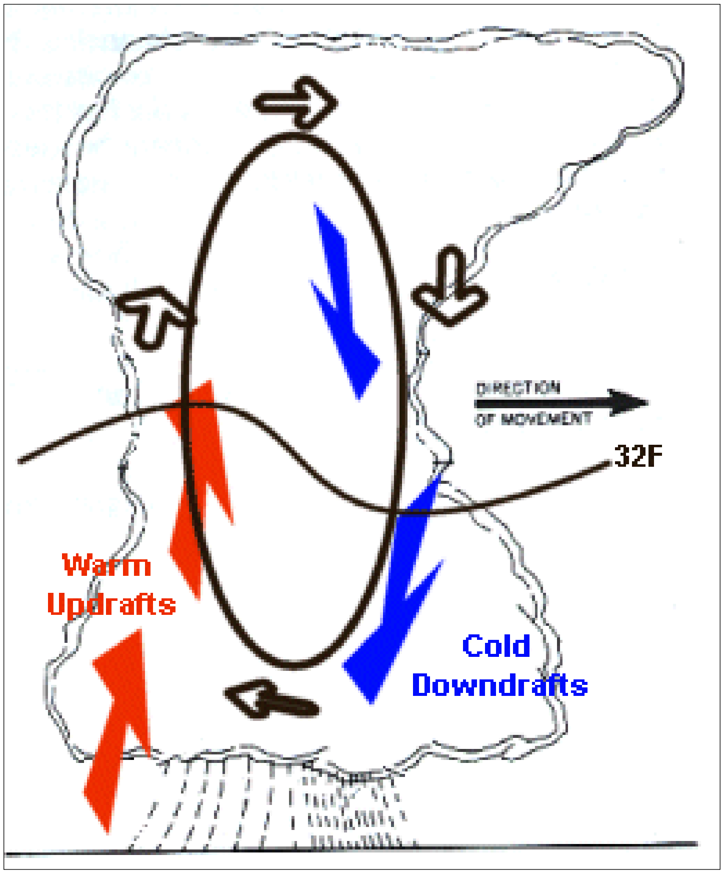


4.3.5 Hailstorm

Hail forms inside a thunderstorm when strong updrafts of warm air and downdrafts of cold water are present. If a water droplet is picked up by the updrafts, it can be carried well above the freezing level. Water droplets freeze when temperatures reach 32°F or colder. As the frozen droplet begins to fall, it may thaw as it moves into warmer air toward the bottom of the thunderstorm. However, the droplet may be picked up again by another updraft, carried back into the cold air, and re-frozen. The frozen droplet adds another layer of ice with each trip above and below the freezing level. The frozen droplet, with many layers of ice, falls to the ground as hail. Most hail is small and typically less than 2 inches in diameter (National Weather Service [NWS] 2010). Figure 4.3.5-1 illustrates the process that occurs in hail formulation.

The size of hailstones is a direct function of the size and severity of the storm. The higher the temperatures at the earth's surface, the greater the strength of the updrafts, and the greater the amount of time the hailstones are suspended, giving them more time to increase in size. Damage to crops and vehicles is typically the most significant impact of hailstorms.

Figure 4.3.5-1. Hail Formation



Source: National Oceanic and Atmospheric Administration (NOAA) 2012

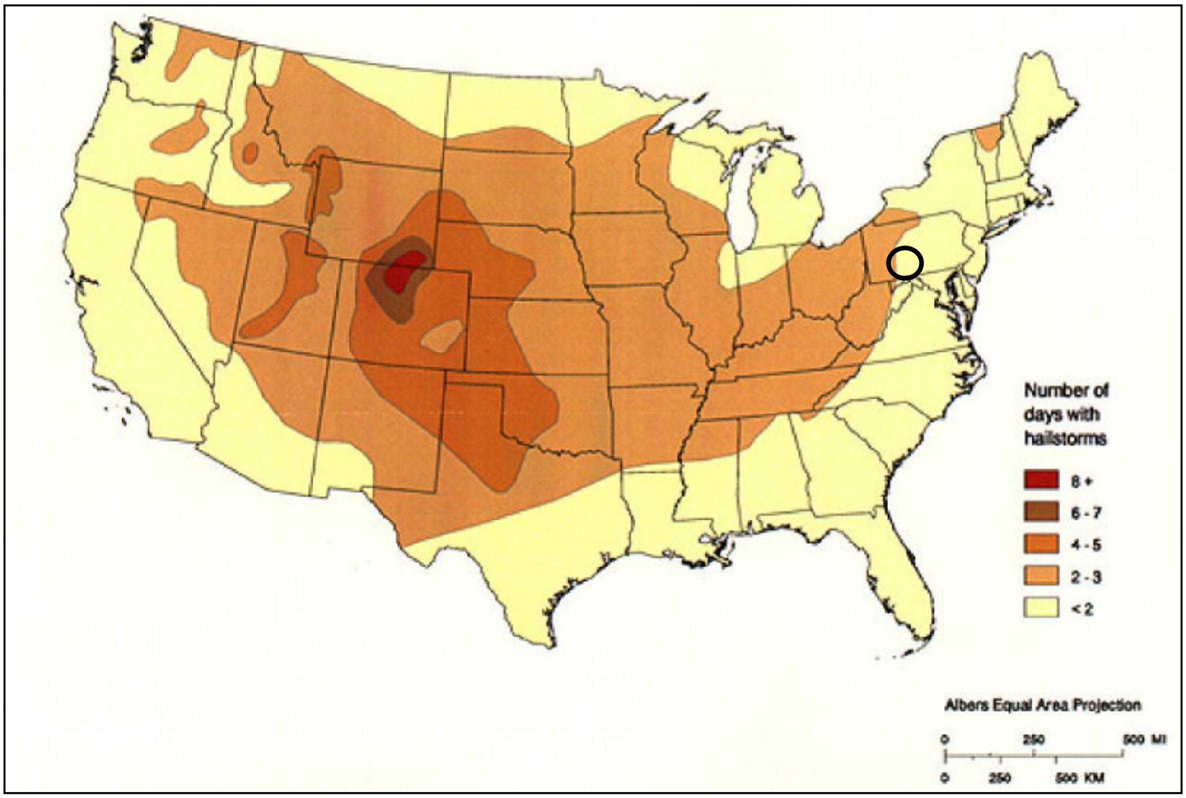
°F degrees Fahrenheit

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the hailstorm hazard for the Bedford County Hazard Mitigation Plan (HMP).

4.3.5.1 Location and Extent

Hail causes nearly $2 billion in crop and property damages, on average, each year in the United States. Hail occurs most frequently in states within the southern and central plains; however, hail damage is possible throughout the entire United States because hail accompanies thunderstorms (Federal Alliance for Safe Homes 2013). As indicated on Figure 4.3.5-2, Bedford County undergoes fewer than two hailstorms a year, on average.

Figure 4.3.5-2. Annual Frequency of Hailstorms in the U.S.



Source: Federal Emergency Management Agency (FEMA) 1997
Note: The black oval indicates the approximate location of Bedford County.

The National Oceanic and Atmospheric Administration's (NOAA) National Severe Storms Laboratory (NSSL) started a project to estimate the likelihood of severe weather hazards in the United States. "Severe thunderstorms" were defined as having one or more of the following characteristics: associated tornados, gusts at least 58 miles per hour (mph), or hail at least 0.75 inch in diameter.

4.3.5.2 Range of Magnitude

Hail can vary in size from less than 1 inch to several inches in diameter and can cause significant damage to crops and property. Damage depends on the size, duration, and intensity of hail precipitation. Individuals who do not seek shelter could face serious injury. Automobiles and aircraft are particularly susceptible to damage. Effects of other hazards associated with thunderstorms (strong winds, intense precipitation, and lightning) often occur concurrently because hail precipitation usually occurs during thunderstorms.

Bedford County has experienced hail ranging in size from 0.75 to 1.75 inches in diameter. No deaths or injuries due to hail have been recorded in the County. Bedford County's worst hailstorm occurred on May 28, 2010, when a backdoor cold front triggered strong thunderstorms that produced dime- to golf-ball-sized hail across Central Pennsylvania.

Based on reports from the National Climatic Data Center (NCDC) and Bedford County residents, the worst-case scenario for a hailstorm in Bedford County would be a storm that dropped softball-sized hail (the largest observed in the County) throughout the County. This hail would cause widespread damage to property and crops.

Hail can be produced during many different types of storms. Typically, hail occurs with thunderstorms. The size of hail is estimated by comparing it with a known object. During most hailstorms, hail is produced in a variety of sizes, and only the very largest hail stones pose serious risk to people who are exposed. Table 4.3.5-1 shows the various sizes of hail as compared to real-world objects.

Table 4.3.5-1. Hail Size

Size	Inches in Diameter
Pea	0.25
Marble/mothball	0.50
Dime/Penny	0.75
Nickel	0.875
Quarter	1.0
Ping-Pong Ball	1.5
Golf Ball	1.75
Tennis Ball	2.5
Baseball	2.75
Tea Cup	3.0
Grapefruit	4.0
Softball	4.5

Source: NOAA 2012

4.3.5.3 Past Occurrence

Hailstorms can occur as a routine part of severe weather in Bedford County. The potential for hail storms exists throughout the County, with a few minor incidents occurring each year. While the future occurrence of hailstorms in the County can be considered likely, Bedford County has a low potential for significant hail events based on previous records.

The Commonwealth of Pennsylvania 2013 All-Hazard Mitigation Plan (PA HMP) states that approximately 96 percent of hailstorm events throughout the Commonwealth have occurred during the months of April, May, June, July, August, and September. Moreover, approximately 87 percent of historical hailstorm events have occurred during the afternoon (noon to 5:00 p.m.) or evening (5:00 p.m. to 9:00 p.m.) hours. Both of these two preceding statements are consistent with historical hailstorm reports from Bedford County.

According to the U.S. Department of Agriculture (USDA) Risk Management Agency, hailstorm events within Bedford County between 1948 and 2015 have resulted in $179,486 in crop insurance claims. The significant amount of crop loss came from only 2 years of hail events – 2010 and 2012. In 2011, the County experienced $12,185 in loss claims, and in 2013, the County claimed $164,078 in losses (USDA 2016).

Pennsylvania has never received a federal disaster declaration because of a hail event. In the Pennsylvania Disaster History events list maintained by the Pennsylvania Emergency Management Agency (PEMA), Pennsylvania has experienced only three noteworthy hail events, none of which affected Bedford County. Only two of these events were eligible for Small Business Administration (SBA) Economic Injury benefits, while the third was not eligible for any recovery actions.

The NOAA-NCDC Storm Events database contains references to hail as a reported storm incident in Bedford County from 1950 to July 31, 2016, as shown in Table 4.3.5-2. The database indicates that 41 separate reports were issued throughout the county from 1950 to 2016. Some reports specified different times of day or different localities regarding the same storm. According to these reports, Bedford County has undergone hail ranging in size from 0.75 inch to 2.75 inches in diameter, with no reported deaths or injuries, and one event each contributing to property and crop damages.

Table 4.3.5-2. History of Hailstorms in Bedford County, 1950 to 2016

Date	Location	Diameter (in)	Deaths	Injuries	Property Damage ($)	Crop Damage ($)
7/7/1989	Bedford	1.25	0	0	0	0
7/7/1989	Bedford	.75	0	0	0	0
4/1/1990	Bedford	.75	0	0	0	0
4/16/1993	Bedford	1.00	0	0	0	0
8/11/1993	Bedford	.75	0	0	0	50
9/2/1993	Breezewood	1.5	0	0	0	0
4/15/1994	Tidioute	.88	0	0	0	0
7/6/1994	Bedford	1.00	0	0	0	0
7/10/1995	Breezewood	.75	0	0	0	0
6/11/1996	Hyndman	UNK	0	0	0	0
6/14/1996	Bedford	UNK	0	0	0	0
9/12/1996	Bedford	1.00	0	0	0	0
3/29/1997	Langondale	.75	0	0	0	0
6/18/1997	Hyndman	.88	0	0	0	0
6/18/1997	Bedford	.75	0	0	0	0
7/9/1997	Riddlesburg	.75	0	0	0	0
6/27/2001	Bedford	1.00	0	0	0	0
8/3/2002	Osterburg	1.00	0	0	0	0
5/15/2004	Pavia	.88	0	0	0	0
6/6/2005	New	.75	0	0	0	0
6/6/2005	Bedford	.75	0	0	0	0
6/13/2007	Breezewood	.75	0	0	0	0
6/13/2007	Charleysville	.75	0	0	0	0
4/26/2008	Bedford	.75	0	0	0	0
4/26/2008	Charleysville	1.00	0	0	0	0
5/28/2010	Manns	.88	0	0	0	0
5/28/2010	Manns	1.75	0	0	0	0
5/28/2010	Hyndman	.88	0	0	0	0
03/23/2011	Alum Bank	1.00	0	0	0	0
05/26/2011	Inglesmith	1.00	0	0	0	0
05/27/2012	Saxton	0.88	0	0	0	0
06/29/2012	Mattie	1.00	0	0	0	0
06/29/2012	Beegleton	1.00	0	0	0	0
07/04/2012	Hyndman	1.00	0	0	0	0
06/28/2013	Clearville	1.00	0	0	0	0
06/11/2014	Hyndman	1.25	0	0	0	0
06/11/2014	Everett	1.75	0	0	0	0
06/11/2014	Bedford Spgs	1.75	0	0	0	0
04/20/2015	Charlesville	1.50	0	0	0	0
06/16/2016	Bard	1.25	0	0	0	0
06/16/2016	Inglesmith	2.75	0	0	10,000	0

Source: NCDC 2016

Notes: Information regarding municipal event occurrences prior to 1992 was unavailable through NCDC or other researched means.

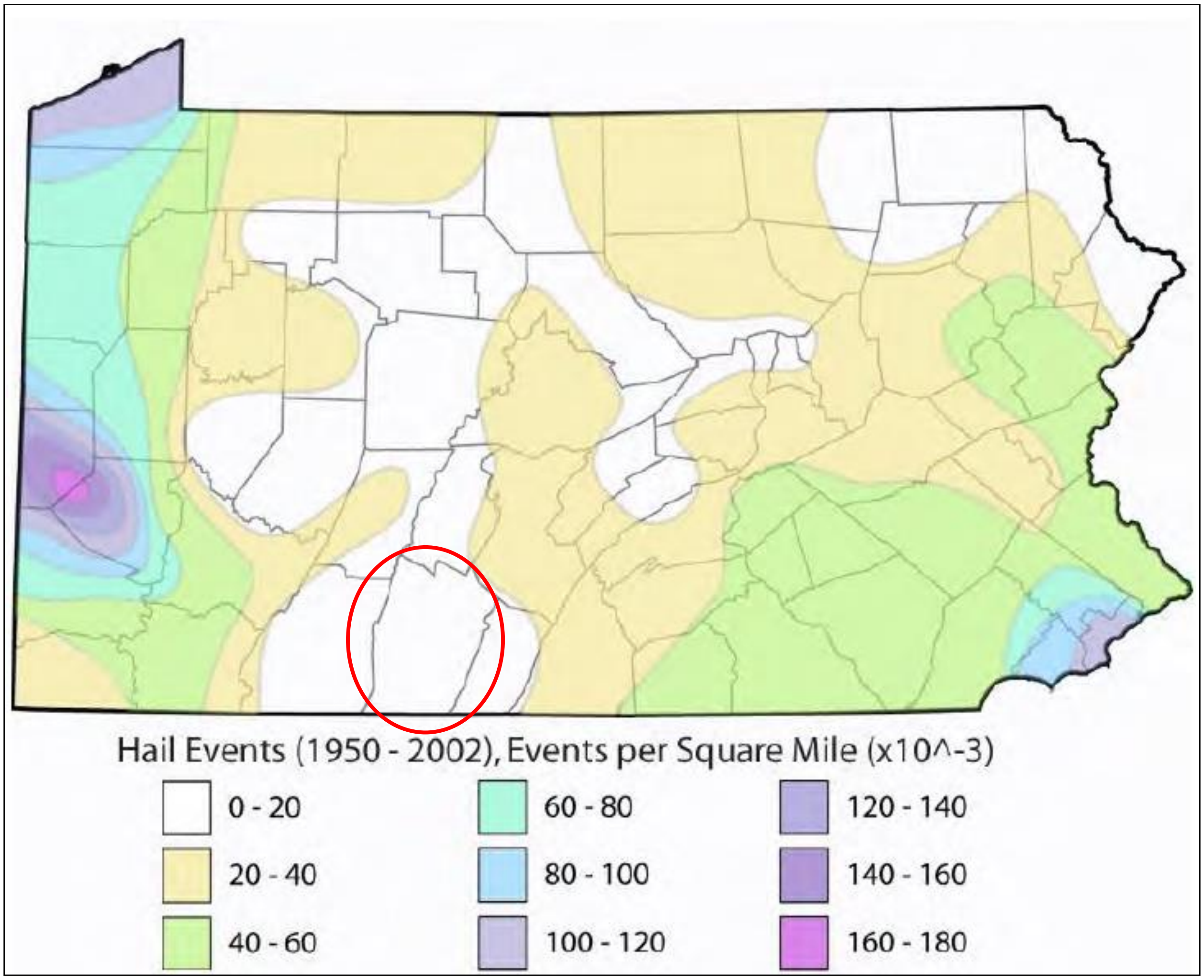
Events occurring on the same date in the same municipality were recorded as separate events based on hail diameter.

Personal narratives from County residents and local officials report that the worst-case scenario for hailstorms in the County occurred on June 16, 2016. While this event is noted in the NCDC database, the database does not list some of the property damage reported by residents, which led to a minimum of $10,000 worth of repairs. Southampton Township, in particular, was severely impacted. Hail up to the size of baseballs was reported near Inglesmith. Extensive leaf damage was noted, and snow plows were out clearing leaves from the roads. A car windshield was broken from the hail, as well as several windows on homes and barns.

4.3.5.4 Future Occurrence

It is not possible to predict formation of a hailstorm with more than a few days' lead time. The past occurrences described above, however, indicate that hailstorm events in Bedford County probably will occur every year throughout the months of May until September. Encompassing events State-wide between 1950 and 2002, Figure 4.3.5-3 below shows the number of hail events per square mile across Pennsylvania. Based on these historical data, the most northeast tip of Bedford County can expect to undergo a higher number of hailstorm events than will other areas of the County. Bedford County as a whole has undergone significantly fewer hailstorms per square mile than other areas in south-central Pennsylvania.

Figure 4.3.5-3. Hail Events per Square Mile in Pennsylvania



Source: PEMA 2013
Note: The red oval indicates the location of Bedford County.

Future occurrences of hailstorms can be considered *likely* as defined by the Risk Factor Methodology probability criteria (further discussed in Section 4.4).

4.3.5.5 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable assets within the identified hazard area. Regarding hail events, the entire County has been identified as the hazard area. Therefore, all assets in Bedford County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 2), are vulnerable. This section evaluates and estimates the potential impact of hailstorm events on the County in the following sections:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on: (1) life, health, and safety of residents; (2) general building stock; (3) critical facilities; (4) economy; and (5) future growth and development
- Effect of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time

Overview of Vulnerability

The entire County, including all critical infrastructure, is vulnerable to the effects of hail, as the storm cells that produce this hazard can develop over any part of the region. The area of damage caused by these storms is relatively small because a single storm does not cause widespread devastation, but may cause damage within a focused area.

Hail can cause serious damage to automobiles, aircraft, skylights, livestock, and crops. Areas of the County with large amounts of farmland and high agricultural yields are more likely to be affected by hailstorm hazards.

Data and Methodology

National weather databases, the PA HMP, the USDA Census of Agriculture, and local resources were referenced to collect and analyze data regarding hazard impacts on Bedford County.

Impact on Life, Health, and Safety

The entire population of the County is considered exposed to the hail hazard. People outdoors (for example, pursuing recreational activities and farming) are considered most vulnerable to the hazard because they ordinarily would receive little to no warning, and shelter may not be available to them. Moving to a lower-risk location decreases a person's vulnerability.

Impact on General Building Stock, Critical Facilities, and the Economy

Hailstorms primarily affect agricultural products. The facilities most vulnerable to hailstorm threats are food- and agriculture-related producers and manufacturers. These facilities are present within both urban and rural areas and would be directly or indirectly affected by a hailstorm event. According to the PA HMP, Bedford County does not have a food or agricultural-related State facility within its borders.

As discussed earlier in the Past Occurrence subsection, Bedford County has experienced some historical hailstorm property damage and slightly more significant crop damage ($10,000 in property damage claims from only one event [per NCDC records] and $179,486 in USDA crop damage claims from three events [per USDA records, which differ from the NCDC records]). However, given the unpredictability of hailstorms, significant property and crop damage is possible during any hailstorm event. Jurisdictional loss estimation is based on lost agricultural revenues throughout the County. The USDA Census of Agriculture enumerates farmland acreage by county, as well as the annual market value of all agricultural products sold by county, from year 2012. If a hailstorm would eliminate the entire agricultural yield in Bedford County, total losses on the County's 209,795 acres of farmland could reach $122,820,000.

Future Growth and Development

Areas targeted for potential future growth and development within the next 5 to 10 years have been identified across Bedford County, and are further discussed in Section 2.4 in this HMP. Exposure of any new development and new residents to the hailstorm hazard is expected.

Effect of Climate Change on Vulnerability

The definition of “climate” is not restricted to average temperature and precipitation, but also includes type, frequency, and intensity of weather events. On both global and local scales, climate change could alter the prevalence and severity of extremes such as hailstorms. While predicting changes of storm events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating effects of future climate change on human health, society, and the environment (U.S. Environmental Protection Agency [EPA] 2006).

As directed by the Climate Change Act (Act 70 of 2008), Pennsylvania’s Department of Environmental Protection (PA DEP) initiated a study of potential impacts of global climate change on the Commonwealth. The June 2009 Pennsylvania Climate Impact Assessment’s main findings indicate likelihood that Pennsylvania will undergo increased temperatures in the 21st century. An increase in variability of temperature and precipitation may well lead to increased frequency and severity of hailstorm events. Future improvements in modeling smaller-scale climatic processes such as thunderstorms and associated hailstorms can be expected and will lead to improved understanding of the ways in which the changing climate will alter storms, such as hailstorm events, in Pennsylvania (Shortle et al. 2009).

Additional Data and Next Steps

The assessment above identifies vulnerable populations and potential structural and economic losses associated with this hazard of concern. Collection of additional and actual loss data specific to the plan participants will further enhance Bedford County’s vulnerability assessment.

4.3.6 Invasive Species

This section provides a profile and vulnerability assessment for the invasive species hazard. An invasive species is a species that is not indigenous to a given ecosystem and that, when introduced to a non-native environment, is likely to cause economic or environmental harm, or pose a hazard to human health.

4.3.6.1 Location and Extent

The Commonwealth of Pennsylvania plays host to a number of invasive pathogens, insects, plants, invertebrates, fish, and higher mammals. These species have largely been introduced by the actions of humans. Common pathways for invasive species include unintentional release, the movement of goods and equipment that may unknowingly harbor species, smuggling, emptying ship ballast water, hull fouling, and escape from cultivation (PISC 2010). Invasive species threats are generally divided into two main subsets, as described below.

- Aquatic invasive species are non-native viruses, invertebrates, fish, and aquatic plants that threaten the diversity or abundance of native species; the ecological stability of the infested waters; human health and safety; or commercial, agriculture, aquaculture, or recreational activities dependent on such waters.
- Terrestrial invasive species are non-native arthropods, vascular plants, higher vertebrates, or pathogens that complete their life cycle on land instead of water and whose introduction does or is likely to cause economic or environmental harm or harm to human health.

The Governor's Invasive Species Council of Pennsylvania (PISC), the lead organization for invasive species threats, has identified over 100 species threats that are or could potentially become significant in Pennsylvania. Of these threats, Bedford County officials and municipal leaders believe that the most significant are invasive pests such as the emerald ash borer, Eurasian wood wasp, Asian longhorned beetle, hemlock woolly adelgid, and gypsy moth; as well as pathogens such as *Phytophthora ramorum*, which causes sudden oak death; and plants like mile-a-minute weed, Oriental bittersweet, and the Japanese angelica tree. Wavy leaf basket grass has not been seen in the county, but is expected to affect the county in the near future. The location and extent of these invasive threats depends on the preferred habitat of the species as well as the species' ease of movement and establishment.

4.3.6.2 Range of Magnitude

The magnitude of invasive species threats ranges from nuisance to widespread killer. Some invasive species are not considered agricultural pests and do not harm humans. Other invasive species can cause significant changes in the composition of Pennsylvania's ecosystems. Forest-feeding invasive species could have a significant economic impact in Bedford County, because it hosts a large base of logging and forest-based tourism. Still more invasive species can cause widespread illness or death in humans.

Invasive species contribute to a broad range of environmental impacts. The aggressive nature of many invasive species can cause significant reductions in biodiversity by crowding out native species. This can affect the health of individual host organisms as well as the overall well-being of the affected ecosystem.

Beyond causing human, animal, and plant harm, there are secondary impacts of invasive species also cause harm to host species and ecosystems, particularly in the case of invasive species that attack forests. Forests prevent soil degradation and erosion, protect watersheds, stabilize slopes, and absorb carbon dioxide emissions. The key role of forests in the hydrologic system means that if forest land is wiped out, the effects of erosion and flooding will be amplified. There would also be an impact on agricultural harvests.

The magnitude of an invasive species threat is generally amplified when the ecosystem or host species is already stressed, such as in times of drought. The already-weakened state of the native ecosystem causes it to more easily succumb to an infestation. An example of a possible worst-case invasive species scenario is if the emerald ash borer would break through the quarantine in Pennsylvania and invade the county's ash trees. With the high mortality rate associated with the emerald ash borer, the forests would be devastated, causing logging establishments to shut down, which, in turn, could mean a potential drop in forest-based tourism, resulting in the loss of jobs and valuable income to the county.

4.3.6.3 Past Occurrence

Invasive species have been entering Pennsylvania since the arrival of early European settlers. A 2010 Forest Health Report confirmed the presence of the emerald ash borer and hemlock woolly adelgid in Bedford County. Bedford County is part of the 2010 emerald ash borer quarantine zone, along with 43 other western counties. This means it is legal to move firewood, ash, and the insect between counties, but it is not legal to move non-compliant items out of the state, nor is it legal to move non-compliant firewood into the state. Additionally, the hemlock woolly adelgid has been present in Bedford County since 1967. DCNR continues to monitor the westerly progression of the invasive species and since 2010, has detected a general movement west. Pennsylvania, along with areas of Maryland, North Carolina, Ohio, Virginia, and West Virginia, has also seen an increased population of the yellow poplar weevil since 2015.

4.3.6.4 Future Occurrence

According to the PISC, the probability of future occurrence for invasive species threats is on the rise because of the growing volume of transported goods, increasing technology, efficiency, and speed of transportation, and expanding international trade agreements. Expanded global trade has created opportunities for many organisms to be transported to and establish themselves in new countries and regions. Furthermore, climate change is contributing to the introduction of new invasive species. As maximum and minimum seasonal temperatures change, pests are able to establish themselves in previously inhospitable climates. This also gives introduced species an earlier start and increases the magnitude of their growth, which may shift the dominance of ecosystems in the favor of non-native species.

In order to combat the increase in future occurrences, the PISC, which is a collaboration of state agencies, public organizations, and federal agencies, released the Invasive Species Management Plan in April 2010. This plan outlines the Commonwealth's goals for the management of the spread of non-native invasive species, and creates a framework for responding to threats through research, action, and public outreach and communication. More information on the Species Management Plan can be found online at www.invasivespeciescouncil.com. It is reasonable to assume that both the emerald ash borer and hemlock woolly adelgid will continue to have a presence in Bedford County.

4.3.6.5 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the area identified. The following sections discuss the potential impact of the invasive species hazard on Bedford County, including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on (1) life, (2) health and safety, (3) general building stock, (4) critical facilities, economy, and (5) future growth and development
- Effect of climate change on vulnerability
- Additional data and next steps

Overview of Vulnerability

Bedford County's exact vulnerability will depend on the invasive species in question. In general, though, the University of Arizona and the National Invasive Species Information Center have identified the following characteristics of areas that are more likely to be invaded:

- Lack of natural predators or diseases that kept the species under control in its native environment

- Present vacant ecological niches that can be exploited by non-native species
- Lacki of species diversity
- Lack of a multi-tiered canopy (in the case of invasive plants)
- Disturbed by fire, construction, or agriculture prior to invasion (University of Arizona 2006)

Estimated losses are difficult to quantify; however infestation can impact Bedford County's population and economy. Direct effects of infestation lead to cascading indirect impacts. As vegetation dies or becomes stressed and weakened by pests such as the emerald ash borer, available fuel and high-intensity wildfires increase. As species compositions change due to infestation outbreaks, whole fire regimes can shift. Physical stresses on trees may also affect how trees respond to other natural hazards such as hurricanes, drought, and ice storms (Kurtz 2007).

Due to the current presence of invasive species in Bedford County, it is clear that the county is vulnerable to invasive species. Bedford County is in the middle of an active zone in the Commonwealth and considering the instances and extent of the current infestation, it is reasonable to project that the county's vulnerability will increase.

Data and Methodology

Because of lack of quantifiable loss information, a qualitative assessment has been used to evaluate assets exposed to this hazard and potential impacts associated with this hazard.

Impact on Life, Health, and Safety

The entire population of Bedford County is vulnerable to invasive species to some extent, but direct impacts to life, health, and safety are minor.

Impact on General Building Stock and Critical Facilities

No structures are anticipated to be affected directly by infestation or invasive species; however, the emerald ash borer may cause a catastrophic loss of the ash tree throughout state forests, which could result in stream bank instability, erosion, and increased sedimentation. In addition, a preponderance of dead tree limbs could increase the occurrence of downed trees on roadways and power lines during storms with heavy winds.

Impact on Economy

Impacts of infestation and invasive species on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with activities and programs implemented to conduct surveillance and address infestation have not been quantified in available documentation.

The emerald ash borer can infect nursery stock and mature trees, which could reduce the timber value of hardwood exports (CFIA 2014). In 2010, the USDA Northern Research Station conducted computer simulations of emerald ash borer spread to estimate the cost of ash tree treatment, removal, and replacement (re-planting of new trees) between 2009 and 2019. The simulations predicted an infestation covering 25 states, and assumed treatment, removal, and replacement of more than 17 million ash trees on developed land within established communities. The total costs were estimated at $10.7 billion. This figure doubled when the model was reset to include developed land outside, as well as inside, human communities (USDA 2013).

Impact of Future Growth and Development

As discussed in Section 2, areas targeted for future growth and development have been identified across the county. Any areas of growth could be impacted by the infestation hazard because the entire planning area is exposed and vulnerable.

Change of Vulnerability

Overall, the county's vulnerability has not changed since the 2011 HMP, and exposure and vulnerability to invasive species will continue throughout Bedford County.

Additional Data and Next Steps

Any additional information regarding localized concerns and past impacts will be collected and analyzed. These data will be developed to support future revisions to the plan. Future mitigation efforts could include partnering and collaborating with existing Commonwealth of Pennsylvania and local efforts.

4.3.7 Landslide

This section provides a profile and vulnerability assessment of the landslide hazard. A landslide is described in the Commonwealth of Pennsylvania 2013 Standard All-Hazard Mitigation Plan (PA HMP) as downward and outward movement of slope-forming soil, rock, and vegetation reacting to the force of gravity. Materials can move at speeds as high as 120 miles per hour (mph) or more; slides can last a few seconds or a few minutes, or can be gradual, slower movements over several hours or days. Several different types of landslides include:

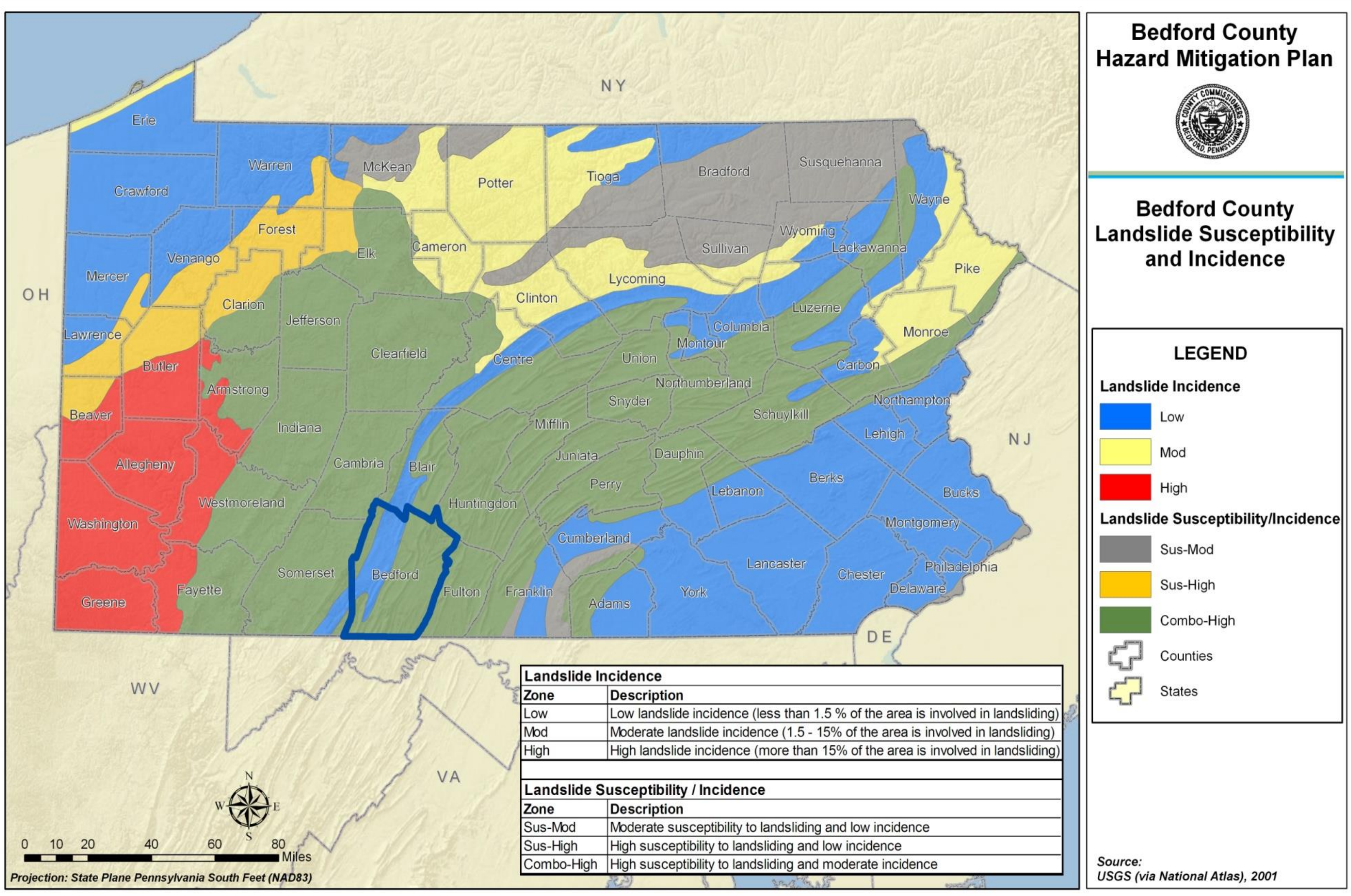
- *Rock Fall* involves detachment of mass from a steep slope or cliff, and descent by free fall, bounding, or rolling.
- *Rock Topple* involves tilt or rotation of a mass forward as a unit.
- *Slide* involves displacement of a mass on one or more recognizable surfaces, which may be curved or planar.
- *Flow* involves movement of a mass downslope with a fluid motion. A significant amount of water may or may not be part of the mass (PEMA 2013).

Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes through construction or erosion, earthquakes, and changes in groundwater levels. Areas generally prone to landslide hazards include previous landslide areas, bases of steep slopes, bases of drainage channels, developed hillsides, and areas recently burned by forest and brush fires (Delano and Wilshusen 2001). Human activities that contribute to slope failure include alteration of the natural slope gradient, increase of soil water content, and removal of vegetation cover.

4.3.7.1 Location and Extent

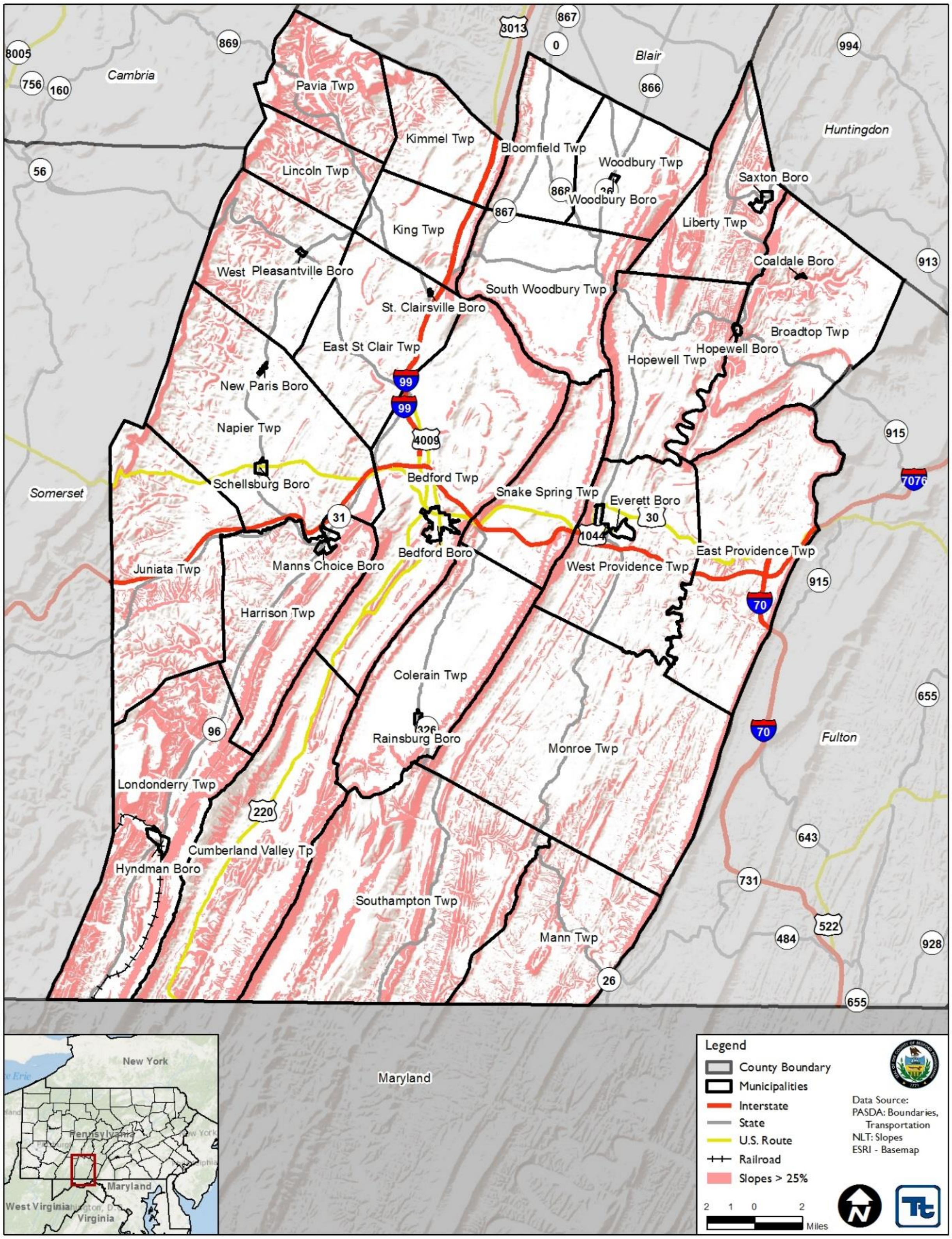
According to the 2013 PA HMP, landslides have occurred in many parts of Pennsylvania but are most abundant and troublesome in much of the western and north-central portions of the State and adjacent states. Rockfalls and other slope failures can occur in areas of Bedford County at locations of moderate to steep slopes. Areas undergoing erosion, decline in vegetation cover, and earthquakes are also susceptible to landslides. Figure 4.3.7-1 shows areas of low, moderate, and high landslide susceptibility as identified by the U.S. Geological Survey (USGS). Most of Bedford County ranks as having high susceptibility and a moderate number of incidents, while a swath along the western part of the County falls within the Low Incidence zone with less than 1.5 percent of the area involved in landsliding. Figure 4.3.7-2 shows areas in Bedford County on 25% or greater slopes, as generated by the Natural Lands Trust (2010). Almost every municipality in the County has at least some slopes with 25% or greater steepness.

Figure 4.3.7-1. U.S. Geological Survey. Landslide Incidence and Susceptibility.



Source: PEMA 2013
Note: Highlight added.

Figure 4.3.7-2. Natural Lands Trust. Slopes Greater than 25%.



Source: Natural Lands Trust 2010

4.3.7.2 Range of Magnitude

Landslides damage transportation routes, utilities, and buildings. They can also create travel delays and other side effects. Fortunately, deaths and injuries caused by landslides are rare in Pennsylvania, and most landslides in the State are moderate to slow moving, damaging things rather than people. Almost all known deaths caused by landslides have occurred when rockfalls or other slides along highways have involved vehicles. Storm-induced debris flows are the only other type of landslide likely to cause death and injuries. Hazards from these events will also increase as residential and recreational development increases on and near steep mountain slopes.

The worst-case scenario for a landslide in Bedford County would be an event similar to one in Beaver County in 1942 (PEMA 2013). In that event, 150 cubic yards of rock fell from a highway cut onto a bus. Twenty-two people were killed and four others were injured. In Bedford County's worst-case scenario, the landslide would hit the Pennsylvania Turnpike, Route 30, or another busy highway. Depending on the time of day, and the number of vehicles on the road at that time, this could trigger a severe traffic accident, resulting in multiple fatalities. Closure of a major transportation route would affect commerce in the County, as well as the Commonwealth, because the Pennsylvania Turnpike is a major east-west transportation corridor. This is the worst-case scenario because it could exert the greatest impact on the County, surrounding counties, and the Commonwealth. The most likely landslide would occur within an unpopulated area and likely would be undetected.

4.3.7.3 Past Occurrence

Outside of impacts on important transportation routes, the history of landslides is not documented as completely (if at all) as other hazards, primarily because landslides are not always seen, and therefore historical landslide occurrences in Bedford County are not well known. The National Climatic Data Center does not have any records of landslides in the County (NOAA-NCDC 2016). No deaths, serious injury, or property damages have been reported from landslides in local records.

Pennsylvania has no history of federally declared disasters as a result of landslides. One federally declared disaster included mudslides, in June 2006. Bedford County was not included in that declaration. PEMA also notes only one disaster incident including mudslides, in April 2005, which did not include Bedford County. This event was eligible for individual assistance, public assistance, and hazard mitigation.

4.3.7.4 Future Occurrence

Mismanaged, intense development within steeply sloped areas could increase frequency of landslides in Bedford County. Often, building and road construction contributes to potential for landslides by undermining or steepening otherwise stable soil.

Current landslide events occur within steeply sloped areas that do not feature extensive land development or many structures. However, increased deforestation, timbering, and soil disturbances caused by development within sloped areas significantly increases risk of landslides.

Based on available historical data, future occurrence of landslides can be considered *unlikely* as defined by the Risk Factor Methodology probability criteria (refer to Section 4.4).

4.3.7.5 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed or vulnerable within the hazard area identified. The following section discusses potential impacts of the landslide hazard on Bedford County, including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on (1) life, (2) health and safety, (3) general building stock, (4) critical facilities and economy, and (5) future growth and development

- Effect of climate change on vulnerability
- Additional data and next steps.

Overview of Vulnerability

Vulnerability to ground failure hazards is a function of location, soil type, geology, type of human activity, use, and frequency of events. Effects of landslides on people and structures can be reduced by total avoidance of hazard areas or by restricting, prohibiting, or imposing conditions on hazard-zone activity. Local governments can reduce effects of landslides through land use policies and regulations. Individuals can reduce their exposure to hazards by educating themselves on the past hazard history of the site and by inquiring about hazards to planning and engineering departments of local governments (National Atlas 2007).

Overall, most of the County is exposed to the landslide hazard, with the most vulnerable portion of the County located within the high-susceptibility/moderate-incidence hazard area; approximately 75.5% of the County is within this hazard area (refer to Figure 4.3.7-1 earlier in this section). East St. Clair Township, Harrison Township, Kimmel Township, King Township, Manns Choice Borough, New Paris Borough, Pleasantville borough, Schellsburg Borough, and St. Clairsville Borough are completely within the low incidence hazard area and are not susceptible to the landslide hazard. Because of widespread cover of high susceptibility/moderate incidence, areas on slopes of 25% or greater were determined at greater risk from the landslide hazard. Further information regarding these hazard areas is described below.

Data and Methodology

Unlike the flood, wind, and earthquake hazards, no standard loss estimation models for the landslide hazard are available. In an attempt to estimate Bedford County's vulnerability, the Geology – Landslide Incidence and Susceptibility geographic information system (GIS) layer from the National Atlas was used to coarsely define the general landslide-susceptible area ("approximate hazard area") (Figure 4.3.7-1). Limitations of this analysis are recognized, and results of it are used only to provide a general estimate. Over time, additional data will be acquired to allow better analysis of this hazard. Available information and a preliminary assessment appear below.

According to Radbruch-Hall and others, the Landslide Incidence and Susceptibility GIS layer from National Atlas:

> "….was prepared by evaluating formations or groups of formations shown on the geologic map of the United States (King and Beikman, 1974) and classifying them as having high, medium, or low landslide incidence (number of landslides) and being of high, medium, or low susceptibility to landsliding. Thus, those map units or parts of units with more than 15 percent of their area involved in landsliding were classified as having high incidence; those with 1.5 to 15 percent of their area involved in landsliding, as having medium incidence; and those with less than 1.5 percent of their area involved, as having low incidence. This classification scheme was modified where particular lithofacies are known to have variable landslide incidence or susceptibility. In continental glaciated areas, additional data were used to identify surficial deposits that are susceptible to slope movement. Susceptibility to landsliding was defined as the probable degree of response of the areal rocks and soils to natural or artificial cutting or loading of slopes or to anomalously high precipitation. High, medium, and low susceptibility are delimited by the same percentages used in classifying the incidence of landsliding. For example, it was estimated that a rock or soil unit characterized by high landslide susceptibility would respond to widespread artificial cutting by some movement in 15 percent or more of the affected area. We did not evaluate the effect of earthquakes on slope stability, although many catastrophic landslides have been generated by ground shaking during earthquakes. Areas susceptible to ground failure under static conditions would probably also be susceptible to failure during earthquakes." (Radbruch-Hall 1982).

The Natural Lands Trust generated a GIS layer displaying areas with slopes greater than 25% within the Central Appalachian Forest Ecoregion using the U.S. Geological Survey's National Elevation Dataset (Figure 4.3.7-2). This layer was used to determine the County's vulnerability to steep slopes.

Impacts on Life, Health, and Safety

As discussed above, most of the County is within the high-susceptibility/moderate-incidence hazard area; therefore the steep slopes hazard was used to estimate the population vulnerable to the hazard. Potential landslide events can directly and indirectly damage the County's population via impacts on buildings. To estimate the population located on slopes greater than 25%, hazard area boundaries were overlaid upon 2010 Census population data (U.S. Census 2010). Census blocks with their centers (centroids) within the boundaries of steep slope hazard areas were used to calculate the estimated population considered exposed to this hazard. Because census blocks do not align exactly with hazard areas, these estimates should be considered for planning purposes only. Table 4.3.7-1 summarizes the population exposed by municipality (U.S. Census 2010). Populations downslope of landslide hazard areas are particularly vulnerable to this hazard. Identifying populations vulnerable to mass movements of geological material by reference only to census block data is difficult. But via this approach, 4,696 people, or 9.4% of the overall population, are within areas with steep slopes.

Table 4.3.7-1 Estimated Bedford County Population Located in the Steep Slope Hazard Area

Municipality	Total Population	Population in the Hazard Area	Percent Population in Hazard Area
Bedford Borough	2,841	18	<1%
Bedford Township	5,395	621	11.5%
Bloomfield Township	1,016	3	<1%
Broad Top Township	1,687	450	26.7%
Coaldale Borough	161	0	0.0%
Colerain Township	1,195	5	<1%
Cumberland Valley Township	1,597	247	15.5%
East Providence Township	1,854	110	5.9%
East St. Clair Township	3,042	122	4.0%
Everett Borough	1,832	0	0.0%
Harrison Township	978	123	12.6%
Hopewell Borough	230	27	11.7%
Hopewell Township	2,010	240	11.9%
Hyndman Borough	910	8	<1%
Juniata Township	954	137	14.4%
Kimmel Township	1,616	123	7.6%
King Township	1,238	0	0.0%
Liberty Township	1,418	275	19.4%
Lincoln Township	425	73	17.2%
Londonderry Township	1,856	745	40.1%
Mann Township	500	95	19.0%
Manns Choice Borough	294	0	0.0%
Monroe Township	1,336	74	5.5%
Napier Township	2,198	84	3.8%

Municipality	Total Population	Population in the Hazard Area	Percent Population in Hazard Area
New Paris Borough	186	0	0.0%
Pavia Township	295	31	10.5%
Pleasantville Borough	198	0	0.0%
Rainsburg Borough	133	0	0.0%
Saxton Borough	686	0	0.0%
Schellsburg Borough	338	0	0.0%
Snake Spring Township	1,639	175	10.7%
South Woodbury Township	2,155	147	6.8%
Southampton Township	976	372	38.1%
St. Clairsville Borough	78	0	0.0%
West Providence Township	3,212	186	5.8%
West Saint Clair Township	1,736	172	9.9%
Woodbury Borough	284	0	0.0%
Woodbury Township	1,263	33	2.6%
Bedford County (Total)	**49,762**	**4,696**	**9.4%**

Sources: U.S. Census 2010; Natural Lands Trust 2010.

Impact on General Building Stock

As discussed above, most of the County is within the high-susceptibility/moderate-incidence area, and areas of steep slope will be referenced to estimate vulnerability of the County's general building stock. Direct building losses are estimated costs to repair or replace damage caused to buildings.

Similar to the population, building stock data are presented by census block. To estimate the value of building stock exposed to steep slopes, hazard area boundaries were overlaid upon HAZUS-MH building stock data in GIS. Using the default general building stock, replacement cost values of the Census blocks with their centroids in hazard areas were totaled. Approximately $444 million of buildings/contents are on steep slopes in Bedford County. This represents approximately 5.9% of the County's total general building stock replacement value inventory ($7.5 billion).

To estimate the number of structures exposed to the hazard boundary, the County's spatial layer of structures was overlaid by the steep slopes layer. In total, 1,040 structures, or 1.8% of building stock, would be exposed to the hazard. Building stock exposures per municipality are listed in Table 4.3.7-2.

Table 4.3.7-2 Estimated General Building Stock Within the Steep Slope Hazard Area

Municipality	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings	% of Total	RCV	% of Total
Bedford Borough	1,892	$646,059,000	6	<1%	$3,532,000	<1%
Bedford Township	5,482	$1,064,751,000	36	<1%	$97,957,000	9.2%
Bloomfield Township	1,053	$98,910,000	2	<1%	$3,526,000	3.6%
Broad Top Township	1,989	$210,095,000	124	6.2%	$38,051,000	18.1%
Coaldale Borough	101	$12,009,000	2	2.0%	$0	0.0%

Municipality	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings	% of Total	RCV	% of Total
Colerain Township	1,879	$124,874,000	3	<1%	$908,000	<1%
Cumberland Valley Township	2,167	$186,632,000	86	4.0%	$21,501,000	11.5%
East Providence Township	2,599	$278,118,000	27	1.0%	$8,833,000	3.2%
East St. Clair Township	3,216	$370,063,000	23	<1%	$606,000	<1%
Everett Borough	1,222	$438,564,000	0	0.0%	$0	0.0%
Harrison Township	1,664	$163,407,000	51	3.1%	$25,726,000	15.7%
Hopewell Borough	164	$24,173,000	16	9.8%	$1,649,000	6.8%
Hopewell Township	2,146	$222,875,000	39	1.8%	$27,248,000	12.2%
Hyndman Borough	778	$117,166,000	2	<1%	$0	0.0%
Juniata Township	1,979	$125,361,000	36	1.8%	$17,074,000	13.6%
Kimmel Township	1,852	$207,126,000	14	<1%	$15,957,000	7.7%
King Township	1,354	$128,234,000	6	<1%	$225,000	<1%
Liberty Township	1,764	$190,571,000	44	2.5%	$20,578,000	10.8%
Lincoln Township	462	$43,153,000	23	5.0%	$8,813,000	20.4%
Londonderry Township	2,507	$197,714,000	115	4.6%	$27,897,000	14.1%
Mann Township	1,125	$84,599,000	35	3.1%	$4,425,000	5.2%
Manns Choice Borough	269	$32,878,000	11	4.1%	$0	0.0%
Monroe Township	2,558	$164,383,000	63	2.5%	$12,708,000	7.7%
Napier Township	3,539	$277,952,000	55	1.6%	$14,122,000	5.1%
New Paris Borough	135	$21,772,000	0	0.0%	$0	0.0%
Pavia Township	559	$46,739,000	57	10.2%	$22,290,000	47.7%
Pleasantville Borough	170	$22,172,000	0	0.0%	$0	0.0%
Rainsburg Borough	157	$14,504,000	0	0.0%	$0	0.0%
Saxton Borough	504	$168,466,000	2	<1%	$0	0.0%
Schellsburg Borough	266	$41,027,000	0	0.0%	$0	0.0%
Snake Spring Township	1,768	$383,646,000	29	1.6%	$3,808,000	1.0%
South Woodbury Township	2,245	$245,720,000	11	<1%	$208,000	<1%
Southampton Township	1,932	$133,937,000	59	3.1%	$29,097,000	21.7%
St. Clairsville Borough	73	$10,568,000	0	0.0%	$0	0.0%
West Providence Township	3,696	$618,794,000	28	<1%	$19,007,000	3.1%
West Saint Clair Township	1,790	$179,339,000	28	1.6%	$17,970,000	10.0%
Woodbury Borough	238	$31,161,000	0	0.0%	$0	0.0%
Woodbury Township	1,614	$198,967,000	7	<1%	$0	0.0%
Bedford County (Total)	**58,908**	**$7,526,479,000**	**1,040**	**1.8%**	**$443,716,000**	**5.9%**

Sources: HAZUS-MH 3.1, Natural Lands Trust 2010, Bedford County 2016.

Critical Facilities and the Economy

As discussed above, most of the County is within the high-susceptibility/moderate-incidence landslide hazard area. As with impacts on population and general building stock of the County, the steep slope hazard area was referenced to estimate vulnerabilities of critical facilities within the County. One hazmat facility in Kimmel Twp, one municipal building in Pavia Twp, and two wastewater treatment plants, one in Napier Township and one in South Woodbury Township, are on slopes of 25% or greater.

A landslide's impact on the economy and estimated dollar losses are difficult to measure. As stated earlier, landslides can impose direct and indirect impacts on society. Direct costs include actual damage sustained by buildings, property, and infrastructure. Indirect costs, such as cleanup costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity, are difficult to measure. Additionally, ground failure threatens transportation corridors, fuel and energy conduits, and communication lines (USGS 2003). Losses to the County's total building inventory replacement value would affect the local tax base and economy.

Future Growth and Development

Areas targeted for potential future growth and development within the next 5 to 10 years have been identified across Bedford County. Refer to Section 2.4 of this HMP. New development within identified landslide hazard areas will be exposed to these risks.

Effect of Climate Change on Vulnerability

Climate is defined not just as average temperature and precipitation but also by type, frequency, and intensity of weather events. Both globally and at the local scale, climate change can alter prevalence and severity of extremes such as severe storms, including those that may bring intense or prolonged precipitation (U.S. Environmental Protection Agency [EPA] 2006). An increase in rainfall intensity and duration will saturate the soil and potentially erode the local landscape and impair slope stability, leading to an increase of landslide events in Bedford County.

While predicting changes in these types of events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (EPA 2006). Potential effects of climate change on the County's vulnerability to landslide events must be considered as understanding of regional climate change impacts increases.

Additional Data and Next Steps

More detailed landslide susceptibility zones can be generated so that communities can more specifically identify high hazard areas. A pilot study conducted for Schenectady County, New York, as described in the 2014 New York State Hazard Mitigation Plan, developed higher resolution images of landslide susceptibility zones. The methodology included use of the Natural Resource Conservation Services (NRCS) Digital Soil Survey soil units and their associated properties, including the American Association of State Highway and Transportation Officials (AASHTO) rating, liquid limit, hydrologic group, percentage of silt and clay, erosion potential, and slope, derived from high-resolution digital elevation models. Determining historical damages to buildings and infrastructure incurred from landslides will also help improve loss estimates and future modeling efforts, given a margin of uncertainty. Furthermore, research on rainfall thresholds for forecasting landslide potential may also be an option for Bedford County.

4.3.8 Lightning Strike

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 and the discharge is seen as a bright flash of lightning.

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the lightning strike hazard for the Bedford County Hazard Mitigation Plan (HMP).

4.3.8.1 Location and Extent

More than 100,000 thunderstorms occur in the United States each year, with lightning striking more than 25 million points on the ground during that same period, causing numerous injuries and fatalities (National Oceanic and Atmospheric Administration [NOAA] n.d.). Lightning can occur with all thunderstorms, making all of Bedford County susceptible. Different geographic areas experience varying event frequencies, but in all cases lightning strikes and associated fatalities occur primarily during the summer months.

While the impact of lightning events is highly localized, strong storms can result in numerous widespread events over a broad area. According to the Commonwealth of Pennsylvania 2013 Standard All-Hazard Mitigation Plan (PA HMP), Bedford County experienced three lightning strikes that resulted in injury, fatality, or property or crop loss from 1950 to 2013 (Pennsylvania Emergency Management Agency [PEMA] 2013).

4.3.8.2 Range of Magnitude

Because lightning damage is largely unreported, statistics vary considerably. The insurance industry estimates that 6.5 percent of all property and casualty claims are related to lightning strikes. While it is difficult to quantify lightning losses, it is estimated that $4 to $5 billion in damage occurs each year across the United States. Likewise, the cost of lightning protection to safeguard critical equipment and facilities from lightning strikes during severe weather is enormous.

Each year, lightning strikes across the United States are responsible for an average of between 55 and 60 fatalities, several hundred injuries, and billions of dollars in property damage. Many case histories show observed heart damage, inflated lungs, and brain damage in lightning-related fatalities. Many individuals who have survived lightning strikes report a loss of consciousness, amnesia, paralysis, and burns. Death and injury to livestock and other animals; thousands of forest and brush fires; and damage to buildings, communications systems, power lines, and electrical systems are also the result of lightning (PEMA 2013).

Bedford County's worst lightning event occurred on August 12, 1994, when lightning struck a church bell tower in Saxton, causing $5,000 in damages. No injuries were reported. The worst-case scenario for lightning strikes would be a strike in a large group of people, such as at an outdoor sporting event or concert (PEMA 2013). Numerous injuries or deaths could occur.

4.3.8.3 Past Occurrence

Between 2000 and 2010, Pennsylvania ranked tenth among all states in the United States reporting lightning strike incidents with 13 reported fatalities caused by lightning, which represents approximately 3 percent of all lightning-caused deaths in the U.S. over that period of time (NOAA n.d.; National Weather Service [NWS] 2012). Between 1959 and 2015, Pennsylvania ranked ninth among all states in the United States, with 133 deaths (not including survivors with injuries). This represents approximately 3.2 percent of casualties that occurred throughout the United States over that 35-year period (Vaisala, Inc. 2016).

Records from the National Climatic Data Center (NCDC) and Knowledge Center show that two major lightning events were reported in Bedford County between 1950 and 2016, though lightning occurs multiple times during each severe storm. Table 4.3.8-1 summarizes details from the three reported lightning events in Bedford County.

Table 4.3.8-1. Bedford County Recorded Lightning Events

Location	Date	Deaths	Injuries	Property Damage
Saxton	8/12/1994	0	0	$5,000
Breezewood	7/10/1995	0	0	$2,000

Source: NOAA-NCDC 2013; Knowledge Center 2013

4.3.8.4 Future Occurrence

Lightning can be expected in any severe storm event. While injuries or fatalities caused by lightning strikes are rare, lightning events severe enough to be reported can be expected at least once every 2 years. The future occurrence of lightning strikes can be considered likely as defined by the Risk Factor Methodology probability criteria (described in Section 4.4 of this HMP).

4.3.8.5 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable within the identified hazard area. For lightning events, all of Bedford County has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities, and lifelines), as described in Section 2 of this HMP, are vulnerable. This section evaluates and estimates the potential impact of lightning strike events on Bedford County in the following sections:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on: (1) life, health, and safety; (2) general building stock, critical facilities, and the economy; and future growth and development
- Effect of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time

Overview of Vulnerability

Evaluation of NCDC and Knowledge Center lightning data for Bedford County, along with data from the current and previous versions of the PA HMP, show that while the absolute number of lightning events has changed for individual municipalities, the basic pattern of vulnerability across the County has remained relatively consistent.

The potential for lightning strikes will continue to exist for all municipalities in the County. The direct and indirect losses associated with these events include injury and loss of life, damage to structures and infrastructure, agricultural losses, utility failure (power outages), and stress on community resources.

Bedford County is a StormReady county. This designation is obtained through participation in the NWS StormReady Program, which includes the following six guidelines met by the County:

- **Communication** – A 24-hour warning point (WP) must be fully staffed at all times, and a County Emergency Operations Center (EOC) must be established.
- **NWS Information Reception** – At least four redundant systems must be in place at the WP to receive weather warnings.
- **Hydrometeorological Monitoring** – At least four methods of monitoring hydrometeorological data must be available.
- **Local Warning Dissemination** – At least four redundant systems must be in place to notify the County of severe weather warnings, and there must be National Weather Radio-Specific Area Messaging Encoding receivers in public facilities.

- **Community Preparedness** – The County must present at a minimum of four annual weather safety talks, spotters and dispatchers must be trained biennially, and the County must host or co-host NWS spotter training annually.
- **Administration** – The County must also meet a number of administrative criteria that include formal hazardous weather operations planning, biennial visits of the County Emergency Management Coordinator (EMC) to the NWS office, and annual visits by an NWS official to the County.

Meeting the criteria of the StormReady program results in a decrease in vulnerability to all severe weather events, including lightning strikes.

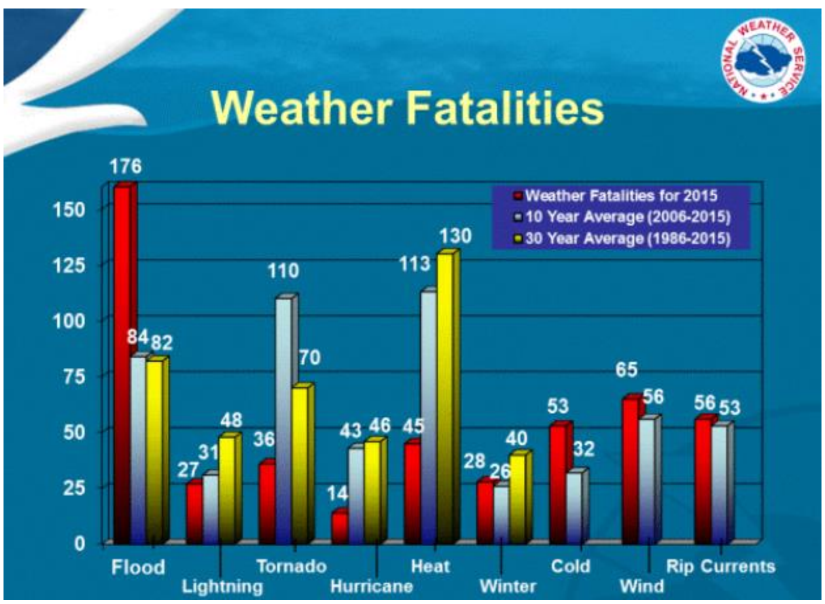
Data and Methodology

National weather databases and local resources were used to collect and analyze lightning impacts on Bedford County.

Impact on Life, Health, and Safety

Across the United States, the 10-year average (2006 to 2015) for fatalities caused by lightning is 31, while the 30-year average (1986 to 2015) is 48; Figure 4.3.8-1 illustrates these statistics (NOAA 2016). According to NOAA, no fatalities or injuries have resulted from lightning events from 1950 to 2015 in Bedford County (NOAA-NCDC 2016).

Figure 4.3.8-1. Weather Fatalities in the United States



Source: NOAA 2016

The entire population of the County is considered exposed to the lightning hazard. Lightning strikes in Pennsylvania occur primarily during the summer months. In general, population and building density have a correlation with hazard vulnerability and loss. The urban areas of Bedford County are at greater lightning risk than others because of it higher population density. Populations located outdoors are considered at risk and more vulnerable to a lightning strike compared to those inside a shelter. Moving to a lower-risk location will decrease a person's vulnerability.

Impact on General Building Stock, Critical Facilities, and the Economy

For the purposes of this plan update, the entire general building stock and all infrastructure of Bedford County are considered exposed to the lightning strike hazard. In general, urban and suburban areas in the County are at greater lightning risk than more rural areas because of the higher population and structure density. Taller buildings can act as lightning rods; therefore, they naturally have experienced greater vulnerability and loss during past lightning strike events (PEMA 2013).

The precise vulnerability of lightning strikes will depend on a facility's height in relation to surrounding buildings, as well as the absence or presence of a lightning rod or other lightning channeling technology on the structure. According to the PA HMP, fire departments, schools, and police departments are the most vulnerable to lightning strikes. Food and agriculture facilities that raise livestock may also be more vulnerable to damage caused by lightning strikes as the animals housed at the properties tend to shelter under trees in storm situations. It is important to note that most of the food and agriculture-related critical facilities are privately owned farms that may own sizeable herds of livestock; however, the Commonwealth critical facilities list does not indicate which of the farms own herds. Finally, entertainment and recreation facilities that include outdoor recreation spaces with wide-open spaces may be at increased vulnerability to lightning strikes (PEMA 2013).

According to NOAA's Technical Paper titled "Lightning Fatalities, Injuries, and Damage Reports in the United States from 1959 - 1994," monetary losses for lightning events range from less than $50 to greater than $5 million (larger losses associated with forest fires, destroyed homes, and crop loss) (NOAA 1997). Lightning can (1) be responsible for damages to buildings; (2) cause electrical, forest, and/or wildfires; and (3) damage infrastructure such as power transmission lines and communication towers. Agricultural losses caused by lightning and lightning-resulting fires can be devastating.

The PA HMP estimated jurisdictional losses for the 21 counties most threatened by lightning strike, including Bedford County. Using geographic information systems (GIS), losses for the County were estimated to total over $4.9 million. Note that losses due to lightning strikes will differ based on the magnitude of the event and the lightning protection measures on a given facility (PEMA 2013).

Future Growth and Development

Areas targeted for potential future growth and development in the next 5 to 10 years have been identified across Bedford County at the municipal level, as described in Section 4.4 of this HMP. New development is anticipated to be exposed to the lightning strike hazard.

Effect of Climate Change on Vulnerability

The definition of "climate" is not restricted to average temperature and precipitation, but also includes type, frequency, and intensity of weather events. On both global and local scales, climate change has the potential to alter the prevalence and severity of weather extremes such as storms, including those that may bring lightning. While predicting changes of lightning events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA] 2006).

Since the 1970s, globally there has been an increase in tropical cyclone destructiveness. The increased tropical cyclone intensity and duration correlates with sea surface temperature. This suggests that future increases of tropical sea surface temperature may lead to future increases in tropical cyclone intensity and duration. However, there is a high level of uncertainty regarding the relationship between climate change and storm events. Future improvements in modeling smaller-scale climatic processes can be expected and will lead to improved understanding of the ways in which the changing climate will alter temperature, precipitation, and storms events in Pennsylvania (Shortle et al. 2009).

Additional Data and Next Steps

The assessment above identifies vulnerable populations and potential structural and economic losses associated with the lightning strike hazard. Research performed at NOAA and other private organizations is ongoing to improve warning and threat information for the public. The continued collection of additional and actual loss data specific to the plan participants will further enhance Bedford County's vulnerability assessment.

4.3.9 Pandemic Disease

Pandemics are large-scale disease outbreaks, defined by the way in which a disease spreads, not by the number of fatalities associated with it. A pandemic outbreak has several recognizable characteristics, including rapid, large-scale (potentially global) spread causing overloaded healthcare systems; inadequate medical supplies; medical supply shortages; and a disrupted economy and society (Flu.gov 2015). Pandemics typically result from infectious diseases. An infectious disease, as defined by the World Health Organization (WHO), is caused by pathogenic organisms (e.g., bacteria, viruses, fungus, or parasites) that spread from one person to another, whether through direct or indirect contact. Zoonotic disease, a type of infectious disease, occurs when animals transmit a disease to humans (WHO 2015). Although any infectious disease can reach pandemic levels, influenza (flu) has the greatest likelihood of causing the next pandemic.

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the pandemic disease hazard for the Bedford County Hazard Mitigation Plan (HMP).

4.3.9.1 Location and Extent

Pandemic events cover a wide geographic area and can affect large populations, which can include multiple countries or continents. Size and extent of an infected population depends on how easily the illness is spread, mode of transmission, and amount of contact between infected and uninfected individuals. Locations with higher density populations are more susceptible to pandemic outbreaks, as the disease can be transmitted more easily. Additionally, vulnerable populations, especially the young and the elderly (who have weaker immune systems), are at greater risk for both contracting a disease and suffering fatal or severe consequences. Flu most frequently spreads through the air or by touch; when an infected person coughs, infected droplets go into the air or onto their hands, facilitating transmission of the disease to other people (WHO 2015).

When a pandemic or disease outbreak occurs, WHO and other public health institutions begin tracking the disease outbreak, treatment, and more. Ebola was a significant pandemic concern for American public health officials in 2014; however, the disease has primarily remained in Africa to date. Should a pandemic take hold in the United States, the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) would be actively involved in managing the outbreak and treatment of the disease.

Although Ebola is still recognized as a global health threat, Bedford County is primarily concerned with the possibility of a pandemic flu outbreak. Influenza viruses with the potential to reach pandemic levels include the avian influenza A (H5N1) and avian influenza H7N9 (CDC 2015). Several years ago, the swine influenza (H1N1) was of particular concern. H1N1 was first detected in people in the United States in April 2009. On June 11, 2009, WHO signaled that a pandemic of 2009 H1N1 flu was underway (CDC 2009).

4.3.9.2 Range of Magnitude

Severity of a pandemic disease depends on a number of factors, as indicated in the previous section. These include aggressiveness of the disease, ease of transmission, and factors associated with the impacted community (e.g., access to medical care, demographic data, and population density). Advancements in medical technologies have greatly reduced the number of deaths caused by influenza, the disease most likely to reach pandemic scale in Pennsylvania. Consequently, global effects of various influenza outbreaks have declined over the past century. High-risk populations considered more vulnerable to various pandemic diseases are described in the vulnerability assessment.

Pandemic flu should not be confused with seasonal flu. Seasonal flu is a less severe concern because of its regularity of occurrence and predictability. Table 4.3.9-1 lists key differences between pandemic and seasonal flus.

Table 4.3.9-1. Seasonal Flu vs Pandemic Flu

Pandemic Flu	Seasonal Flu
Rarely happens (three times in 20th century).	Happens annually and usually peaks in January or February.
People have little or no immunity because they have no previous exposure to the virus.	Usually some immunity built up from previous exposure.
Healthy people may be at increased risk for serious complications.	Usually only people at high risk, not healthy adults, are at risk of serious complications.
Healthcare providers and hospitals may be overwhelmed.	Healthcare providers and hospitals can usually meet public and patient needs.
Vaccine probably would not be available in the early stages of a pandemic.	Vaccine available for annual flu season.
Effective antivirals may be in limited supply	Adequate supplies of antivirals are usually available.
Number of deaths could be high (U.S. death toll during the 1918 pandemic was approximately 675,000).	Seasonal flu-associated deaths in the U.S. over 30 years ending in 2007 have ranged from about 3,000 per season to about 49,000 per season.
Symptoms may be more severe	Symptoms include fever, cough, runny nose, and muscle pain.
May cause major impact on the general public, such as widespread travel restrictions and school or business closings.	Usually causes minor impact on the general public; some schools may close and sick people are encouraged to stay home.
Potential for severe impact on domestic and world economy.	Manageable impact on domestic and world economy.

Source: Flu.gov 2015

Approximately 12,470 Americans died from H1N1 within a roughly 1-year period from April 2009 to April 2010 (CDC 2010). Between October 2014 and late May 2015, 6.4 percent of deaths were attributable to pneumonia and influenza—below the epidemic threshold of 6.6 percent (an epidemic occurs when incidence rate exceeds expected rate but is not at the magnitude of a pandemic) (CDC FluView 2016).

WHO described a series of pandemic phases in 1999 (revised these in 2005 and 2009) to provide a global framework and aid in pandemic preparedness and response planning. In addition to facilitating implementation of preparedness recommendations, the phases also help provide greater understanding of when an event is considered to have reached pandemic levels. The six phases are described as follows:

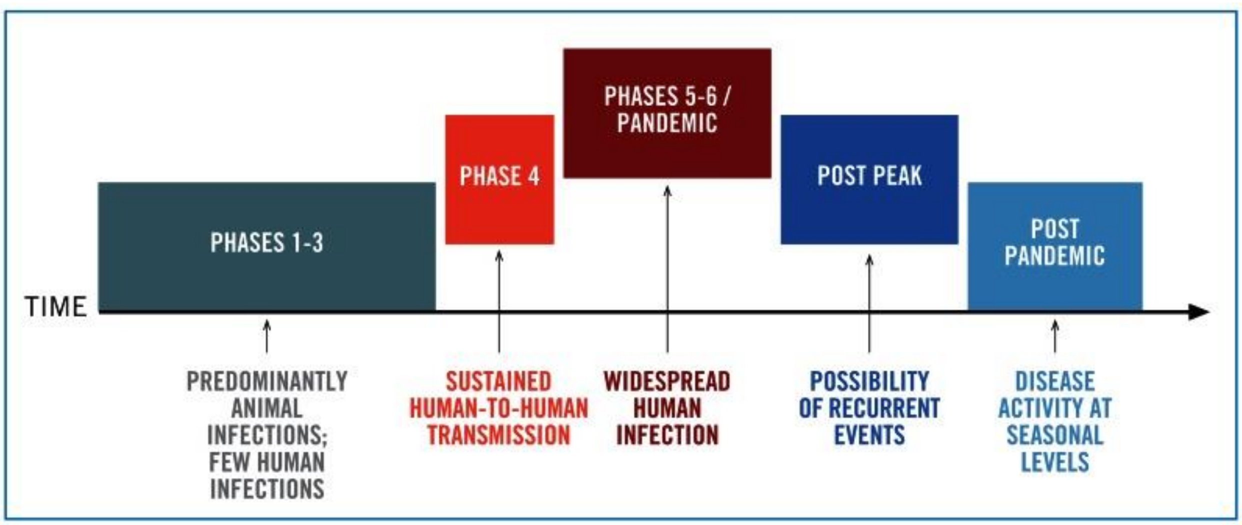
- Phase 1: No viruses circulating among animals have been reported among humans.
- Phase 2: An animal influenza virus circulating among domesticated or wild animals has caused known infection in humans and is now considered a potential pandemic threat.
- Phase 3: An animal or human-animal influenza reassortment virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain

community-level outbreaks. Limited human-to-human transmission may occur under some circumstances, such as close contact between an infected person and an unprotected caregiver.

- Phase 4: Verified human-to-human transmission of an animal or human-animal influenza reassortment virus is able to cause "community-level outbreaks." The ability to cause sustained disease outbreaks in a community marks a significant upwards shift in the risk of a pandemic. Any country that suspects or has verified such an event should urgently consult with WHO so that the situation can be jointly assessed and a decision made by the affected country if implementation of a rapid pandemic containment operation is warranted. Phase 4 indicates a significant increase in risk of a pandemic but does not necessarily mean that a pandemic is a forgone conclusion.
- Phase 5: There has been human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent, and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
- Phase 6: The pandemic phase is characterized by community-level outbreaks in at least one other country in a different WHO region, in addition to the criteria defined in Phase 5. Phase 6 indicates a global pandemic is underway.

Conclusion of Phase 6 leads to the post-peak period, wherein pandemic levels decrease in most countries with surveillance capabilities. Despite a decrease in activity, countries still must be prepared for additional waves of the pandemic. Pandemic waves can be separated by a period of months, leading to a long recovery time to guarantee entry of the pandemic into the post-pandemic phase (WHO 2009). Figure 4.3.9-1 shows the six phases of pandemic influenza described by WHO.

Figure 4.3.9-1. Pandemic Influenza Phases



Source: WHO 2009

An estimate of potential impacts of pandemic disease influenza was prepared for Bedford County using the CDC's FluSurge 2.0 model. Using a 12-week pandemic wave with a 35-percent attack rate, the model indicated that Bedford County's maximum (worst-case) scenario would involve 341 hospital admissions, with a peak of 102 new admissions in weeks 6 and 7, resulting in 87 deaths.

4.3.9.3 Past Occurrence

Several pandemic influenza outbreaks have occurred over the past 100 years. A list of worldwide pandemic events appears in Table 4.3.9-2. Deaths occurred in the United States as a result of Spanish Flu, Asian flu, and Hong Kong Flu outbreaks. Spanish Flu (1918-1920) claimed 500,000 lives in the United States, with 350,000 cases reported in Pennsylvania. Most deaths resulting from Asian flu occurred between September 1957 and March 1958; within the United States, approximately 70,000 people died, and approximately 15 percent of the population of Pennsylvania was affected. The first cases of Hong Kong Flu in the United States were detected in September 1968, with deaths peaking between December 1968 and January 1969 (Global Security, 2009). As of August 2010, H1N1 was in a post-pandemic period.

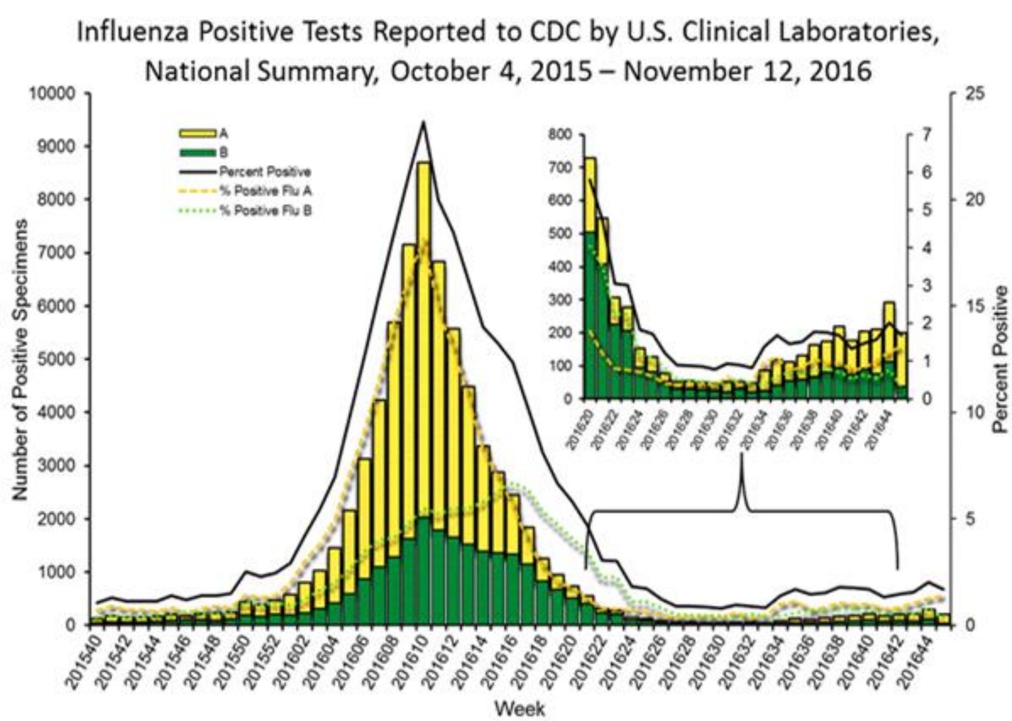
Table 4.3.9-2. Previous Pandemic Outbreaks

Date	Pandemic/Subtype	Worldwide Deaths (Approx.)
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/H1N1	> 18,000

Source: CDC 2010

Epidemiologists and public health officials consistently track the rate of influenza or influenza-like-illnesses (ILI) to monitor potential pandemic threats. This also allows them to provide annual data on ILI seasonal outbreaks. Figure 4.3.9-2 below shows the national number of cases of ILI during the 2014-2015 season, distinguishing each type of ILI by a unique color.

Figure 4.3.9-2. ILI Cases in the United States, 2015-2016 Season



Source: CDC Weekly Flu 2016

In the mid-Atlantic region, which includes the State of Pennsylvania and Bedford County, the following numbers of positive ILI tests were reported:

- A – 2,494
- B – 938
- H3N2v – 0

4.3.9.4 Future Occurrence

Based on historical data, Bedford County is expected to undergo pandemic influenza outbreaks every 11 to 41 years. Exact timing of pandemic influenza outbreaks is unpredictable, and complete avoidance of these is impossible (U.S. Department of Health and Human Services [DHHS] 2009). Future occurrence is considered possible, as defined by the Risk Factor Methodology probability criteria (shown in Table 4.4-1 in Section 4.4 of this HMP).

4.3.9.5 Vulnerability Assessment

Depending on characteristics of the disease or virus, certain population groups can be at higher risk of infection than others. Regarding seasonal influenza, about 60 percent of hospitalizations and 90 percent of flu-related deaths occur among people 65 and older. However, during the H1N1 pandemic, 90 percent of hospitalizations and 87 percent of H1N1-related deaths occurred in people younger than 65. As with seasonal flu, people with underlying health conditions faced a much higher probability of contracting H1N1. Schools, convalescent centers, and other institutions are highly conducive to faster transmission of pandemic diseases (CDC 2010).

Table 4.3.9-3 shows the demographic change in children and the elderly from 2000 through 2014. There are fewer individuals under 65 years of age, but more individuals over 65 years of age in the County. Therefore, Bedford County is more vulnerable to seasonal influenza, but less vulnerable to pandemic influenza such as the H1N1 pandemic.

Table 4.3.9-3: Demographic Trends for Vulnerable Populations

Vulnerable Population	2000 Census	2010 Census	2014 Census Estimate	2000 to 2014 Change
Under 18 years	11,774	10,739	7,893	-3,881
Under 65 years	41,741	40,286	39,614	-2,127
65 years and over	8,243	9,476	9,718	1,475

Source: U.S. Census Bureau

4.3.10 Radon Exposure

Radon is a natural gas that cannot be seen, smelled, or tasted. It is a noble gas that originates from natural radioactive decay of uranium and thorium. Radon is a large component of the natural radiation to which humans are exposed, and can pose a serious threat to public health when it accumulates in poorly ventilated residential and occupation settings. According to the U.S. Environmental Protection Agency (EPA), radon causes more than 20,000 lung cancer deaths per year, second only to smoking as the leading cause of lung cancer (EPA 2003). An estimated 40 percent of the homes in Pennsylvania are believed to have elevated radon levels (Pennsylvania Department of Environmental Protection [PADEP] 2009).

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the radon exposure hazard for the Bedford County Hazard Mitigation Plan (HMP).

4.3.10.1 Location and Extent

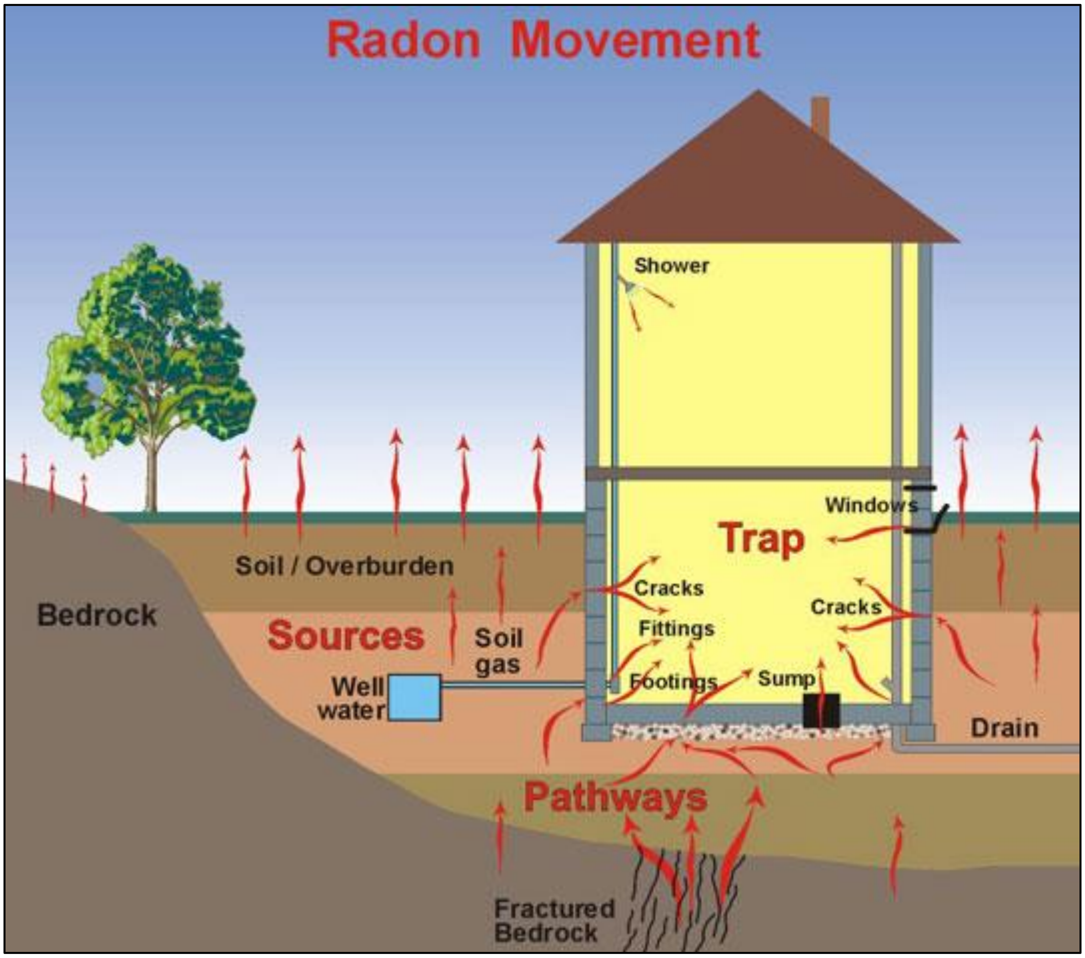
Radioactivity caused by airborne radon has been recognized for many years as an important component in the natural background radioactivity exposure of humans. However, it wasn't until the 1980s that the wide geographic distribution of elevated radon levels in houses and the possibility of extremely high radon concentrations in houses were recognized. In 1984, routine monitoring of employees leaving the Limerick nuclear power plant near Reading, PA, showed that readings from one employee frequently exceeded expected radiation levels, yet only natural, non-fission product radioactivity was detected on him. Radon levels in his home were detected around 2,500 picoCuries per liter (pCi/L), much higher than the 4 pCi/L guideline set by EPA or even the 67 pCi/L limit for uranium miners. As a result of this event, the Reading Prong section of Pennsylvania where this person lived became the focus of the first large-scale radon scare in the world.

Radon (Rn-222), which has a half-life of 3.8 days, is a widespread hazard. The distribution of radon correlates with the distribution of radium (Ra-226), its immediate radioactive parent, and with uranium, its original ancestor. Because of the short half-life of radon, the distance radon atoms travel from their parent before they decay is generally limited to extents of feet or tens of feet. Three sources of radon in houses are now recognized:

- Radon in soil air flows into the house.
- Radon dissolved in water from private wells and exsolved during water usage; this source is rarely a problem in Pennsylvania.
- Radon emanating from uranium-rich building materials (such as concrete blocks or gypsum wallboard); this source also is not known to be a problem in Pennsylvania (PEMA 2013).

Figure 4.3.10-1 illustrates radon entry points into a home.

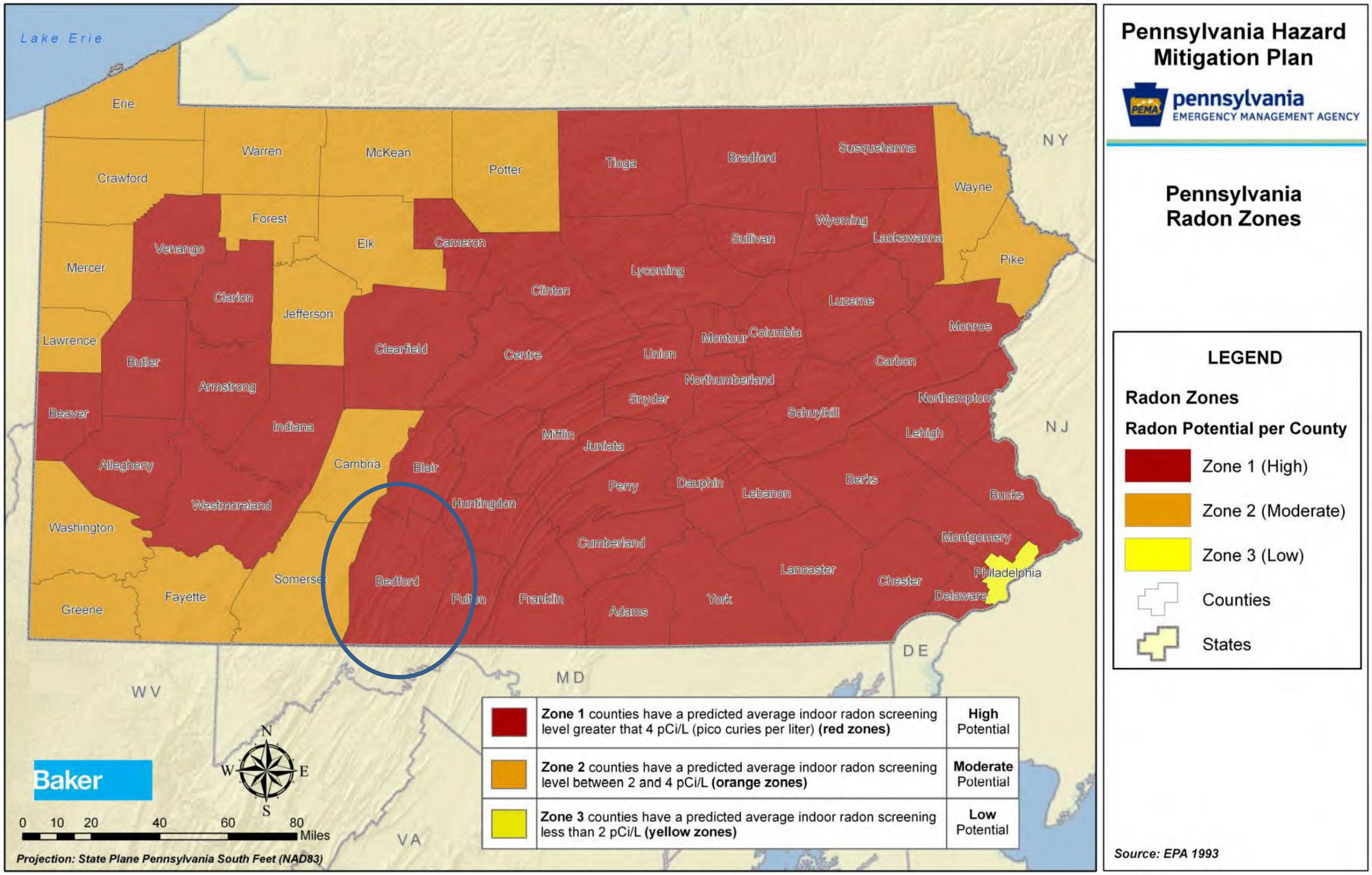
Figure 4.3.10-1. Sketch of Radon Entry Points into a House



Sources: PEMA 2013

Each county in Pennsylvania is classified as having a low, moderate, or high radon hazard potential. A majority of counties across the Commonwealth, particularly counties in eastern Pennsylvania, have a high hazard potential. Western Pennsylvania counties, however, are not completely immune from the threat of radon, as high potential for radon exposure exists within nine western counties. The average indoor radon screening level within high-exposure counties exceeds 4 pCi/L. Bedford County is in Zone 1 – High Radon Potential, as noted on Figure 4.3.10-2 below.

Figure 4.3.10-2. Radon Hazard Zones in Pennsylvania



Sources: PEMA 2013 (blue highlight added)

High radon levels were initially thought to be exacerbated in tightly sealed houses, although 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 affecting radon concentrations. Air must be drawn into a house to compensate for outflows of air from the house caused by a furnace, fan, thermal "chimney" effect, or wind effects. If the upper part of the house is tight enough to impede influx of outdoor air (radon concentration generally below 0.1 pCi/L), 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.

Radon concentration in soil gas depends on a number of soil properties, the importance of which are still being evaluated. In general, 10 to 50 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. Fractured zones may supply air having radon concentrations similar to those in deep soil for houses built on bedrock.

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

- <u>Areas of very elevated uranium content (above 50 parts per million [ppm]) around uranium deposits and prospects</u>: Although very high levels of radon can occur in these areas, the hazard normally is restricted to within a few hundred feet of the deposit. In Pennsylvania, these localities occupy an insignificant area.
- <u>Areas of common rocks having higher than average uranium content (5 to 50 parts per million [ppm])</u>: In Pennsylvania, these rock types include granitic and felsic alkali igneous rocks and black shales. High uranium values in rock or soil and high radon levels in houses in the Reading Prong are associated with Precambrian granitic gneisses commonly containing 10 to 20 ppm uranium, but locally containing more than 500 ppm uranium. Elevated uranium occurs in black shales of the Devonian Marcellus Formation and possibly the Ordovician Martinsburg Formation in Pennsylvania. High radon values are locally present in areas underlain by these formations.
- <u>Areas of soil or bedrock that have normal uranium content but properties that promote high radon levels in houses</u>: This group is incompletely understood at present. Relatively high soil permeability can lead to high radon concentrations, 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 where radium is concentrated by weathering on iron oxide or clay surfaces, coupled with moderate porosity and permeability. The importance of carbonate soils is indicated by exceedance of 4 pCi/L in 93 percent of a sample of houses built on limestone-dolomite soils near State College, Centre County, and exceedance of 20 pCi/L in 21 percent of that sample of houses, even though uranium levels in the underlying bedrock are all within the normal range of 0.5 to 5 ppm (PEMA 2013).

According to the State HMP, radon tends to exist as a gas or as a dissolved atomic component in groundwater. The most problematic source of radon in houses in Pennsylvania is radon in soil gas that flows into the house. Even a small rate of soil gas inflow can lead to elevated radon concentrations in a house. The State HMP indicates that current data on abundance and distribution of radon in Pennsylvania homes are incomplete and biased, but the plan identifies general patterns (PEMA 2013).

4.3.10.2 Range of Magnitude

Exposure to radon is the second-leading cause of lung cancer after smoking, and the leading cause of lung cancer among non-smokers. As stated earlier, radon is responsible for more than 20,000 lung cancer deaths every year. Lung cancer is the only known effect on human health from exposure to radon in air and, thus far, no evidence indicates that children are at greater risk of lung cancer than adults (EPA 2013). The main hazard is actually from the radon daughter products (polonium-218, lead-214, bismuth-214), which may become attached to lung tissue and induce lung cancer by their radioactive decay. Table 4.3.10-1 lists (1) cancer risks from exposure to radon at various levels for smokers and non-smokers, (2) lung cancer risks from radon exposure compared to cancer risks from other hazards for smokers and non-smokers, and (3) action thresholds.

Table 4.3.10-1. Radon Risk for Smokers and Non-Smokers

Radon Level (picoCuries per liter [pCi/L])	Cancer Rate per 1,000 People with Lifetime Exposure	Comparative Cancer Risk of Radon Exposure	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 2 pCi/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.

Source: EPA 2010

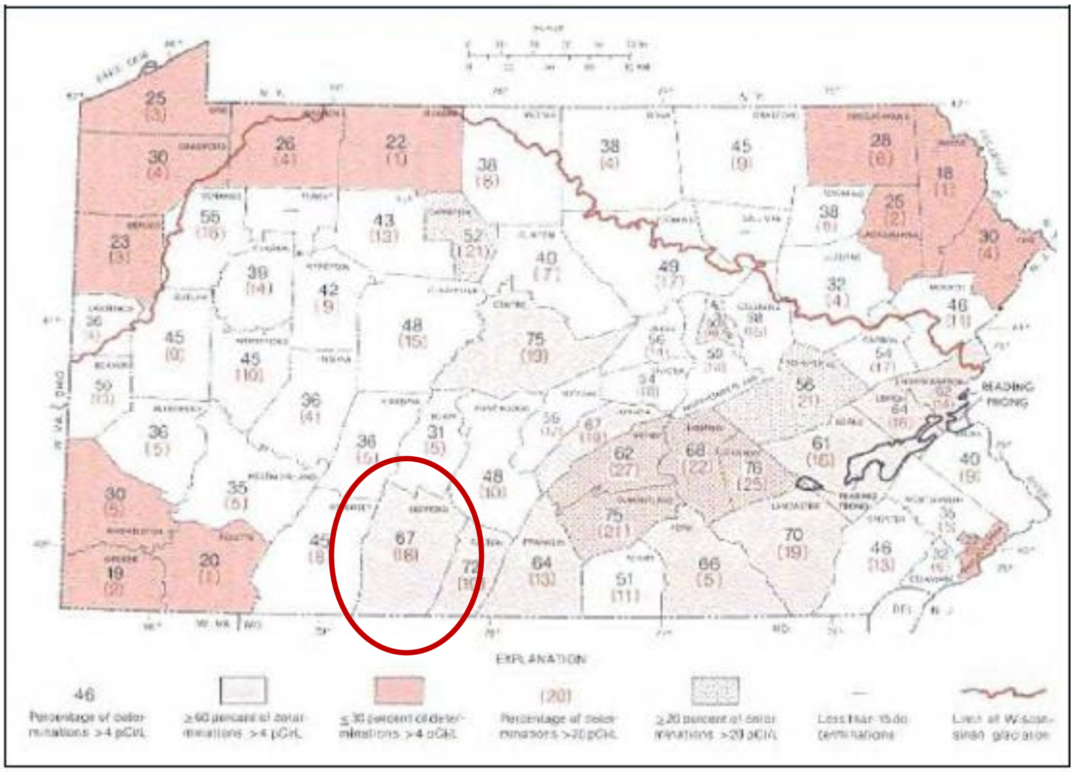
According to EPA, the average radon concentration in the indoor air in homes in the United States is about 1.3 pCi/L. EPA recommends that homes be repaired if the radon level is 4 pCi/L or more. However, EPA also recommends that Americans consider fixing their home if radon levels are between 2 and 4 pCi/L because there is no known safe level of exposure to radon. As listed 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 a large area of tightly sealed homes inducing high levels of exposure to residents over a prolonged period of time, without awareness of this by the residents. This worst-case scenario exposure then could lead to a large number of people contracting cancer attributed to the radon exposure (PEMA 2013). The most likely scenario is a single household exposed to a very low concentration of radon, with no adverse health effects.

4.3.10.3 Past Occurrence

Current data on abundance and distribution of radon in Pennsylvania houses are considered incomplete and potentially biased, but some general patterns are evident (shown in Figure 4.3.10-3).

Figure 4.3.10-3. Percentage of Pennsylvania Homes with Radon Levels Exceeding 4 pCi/L



Source: PEMA 2013 (red highlight added)

PADEP Bureau of Radiation Protection (Bureau) provides information for homeowners on how to test for radon in their houses. If results of a test reported to the Bureau exceed 4 pCi/L, the Bureau works to help the homeowner repair the house so as to mitigate high radon levels. The total number of tests reported to the Bureau since 1990 and test results by zip code are accessible on the Bureau's website. However, to best approximate the average for an area, this information is provided only if more than 30 tests within that area were reported.

The Bureau collected the sufficient number of radon results from residences in six zip codes within Bedford County to allow them to report the findings (summarized in Table 4.3.10-2). PADEP does not publish results unless a zip code has had at least 30 tests conducted. PADEP only publishes the average and maximum results for a zip code; it does not offer a range of results for a zip code, municipality, or region. The PADEP Radon Division recommends that ***all*** homeowners test for radon, regardless of test results within their respective zip codes. Despite a low average text result within a zip code, many homes in that zip code may have elevated radon levels.

Table 4.3.10-2. Radon Level Tests and Results by Zip Codes

ZIP Code	Location	Area in Home	Number of Tests	Maximum Result (pCi/L)	Average Result (pCi/L)
15522	Bedford	Basement	563	163.0	8.8
		First Floor	51	37.3	4.7
15535	Clearville	Basement	32	128.3	19.4
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data
15537	Everett	Basement	184	138.0	11.3
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data
15554	New Paris	Basement	58	138.0	9.8
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data
16625	Steifer Corner	Basement	31	32.5	5.8
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data
16678	Saxton	Basement	42	68.8	7.6
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data

Source: PADEP 2016

4.3.10.4 Future Occurrence

Radon exposure is inevitable given present soil, geologic, and geomorphic factors across Pennsylvania. Residents who live in developments within areas where radon levels previously have been found to be 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 by conducting proper testing within both existing and future developments, and implementing appropriate mitigation measures (PEMA 2013). As part of a 2014 initiative to raise awareness, EPA implemented the "Test, Fix, Save a Life" radon action campaign to highlight radon testing and mitigation as a simple and affordable step to significantly reduce the risk of lung cancer. Through this initiative, the "Test, Fix, Save a Life" mantra specifies activities and facts for the public regarding radon poisoning, as indicated below:

- Test: All homes with or without basements should be tested for radon. Affordable do-it-yourself radon test kits are available online and at home improvement and hardware stores, or you can hire a qualified radon tester.
- Fix: EPA recommends taking corrective action to fix radon levels at or above 4 pCi/L and contacting a qualified radon-reduction contractor. In most cases, a system with a vent pipe and fan is used to reduce radon. Addressing high radon levels often costs the same as other minor home repairs.
- Save a Life: More than 20,000 Americans die from radon-related lung cancer each year. By decreasing elevated levels in the home, residents can help prevent lung cancer while creating a healthier home (EPA 2013).

Future occurrences of radon exposure can be considered *likely* as defined by the Risk Factor Methodology probability criteria (discussed in to Section 4.4).

4.3.10.5 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable within the identified hazard area. This section evaluations and estimates the potential impact of the radon exposure hazard on Bedford County in the following sections:

- Overview of vulnerability
- Data and methodology used for the evaluation

- Impacts on (1) life, health, and safety; (2) general building stock and critical facilities; (3) the economy; (4) the environment; and (5) future growth and development
- Further data collections that will assist in understanding this hazard over time.

Overview of Vulnerability

Radon exposure is of particular concern in Bedford County because of the County's location within a High Potential (Level 1) EPA Radon Zone. While structural factors (such as building construction and engineered mitigation measures) can influence the level of radon exposure, all residents and structures within Bedford County are vulnerable to radon exposure.

Data and Methodology

The 2010 U.S. Census data and the Hazards U.S. - Multi Hazard (HAZUS-MH) building inventory for Bedford County were referenced to support an evaluation of assets exposed to this hazard and potential impacts associated with this hazard. Per the 2013 Pennsylvania State Hazard Mitigation Plan, an average radon mitigation system cost of $1,200 was applied to 20 percent of the building stock to evaluate economic vulnerability (PEMA 2013).

Impact on Life, Health, and Safety

For the purposes of this plan, the entire population of the County is assumed exposed to risk of radon exposure. Radon is responsible for more than 20,000 of lung cancer deaths every year. Lung cancer is the only known effect on human health from exposure to radon in air, and thus far, no evidence indicates that children are at greater risk of lung cancer than are adults (EPA 2013).

As shown in Figure 4.3.10-3 above, 67 percent of homes in Bedford County have measured radon levels exceeding 4 pCi/L. Excess human cancer risk posed by radon exposure at this elevated level is identified in Table 4.3.10-1.

Impact on General Building Stock and Critical Facilities

While the entire general building stock and critical facility inventory in Bedford County is exposed to radon, radon does not result in direct damage to structures and facilities. Rather, engineering methods installed to mitigate human exposure to radon in structures results in economic costs described in the following subsection.

Impact on the Economy

EPA has concluded that an average radon mitigation system costs $1,200. EPA also states that current State surveys indicate one home in five with elevated radon levels. By use of this information, radon loss estimation is factored by assuming that 20 percent of the residential buildings within High Potential (Level 1) counties have elevated radon levels, and each would require a radon mitigation system installed at the EPA estimated average of $1,200 (PEMA 2013). Therefore, estimated radon mitigation costs for residential structures in Bedford County could exceed $1.7 million. However, 67 percent of households in the County have measured basement-level average radon levels exceeding 4 pCi/L (shown on Figure 4.3.10-3), indicating that the cost of radon mitigation may be higher than the estimate based on the above-cited information from EPA, whereby only 20 percent of structures are considered for mitigation.

Impact on the Environment

Radon exposure exerts minimal environmental impacts. Because of the relatively short half-life of radon, it tends to affect only living and breathing organisms such as humans or pets that are routinely within contained areas (basement or house) where the gas is released (PEMA 2013).

Future Growth and Development

Because the entirety of Bedford County has been determined at risk for the radon exposure hazard, any new development will be exposed to this risk. Measures to reduce human exposure to radon in structures are readily available and can be incorporated during new construction at significantly lower cost and greater effectiveness than cost and effectiveness of retrofitting existing structures to implement these measures.

Additional Data and Next Steps

The assessment above identifies human health and economic losses associated with this hazard of concern; however, these estimates are based on national epidemiological statistics and generalized estimates of costs to mitigate structures in Bedford County. Because specific structural conditions affect human exposure to radon, direct radon measurements within facilities are necessary to properly assess the level of health risk and indicate need for mitigation measures. Furthermore, EPA recommends consideration of radon exposure risk and installation of mitigation measures as appropriate during all new construction.

4.3.11 Subsidence and Sinkholes

This section provides a profile and vulnerability assessment for the subsidence/sinkhole hazard for Bedford County. Subsidence/sinkholes may be natural or related to underground mining activities. The predominant cause of subsidence and sinkholes in Bedford County is its underlying carbonite bedrock composition, which can include limestone and dolomite. Although underground mining is not considered the primary cause of sinkholes or subsidence in the county, subsidence/sinkholes may still occur in the future because of mining activity. Thus, information will be presented to highlight this hazard cause and its potential impacts. Although underground mining is not considered a geologic hazard, it will be treated as such in this document, due to its relation with the potential for subsidence events.

Land subsidence can be defined as the sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion, owing to the subsurface movement of earth materials (U.S. Geological Survey [USGS] 2007). Subsidence often occurs through the loss of subsurface support due to mining or in karst terrain, which may result from a number of natural and human-caused occurrences. Karst is a distinctive topography, in which the landscape is largely shaped by the dissolving action of water on carbonate bedrock (usually limestone, dolomite, or marble).

Karst features are defined as pockets of limestone or dolomite bedrock located within more stable geological formations that could cause subsidence or sinkholes. The density of karst features ranges from 0 to 600 features per square mile, with wide variations in size. Fewer karst features have been mapped in existing urban areas; however, this is likely a result of development activities that disguise, cover, or fill existing features rather than an absence of the features themselves (Pennsylvania Emergency Management Agency [PEMA] 2013).

Sinkholes are a natural and common geologic feature in areas with underlying limestone, carbonate rock, salt beds, or other rocks that are soluble in water. Over periods of time measured in thousands of years, the carbonate bedrock can be dissolved through acidic rainwater moving through fractures or cracks in the bedrock. This creates larger openings in the rock through which water and overlying soil materials travel. Over time, the deposited soils compromise the strength of the bedrock, until it is unable to support the land surface above, causing a collapse or sinkhole. In this example the sinkhole occurs naturally; however, in other cases, the root causes of a sinkhole are anthropogenic, especially those that involve changes to the water balance of an area including over-withdrawal of groundwater, diverting surface water from a large area and concentrating it in a single point, artificially creating ponds of surface water, and drilling new water wells. These actions can also serve to accelerate the natural processes of bedrock degradation, which can directly impact sinkhole creation.

Both natural and manmade sinkholes can occur without warning. Specific signs that a sinkhole is forming include slumping or falling fence posts, trees, or foundations; sudden formation of small ponds; wilting vegetation; discolored well water; and/or structural cracks in walls and floors. Sinkholes can form into steep-walled holes or into bowl- or cone-shaped depressions. When sinkholes occur in developed areas, they can cause severe property damage, injury, and loss of life; disruption of utilities; and damage to roadways. In urban and suburban areas, sinkholes can destroy highways and buildings.

Two common causes of subsidence in Pennsylvania are (1) dissolution of carbonate rock, such as limestone or dolomite; and (2) mining activity. Water passing through naturally occurring fractures and bedding planes dissolves bedrock, leaving voids below the surface. Eventually, overburden on top of the voids collapses, leaving surface depressions resulting in karst topography. Characteristic features associated with karst topography include sinkholes, linear depressions, and caves. Often, subsurface solution of limestone will not result in the immediate formation of karst features. Collapse sometimes occurs only after a large amount of activity, or when a heavy burden is placed on the overlying material (PEMA 2013).

The following sections discuss the location and extent, range of magnitude, previous occurrence, future occurrence, and vulnerability assessment associated with the subsidence/sinkhole hazard for Bedford County.

4.3.11.1 Location and Extent

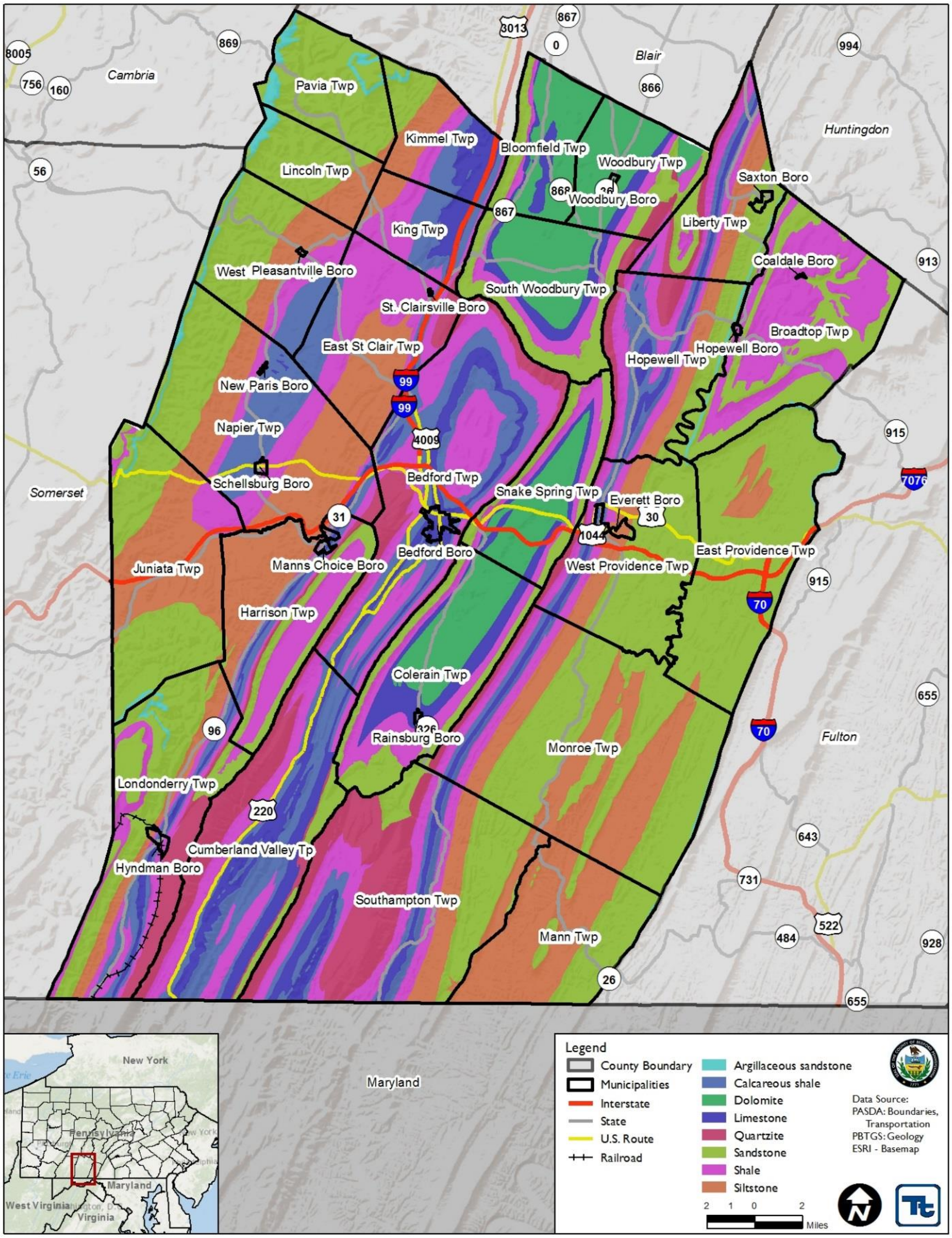
Approximately 6.9 percent of Bedford County (69.7 square miles) is underlain by carbonate bedrock (e.g., limestone). Bedford County has a very low susceptibility to sinkholes and subsidence attributable to abandoned mines; however, this does not mean such an event cannot occur.

Figure 4.3.11-1 illustrates the bedrock geology of Bedford County. Figure 4.3.11-2 highlights the areas of Pennsylvania subject to natural subsidence caused by the presence of limestone bedrock and Figure 4.3.11-3 more specifically illustrates the limestone bedrock across Bedford County. The following municipalities have identified near-surface limestone:

- Bedford Borough
- Bedford Township
- Bloomfield Township
- Colerain Township
- Cumberland Valley Township
- East St. Clair Township
- Everett Borough
- Harrison Township
- Hopewell Township
- Hyndman Borough
- Kimmel Township
- King Township
- Liberty Township
- Londonderry Township
- Manns Choice Borough
- Monroe Township
- Napier Township
- Rainsburg Borough
- Snake Spring Township
- South Woodbury Township
- Southampton Township
- West Providence Township
- Woodbury Township

Figure 4.3.11-4 shows the approximate location of abandoned mines and land hazards created by past coal mining; information is based on a subset of data contained in the Office of Surface Mining Reclamation and Enforcement (OSMRE) Abandoned Mine Land Inventory. In addition, detailed maps of abandoned mines are available for 231 mines in Bedford County through the National Mine Map Repository (NMMR), maintained by the OSMRE (OSMRE Date Unknown). The NMMR contains over 183,000 maps from the 1790s to the present day, providing information for both surface and underground mines throughout the United States.

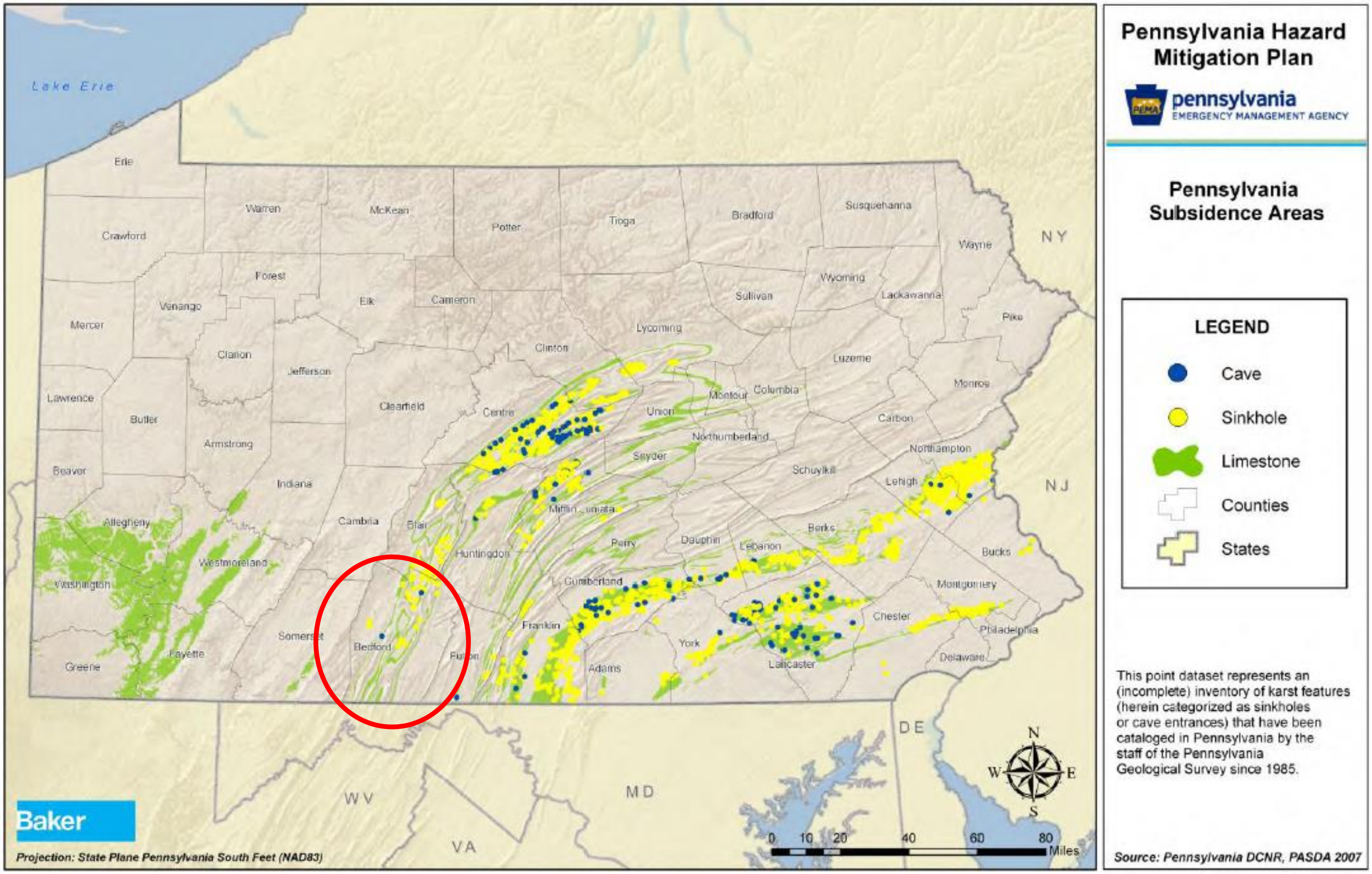
Figure 4.3.11-1. Bedford County Geology



Source: Pennsylvania Bureau of Topographic and Geologic Survey 2001

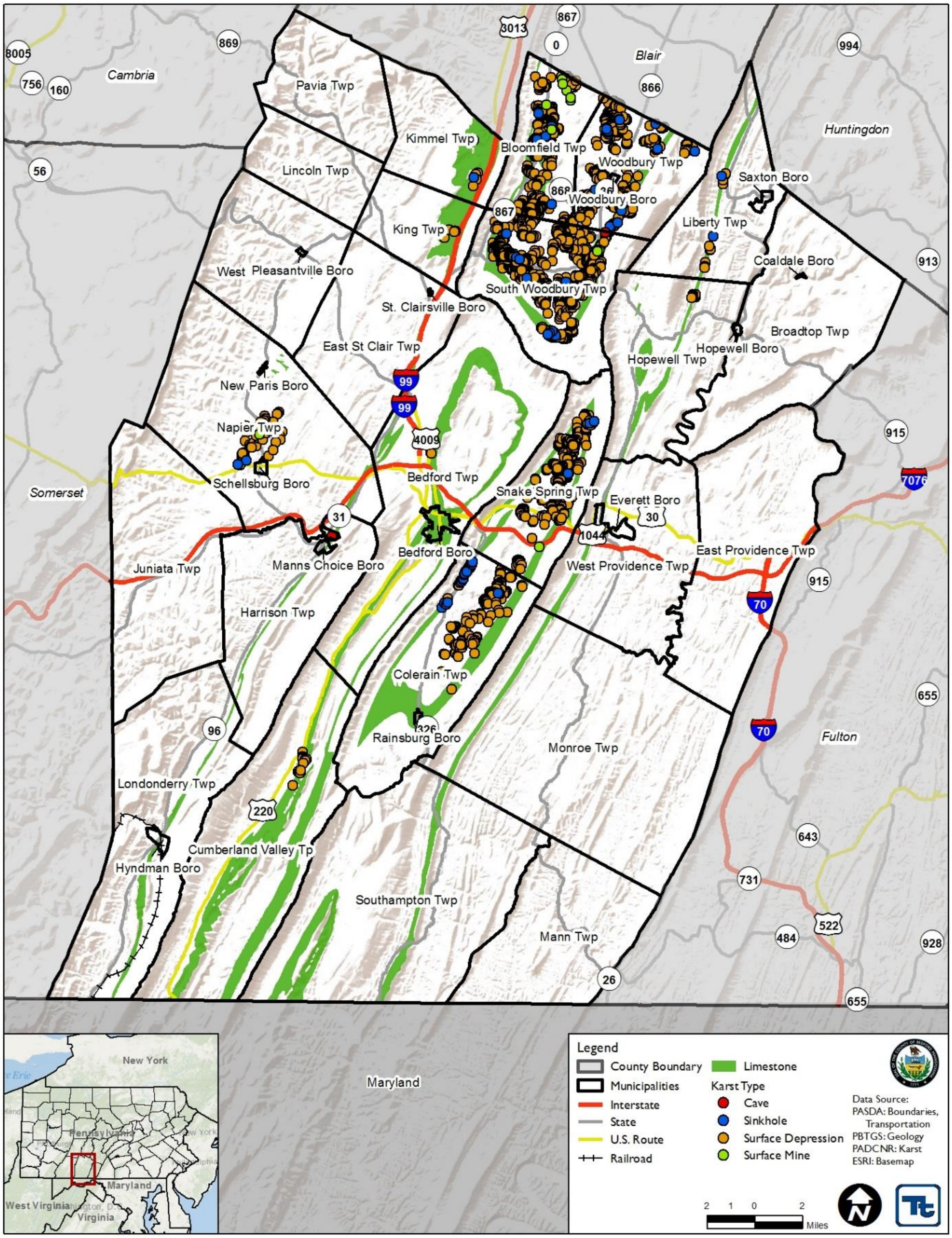
Note: The numbers shown in circles on the map are local roadway designations.

Figure 4.3.11-2. Areas of Pennsylvania Subject to Natural Subsidence Due to the Presence of Limestone Bedrock



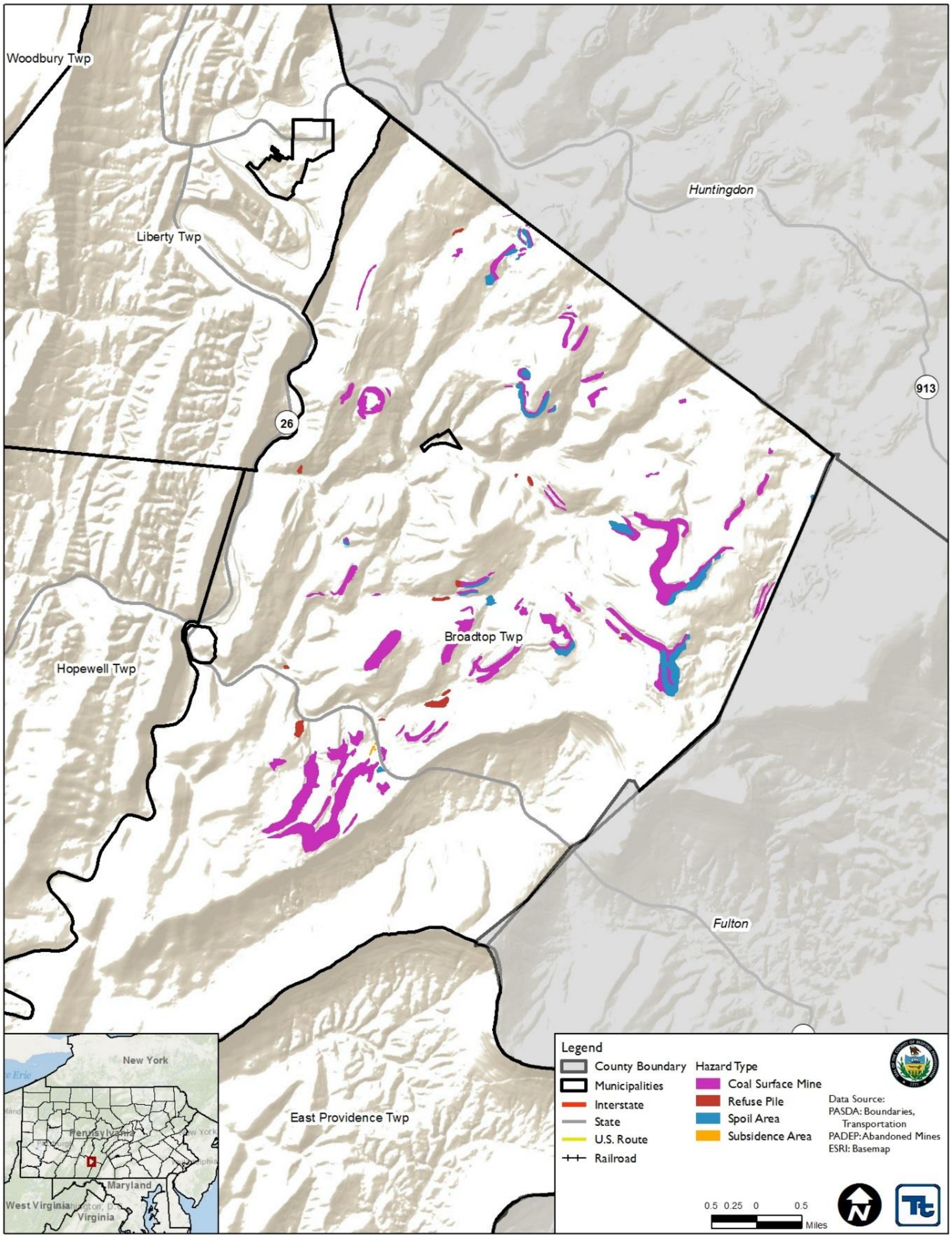
Source: PEMA 2013 (highlight added)

Figure 4.3.11-3. Bedford County Limestone Bedrock Geology



Source: Pennsylvania Bureau of Topographic and Geologic Survey 2001
PA Department of Conservation and Natural Resources 2014

Figure 4.3.11-4. Abandoned Mines in Bedford County



Source: Pennsylvania Department of Environmental Protection (PADEP) 2014
Note: Red areas indicate abandoned mines that have been identified as subsidence areas.
Map extent is decreased to show areas with abandoned mines.

While fewer karst features have been mapped in existing urban areas, human activity can often be the cause of a subsidence area or sinkhole. Leaking water pipes or structures that convey stormwater runoff may also result in areas of subsidence as the water dissolves substantial amounts of rock over time. In some cases, construction, land grading, or earthmoving activities that cause changes in stormwater flow can trigger sinkhole events. Subsidence or sinkhole events may during mining activities, especially in areas where the cover of a mine is thin, or in areas where bedrock is not necessarily conducive to their formation. In their article titled "Sinkholes are Bad," authors Piggott and Eynon indicated that sinkhole development normally occurs where the interval to the ground surface is less than three to five times the thickness of the extracted seam and the maximum interval is up to ten times the thickness of the extracted seam. Subsurface (i.e., underground) extraction of materials such as oil, gas, coal, metal ores (i.e., copper, iron, and zinc), clay, shale, limestone, or water may result in slow-moving or abrupt shifts in the ground surface (Piggott and Eynon 1978).

4.3.11.2 Range of Magnitude

Based on the geologic formations underlying parts of Bedford County, subsidence and sinkhole events may occur gradually or abruptly. Events could result in minor elevation changes or deep, gaping holes in the ground surface. Abrupt subsidence and sinkhole events can cause severe damage in urban environments; gradual events can be addressed before significant damage occurs. 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.

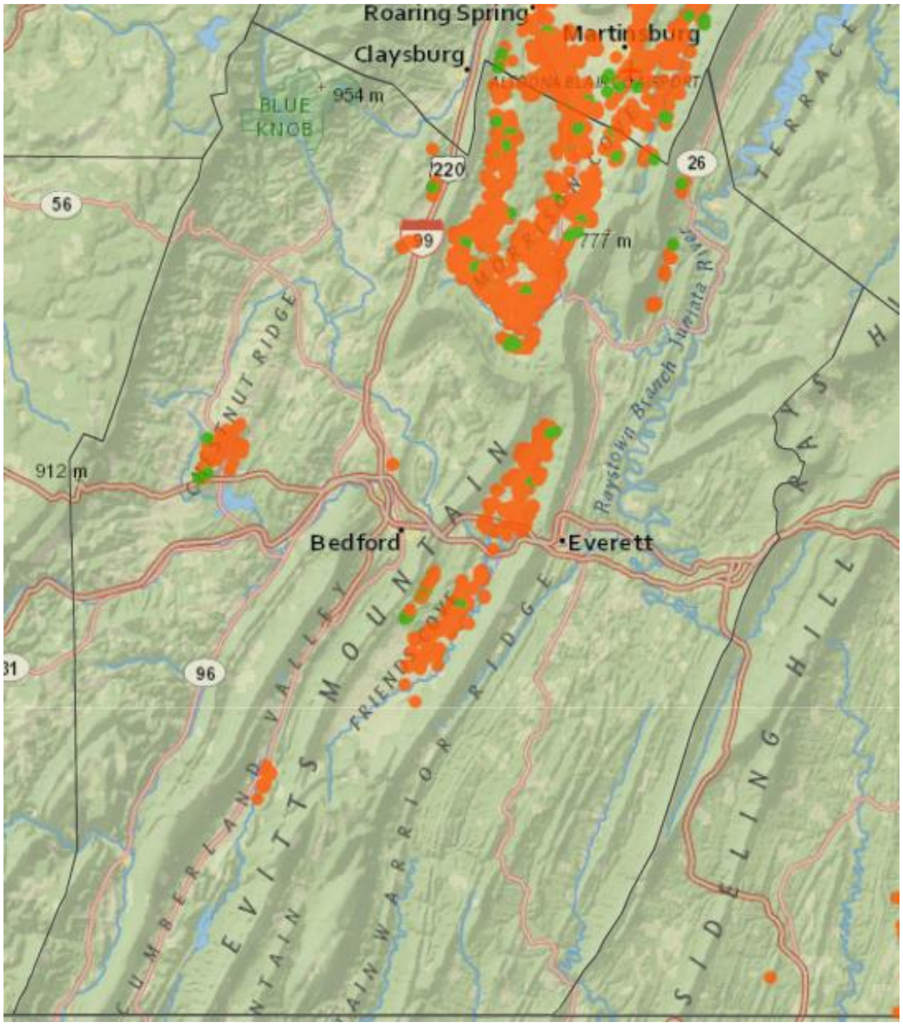
Sinkholes also may have negative effects on local groundwater. Groundwater in limestone and other similar carbonate rock formations can be easily polluted, because water moves readily from the earth's surface down through solution cavities and fractures, thus undergoing very little filtration. Contaminants such as sewage, fertilizers, herbicides, pesticides, or industrial products are of concern.

The worst-case scenario for sinkholes in Bedford County would be a series of large sinkholes opening in Bedford Borough. Long swaths of the borough have near-surface limestone, making it vulnerable to sinkholes. The borough is home to 9 critical infrastructure facilities and 2,454 people over limestone bedrock. A sinkhole in Bedford Borough could potentially cause significant property damage. This series of sinkholes could close roads, cause power outages, prevent the delivery of emergency services, cause injuries or death to residents, and could cost millions of dollars in property damage ($560 million of replacement cost value for structures and contents exists on limestone bedrock).

4.3.11.3 Past Occurrence

The Pennsylvania Department of Conservation and Natural Resources (PA DCNR) Interactive Map (see Figure 4.3.11-5) shows dozens of sinkholes and hundreds of surface depressions in Bedford County (PA DCNR Date Unknown).

Figure 4.3.11-5. Sinkholes and Surface Depressions in Bedford County



Source: PA DCNR Date Unknown
Sinkholes are shown with green dots; surface depressions are shown with orange dots.

Because large-scale or fast-moving subsidence events can trigger landslides, landslides can be an indication of a potentially greater or secondary hazard. Bedford County has noted only one potential (i.e., non-documented) landslide occurrence in recent years. More information on this hazard event is available in Section 4.3.7.

4.3.11.4 Future Occurrence

Although sinkhole occurrence will continue to be a possibility in Bedford County, the probability of a sinkhole or subsidence event is difficult to predict due to the low number of previous events. Areas to monitor for future sinkhole and subsidence events due to their geologic bedrock are listed above in Section 4.3.11.1.

Potential losses caused by sinkhole formation are difficult to calculate for all existing buildings, critical facilities, and infrastructure, because the hazard area may affect so much of the county. However, the future occurrence of subsidence areas and sinkholes is considered likely as defined by the Risk Factor Methodology probability criteria (further discussed in Section 4.4).

4.3.11.5 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable in the identified hazard area. This section discusses the potential impact of the subsidence and sinkhole hazard on Bedford County in the following subsections:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on (1) life, health and safety, (2) general building stock, (3) critical facilities, (4) economy, and (5) future growth and development
- Effects of climate change on vulnerability

Overview of Vulnerability

Approximately 6.9 percent of Bedford County (69.7 square miles) is underlain by carbonate bedrock. For the purposes of this planning effort, the area underlain by carbonate (limestone) bedrock is considered exposed to this hazard. Table 4.3.11-1 summarizes the municipalities potentially vulnerable to sinkholes/subsidence events based on the presence of limestone bedrock and/or abandoned mines.

Table 4.3.11-1. Municipalities Vulnerable to Sinkholes/Subsidence Events.

Municipality	Carbonate Rock	Abandoned Mine	Abandoned Mine noted as 'Subsidence Area'
Bedford Borough	X		
Bedford Township	X		
Bloomfield Township	X	X	
Broad Top Township			X
Coaldale Borough			
Colerain Township	X		
Cumberland Valley Township	X		
East Providence Township			
East St. Clair Township	X		
Everett Borough	X		
Harrison Township	X		
Hopewell Borough			
Hopewell Township	X		
Hyndman Borough	X		
Juniata Township			
Kimmel Township	X		
King Township	X		

Municipality	Carbonate Rock	Abandoned Mine	Abandoned Mine noted as 'Subsidence Area'
Liberty Township	X		
Lincoln Township			
Londonderry Township	X		
Mann Township			
Manns Choice Borough	X		
Monroe Township	X		
Napier Township	X	X	
New Paris Borough			
Pavia Township			
Pleasantville Borough			
Rainsburg Borough	X		
Saxton Borough			
Schellsburg Borough			
Snake Spring Township	X	X	
South Woodbury Township	X	X	
Southampton Township	X		
St. Clairsville Borough			
West Providence Township	X		
West Saint Clair Township			
Woodbury Borough			
Woodbury Township	X		

Source: Pennsylvania Bureau of Topographic and Geologic Survey 2001; PADEP 2014

Data and Methodology

Unlike the flood, wind, and earthquake hazards, no standard loss estimation models or methodologies exist for the subsidence/sinkhole hazard. To estimate the county's vulnerability, the portion of the region underlain by limestone bedrock is considered exposed to natural subsidence and sink holes. To determine the assets that are exposed to this hazard, available and appropriate bedrock geology spatial data, generated by the Pennsylvania Bureau of Topographic and Geologic Survey, were overlaid upon the assets. The limitations of this analysis are recognized and are only used to provide a general estimate. Over time, additional data will be collected to allow better analysis for this hazard. Available information reviewed and a preliminary assessment are provided in the sections below.

Impact on Life, Health, and Safety

To estimate the population exposed to the hazard, the approximate hazard area (limestone bedrock) was overlaid upon the 2010 U.S. Census population data. The Census blocks with their center (centroid) within the boundary were used to calculate the estimated population exposed to this hazard. Table 4.3.11-2 summarizes the Bedford County population exposed to this hazard by municipality (U.S. Census 2010). Please note U.S. Census blocks do not align with the limestone bedrock polygon in the spatial data, and these estimates are for planning purposes only.

Table 4.3.11-2. Estimated Population Located over Limestone Bedrock (U.S. Census 2010)

Municipality	Total Population (2010 U.S. Census)	Estimated Population Exposed	Percent of Total
Bedford Borough	2,841	2,454	86.4%
Bedford Township	5,395	1,225	22.7%
Bloomfield Township	1,016	84	8.3%
Broad Top Township	1,687	0	0.0%
Coaldale Borough	161	0	0.0%
Colerain Township	1,195	106	8.9%
Cumberland Valley Township	1,597	382	23.9%
East Providence Township	1,854	0	0.0%
East St. Clair Township	3,042	28	<1%
Everett Borough	1,832	410	22.4%
Harrison Township	978	48	4.9%
Hopewell Borough	230	0	0.0%
Hopewell Township	2,010	224	11.1%
Hyndman Borough	910	153	16.8%
Juniata Township	954	0	0.0%
Kimmel Township	1,616	512	31.7%
King Township	1,238	86	6.9%
Liberty Township	1,418	31	2.2%
Lincoln Township	425	0	0.0%
Londonderry Township	1,856	153	8.2%
Mann Township	500	0	0.0%
Manns Choice Borough	294	86	29.3%
Monroe Township	1,336	4	<1%
Napier Township	2,198	37	1.7%
New Paris Borough	186	0	0.0%
Pavia Township	295	0	0.0%
Pleasantville Borough	198	0	0.0%
Rainsburg Borough	133	133	100.0%
Saxton Borough	686	0	0.0%
Schellsburg Borough	338	0	0.0%
Snake Spring Township	1,639	206	12.6%
South Woodbury Township	2,155	222	10.3%
Southampton Township	976	19	1.9%
St. Clairsville Borough	78	0	0.0%
West Providence Township	3,212	384	12.0%
West Saint Clair Township	1,736	0	0.0%
Woodbury Borough	284	0	0.0%
Woodbury Township	1,263	64	5.1%
Bedford County (Total)	**49,762**	**7,051**	**14.2%**

Source: U.S. Census 2010; Pennsylvania Bureau of Topographic and Geologic Survey 2001

Impact on General Building Stock

As noted above, no standard loss estimation models exist for the subsidence/sinkhole hazard. In general, the built environment located on limestone is exposed to this hazard. In an attempt to estimate the general building stock potentially vulnerable to this hazard, the associated building replacement values (buildings and contents) were determined for the identified Census blocks within the approximate hazard area. The county-provided spatial layer for building structures was also used to determine the number of structures located within the hazard area. Table 4.3.11-3 lists the replacement cost value (RCV) (structure and contents) of general building stock (GBS) and number of structures located within the defined hazard area.

Table4.3.11-3. Estimated General Building Stock Located over Limestone Bedrock

Municipality	Total Number of Buildings	Total RCV	Limestone Hazard Area			
			Number of Buildings	% of Total	RCV	% of Total
Bedford Borough	1,892	$646,059,000	1,668	88.2%	$559,923,000	86.7%
Bedford Township	5,482	$1,064,751,000	1,073	19.6%	$191,057,000	17.9%
Bloomfield Township	1,053	$98,910,000	114	10.8%	$21,316,000	21.6%
Broad Top Township	1,989	$210,095,000	0	0.0%	$0	0.0%
Coaldale Borough	101	$12,009,000	0	0.0%	$0	0.0%
Colerain Township	1,879	$124,874,000	530	28.2%	$32,248,000	25.8%
Cumberland Valley Township	2,167	$186,632,000	308	14.2%	$53,788,000	28.8%
East Providence Township	2,599	$278,118,000	0	0.0%	$0	0.0%
East St. Clair Township	3,216	$370,063,000	17	0.5%	$4,316,000	1.2%
Everett Borough	1,222	$438,564,000	244	20.0%	$43,510,000	9.9%
Harrison Township	1,664	$163,407,000	80	4.8%	$10,994,000	6.7%
Hopewell Borough	164	$24,173,000	0	0.0%	$0	0.0%
Hopewell Township	2,146	$222,875,000	236	11.0%	$56,974,000	25.6%
Hyndman Borough	778	$117,166,000	144	18.5%	$17,101,000	14.6%
Juniata Township	1,979	$125,361,000	0	0.0%	$0	0.0%
Kimmel Township	1,852	$207,126,000	422	22.8%	$42,262,000	20.4%
King Township	1,354	$128,234,000	195	14.4%	$10,340,000	8.1%
Liberty Township	1,764	$190,571,000	168	9.5%	$10,105,000	5.3%
Lincoln Township	462	$43,153,000	0	0.0%	$0	0.0%
Londonderry Township	2,507	$197,714,000	199	7.9%	$13,086,000	6.6%
Mann Township	1,125	$84,599,000	0	0.0%	$0	0.0%
Manns Choice Borough	269	$32,878,000	11	4.1%	$3,232,000	9.8%
Monroe Township	2,558	$164,383,000	93	3.6%	$1,485,000	0.9%
Napier Township	3,539	$277,952,000	46	1.3%	$6,241,000	2.2%
New Paris Borough	135	$21,772,000	0	0.0%	$0	0.0%
Pavia Township	559	$46,739,000	0	0.0%	$0	0.0%
Pleasantville Borough	170	$22,172,000	0	0.0%	$0	0.0%
Rainsburg Borough	157	$14,504,000	157	100.0%	$14,504,000	100.0%
Saxton Borough	504	$168,466,000	0	0.0%	$0	0.0%
Schellsburg Borough	266	$41,027,000	0	0.0%	$0	0.0%
Snake Spring Township	1,768	$383,646,000	367	20.8%	$82,353,000	21.5%

Municipality	Total Number of Buildings	Total RCV	Limestone Hazard Area			
			Number of Buildings	% of Total	RCV	% of Total
South Woodbury Township	2,245	$245,720,000	566	25.2%	$49,979,000	20.3%
Southampton Township	1,932	$133,937,000	225	11.6%	$19,873,000	14.8%
St. Clairsville Borough	73	$10,568,000	0	0.0%	$0	0.0%
West Providence Township	3,696	$618,794,000	390	10.6%	$61,188,000	9.9%
West Saint Clair Township	1,790	$179,339,000	0	0.0%	$0	0.0%
Woodbury Borough	238	$31,161,000	0	0.0%	$0	0.0%
Woodbury Township	1,614	$198,967,000	147	9.1%	$24,142,000	12.1%
Bedford County (Total)	**58,908**	**$7,526,479,000**	**7,400**	**12.6%**	**$1,330,017,000**	**17.7%**

Source: HAZUS-MH 3.1; Pennsylvania Bureau of Topographic and Geologic Survey 2001; Bedford County 2016

Notes: GBS = General Building Stock
RCV = Replacement Cost Value

Impact on Critical Facilities

A number of critical facilities and utility assets are located in the hazard area, and are also exposed to subsidence/sinkholes. Table 4.3.11-4 summarizes the number of critical facilities identified by the County Hazard Mitigation Plan (HMP) participants that are located within the identified hazard area.

Table 4.3.11-4. Number of Critical Facilities Located in the Identified Hazard Area (Limestone Bedrock)

Municipality	Facility Types								
	EOC	Fire Station	Hazmat	Police Station	School	Substation	Potable Pump	Potable Tank	Wastewater Facility
Bedford Borough	1	1	2	1	3	0	0	0	1
Bedford Township	0	0	2	0	1	0	2	1	0
Hyndman Borough	0	1	0	0	0	0	0	0	0
Kimmel Township	0	0	1	0	2	1	0	0	0
Snake Spring Township	0	0	1	0	2	1	0	0	0
Bedford County (Total)	**1**	**2**	**6**	**1**	**6**	**1**	**2**	**1**	**1**

Source: Pennsylvania Bureau of Topographic and Geologic Survey 2001; Bedford County 2016

Impact on the Economy

Subsidence and sinkholes can severely impact roads and infrastructure. As noted earlier, limestone formations underlie almost 7 percent of the county. Major roadways that serve the County include two Interstate highways (I-76 and I-99), U.S. Highways 30 and 220, and multiple state highways, including PA-26, PA-31, PA-96, PA-326, and PA-829. Portions of each of these roadways are located in the identified subsidence/sinkhole hazard area. It is not possible to estimate potential future economic losses caused by subsidence/sinkhole events at this time.

Future Growth and Development

Areas targeted for potential future growth and development in the next 5 to 10 years have been identified across the county at the municipal level and are described in Section 2.4 of this Plan. New development occurring within the identified hazard areas may be exposed to risks associated with the subsidence and sinkhole hazard.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local level, climate change has the potential to alter the prevalence and severity of weather extremes (U.S. Environmental Protection Agency [EPA] 2006).

Climate change factors such as an extended growing season, higher temperatures, and the possibility of more intense and less frequent summer rainfall, may lead to changes in water resource availability. As stated earlier in this profile, changes to the water balance of an area (including over-withdrawal of groundwater, diverting surface water from a large area and concentrating it in a single point, artificially creating ponds of surface water, and drilling new water wells) will cause sinkholes. These actions can also serve to accelerate the natural processes of bedrock degradation, which can have a direct impact on sinkhole creation.

The potential effects of climate change on Bedford County's vulnerability to subsidence/sinkhole events will need to be considered as more information develops regarding regional climate change impacts.

4.3.12 Tornado, Windstorm

This section provides a profile and vulnerability assessment for the tornado and windstorm hazard. The wind hazard includes various types of wind events, including windstorms and tornadoes, which are defined below.

Wind is air moving from high to low pressure. It is the rough horizontal movement of air (as opposed to an air current) caused by uneven heating of the earth's surface. Wind occurs at all scales, from local breezes generated by heating of land surfaces and lasting tens of minutes, to global winds resulting from solar heating of the earth (Federal Emergency Management Agency [FEMA] 1997). There are different types of damaging winds: straight-line wind, downdraft, downburst, microburst, gust front, derecho, bow echo, and hook echo. Each wind type is described below:

- **Straight-line wind** is a term used to define any thunderstorm wind that is not associated with rotation. Straight-line winds are the movement of air from areas of higher pressure to areas of lower pressure – the greater the difference in pressure, the stronger the winds. It is used mainly to differentiate from tornadic winds.
- A **downdraft** is a small-scale column of air that rapidly sinks toward the ground and usually results in a downburst.
- A **downburst** is a strong downdraft with horizontal dimensions larger than 2.5 miles, resulting in an outward burst or damaging winds on or near the ground. It is usually associated with thunderstorms, but can occur with rain storms too weak to produce thunder.
- A **microburst** is a small, concentrated downburst that produces an outward burst of damaging winds near the surface. It is typically short-lived, lasting only 5 to 10 minutes, with maximum wind speeds of up to 168 miles per hour (mph).
- A **gust front** is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. It is characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm (National Severe Storms Laboratory [NSSL] Date Unknown).
- A **derecho** is a widespread and long-lived windstorm associated with thunderstorms that are often curved (Johns and others 2011). The two major influences on the atmospheric circulation are the differential heating between the equator and the poles, and the rotation of the planet (FEMA 1997).
- A **bow echo** is a radar echo that is linear but bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo (crest). A bow echo can be more than 300 kilometers long, last for several hours, and produce extensive swaths of wind damage at the ground (NSSL Date Unknown).
- A **hook echo** is a radar echo that is the most recognized and well-known radar signature for tornadic supercells. This "hook-like" feature occurs when the strong counter-clockwise winds circling the mesocyclone (rotating updraft) are strong enough to wrap precipitation around the rain-free updraft area of the storm (Provic 2013).

High winds, other than tornadoes, are experienced in all parts of the United States. Areas that experience the highest wind speeds are coastal regions from Texas to Maine and the Alaskan coast; however, exposed mountain areas experience winds at least as high as those along the coast (FEMA 1997; Robinson 2013). Wind begins with differences in air pressures, and is essentially the horizontal movement of air caused by uneven heating of the earth. Wind occurs everywhere. Effects from high winds can include downed trees and power lines, and damaged roofs and windows. Table 4.3.12-1 describes wind classifications used by the National Weather Service (NWS).

Table 4.3.12-1. NWS Wind Descriptions

Descriptive Term	Sustained Wind Speed (mph)
Strong, dangerous, or damaging	≥40
Very windy	30-40
Windy	20-30
Breezy, brisk, or blustery	15-25
None	5-15 or 10-20
Light, or light and variable wind	0-5

Source: NWS 2010
mph Miles per hour

Extreme windstorm events are associated with extra-tropical and tropical cyclones, winter cyclones, severe thunderstorms, and accompanying mesoscale offspring such as tornadoes and downbursts. Wind speeds vary from 0 mph at ground level to 200 mph in the upper atmospheric jet stream 6 to 8 miles above the earth's surface (FEMA 1997).

A derecho is type of windstorm that can occur during a rapidly moving thunderstorm. A derecho is a long-lived windstorm associated with a moving squall line of thunderstorms. It produces straight-line winds gusts of at least 58 mph and often has isolated gusts exceeding 75 mph. As a result, trees generally fall and debris is blown in one direction. To be considered a derecho, these conditions must continue along a path of at least 240 miles. Derechos are more common in the Great Lakes and Midwest regions of the United States, though, on occasion, can persist into the mid-Atlantic and northeast United States (Office of the New Jersey State Climatologist [ONJSC] Rutgers University 2013).

Tornadoes are nature's most violent storms and can cause fatalities and devastate neighborhoods in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 250 mph. Damage paths can be greater than 1 mile wide and 50 miles long. Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes typically move at speeds between 30 and 125 mph and can generate internal winds exceeding 300 mph. The lifespan of a tornado rarely is longer than 30 minutes (FEMA 1997). Tornadoes cause high wind velocity generating wind-blown debris, along with lightning or hail, resulting in additional damage. Destruction caused by tornadoes depends on the size, intensity, and duration of the storm. Tornadoes cause the greatest damage to structures that are light, such as residential and mobile homes, and tend to remain localized during impact (Northern Virginia Regional Commission [NVRC] 2006).

The following sections discuss the location and extent, range of magnitude, previous occurrence, future occurrence, and vulnerability assessment associated with the wind and tornado hazard for Bedford County.

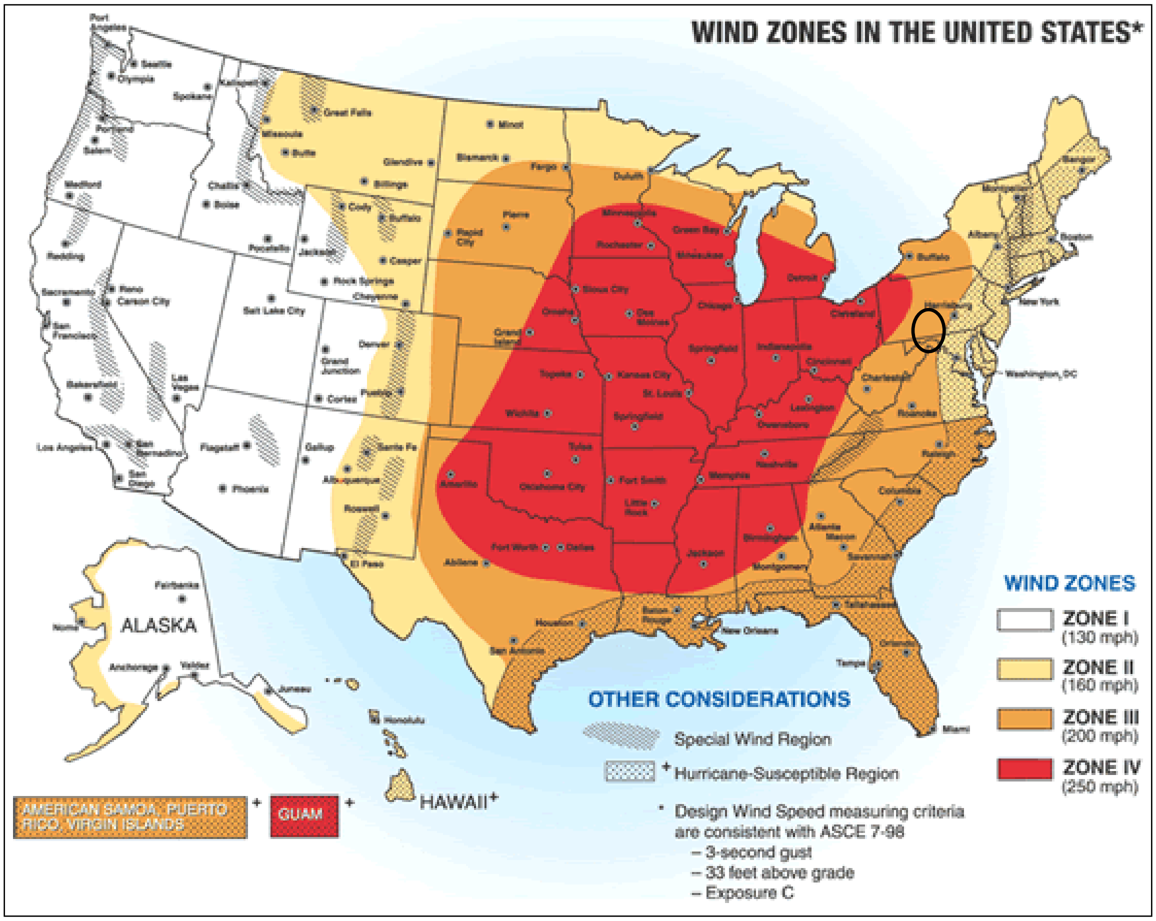
4.3.12.1 Location and Extent

Tornadoes and windstorms can occur throughout Pennsylvania. Tornadoes are usually localized; however, severe thunderstorms can result in conditions favorable to the formation of numerous or long-lived tornadoes. Straight-line winds and windstorms are experienced on a region-wide scale (Pennsylvania Emergency Management Agency [PEMA] 2013).

Windstorms

Figure 4.3.12-1 illustrates the ways in which the frequency and strength of windstorms affect the United States and indicates the general locations of wind activity. This figure is based on 40 years of tornado history and 100 years of hurricane history collected by FEMA. States located in Wind Zone IV have experienced the greatest number of tornadoes and the strongest tornadoes (NVRC 2006). Bedford County is located in Wind Zone III, and has experienced tornadoes with speeds up to 200 mph. Table 4.3.12-2 describes the areas within the various wind zones of the United States.

Figure 4.3.12-1. Wind Zones in the United States



Source: FEMA 2010
Note: The black oval indicates the approximate location of Bedford County.

Table 4.3.12-2. Wind Zones in the United States

Wind Zones	Areas Affected
Zone I (130 mph)	All of Washington, Oregon, California, Idaho, Utah, and Arizona. Western parts of Montana, Wyoming, Colorado, and New Mexico. Most of Alaska, except the east and south coastlines.
Zone II (160 mph)	Eastern parts of Montana, Wyoming, Colorado, and New Mexico. Most of North Dakota. Northern parts of Minnesota, Wisconsin, and Michigan. Western parts of South Dakota, Nebraska, and Texas. All New England States. Eastern parts of New York, Pennsylvania, Maryland, and Virginia. Washington DC.
Zone III (200 mph)	Areas of Minnesota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, Pennsylvania, New York, Michigan, and Wisconsin. Most or all of Florida, Georgia, South Carolina, North Carolina, Virginia, and West Virginia. All of American Samoa, Puerto Rico, and Virgin Islands.
Zone IV (250 mph)	Mid United States ,including all of Iowa, Missouri, Arkansas, Illinois, Indiana, and Ohio and parts of adjoining states of Minnesota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, Kentucky, Pennsylvania, Michigan, and Wisconsin. Guam.

Wind Zones	Areas Affected
Special Wind Region	Isolated areas in the following states: Washington, Oregon, California, Idaho, Utah, Arizona, Montana, Wyoming, Colorado, and New Mexico. The borders between Vermont and New Hampshire; between New York, Massachusetts, and Connecticut; between Tennessee and North Carolina.
Hurricane Susceptible Region	Southern United States coastline from Gulf Coast of Texas eastward to include entire State of Florida. East coastline from Maine to Florida, including all of Massachusetts, Connecticut, Rhode Island, Delaware, and Washington DC. All of Hawaii, Guam, American Samoa, Puerto Rico, and Virgin Islands.

Source: FEMA 2010
mph Miles per hour

Tornadoes

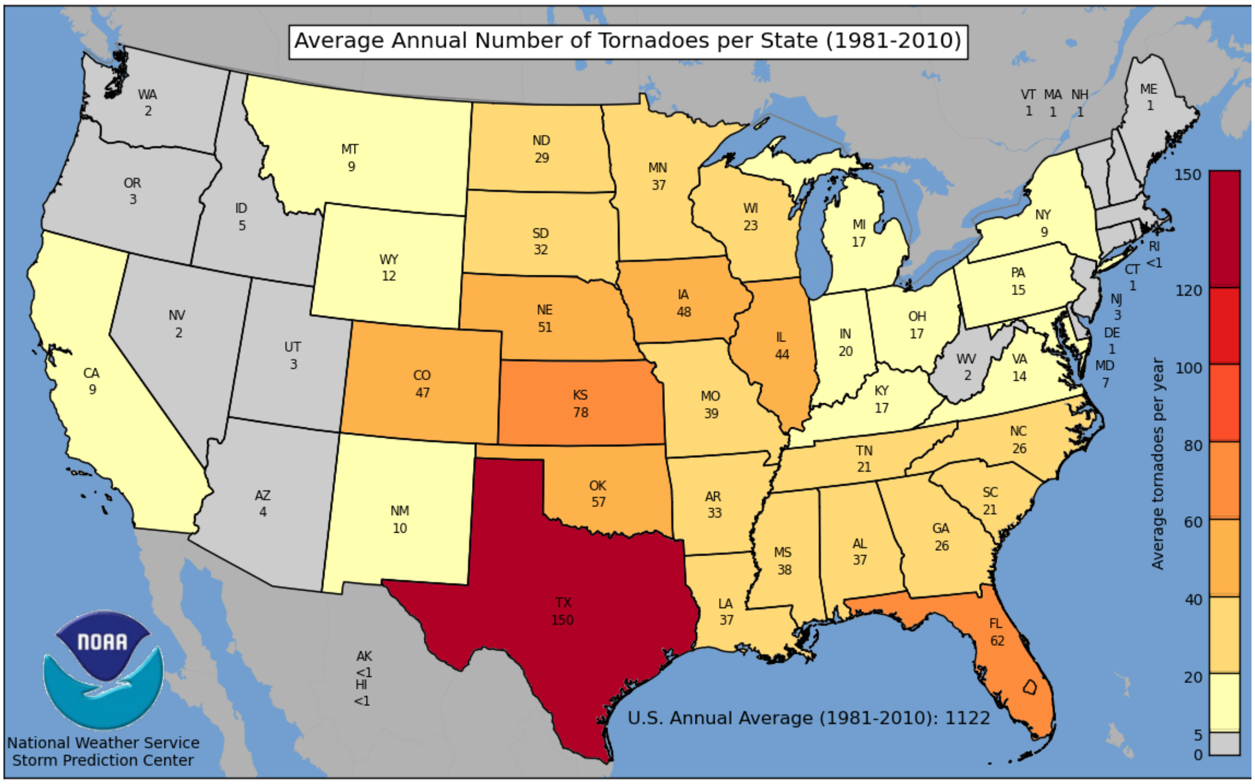
The United States experiences more tornadoes than any other country with approximately 1,000 occurring in a typical year. The peak of the U.S. tornado season is April through June, with the highest concentration of tornadoes in the central United States, although tornadoes can occur at any time of year (NWS 2011). Tornadoes tend to strike in the afternoons and evening, the warmest hours of the day, with approximately 80 percent of all tornadoes striking between noon and 9:00 p.m. (PEMA 2013).

Tornado movement is characterized in two ways: direction and speed of the spinning winds, and forward movement of the tornado and 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 0 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. The forward motion of the tornado path can be a few hundred yards or several hundred miles in length. The width of tornadoes can vary greatly, but they generally range in size from less than 100 feet to more than a mile in width. Some tornadoes never touch the ground and are short-lived, while others may touch the ground several times.

While the extent of tornado damage is usually localized, the extreme winds of this vortex can be among the most destructive on earth when they move through populated, developed areas.

Figure 4.3.12-2 shows the annual average number of tornadoes between 1981 and 2010 (Storm Prediction Center [SPC] 2012). The Commonwealth of Pennsylvania experienced an average of 15 tornado events annually between 1981 and 2010.

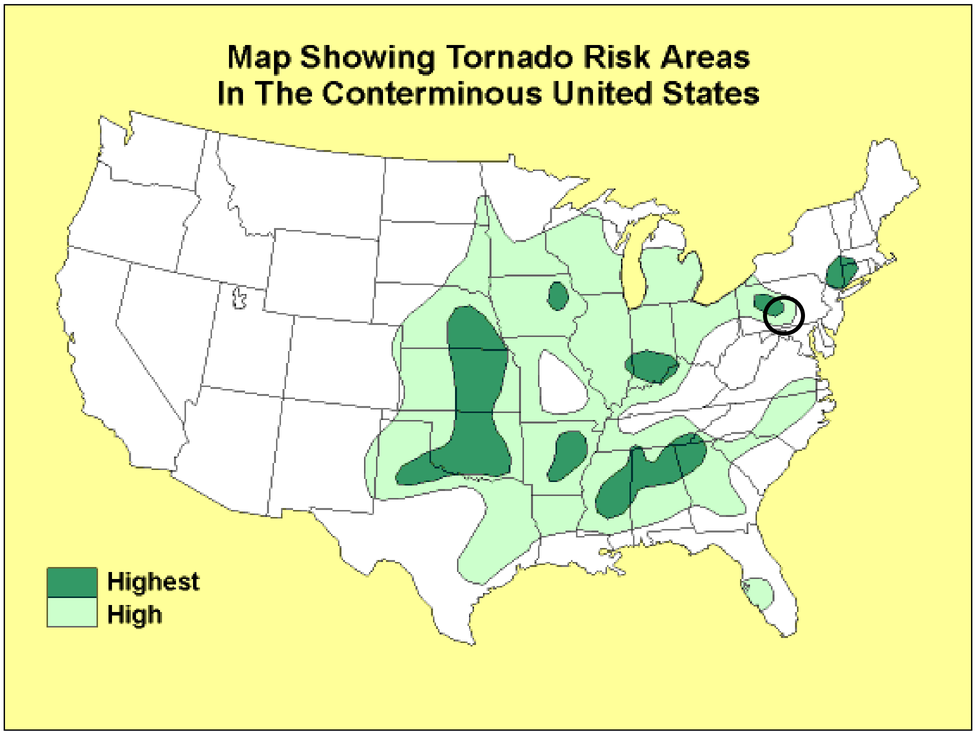
Figure 4.3.12-2. Annual Average Number of Tornadoes in the United States, 1981 to 2010



Source: SPC 2012

Figure 4.3.12-3 indicates that a large portion of Pennsylvania is at high risk for tornadoes; with a portion considered to be at the highest risk. According to this graphic, Bedford County has a relatively high risk for tornado. Details regarding historical tornado events are discussed in the Past Occurrences section (Section 4.3.12.3) of this profile.

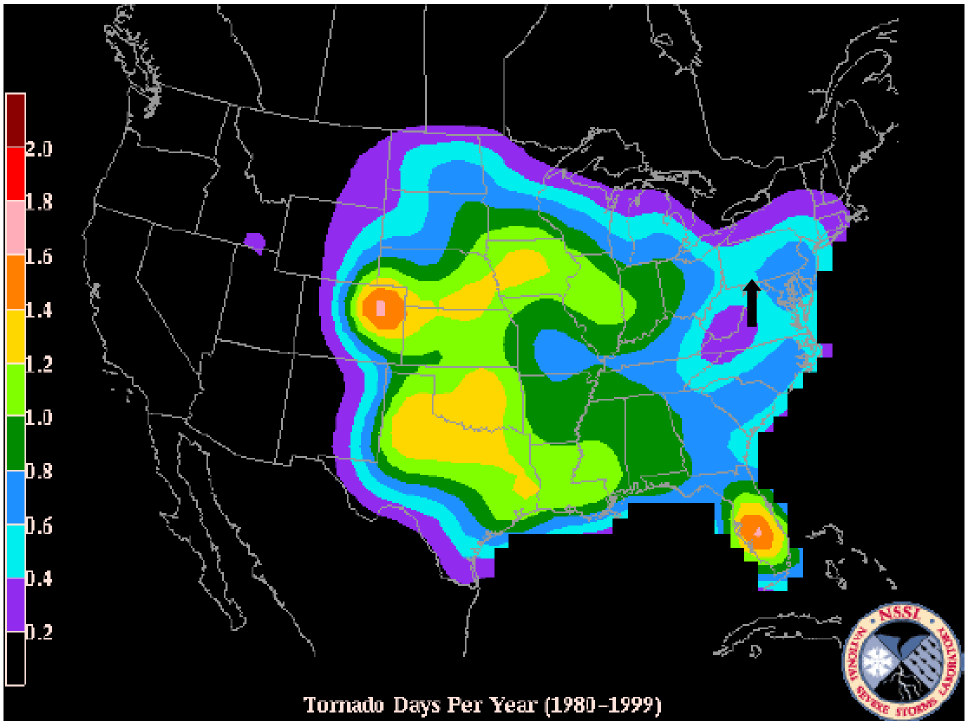
Figure 4.3.12-3. Tornado Risk in the United States



Source: American Red Cross 2010
Note: The black circle indicates the general location of Bedford County.

A study from the National Oceanic and Atmospheric Administration's (NOAA) NSSL provided estimates of the long-term threat from tornadoes. The NSSL used historical data to estimate the daily probability of tornado occurrences across the United States, without considering the magnitude of the tornado. Figure 4.3.12-4 shows the estimates prepared by the NSSL. In Pennsylvania, it is estimated that the probability of a tornado occurring is 0.2 to 0.8 day per year. In Bedford County, it is estimated that the probability of a tornado occurring is 0.4 to 0.6 day per year (NSSL 2003).

Figure 4.3.12-4. Total Annual Threat of Tornado Events in the United States, 1980-1999



Source: NSSL 2003

Notes: The mean number of days per year with one or more events within 25 miles of a point is shown here. The fill interval for tornadoes is 0.2, with the purple starting at 0.2 day. For the non-tornadic threats, the fill interval is 1, with the purple starting at 1. For the significant (violent) threats, it is 5 days per century (millennium).

The black arrow indicates the general location of Bedford County.

4.3.12.2 Range of Magnitude

Windstorms are generally defined as sustained wind speeds of 40 mph or greater, lasting for 1 hour or longer, or winds of 58 mph or greater for any duration. A tornado's magnitude is classified using the Enhanced Fujita Scale, which is further discussed below.

The magnitude or severity of a tornado was originally categorized using the Fujita Scale (F-Scale) or the Pearson Fujita Scale introduced in 1971, based on a relationship between the Beaufort Wind Scales (B-Scales) (measure of wind intensity) and the Mach number scale (measure of relative speed). It is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure (Tornado Project Date Unknown). The F-Scale categorizes each tornado by intensity and area. The scale is divided into six categories, F0 (Gale) to F5 (Incredible) (Edwards 2013).

Although the F-Scale has been in use for more than 30 years, the scale has limitations. The primary limitations are a lack of damage indicators, no account of construction quality and variability, and no definitive correlation between damage and wind speed. These limitations have led to the inconsistent rating of tornadoes and, in some cases, an overestimate of tornado wind speeds. The limitations listed above led to the development of the Enhanced Fujita Scale (EF Scale). The Texas Tech University Wind Science and Engineering (WISE) Center, along with a forum of nationally renowned meteorologists and wind engineers from across the country, developed the EF Scale (WISE 2004).

The EF Scale was adopted on February 1, 2007. It is used to assign a tornado with a rating based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared with a list of Damage Indicators (DI) and Degrees of Damage (DOD), which help better estimate the range of wind speeds produced by the tornado. From that, a rating is assigned, similar to that of the F-Scale, with six categories from EF0 to EF5, representing increasing degrees of damage. The EF Scale was revised from the original F-Scale to reflect better examinations of tornado damage. The EF scale also relates to how most structures are designed (NWS 2007). Table 4.3.12-3 displays each of its six categories of the EF Scale.

Table 4.3.12-3. Enhanced Fujita Damage Scale

EF-Scale Number	Intensity Phrase	Wind Speed (mph)	Type of Damage Done
EF0	Light tornado	65–85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	Moderate tornado	86-110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	Significant tornado	111-135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	Severe tornado	136-165	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	Devastating tornado	166-200	Devastating damage. Well-constructed houses and whole-frame houses completely leveled; cars thrown, and small missiles generated.
EF5	Incredible tornado	>200	Incredible damage. Strong-frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NWS 2007
mph Miles per hour

The EF Scale takes into account more variables than the original F-Scale did in assigning a wind speed rating to a tornado. The EF Scale incorporates 28 DIs, such as building type, structures, and trees. There are eight DODs for each damage indicator, ranging from the beginning of visible damage to complete destruction of the damage indicator. Table 4.3.12-4 lists the 28 DIs. A description is provided for each one of these indicators of the typical construction for that category. Each DOD in every category is assigned an expected estimate of wind speed, a lower bound of wind speed, and an upper bound of wind speed.

Table 4.3.12-4. EF Scale Damage Indicators

Number	Damage Indicator	Abbreviation	Number	Damage Indicator	Abbreviation
1	Small barns, farm outbuildings	SBO	15	School - 1-story elementary (interior or exterior halls)	ES
2	One- or two-family residences	FR12	16	School - junior or senior high school	JHSH
3	Single-wide mobile home	MHSW	17	Low-rise (1-4 story) building	LRB
4	Double-wide mobile home	MHDW	18	Mid-rise (5-20 story) building	MRB
5	Apartment, condominium, townhouse (3 stories or less)	ACT	19	High-rise (over 20 stories)	HRB
6	Motel	M	20	Institutional building (hospital, government. or university)	IB
7	Masonry apartment or motel	MAM	21	Metal building system	MBS
8	Small retail building (fast food)	SRB	22	Service station canopy	SSC
9	Small professional (doctor office, branch bank)	SPB	23	Warehouse (tilt-up walls or heavy timber)	WHB
10	Strip mall	SM	24	Transmission line tower	TLT
11	Large shopping mall	LSM	25	Free-standing tower	FST
12	Large, isolated (“big box”) retail building	LIRB	26	Free-standing pole (light, flag, luminary)	FSP
13	Automobile showroom	ASR	27	Tree - hardwood	TH
14	Automotive service building	ASB	28	Tree - softwood	TS

Source: SPC Date Unknown

Since the EF Scale went into effect in February 2007, previous occurrences and losses associated with historical tornado events, described in Section 4.3.12.3, Past Occurrences, are classified based on the former Fujita Scale. Events after February 2007 are classified based on the Enhance Fujita Scale.

Bedford County’s worst tornado event occurred on November 8, 1996, when an F1 tornado moved across the county causing intermittent damage along a 15-mile path. The storm blew over trees, damaged nine homes and three barns, and destroyed a mobile home. A man in the mobile home suffered a broken arm, but no deaths or other significant injuries were reported. Total damage was estimated at $500,000.

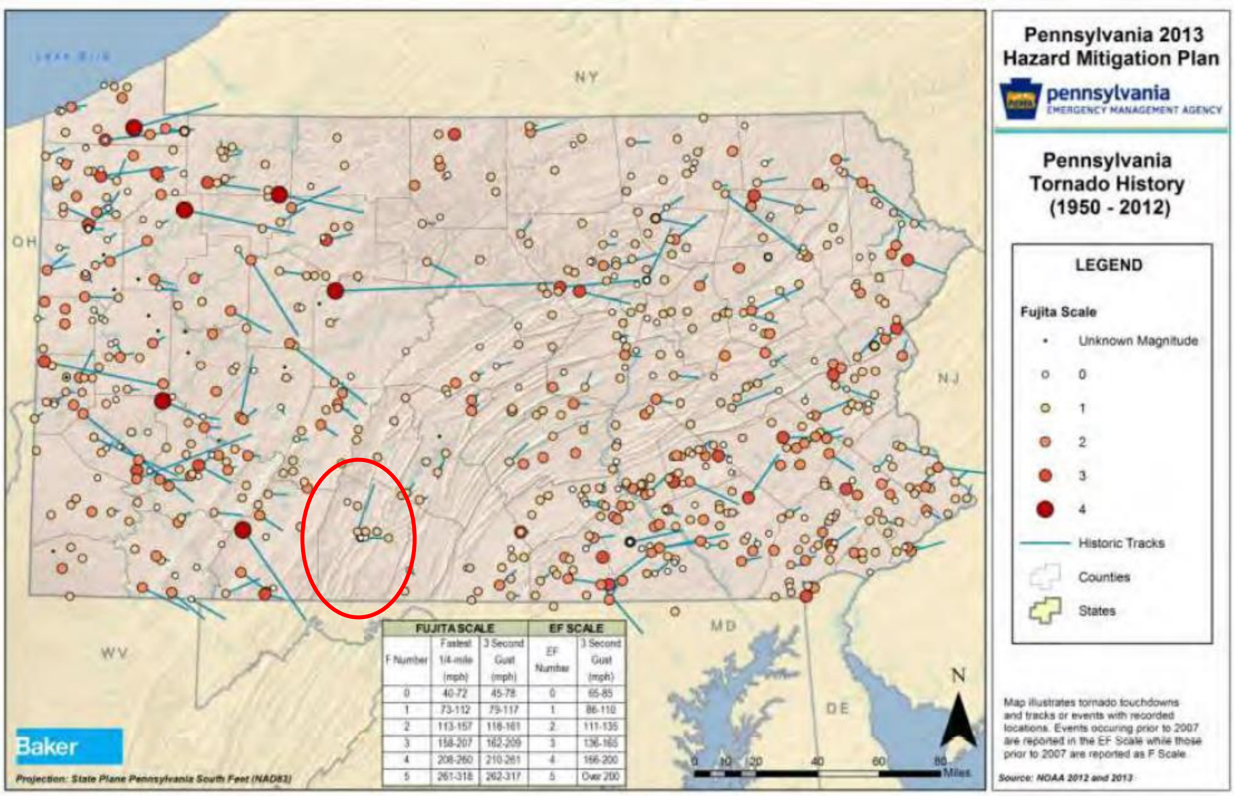
4.3.12.3 Past Occurrence

Many sources provided historical information regarding previous occurrences and losses associated with tornado and windstorm events throughout the Commonwealth of Pennsylvania and Bedford County. With so many sources reviewed for this plan, loss and impact information varies depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this Hazard Mitigation Plan (HMP).

According to NOAA's National Climatic Data Center (NCDC) storm events database, Bedford County experienced 104 tornado and windstorm events between August 1, 1950, and August 31, 2016. These events include high winds, strong winds, thunderstorm winds, and tornadoes. Total property damage, as a result of these tornado and windstorm events, was estimated at over $1.2 million. This total also includes damage to other counties.

Figure 4.3.12-5 shows the tornadoes that have occurred across Pennsylvania from 1950 to 2012 (PEMA 2013).

Figure 4.3.12-5. Pennsylvania Tornado History



Source: PEMA 2013
Note: Bedford County is indicated by the red oval.

According to NOAA's NCDC, there were 11 recorded tornadoes in Bedford County between 1950 and 2016. These tornadoes included three with an intensity of F/EF0 and eight with an intensity of F/EF1. Bedford County's worst tornado event occurred on November 8, 1996, when an F1 tornado caused damage and an injury.

Between 1954 and 2016, the Commonwealth of Pennsylvania experienced 36 federally declared windstorm or tornado-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: hurricane, tropical storm, tropical depression, severe storms, flash flooding, flooding, and high winds. Generally, these disasters cover a wide region of the Commonwealth; therefore, they may have affected many counties. However, not all counties were included in the disaster declarations. Bedford County was included in nine declared disasters (FEMA 2016).

Based on all sources researched, select significant windstorms (those with damages of at least $5,000), and tornado events that have affected Bedford County and its municipalities between 1954 and 2016 are identified in Table 4.3.12-5. With tornado and windstorm documentation for the Commonwealth of Pennsylvania being so extensive, not all sources have been identified or researched. Therefore, Table 4.3.12-5 may not include all events that have occurred throughout Bedford County.

Table 4.3.12-5. Tornado and Windstorm Events in Bedford County, 1954 to 2016

Dates of Event	Event Type	Location	Magnitude	Losses / Impacts
April 9, 1991	Tornado	Bedford	F1	$400,000 in property damage
April 24, 1992	Tornado	Bedford	F1	$25,000 in property damage
September 2, 1993	Tstm Wind	Mattie	UNK	$5,000 in property damage
June 8, 1996	Tstm Wind	Bedford	UNK	$10,000 in property damage
July 19, 1996	Tornado	Penwood	F0	An F0 tornado was sighted about 12:30 p.m. EST near Hospital Hill east of Bedford near Penwood and moved one quarter mile southeast before ending near Route 30 east of Everett, a distance of about 5 miles. Path width was approximately 50 yards with a damage width of 1/4 mile. Between 40 and 50 trees were damaged along a 1/4 mile section of Spring Street on the north side of Everett.
November 8, 1996	Tornado	Wolfsburg	F1	1 injury; $500,000 in property damage
June 16, 1998	Tstm Wind	Osterburg	51 kts.	1 injury
June 16, 1998	Tstm Wind	Hyndman	51 kts.	1 injury
January 18, 1999	Tornado	Bedford	F0	$50,000 in property damage
June 2, 1999	Tstm Wind	Schellsburg	UNK	$25,000 in property damage
June 2, 1999	Tstm Wind	Loysburg	UNK	$15,000 in property damage
June 2, 1999	Tstm Wind	Bedford	UNK	$10,000 in property damage
July 9, 1999	Tstm Wind	Centerville	UNK	$5,000 in property damage
September 17, 2004	Strong Wind	Bedford	45 kts	$50,000 in property damage
September 17, 2004	Tornado	Everett	F1	UNK
September 17, 2004	Tornado	Bedford	F1	UNK
June 10, 2008	Tstm Wind	Bedford Springs	50 kts.	$10,000 in property damage
February 11, 2009	Tstm Wind	Defiance	50 kts.	$5,000 in property damage
February 12, 2009	High Wind	Bedford County	50 kts.	Non-thunderstorm wind gusts between 55 and 65 mph toppled numerous trees and power lines across Bedford County. The high winds caused a barn to collapse as well as moderate structural damage to several area residences. $100,000 in property damage

Dates of Event	Event Type	Location	Magnitude	Losses / Impacts
May 27, 2011	Tstm Wind	Woodbury	50 kts.	Thunderstorm winds estimated near 60 mph knocked down trees in Woodbury, Saxton, Inglesmith, and Clearville. $20,000 in property damage
May 27, 2012	Tstm Wind	Saxton	50 kts.	Thunderstorm winds estimated near 60 mph knocked down a few trees in Saxton. One downed treed blocked Cove Mountain Road. $5,000 in property damage
June 1, 2012	Tornado	Alum Bank	EF0	A storm survey team from the National Weather Service concluded that a short-lived tornado touched down near Alum Bank in Bedford County. The tornado touched down at the intersection of Route 96 and Gordon Hall Road and was on the ground about one and one half miles before lifting up at the intersection of Route 96 and Township Road T606. The tornado was embedded within a larger area of straight line winds. Maximum winds were estimated at 70 mph, which damaged a barn and caused minor damage to three other structures. Approximately 30 trees were also knocked down from the storm which several witnesses reported as being accompanied by whirling clouds and a driving rain. There were no injuries or fatalities. $25,000 in property damage
July 4, 2012	Tstm Wind	Buffalo Mills	50 kts.	Trees and utility lines were downed. $5,000 in property damage
July 26, 2012	Tstm Wind	Woodbury	50 kts.	Trees down. $5,000 in property damage
July 26, 2012	Tstm Wind	New Paris	50 kts.	Trees down. $5,000 in property damage
June 25, 2013	Tstm Wind	Bedford Springs	50 kts.	Trees down. $5,000 in property damage
June 11, 2014	Tornado	Lutzville	EF1	An NWS storm survey confirmed an EF1 tornado in Bedford County, with maximum winds around 95 mph. The tornado touched down near Everett and crossed U.S. Route 30, starting an approximate 11- mile damage path to the northeast toward Hopewell. The damage path was not continuous, as the tornado intermittently lifted up and touched back down several times during its lifespan. Damage included sporadic uprooted and snapped trees, along with structural damage to two homes and two barns,-one of which was destroyed. $2,500 in property damage
June 16, 2016	Tstm Wind	Bard	70 kts.	A severe thunderstorm produced a microburst that began approximately 1 mile north of Bard in Bedford County. Winds appeared to funnel to the south-southwest along the valley and parallel to Route 96. Wind damage included sporadic uprooted trees and numerous trees with large limbs snapped off. One home had a portion of a metal roof ripped off, while a second home had a partial porch collapse. A small portion of a barn roof was peeled back as well. $25,000 in property damage

Source: FEMA 2016; NOAA-NCDC 2016
Notes:

(1) Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of increased U.S. Inflation Rates.

FEMA	Federal Emergency Management Agency
K	Thousand ($)
Kts.	Knots
M	Million ($)
mph	Miles per hour
NCDC	National Climatic Data Center
NOAA	National Oceanic Atmospheric Administration
PEMA	Pennsylvania Emergency Management Agency
Tstm	Thunderstorm

4.3.12.4 Future Occurrence

In Section 4.4, the hazards of concern identified for Bedford County are ranked according to relative risk. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. The probability of occurrence for severe tornado and windstorm events in Bedford County is considered likely (between 50 and 90 percent annual probability) as defined by the Risk Factor Methodology probability criteria (Section 4.4).

Bedford County experiences strong winds on a frequent basis, and when those winds occur, they can result in significant property damage, downed trees, and utility outages. It can be reasonably assumed that future tornadoes will be similar in nature to those that have affected Bedford County in the past. It is estimated that Bedford County will continue to experience direct and indirect impacts of annual windstorms and tornadoes that may induce secondary hazards, such as infrastructure deterioration or failure; utility failures; power outages; water quality and supply concerns; and transportation delays, accidents, and inconveniences.

4.3.12.5 Vulnerability Assessment

To understand risk, a community must evaluate which assets are exposed and vulnerable in the identified hazard. The entire county has been identified as the hazard area for tornado and other windstorm events. Therefore, all assets in the county (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 2), are potentially vulnerable. The following text evaluates and estimates the potential impact of strong winds on the County, including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health of residents, (2) general building stock, (3) critical facilities, (4) economy, and (5) future growth and development
- Effect of climate change on vulnerability

Overview of Vulnerability

The high winds and air speeds of a severe windstorm event, including winds in a tornado, can result in power outages, disruptions to transportation corridors and equipment, loss of workplace access, significant property damage, injuries and loss of life, and the need to shelter and care for individuals affected by the events. A large amount of damage can be inflicted by trees, branches, and other objects that fall onto power lines, buildings, roads, vehicles, and, in some cases, people. The risk assessment for tornadoes and windstorms evaluates available data for a range of storms included in this hazard category.

The entire inventory of the county is at risk of being damaged or lost through the impacts of tornadoes and windstorms. Certain areas, infrastructure, and types of buildings are at greater risk than others because of their proximity to falling hazards or their manner of construction. Potential losses associated with high wind events were calculated for for two probabilistic hurricane events: the 100-year and 500-year mean return period (MRP) hurricane events. The impacts on population, existing structures, critical facilities, and the economy are presented below, after a summary of the data and methodology used. Although the estimate is based on a hurricane event, the data can also be used to estimate potential damage from other windstorm events.

Data and Methodology

After historical data had been reviewed, the Hazards U.S.—Multi-Hazard (HAZUS-MH) methodology and model were used to analyze windstorms for Bedford County. Data used to assess this hazard include data available in the HAZUS-MH 3.1 wind model and professional knowledge.

HAZUS-MH contains data on historical hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support modeling of wind force across various types of land surfaces. Hurricane and inventory data available in HAZUS-MH were used to evaluate potential losses from the 100- and 500-year MRP events (severe wind impacts). Other than updated data for the general building stock and critical facility inventories, the default data in HAZUS-MH 3.1 were the best available for use in this evaluation.

Impact on Life, Health, and Safety

The impact of a tornado or windstorm on life, health, and safety depends on several factors, including the severity of the event and whether adequate warning time was provided to residents. It is assumed that the entire population of Bedford County (U.S. Census 2010 population of 49,762 people) is exposed to this hazard.

Residents may be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings, and debris carried by high winds can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on a number of factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. HAZUS-MH estimates there will be zero people displaced and zero people who may require temporary shelter as a result of the 100- and 500-year MRP events.

Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions based on the major economic impact to their family and may not have funds to evacuate. The population over the age of 65 is also more vulnerable and, physically, they may have more difficulty evacuating. The elderly are considered most vulnerable because they require extra time or outside assistance during evacuations and are more likely to seek or need medical attention that may not be available due to isolation during a storm event. Section 2 presents the statistical information regarding these populations in the county.

Impact on General Building Stock

After the population exposed to the tornado or windstorm hazard has been considered, the general building stock replacement value exposed to and damaged by 100- and 500-year MRP events was examined. Wind-only impacts are reported based on the probabilistic hurricane runs using HAZUS-MH 3.1. Potential damage is the modeled loss that could occur to the exposed inventory, including damage to structural and content value based on the wind-only impacts associated with a hurricane (using the methodology described in Section 4.4). Although the estimate is based on a hurricane event, the data can also be used to estimate potential damage from other windstorm events.

It is assumed that the entire county's general building stock is exposed to the wind hazard (greater than $3.4 billion for structures only). Expected building damage was evaluated by HAZUS across the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction.

Table 4.3.12-6 summarizes the definitions of the damage categories.

Table 4.3.12-6. Description of Damage Categories

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very limited water penetration.	≤ 2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door, or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	> 2% and ≤ 15%	One window, door, or garage door failure	No	< 5 Impacts	No	No
Moderate Damage Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	> 15% and ≤ 50%	> the larger of 20% & 3 and ≤ 50%	1 to 3 Panels	Typically 5 to 10 Impacts	No	No
Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	> 50%	> one and ≤ the larger of 20% & 3	> 3 and ≤ 25%	Typically 10 to 20 Impacts	No	No
Destruction Complete roof failure or failure of wall frame. Loss of more than 50 percent of roof sheathing.	Typically > 50%	> 50%	> 25%	Typically > 20 Impacts	Yes	Yes

Source: FEMA 2013

As noted earlier in the profile, HAZUS estimates the 100-year MRP peak gust wind speeds for Bedford County to be 37 to 55 mph, which equates to a *Tropical Storm*. As depicted in Table 4.3.12-7, HAZUS-MH 3.1 estimates over $1,500 in structure damage across the county for the 100-year MRP event. Residential buildings comprise of all of the building inventory and are estimated to experience all of the damage.

HAZUS estimates the 500-year MRP peak gust wind speeds for Bedford County to range from 61 to 68 mph. This wind speed equates to a *Tropical Storm* and approximately $1.5 million in damages to the general building stock (structure only). This amount is less than 1 percent of the county's building inventory. The residential buildings are estimated to experience the majority of the damage. Table 4.3.12-7 summarizes the building value (structure only) damage estimated for the 100- and 500-year MRP wind-only events by occupancy class.

Table 4.3.12-7. Estimated Building Replacement Value (Structure Only) Damaged by the 100-Year and 500-Year Mean Return Period Winds for All Occupancy Classes

Municipality	Total Building Replacement Value (Structure Only)	Total Building Damage (All Occupancies)		Residential Buildings		Commercial Buildings	
		100-Year	500-Year	100-Year	500-Year	100-Year	500-Year
		Probable Loss	Probable Loss	Probable Loss	Probable Loss	Probable Loss	Probable Loss
Bedford Borough	$379,390,000	$0	$104,243	$0	$89,173	$0	$10,384
Bedford Township	$604,859,000	$0	$162,987	$0	$140,323	$0	$10,794
Bloomfield Township	$60,640,000	$0	$18,008	$0	$17,496	$0	<$1,000
Broad Top Township	$135,101,000	<$1,000	$38,796	<$1,000	$37,375	$0	<$1,000
Coaldale Borough	$7,953,000	<$1,000	$2,385	<$1,000	$2,369	$0	$0
Colerain Township	$78,852,000	$0	$67,012	$0	$66,064	$0	<$1,000
Cumberland Valley Township	$118,265,000	$0	$58,490	$0	$56,935	$0	<$1,000
East Providence Township	$171,953,000	$1,242	$54,576	$1,242	$51,269	$0	$2,214
East St. Clair Township	$233,453,000	$0	$68,195	$0	$65,002	$0	$2,170
Everett Borough	$249,715,000	$0	$65,135	$0	$52,733	$0	$5,831
Harrison Township	$100,282,000	$0	$31,868	$0	$30,224	$0	<$1,000
Hopewell Borough	$15,596,000	$0	$3,030	$0	$2,875	$0	<$1,000
Hopewell Township	$141,511,000	$0	$35,080	$0	$33,151	$0	$1,350
Hyndman Borough	$73,655,000	$0	$37,239	$0	$35,850	$0	<$1,000
Juniata Township	$80,358,000	$0	$28,836	$0	$27,925	$0	<$1,000
Kimmel Township	$128,998,000	$0	$20,985	$0	$20,630	$0	$0
King Township	$80,411,000	$0	$19,696	$0	$19,614	$0	<$1,000
Liberty Township	$114,058,000	$0	$24,983	$0	$22,202	$0	<$1,000
Lincoln Township	$27,172,000	$0	$4,499	$0	$4,499	$0	$0
Londonderry Township	$126,717,000	$0	$64,009	$0	$62,617	$0	<$1,000
Mann Township	$54,296,000	$0	$30,961	$0	$30,196	$0	<$1,000
Manns Choice Borough	$21,218,000	$0	$9,669	$0	$9,433	$0	<$1,000

Municipality	Total Building Replacement Value (Structure Only)	Total Building Damage (All Occupancies)		Residential Buildings		Commercial Buildings	
		100-Year Probable Loss	500-Year Probable Loss	100-Year Probable Loss	500-Year Probable Loss	100-Year Probable Loss	500-Year Probable Loss
Monroe Township	$105,738,000	$0	$61,494	$0	$60,729	$0	<$1,000
Napier Township	$175,388,000	$0	$61,820	$0	$59,450	$0	$1,416
New Paris Borough	$13,119,000	$0	$7,169	$0	$6,974	$0	<$1,000
Pavia Township	$29,135,000	$0	$3,904	$0	$3,904	$0	$0
Pleasantville Borough	$13,791,000	$0	$4,560	$0	$4,261	$0	<$1,000
Rainsburg Borough	$9,489,000	$0	$11,658	$0	$11,604	$0	<$1,000
Saxton Borough	$94,642,000	$0	$17,626	$0	$13,244	$0	$2,926
Schellsburg Borough	$25,282,000	$0	$9,609	$0	$9,029	$0	<$1,000
Snake Spring Township	$225,151,000	$0	$117,899	$0	$110,888	$0	$5,568
South Woodbury Township	$146,948,000	$0	$70,230	$0	$66,416	$0	$1,905
Southampton Township	$84,753,000	$0	$40,407	$0	$39,360	$0	<$1,000
St. Clairsville Borough	$6,635,000	$0	$1,719	$0	$1,577	$0	$0
West Providence Township	$360,054,000	$0	$151,915	$0	$141,791	$0	$8,439
West Saint Clair Township	$112,576,000	$0	$30,441	$0	$28,534	$0	$1,195
Woodbury Borough	$19,709,000	$0	$8,724	$0	$8,358	$0	<$1,000
Woodbury Township	$109,958,000	$0	$40,792	$0	$36,305	$0	$1,570
Bedford County (Total)	**$4,536,821,000**	**$1,582**	**$1,590,645**	**$1,582**	**$1,480,377**	**$0**	**$63,614**

Source: HAZUS-MH 3.1

Because of differences in building construction, residential structures are generally more susceptible to wind damage than are commercial and industrial structures. Wood and masonry buildings, regardless of their occupancy class, generally tend to experience more damage than concrete or steel buildings. The damage counts include buildings damaged at all severity levels from minor damage to total destruction. Total damage dollar amounts reflect the overall impact to buildings at an aggregate level.

Of the more than $4.5 billion in total residential replacement value (structure) for the entire county, an estimated $1,582 in residential building damage can be anticipated for the 100-year event and over $1.5 million in residential building damage can be anticipated for the 500-year event. Residential building damage accounts for 93.1 percent of total damage for the 500-year wind-only event. This information illustrates residential structures are the most vulnerable to the wind hazard.

Annualized losses were also examined for Bedford County. A total of more than $13,000 is estimated as the annualized loss for the entire county; however, annualized loss does not predict which losses will occur in any particular year.

Impact on Critical Facilities

HAZUS-MH estimates the probability that critical facilities (medical facilities, fire/emergency medical services, police, emergency operation centers, schools, and user-defined facilities such as shelters and municipal buildings) may sustain damage as a result of 100-year and 500-year MRP wind-only events. Additionally, HAZUS-MH estimates the loss of use for each facility in number of days. HAZUS-MH estimates that there will be no structural losses to critical facilities in Bedford County; and continuity of operations at these facilities will not be interrupted (loss of use is estimated to be 0 days) as a result of a 100-year MRP event. For the 500-year event, HAZUS-MH estimates a 1 percent or less chance that there will be minor to moderate damage to critical facilities in Bedford County; continuity of operations at these facilities will not be interrupted.

At this time, HAZUS-MH 3.1 does not estimate losses to transportation lifelines and utilities as part of the hurricane model. Transportation lifelines are not considered particularly vulnerable to the wind hazard; they are more vulnerable to cascading effects such as flooding, and falling debris. Impacts to transportation lifelines affect both short-term (evacuation activities) and long-term (day-to-day commuting) transportation needs.

Utility structures could suffer damage associated with falling tree limbs or other debris, resulting in the loss of power, which can impair business operations and can affect heating or cooling provision to citizens (including the young and elderly, who are particularly vulnerable to temperature-related health impacts).

Impact on Economy

Severe storms also affect the economy, including loss of business function (for example, to tourism and recreation), damage to inventory, relocation costs, wage loss, and rental loss from repair or replacement of buildings. HAZUS-MH estimates the total economic loss associated with each storm scenario (direct building losses and business interruption losses). Direct building losses are considered the estimated costs to repair or replace the damage caused to the building. These losses are reported in the "Impact on General Building Stock" section discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event.

HAZUS-MH estimates negligible business interruption losses for Bedford County for the 100-year MRP event (<$100). HAZUS-MH estimates $4,316 in business interruption losses for Bedford County for the 500-year MRP wind only event, which includes loss of income, relocation costs, rental costs, and lost wages.

HAZUS-MH 3.1 also estimates the amount of debris that may be produced a result of the 100- and 500-year MRP wind events. Table 4.3.12-8 estimates the debris produced for Bedford County during a wind event. This estimate is likely conservative; it may be higher if multiple impacts occur or if the event occurs in conjunction with rain or other hazards, because the estimated debris production does not include flooding. According to the HAZUS-MH Hurricane User Manual:

"The Eligible Tree Debris columns provide estimates of the weight and volume of downed trees that would likely be collected and disposed at public expense. As discussed in Chapter 12 of the HAZUS-MH Hurricane Model Technical Manual, the eligible tree debris estimates produced by the Hurricane Model tend to underestimate reported volumes of debris brought to landfills for a number of events that have occurred over the past several years. This indicates that that there may be other sources of vegetative and non-vegetative debris that are not currently being modeled in HAZUS. For landfill estimation purposes, it is recommended that the HAZUS debris volume estimate be treated as an approximate lower bound. Based on actual reported debris volumes, it is recommended that the HAZUS results be multiplied by three to obtain an approximate upper bound estimate. It is also important to note that the Hurricane Model assumes a bulking factor of 10 cubic yards per ton of tree debris. If the debris is chipped prior to transport or disposal, a bulking factor of 4 is recommended. Thus, for chipped debris, the eligible tree debris volume should be multiplied by 0.4." (FEMA 2013)

Table 4.3.12-8. Estimated Debris Production for 100- and 500-Year Mean Return Period Hurricane-Related Winds

Municipality	Brick and Wood (tons)		Concrete and Steel (tons)		Tree (tons)		Eligible Tree Volume (cubic yards)	
	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
Bedford Borough	2	0	0	0	0	7	0	134
Bedford Township	0	0	0	0	0	329	0	573
Bloomfield Township	0	0	0	0	0	131	0	90
Broad Top Township	0	0	0	0	0	46	0	137
Coaldale Borough	0	0	0	0	0	0	0	5
Colerain Township	0	0	0	0	0	614	0	402
Cumberland Valley Township	0	0	0	0	0	159	0	237
East Providence Township	0	0	0	0	0	141	0	215
East St. Clair Township	0	0	0	0	0	154	0	247
Everett Borough	0	0	0	0	0	14	0	74
Harrison Township	0	0	0	0	0	65	0	116
Hopewell Borough	0	0	0	0	0	0	0	10
Hopewell Township	0	0	0	0	0	197	0	235
Hyndman Borough	0	0	0	0	0	5	0	83
Juniata Township	0	0	0	0	0	162	0	148
Kimmel Township	0	0	0	0	0	11	0	34
King Township	0	0	0	0	0	43	0	42
Liberty Township	0	0	0	0	0	46	0	146
Lincoln Township	0	0	0	0	0	0	0	4
Londonderry Township	1	0	0	0	0	121	0	250
Mann Township	0	0	0	0	0	193	0	151
Manns Choice Borough	0	0	0	0	0	4	0	23
Monroe Township	0	0	0	0	0	229	0	169
Napier Township	0	0	0	0	0	262	0	309
New Paris Borough	0	0	0	0	0	0	0	14
Pavia Township	0	0	0	0	0	0	0	4
Pleasantville Borough	0	0	0	0	0	0	0	10
Rainsburg Borough	0	0	0	0	0	3	0	33

Municipality	Brick and Wood (tons)		Concrete and Steel (tons)		Tree (tons)		Eligible Tree Volume (cubic yards)	
	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year	100 Year	500 Year
Saxton Borough	0	0	0	0	0	6	0	33
Schellsburg Borough	0	0	0	0	0	2	0	29
Snake Spring Township	2	0	0	0	0	335	0	486
South Woodbury Township	0	0	0	0	0	218	0	232
Southampton Township	0	0	0	0	0	560	0	323
St. Clairsville Borough	0	0	0	0	0	0	0	7
West Providence Township	0	0	0	0	0	152	0	331
West Saint Clair Township	0	0	0	0	0	110	0	133
Woodbury Borough	0	0	0	0	0	0	0	6
Woodbury Township	1	0	0	0	0	134	0	109
Bedford County (Total)	**6**	**0**	**0**	**0**	**0**	**4,453**	**0**	**5,584**

Source: HAZUS-MH 3.1

Future Growth and Development

As discussed and illustrated in Section 2.4, areas targeted for future growth and development have been identified across Bedford County. Any areas of growth could be affected by the tornado and windstorm hazard because the entire county is exposed and vulnerable to the wind hazard, particularly when associated with severe storms.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of events such as hurricanes. While predicting changes to the prevalence or intensity of a wind event and its effects is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2006).

4.3.13 Wildfire

This section provides a profile of and vulnerability assessment for the wildfire hazard. A wildfire is an uncontrolled fire spreading through vegetative fuels, possibly consuming structures. Wildfires often begin unnoticed and can spread quickly, creating dense smoke that can be seen for miles. A wildland fire is a wildfire in an area where development is essentially nonexistent, except for roads, railroads, power lines, and similar facilities. A wildland-urban interface (WUI) fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

Wildfires can occur at any time of the year, but are most likely in Bedford County during a drought, and 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, has the potential to burn out of control. Most wildfires are caused by human carelessness, negligence, and ignorance. However, some are precipitated by lightning strikes and, in rare instances, spontaneous combustion.

4.3.13.1 Location and Extent

According to 2011 land use/land cover data, almost 7 percent of the land in the county is developed, greater than 70 percent is forested, and just over 22 percent is agricultural (Agricultural and Rangeland) (Table 4.3.13-1) (U.S. Geological Survey [USGS] 2011). As shown in Figure 4.3.13-1, developed areas are located adjacent to forests and farmlands. Both vegetation and structures serve as fuel for wildfire events.

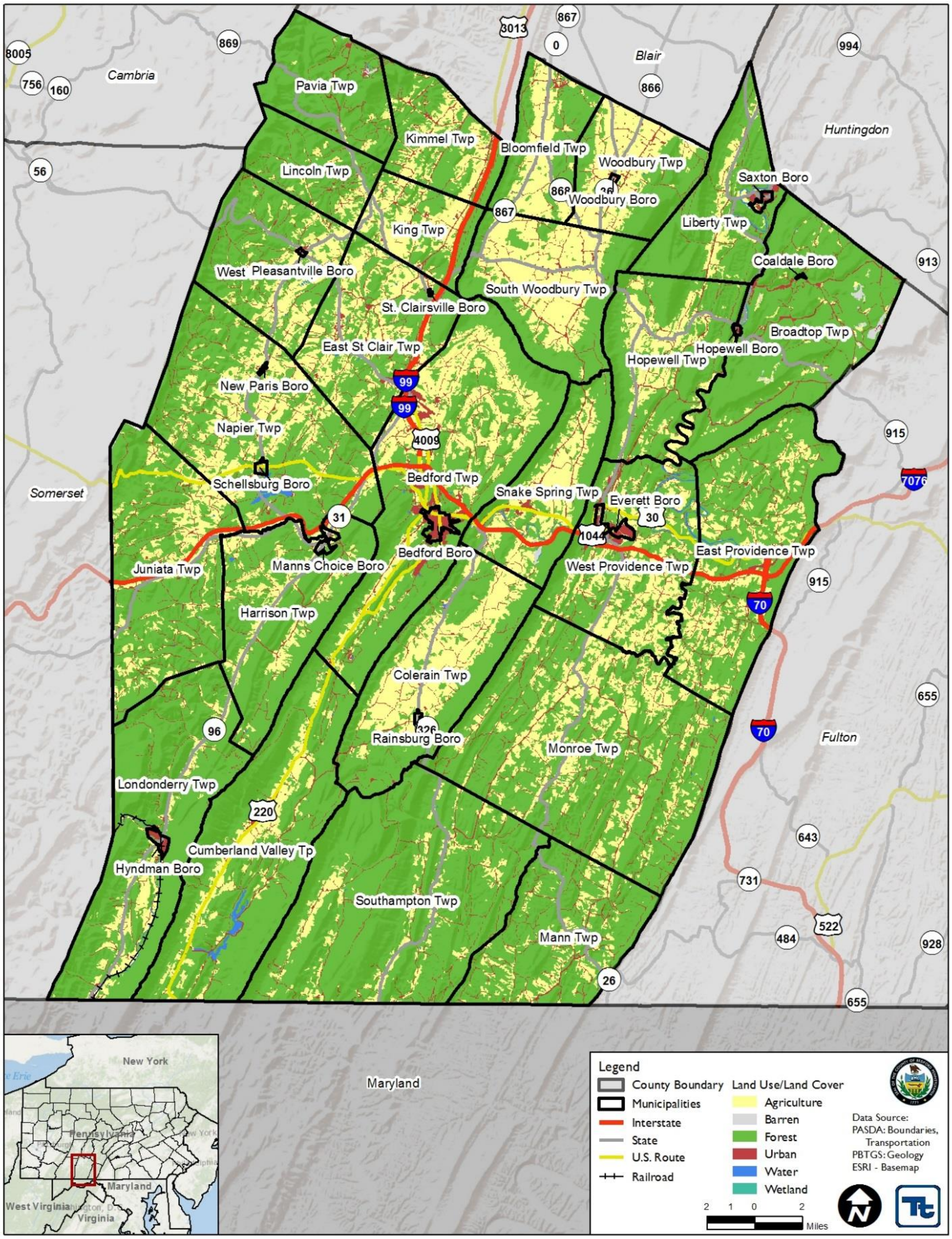
Table 4.3.13-1. Land Use Summary for Bedford County

Land Use Category	Total Area (square miles)	Percent of Total
Agricultural	71.45	7.0%
Barren Land	1.28	<1%
Forest	715.08	70.32%
Rangeland	156.02	15.3%
Urban Built Up	67.67	6.7%
Water	4.32	<1%
Wetland	0.01	<1%
Total	**1,016.86**	**100.0%**

Source: USGS 2011

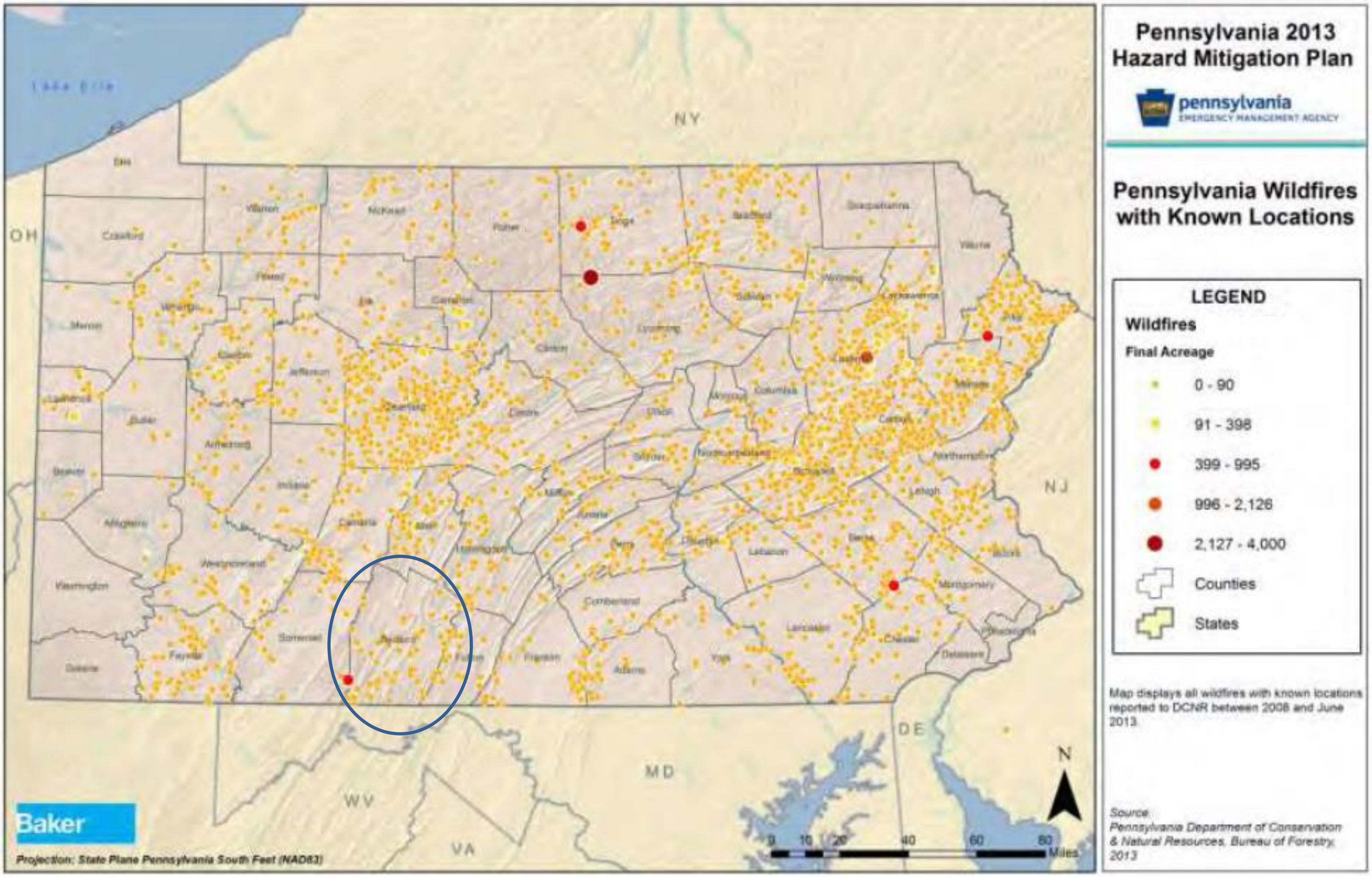
Figure 4.3.13-2 shows the locations of wildfires that the Pennsylvania Department of Conservation and Natural Resources (PA DCNR), Bureau of Forestry (BOF), responded to from 2002 to June 2013. Wildfires are known to be an under-reported event. Many wildfires occur every year and are suppressed by volunteer fire departments without any response or assistance from BOF. Therefore, these locally controlled blazes may not be represented in BOF records.

Figure 4.3.13-1. Land Cover in Bedford County



Source: USGS – National Land Cover Database (NLCD) 2011

Figure 4.3.13-2. Location of Wildfire Events responded to by BOF from 2002-2013



Source: PEMA 2013
Note: Blue oval was added to highlight Bedford County's location within Pennsylvania.

Several tools are available to estimate the potential location and extent of a fire, including (but not limited to) the Wildland/Urban Interface, Wildland Fire Assessment System and PA DCNR Priority Landscape Analysis. These tools are discussed in further detail below.

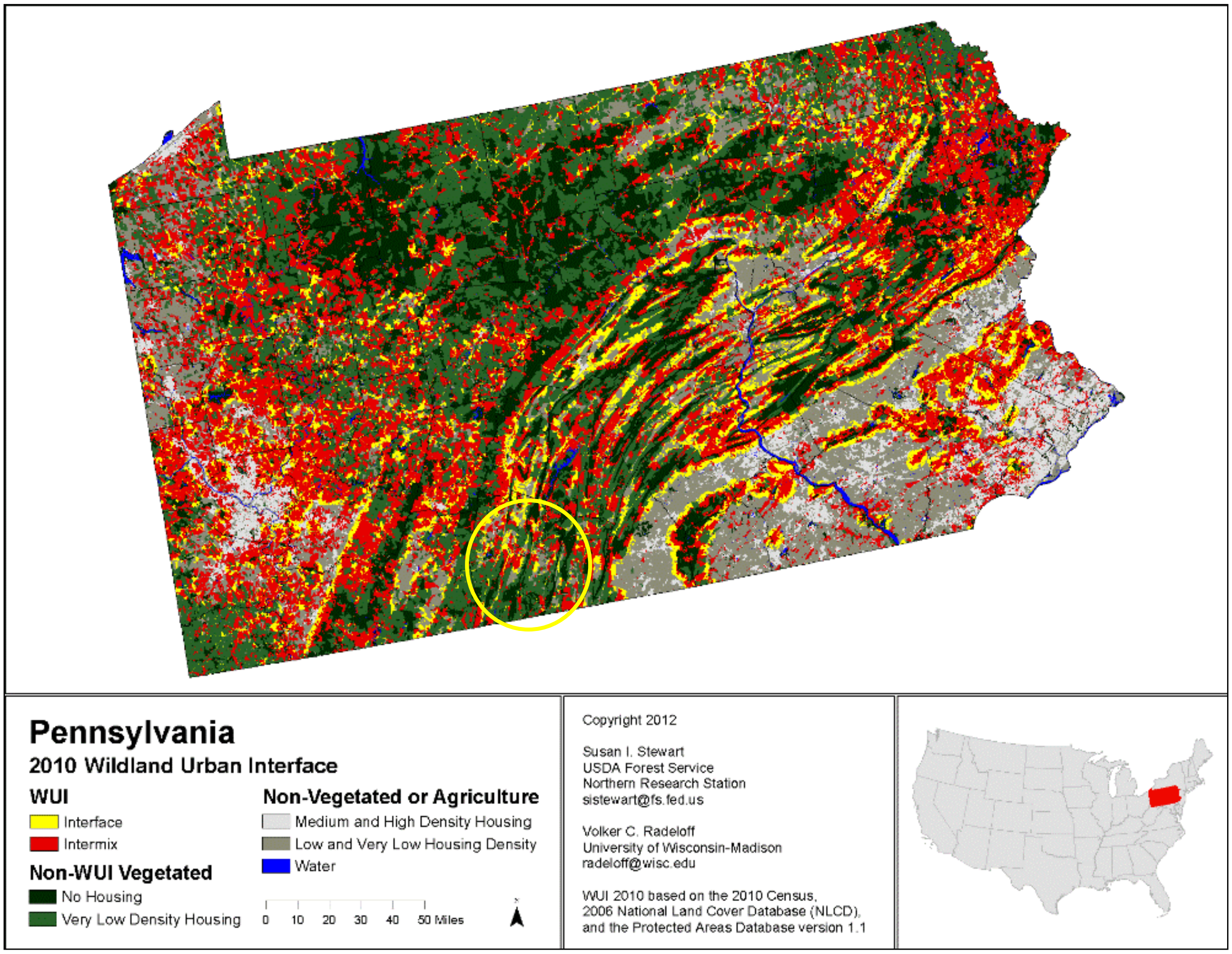
Wildland/Urban Interface (WUI)

The WUI is considered the area where houses and wildland vegetation coincide. According to the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison, the WUI is divided into two categories: intermix and interface. Intermix WUI areas are where housing and vegetation "intermingle." Intermix areas have more than one house per 40 acres and have more than 50 percent vegetation. Interface WUI areas contain housing in the vicinity of contiguous wildland vegetation. Interface areas have more than one house per 40 acres, have less than 50 percent vegetation, and are within 1.5 miles of an area larger than 1,235 acres that is more than 75 percent vegetated (University of Wisconsin Date Unknown).

The California Fire Alliance determined that areas within 1.5 miles of wildland vegetation are the approximate distance that firebrands can be carried from a wildland fire to the roof of a house. Therefore, even structures not located within the forest are at risk from wildfire. This buffer distance, along with housing density and vegetation type, were used to define the WUI (University of Wisconsin Date Unknown).

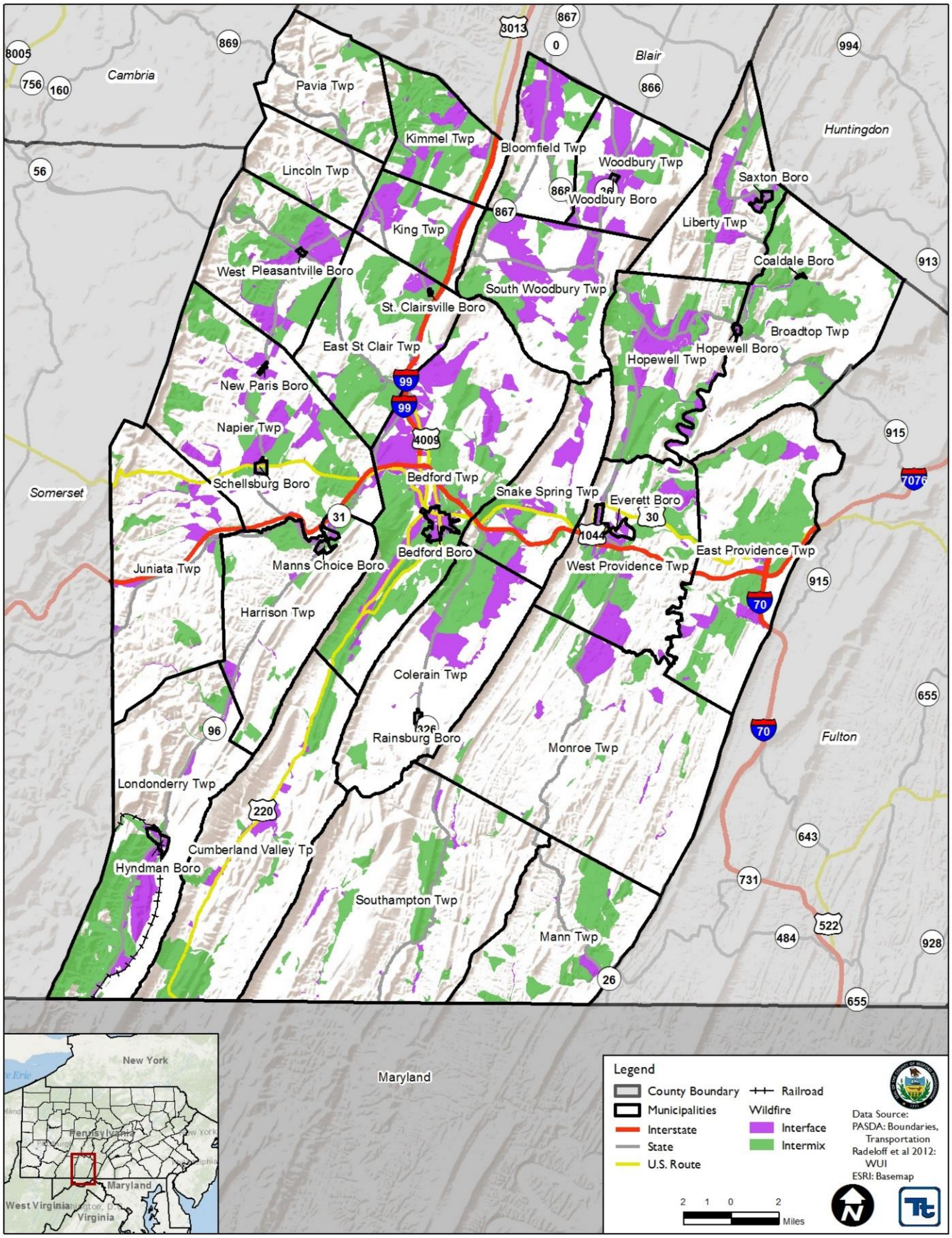
Concentrations of WUI can be seen along the east coast of the United States, including the south-central part of Pennsylvania. Bedford County is identified as having many areas of very low-density housing (or no housing) due to the large amount of forested area. Figure 4.3.13-3 depicts the WUI areas for Pennsylvania in 2010, and Figure 4.3.13-4 illustrates the WUI areas for Bedford County. Concentrations of WUI areas greater than 50 percent are classified as WUI (intermix or interface) in the county.

Figure 4.3.13-3. 2010 WUI for Pennsylvania



Source: Stewart 2012
Note: Yellow oval highlights Bedford County's location within Pennsylvania.

Figure 4.3.13-4. WUI for Bedford County



Source: Stewart and Radeloff 2012

Wildland Fire Assessment System (WFAS)

The Wildland Fire Assessment System (WFAS) is an Internet-based information system maintained at the National Interagency Fire Center (NIFC) in Boise, Idaho. The WFAS provides a national view of weather and fire potential, including national fire danger, weather maps, and satellite-derived "Greenness" maps (USFS Date Unknown). Each day during the fire season, the WFAS produces national maps of selected fire weather and fire danger components of the National Fire Danger Rating System (NFDRS) (USFS Date Unknown). The Fire Danger Rating level, described in Table 4.3.13-2 below, takes into account current and antecedent weather, fuel types, and moisture amounts for both live and dead vegetative fuel. The adjective class rating is a method of normalizing rating classes across different fuel models, indexes, and station locations. It is based primarily on a fuel model cataloged for the station, the fire danger index selected to reflect staffing levels, and climatological class breakpoints. Local station managers provide this information to USFS (USFS 2002).

Table 4.3.13-1. Fire Danger Rating and Color Code

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

Source: USFS Date Unknown

Pennsylvania Department of Conservation and Natural Resources (PA DCNR) Priority Landscape Analysis

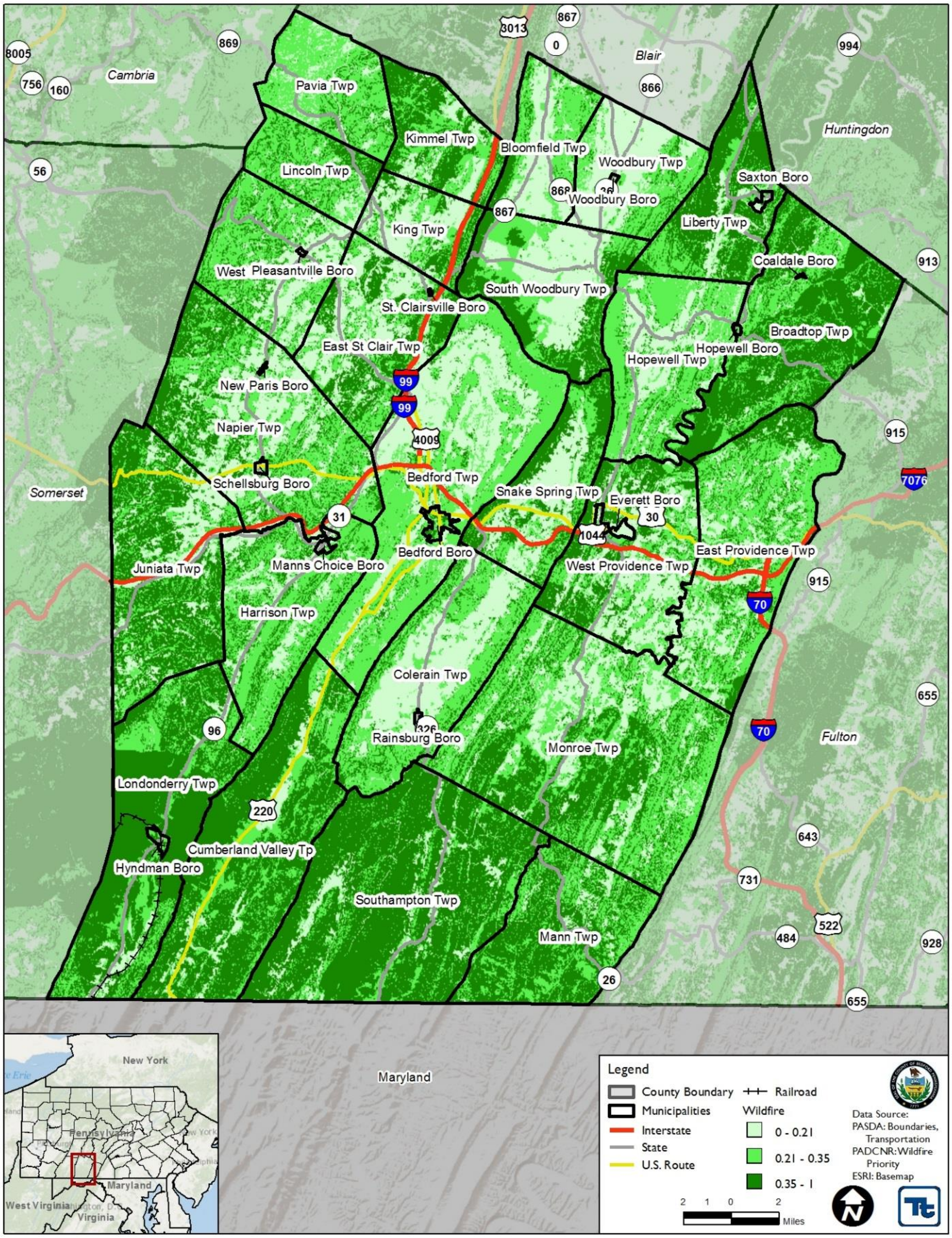
The PA DCNR conducted a wildfire priority landscape analysis identifying areas where wildland fires are predicted to occur and become problematic. The areas are classified into high, medium, and low categories. The high classification is defined as an area prone to extreme fire behavior, with the potential to cause extensive property damage, or that could threaten the safety of the Commonwealth's citizens. The following five data sets were used for this analysis:

- 2002 WUI
- 2006 LANDFIRE
- 2002 – 2008 Pennsylvania Wildfire Point Origin Occurrences
- Percent Slope
- 2009 Local Assessment of Values, Risks, Hazards.

The WUI classifies areas where homes and other human development meet or intermingle with undeveloped land. LANDFIRE characterizes the land's vegetation into fuel models that predict various fire behavior intensities. The Pennsylvania wildfire Point Origin Occurrences consist of records of wildland fire origins that have been reported. Percent slope aids in predicting fire behavior from the terrain. The local assessment of values, risks, and hazards is a municipality-based rating system; this assessment has been made by local wildland fire managers (PA DCNR Date Unknown). Figure 4.3.13-5 illustrates the output for the wildfire priority landscapes model for Bedford County.

The greatest potential for wildfires is in the spring months of March, April, and May, and the autumn months of October and November. These months generally bring clear skies, high winds, low relative humidity, and prolonged periods of dry weather. In the spring, bare trees allow sunlight to reach the forest floor, drying fallen leaves and other ground debris. The same theory applies for the fall; however, the drier conditions are a more crucial factor. People cause most wildfires in Pennsylvania, often by burning debris. Several fires have started in a person's backyard and traveled through dead grasses and weeds into bordering woodlands. According to the Pennsylvania Emergency Management Agency (PEMA) Standard All-Hazard Mitigation Plan, 92 percent of Pennsylvania wildfires burn less than 10 acres and are suppressed within the first burning period (PEMA 2013).

Figure 4.3.13-5. Wildfire Priority Landscapes in Bedford County



Source: PA DCNR Date Unknown

Notes: Low Priority = 0–0.21 (light green); Medium Priority = 0.21–0.35 (medium green); High Priority = 0.35–1 (dark green)

4.3.13.2 Range of Magnitude

Wildfire events in Bedford County can range from small fires that can be managed by local firefighters to large fires burning 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. A wildfire has the potential to kill people, livestock, fish, and wildlife; and to destroy property, valuable timber, forage, and recreational and scenic resources.

The largest wildfire in Pennsylvania in recent years burned 10,000 acres in the north-central area of the commonwealth. This fire was controlled within 1 week; however, before it was controlled, it destroyed five cabins, but there was no loss of life. Several other fires have burned more than 2,000 acres each and again have been controlled within 1 week of the reported start.

Wildfires in Bedford County have generally been small and easily contained. Since 1993, as little as 0.1 acre and as much as 283 acres have been involved in a single event. The year with the greatest acreage involved was 2000 (333.85). The worst-case scenario for Bedford County is a multiple-acre fire occurring during a period of drought, which could cause the fire to spread rapidly. Because much of the county is forested, severe property damage could occur.

4.3.13.3 Past Occurrence

In 2015, a total of 817 wildfire incidents (totaling 4,165 acres burned) throughout Pennsylvania were reported to PA DCNR, Bureau of Forestry (PA DCNR 2016). The majority of wildfire incidents in 2013 were due to debris burning (430 incidents), incendiary (172 incidents), or miscellaneous causes (59 incidents). The least number of wildfires were caused by lightning, smoking, and structure fires (5 incidents each).

The 2013 Pennsylvania Hazard Mitigation Plan (HMP) noted that 58 reported wildfires burned 306.62 acres in Bedford County between 2002 and 2013 (PEMA 2013). Table 4.3.13-3 lists wildfires reported by Bedford County between 2002 and 2009. No wildfires were recorded in local records or in the National Climatic Data Center (NCDC) Storm Events Database.

Table 4.3.13-2. Reported Wildfires in Bedford County

Date	Location	Acreage	Deaths	Injuries	Property Damage, $K
March 8, 2002	Londonderry Township	UNK	0	0	UNK
March 8, 2002	Juniata Township	UNK	0	0	UNK
March 15, 2002	Londonderry Township	UNK	0	0	UNK
August 22, 2002	Hopewell Township	UNK	0	0	UNK
April 20, 2005	Woodbury Township	UNK	0	0	UNK
March 31, 2006	West Providence Township	6	0	0	UNK
April 17, 2006	Liberty Township	UNK	0	0	UNK
April 21, 2006	Kimmel Township	UNK	0	0	UNK
April 28, 2006	Pavia Township	UNK	0	0	UNK
November 1, 2007	Cumberland Valley Township	UNK	0	0	UNK
April 2, 2008	Harrison Township	25	0	0	UNK
April 18, 2008	Londonderry Township	UNK	0	0	UNK
April 19, 2008	East Providence Township	UNK	0	0	UNK
November 3, 2008	Bedford Township	½	0	0	UNK

Date	Location	Acreage	Deaths	Injuries	Property Damage, $K
February 26, 2009	Cumberland Valley Township	50	0	0	UNK
March 11, 2009	Harrison Township	UNK	0	0	UNK
March 11, 2009	Southampton Township	UNK	0	0	UNK

Source: PEMA 2013
UNK - Unknown

4.3.13.4 Future Occurrence

Wildfire experts say that demographic trends in the northeastern United States are contributing to increased wildfire risks. Recent census data show more homes being built in rural areas closer to wildland areas. Forested areas are cleared for housing, and fuels (in the form of logging slash and understory vegetation) remain in proximity to new residences, increasing the potential for wildfires. This trend, along with changing weather patterns and increasingly hot, dry periods throughout the United States, increases wildfire risk in many communities.

Wildfires are likely to affect Bedford County every year. However, the likelihood that one of those fires would attain significant size and intensity is unpredictable and highly dependent on environmental conditions and firefighting response. Weather conditions, particularly drought, increase the likelihood that wildfires will occur. Based on reported occurrences from the most recent years on record, the county can expect approximately three wildfires each year. The future occurrence of wildfires can therefore be considered *highly likely* as defined by the Risk Factor Methodology probability criteria (Section 4.4).

It is important to note that 98 percent of wildfires in Pennsylvania are caused by humans (PEMA 2013). Thus, there is rationale for including this hazard under the summary of human-made hazards. The critical inference to draw from this statistic is the fact that future wildfires will strongly depend on patterns of human activity. Events are more likely to occur in wildfire-prone areas experiencing new or additional development.

4.3.13.5 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of the wildfire hazard on the County, including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on (1) life, health and safety; (2) general building stock; (3) critical facilities; (4) economy; and (5) future growth and development
- Effects of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time.

Overview of Vulnerability

Wildfire hazards can impact significant areas of land, as evidenced by wildfires throughout the United States in recent years. Fires in urban areas have the potential to cause great damage to infrastructure, contribute to loss of life, and place severe strain on lifelines and emergency responders because of the high density of population and structures that can be affected in these areas. Wildfires, however, can spread quickly, become a huge fire complex consisting of thousands of acres, and present greater challenges for allocating resources, defending isolated structures, and coordinating multi-jurisdictional response.

Data and Methodology

Information regarding the wildfire hazard included input and data from PA DCNR, the University of Wisconsin-Madison, and the Steering Committee. The WUI (interface and intermix) data, obtained through the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison, defines the wildfire hazard area. The asset data (population, building stock, and critical facilities) presented in the County Profile (Section 2) was used to support an evaluation of assets exposed and the potential impacts and losses associated with this hazard. Available and appropriate geographic information system (GIS) data were overlaid on the hazard area to identify which assets are exposed to wildfire. The limitations of this analysis are recognized, and, as such, the analysis is used only to provide a general estimate.

Impact on Life, Health, and Safety

As demonstrated by historical wildfire events, potential losses include human health and life of residents and responders. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment.

The county land within the WUI data was overlaid on the 2010 Census population data to estimate the Bedford County population vulnerable to the wildfire hazard (U.S. Census 2010). The census blocks with their center within the hazard area were used to calculate the estimated population exposed to the wildfire hazard. Table 4.3.13-4 summarizes the estimated population exposed by municipality.

Table 4.3.13-3. Estimated Population Located within the WUI in Bedford County

Municipality	U.S. Census 2010 Population	Estimated Population Exposed	Percent of Total
Bedford Borough	2,841	2,841	100.0%
Bedford Township	5,395	4,624	85.7%
Bloomfield Township	1,016	664	65.4%
Broad Top Township	1,687	1,346	79.8%
Coaldale Borough	161	161	100.0%
Colerain Township	1,195	807	67.5%
Cumberland Valley Township	1,597	916	57.4%
East Providence Township	1,854	1,202	64.8%
East St. Clair Township	3,042	1,528	50.2%
Everett Borough	1,832	1,832	100.0%
Harrison Township	978	463	47.3%
Hopewell Borough	230	230	100.0%
Hopewell Township	2,010	1,572	78.2%
Hyndman Borough	910	910	100.0%
Juniata Township	954	362	37.9%
Kimmel Township	1,616	1,507	93.3%
King Township	1,238	1,000	80.8%
Liberty Township	1,418	1,143	80.6%
Lincoln Township	425	141	33.2%
Londonderry Township	1,856	1,505	81.1%
Mann Township	500	320	64.0%
Manns Choice Borough	294	294	100.0%
Monroe Township	1,336	390	29.2%

Municipality	U.S. Census 2010 Population	Estimated Population Exposed	Percent of Total
Napier Township	2,198	1,537	69.9%
New Paris Borough	186	158	84.9%
Pavia Township	295	180	61.0%
Pleasantville Borough	198	198	100.0%
Rainsburg Borough	133	133	100.0%
Saxton Borough	686	686	100.0%
Schellsburg Borough	338	303	89.6%
Snake Spring Township	1,639	1,347	82.2%
South Woodbury Township	2,155	1,458	67.7%
Southampton Township	976	342	35.0%
St. Clairsville Borough	78	78	100.0%
West Providence Township	3,212	2,243	69.8%
West Saint Clair Township	1,736	1,393	80.2%
Woodbury Borough	284	284	100.0%
Woodbury Township	1,263	1,002	79.3%
Bedford County (Total)	**49,762**	**37,100**	**74.6%**

Source: U.S. Census 2010, Stewart and Radeloff 2012
Note:
WUI Wildland-Urban Interface

Impact on General Building Stock

The most vulnerable structures to wildfire events are those within the WUI areas. Buildings constructed of wood or vinyl siding are generally more likely to be damaged by fire than buildings constructed of brick or concrete. The WUI was overlaid on the default building inventory in Hazards U.S. – Multi-Hazard (HAZUS-MH) to estimate the replacement cost of buildings located in the hazard area. Similarly, the county-provided spatial layer of buildings was used to estimate number of structures located in the hazard area and considered exposed to the wildfire hazard in Bedford County. The replacement cost value (RCV) of the census blocks with their center in the WUI was totaled. Table 4.3.13-5 summarizes the estimated building stock inventory exposed by municipality.

Table 4.3.13-4. Building Stock Replacement Value and Structures Located within the WUI in Bedford County

Municipality	Total Number of Buildings	Total RCV	WUI Hazard Area Number of Buildings	WUI Hazard Area % of Total	WUI Hazard Area RCV	WUI Hazard Area % of Total
Bedford Borough	1,892	$646,059,000	1,826	96.5%	$608,122,000	94.1%
Bedford Township	5,482	$1,064,751,000	4,170	76.1%	$828,158,000	77.8%
Bloomfield Township	1,053	$98,910,000	677	64.3%	$69,088,000	69.8%
Broad Top Township	1,989	$210,095,000	1,497	75.3%	$168,125,000	80.0%
Coaldale Borough	101	$12,009,000	96	95.0%	$12,009,000	100.0%
Colerain Township	1,879	$124,874,000	1,044	55.6%	$86,305,000	69.1%
Cumberland Valley Township	2,167	$186,632,000	970	44.8%	$108,800,000	58.3%
East Providence Township	2,599	$278,118,000	1,534	59.0%	$184,199,000	66.2%

Municipality	Total Number of Buildings	Total RCV	WUI Hazard Area			
			Number of Buildings	% of Total	RCV	% of Total
East St. Clair Township	3,216	$370,063,000	1,476	45.9%	$181,519,000	49.1%
Everett Borough	1,222	$438,564,000	1,186	97.1%	$395,278,000	90.1%
Harrison Township	1,664	$163,407,000	749	45.0%	$86,233,000	52.8%
Hopewell Borough	164	$24,173,000	162	98.8%	$24,173,000	100.0%
Hopewell Township	2,146	$222,875,000	1,886	87.9%	$189,319,000	84.9%
Hyndman Borough	778	$117,166,000	763	98.1%	$107,987,000	92.2%
Juniata Township	1,979	$125,361,000	618	31.2%	$43,500,000	34.7%
Kimmel Township	1,852	$207,126,000	1,665	89.9%	$194,528,000	93.9%
King Township	1,354	$128,234,000	972	71.8%	$89,443,000	69.7%
Liberty Township	1,764	$190,571,000	1,436	81.4%	$149,291,000	78.3%
Lincoln Township	462	$43,153,000	143	31.0%	$12,547,000	29.1%
Londonderry Township	2,507	$197,714,000	1,641	65.5%	$154,297,000	78.0%
Mann Township	1,125	$84,599,000	555	49.3%	$52,439,000	62.0%
Manns Choice Borough	269	$32,878,000	257	95.5%	$32,851,000	99.9%
Monroe Township	2,558	$164,383,000	486	19.0%	$40,601,000	24.7%
Napier Township	3,539	$277,952,000	2,059	58.2%	$194,137,000	69.8%
New Paris Borough	135	$21,772,000	131	97.0%	$14,163,000	65.1%
Pavia Township	559	$46,739,000	303	54.2%	$28,465,000	60.9%
Pleasantville Borough	170	$22,172,000	166	97.6%	$22,172,000	100.0%
Rainsburg Borough	157	$14,504,000	152	96.8%	$14,106,000	97.3%
Saxton Borough	504	$168,466,000	502	99.6%	$162,857,000	96.7%
Schellsburg Borough	266	$41,027,000	261	98.1%	$41,027,000	100.0%
Snake Spring Township	1,768	$383,646,000	1,311	74.2%	$301,049,000	78.5%
South Woodbury Township	2,245	$245,720,000	1,383	61.6%	$171,774,000	69.9%
Southampton Township	1,932	$133,937,000	638	33.0%	$55,675,000	41.6%
St. Clairsville Borough	73	$10,568,000	64	87.7%	$10,568,000	100.0%
West Providence Township	3,696	$618,794,000	2,396	64.8%	$429,722,000	69.4%
West Saint Clair Township	1,790	$179,339,000	1,362	76.1%	$141,366,000	78.8%
Woodbury Borough	238	$31,161,000	237	99.6%	$30,216,000	97.0%
Woodbury Township	1,614	$198,967,000	1,167	72.3%	$166,671,000	83.8%
Bedford County (Total)	**58,908**	**$7,526,479,000**	**37,941**	**64.4%**	**$5,602,780,000**	**74.4%**

Source: HAZUS-MH 3.1; Stewart and Radeloff 2012; Bedford County
Notes:
RCV Replacement cost value
WUI Wildland-Urban Interface

Impact on Critical Facilities

A number of critical facilities are located in the wildfire hazard area and are also potentially vulnerable to the threat of wildfire. Many of these facilities are also the locations with vulnerable populations (schools) and responding agencies to wildfire events (fire and police). Table 4.3.13-6 summarizes the number of critical facilities identified by the county plan participants that are located within the wildfire hazard area.

Table 4.3.13-5. Number of Critical Facilities in the WUI in Bedford County

Municipality	Facility Types											
	Fire Station	Hazmat	Helipad	Medical	Police Station	Potable Facility	Potable Pump	Potable Tank	School	Substation	Wastewater Facility	Wastewater Pump
Bedford Borough	1	1	0	0	1	1	0	0	2	0	0	0
Bedford Township	0	6	0	0	1	0	10	3	1	0	0	11
Broad Top Township	1	1	0	0	0	1	0	0	1	0	1	0
Cumberland Valley Township	1	0	0	0	0	0	0	0	0	0	0	0
East Providence Township	1	1	1	0	0	0	0	0	1	0	1	0
East St Clair Township	0	0	0	0	0	2	0	0	1	0	0	0
Everett Borough	0	1	0	0	0	0	0	0	1	1	1	0
Hopewell Borough	0	0	0	0	1	0	0	0	0	0	1	0
Hopewell Township	0	2	0	0	0	0	0	0	0	1	1	0
Hyndman Borough	1	0	0	1	0	0	0	0	0	0	0	0
King Township	1	0	1	0	0	0	0	0	0	0	0	0
Liberty Township	0	0	0	0	1	0	0	0	2	0	0	0
Saxton Borough	1	2	0	0	1	0	0	0	0	0	1	0
Snake Spring Township	0	3	1	1	0	1	0	0	2	0	1	0
South Woodbury Township	0	1	0	0	0	1	0	0	2	1	0	0
Southampton Township	1	0	0	0	0	0	0	0	0	0	0	0
West Providence Township	0	1	0	0	0	0	0	0	2	0	1	0
West St Clair Township	1	1	0	0	0	1	0	0	0	1	0	0
Woodbury Borough	0	1	0	0	0	0	0	0	0	0	0	0
Bedford County (Total)	**9**	**21**	**3**	**2**	**5**	**7**	**10**	**3**	**15**	**4**	**7**	**11**

Source: Stewart and Radeloff 2012; Bedford County 2016
Notes:
WUI Wildland-Urban Interface

Impact on the Economy

Wildfire events can have major economic impacts on a community beginning with the initial loss of structures to the subsequent loss of revenue from destroyed businesses, followed by decreases in tourism. Wildfires can also severely damage roads and infrastructure. Portions of Interstates I-70 and I-99, US Routes US-30 and US-220, and multiple State Highways (including PA-26, PA-31, PA-96, PA-326, and PA-829) run through WUI areas. This factor should be considered when determining evacuation routes for Bedford County residents.

Future Growth and Development

Areas targeted for potential future growth and development in the next 5 to 10 years have been identified across the county at the municipal level. It is anticipated that any new development and new residents in the WUI areas will be exposed to the wildfire hazard.

Effect of Climate Change on Vulnerability

According to USFS, climate change will likely alter the atmospheric patterns that affect fire weather. Changes in fire patterns will, in turn, affect carbon cycling, forest structure, and species composition. Climate change associated with elevated greenhouse gas concentrations may create an atmospheric and fuel environment that is more conducive to large, severe fires (USFS 2011).

Fire interacts with climate and vegetation (fuel) in predictable ways. Understanding the interactions of climate, fire, and vegetation is essential for addressing issues associated with climate change that include:

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land-use change, invasive species, and an increasing WUI area (USFS 2011)

It is projected that higher summer temperatures will likely increase the high fire risk by 10 to 30 percent. Fire occurrence and area burned could increase across the United States as a result of the increase of lightning activity; the frequency of surface pressure and associated circulation patterns conducive to surface drying; and fire weather, in general; which are all conducive to severe wildfires. Warmer temperatures will also increase the effects of drought and increase the number of days each year with flammable fuels, thereby extending fire seasons and areas burned (USFS 2011).

Pennsylvania's Department of Environmental Protection (PADEP) was directed by the Climate Change Act (Act 70 of 2008) to initiate a study of the potential impacts of global climate change on the commonwealth. The June 2009 Pennsylvania Climate Impact Assessment's main findings indicated Pennsylvania may be at increased risk for wildfires, but it was unclear as to how large an increase (Shortle and others 2009).

Future changes in fire frequency and severity are difficult to predict. Global and regional climate changes associated with elevated greenhouse gas concentrations could alter large weather patterns, thereby affecting fire-weather conditions that are conducive to extreme fire behavior (USFS 2011).

Additional Data and Next Steps

As the data and resources become available, a custom building inventory can be generated to capture the construction of structures (such as roofing material, fire detection equipment, and structure age) to further refine the vulnerability analysis. As stated earlier, buildings constructed of wood or vinyl siding are generally more likely to be damaged by the fire hazard than buildings constructed of brick or concrete. The proximity of these building types to the WUI areas should be identified for further evaluation. Development and availability of these data would permit a more detailed estimate of potential vulnerabilities, including loss of life and potential structural damage.

In locations where homes are at risk for wildfires, the BOF's WUI Guidance Document is available to assist homeowners, community associations, local government, and developers in assessing and possibly mitigating 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.

4.3.14 Winter Storm

This section provides a profile and vulnerability assessment of the winter storm hazard in Bedford County. Winter storms occur, on average, approximately five times each year in Pennsylvania. From November through March, the State is exposed to winter storms that move up the Atlantic coast or sweep in from the west. Every county in the Commonwealth is subject to severe winter storms; however, the northern tier, western counties, and mountainous regions tend to experience winter weather more frequently and with greater severity.

Winter storms can produce more damage than any other severe weather event, including tornadoes. Complications caused by winter storms can lead to road closures, especially secondary and farm roads; business losses to commercial centers built in outlying areas because of supply interruption and loss of customers; property losses and roof damages from snow and ice loading and fallen trees; utility interruptions; and loss of water supplies. Flooding can result from winter storm events as well.

Most severe winter storm hazards include heavy snow (snowstorms), blizzards, sleet or freezing rain, ice storms, and mid-Atlantic cyclones locally known as Northeasters or Nor'easters. Because most Nor'easters generally occur during winter weather months, these hazards have also been grouped as a type of severe winter weather storm. Types of severe winter weather events or conditions are further defined as follows:

- Heavy Snow: According to the National Weather Service (NWS), heavy snow is generally considered snowfall accumulating to depth of 4 inches or more within 12 hours or less; or snowfall accumulating to depth of 6 inches or more within 24 hours or less. A snow squall is an intense but limited-duration period of moderate to heavy snowfall, also known as a snowstorm, accompanied by strong, gusty surface winds and possibly lightning (generally moderate to heavy snow showers) (NWS 2009). Snowstorms are complex phenomena involving heavy snow and winds whose impact can be affected by a great many factors, including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and occurrence during the course of the day, weekday versus weekend, and time of season (Kocin and Uccellini 2013).

- Blizzard: Blizzards are characterized by low temperatures, wind gusts of 35 miles per hour (mph) or more, and falling and/or blowing snow that reduces visibility to 0.25 mile or less for an extended period of time (3 or more hours) (NWS 2009). A severe blizzard is defined as having a wind velocity of 45 mph, temperatures of 10°F or lower, and a high density of blowing snow with visibility frequently measured in feet over an extended period of time.

- Sleet or Freezing Rain: Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen, partially-melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground. Both types of precipitation, even in small accumulations, can cause significant hazards to a community (NWS 2009).

- Ice storm: An ice storm is described as an occasion when damaging volumes of ice are expected to accumulate during freezing rain situations. Significant accumulations of ice pull down trees and utility lines, resulting in loss of power and means of communication. These accumulations of ice render walking and driving extremely dangerous, and can create extreme hazards to motorists and pedestrians (NWS 2009).

- Nor'easter: Nor'easters are macro-scale, extra-tropical storms named for the strong northeasterly winds that blow in from the Atlantic Ocean ahead of the storm and over coastal areas of the northeastern United States and Atlantic Canada. They are also referred to as a type of extra-tropical cyclone (mid-latitude storms, or Great Lake storms). Wind gusts associated with Nor'easters can exceed hurricane forces in intensity. Unlike tropical cyclones that form in the tropics and have warm cores (including tropical depressions, tropical storms, and hurricanes), Nor'easters contain a cold core of low barometric pressure that forms in the mid-latitudes. Their strongest winds are close to the earth's surface and often extend several hundred miles across. Nor'easters may occur at any time of the year but are more common during fall and winter months (September through April) (New York City Office of Emergency Management [NYCOEM] Date Unknown).

Nor'easters can induce heavy snow, rain, gale-force winds, and oversized waves (storm surge) that can cause beach erosion, coastal flooding, structural damage, power outages, and unsafe human conditions. If a Nor'easter cyclone stays just offshore, the results are much more devastating than if the cyclone travels up the coast on an inland track. Nor'easters that stay inland are generally weaker and usually cause strong winds and rain. Those that stay offshore can bring heavy snow, blizzards, ice, strong winds, high waves, and severe beach erosion. In these storms, the warmer air is aloft. Precipitation falling from this warm air moves into the colder air at the surface, causing crippling sleet or freezing rain (McNoldy Multi-Community Environmental Storm Observatory [MESO] Date Unknown). While some of the most devastating effects of Nor'easters occur in coastal areas (e.g., beach erosion, coastal flooding), effects on inland areas, like Bedford County, may include heavy snow, strong winds, and blizzards.

4.3.14.1 Location and Extent

Winter storms are regional events most of which impact a large area of or the entire Commonwealth. In many cases, surrounding states and even the northeast region of the United States are affected by a single winter storm event.

The magnitude or severity of a severe winter storm depends on several factors, including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified by meteorological measurements and by evaluating its societal impacts. National Oceanic and Atmospheric Administration (NOAA)'s National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that affect the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5. The index is based on spatial extent of the storm, amount of snowfall, and interaction of the extent and snowfall totals with population (based on the 2000 U.S. Census). NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA-NCDC 2011). Table 4.3.14-1 lists the five RSI ranking categories.

All of Bedford County is susceptible to winter storms. Based on annual snowfall averages according to the 2013 State Hazard Mitigation Plan (HMP) (Figure 4.3.14-1), snowfall accumulation during the winter season in Bedford County ranges between 30 and 50 inches.

Table 4.3.14-1. RSI Ranking Categories

Category	Description	Regional Snowfall Index (RSI)
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	18.0+

Source: NOAA-NCDC 2011

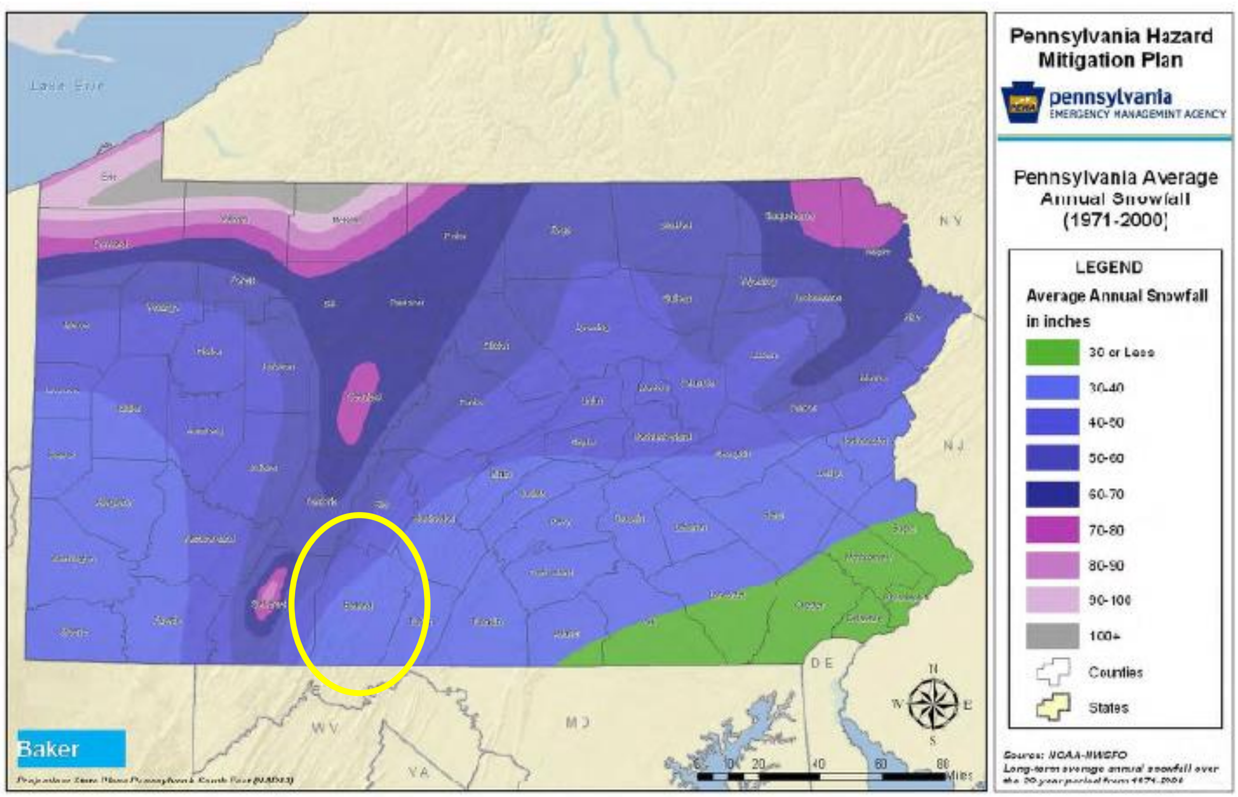
4.3.14.2 Range in Magnitude

A winter storm can adversely affect roadways, utilities, and businesses, and can cause loss of life, frostbite, and freezing conditions. These storms typically fall into one of the following categories, defined in the previous section:

- Heavy snow
- Sleet or freezing rain
- Ice storm
- Blizzard
- Nor'easter

Again, Bedford County typically receives 30-50 inches of snow each year, as shown on Figure 4.3.14-1. The worst winter storm to strike Bedford County occurred in January 1994. Specific snowfall totals from that storm were not available, but snowfall in southwest portions of Pennsylvania exceeded 30 inches in 1 day. The Pennsylvania Turnpike (I-76), as well as I-70 (a major north-south highway in the County), were closed or shut down because of the snow. The storm brought with it strong winds and sleet/freezing rains. Numerous storm-related power outages were reported, and as many as 600,000 residents throughout Pennsylvania were without electricity, some of these for several days at a time. The storm caused 185 injuries and approximately $5 million in damages across the State.

Figure 4.3.14-1. Annual Snowfall



Source: Pennsylvania Emergency Management Agency (PEMA) 2013
Note: The yellow oval surrounds Bedford County.

4.3.14.3 Past Occurrence

Many sources provided historical information regarding previous occurrences and losses associated with winter storm events throughout the Commonwealth of Pennsylvania and Bedford County. With so many sources reviewed for the purpose of this Plan, loss and impact information for many events could vary depending on the source. Therefore, accuracy of monetary figures discussed is based only on available information identified during research for this Plan. Monetary figures may also have been calculated for the region as a whole, based on entire storm damage, and include damage from other counties.

Between 1954 and 2016, the Federal Emergency Management Agency (FEMA) declared that the Commonwealth of Pennsylvania experienced nine winter storm-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: severe winter storms, snowstorms, blizzards, winter storms, severe storms, and snowfalls. Generally, these disasters covered a wide region of the State, and therefore may have impacted many counties. However, not all counties were included in the disaster declarations. PEMA and other sources indicate that Bedford County has been declared as a disaster area as a result of five of the nine winter storm events (FEMA 2012).

According to the NOAA-NCDC storm events database, Bedford County experienced 69 winter storm events between March 1993 and July 31, 2016. Based on all sources researched, known winter storm events that have affected Bedford County (and resulted in injuries, fatalities, and/or damages) are listed in Table 4.3.14-2. Because winter storm documentation for the State of Pennsylvania is so extensive, not all sources have been identified or researched. Therefore, Table 4.3.14-2 may not include all events that have occurred throughout the County.

Table 4.3.14-2. Major Winter Storm Events in Bedford County between 1994 and 2016

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
January 14, 1994	Heavy Snow	N/A	N/A	185 injuries; $5,000,000 in property damages
January 17, 1994	Heavy Snow	N/A	N/A	$500,000 in property damages
January 27, 1994	Ice	N/A	N/A	62 injuries; $50,000 in property damages
March 2, 1994	Heavy Snow/Blizzard	N/A	N/A	1 injury; $5,000,000 in property damages
March 10, 1994	Ice	DR-1015	No	$500,000 in property damages
March 4, 2001	Heavy Snow	N/A	N/A	$150,000 in property damages
October 29, 2002	Ice Storm	N/A	N/A	$1,000,000 in property damages
February 16, 2003	Heavy Snow	N/A	N/A	2 injuries
January 6, 2009	Ice Storm	N/A	N/A	$2,000 in property damages
February 5, 2010	Severe Winter Storms and Snowstorms	DR-1898	Yes	18-30 inches of snow resulted in approximately $266,000 in public assistance for emergency protective measures, including snow assistance, throughout the County
January 22, 2016	Snow	DR-4267	Yes	16-30 inches of snow resulted in over $844,000 in public assistance for emergency protective measures, including snow assistance, throughout the County

Source: NOAA-NCDC 2016.

Notes:

Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, many monetary losses earlier than 2016 would be considerably higher in USDs as a result of increased U.S. Inflation Rates.

DR Federal Disaster Declaration
FEMA Federal Emergency Management Agency
N/A Not applicable/available
NCDC National Climate Data Center
NOAA National Oceanic Atmospheric Administration

4.3.14.4 Future Occurrence

Apparently, given the history of winter storm events that have impacted Bedford County, future winter storm events of varying degrees will occur, and thus many people and properties are at risk from the winter storm hazard in the future.

Based on available historical data, future occurrences of winter storm events are considered likely, according to Risk Factor Methodology probability criteria (further discussed in Section 4.4).

4.3.14.5 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable within the identified hazard area. Regarding winter storm events, all Bedford County has been identified as the hazard area. Therefore, all assets (population, structures, critical facilities and lifelines), as described in the County Profile (Section 2), are potentially vulnerable. The following section includes an evaluation and estimation of potential winter storm impacts on the County, including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on life, health, and safety; general building stock; critical facilities; economy; environment; and future growth and development
- Effect of climate change on vulnerability
- Further data collections that will increase understanding of this hazard over time.

Overview of Vulnerability

In Bedford County, winter storms are a concern because of frequency of these, direct and indirect costs associated with them, delays they cause, and impacts on people and facilities of the region.

Data and Methodology

National weather databases, the 2013 Pennsylvania HMP, and local resources were referenced to acquire information about and analyze severe winter storm impacts on Bedford County. Information from the 2010 U.S. Census data and the Hazards U.S. – Multi-Hazard (HAZUS-MH) building inventory for Bedford County supported an evaluation of exposed assets and potential impacts associated with this hazard.

Impact on Life, Health, and Safety

According to the NOAA National Severe Storms Laboratory (NSSL), winter weather indirectly and deceptively kills hundreds of people in the United States every year, primarily from automobile accidents, overexertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow, extreme cold temperatures, and dangerous wind chill. Winter storms are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, of heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold.

Heavy snow can immobilize a region and paralyze a city, shutting down air and rail transportation, stopping flow of supplies, and disrupting medical and emergency services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. In the mountains, heavy snow can lead to avalanches (NSSL 2015).

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL 2015).

For the purposes of this Plan, the entire population of Bedford County is considered exposed to winter storm events (U.S. Census 2010). The elderly are considered most susceptible to this hazard because of their increased risk of injuries and death from falls and overexertion, and/or hypothermia from exposure while attempting to clear snow and ice. In addition, winter storm events can reduce ability of these populations to access emergency services. Residents with low incomes may not have access to housing, or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). The County Profile (Section 2) of this Plan provides population statistics regarding each participating municipality and a summary of the more vulnerable populations (over the age of 65 and individuals living below the U.S. Census poverty threshold).

Impact on General Building Stock

The entire general building stock inventory in Bedford County is exposed and vulnerable to the winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses from this hazard. As an alternate approach, this plan considers percentage damages that could result from winter storm conditions. Table 4.3.14-3 below summarizes percent damages from winter storm conditions on Bedford County's total general building stock (structure only). Given professional knowledge and currently available information, potential losses from this hazard are considered overestimated; hence, the listed values in Table 4.3.14-3 represent conservative estimates of losses associated with severe winter storm events.

Table 4.3.14-3. General Building Stock Exposure (Structure Only) and Estimated Losses from Winter Storm Events in Bedford County

Municipality	Total GBS (Structure Only)	1% of Total	5% of Total	10% of Total
Bedford Borough	$379,390,000	$3,793,900	$18,969,500	$37,939,000
Bedford Township	$604,859,000	$6,048,590	$30,242,950	$60,485,900
Bloomfield Township	$60,640,000	$606,400	$3,032,000	$6,064,000
Broad Top Township	$135,101,000	$1,351,010	$6,755,050	$13,510,100
Coaldale Borough	$7,953,000	$79,530	$397,650	$795,300
Colerain Township	$78,852,000	$788,520	$3,942,600	$7,885,200
Cumberland Valley Township	$118,265,000	$1,182,650	$5,913,250	$11,826,500
East Providence Township	$171,953,000	$1,719,530	$8,597,650	$17,195,300
East St. Clair Township	$233,453,000	$2,334,530	$11,672,650	$23,345,300
Everett Borough	$249,715,000	$2,497,150	$12,485,750	$24,971,500
Harrison Township	$100,282,000	$1,002,820	$5,014,100	$10,028,200
Hopewell Borough	$15,596,000	$155,960	$779,800	$1,559,600
Hopewell Township	$141,511,000	$1,415,110	$7,075,550	$14,151,100
Hyndman Borough	$73,655,000	$736,550	$3,682,750	$7,365,500
Juniata Township	$80,358,000	$803,580	$4,017,900	$8,035,800
Kimmel Township	$128,998,000	$1,289,980	$6,449,900	$12,899,800
King Township	$80,411,000	$804,110	$4,020,550	$8,041,100
Liberty Township	$114,058,000	$1,140,580	$5,702,900	$11,405,800
Lincoln Township	$27,172,000	$271,720	$1,358,600	$2,717,200
Londonderry Township	$126,717,000	$1,267,170	$6,335,850	$12,671,700
Mann Township	$54,296,000	$542,960	$2,714,800	$5,429,600
Manns Choice Borough	$21,218,000	$212,180	$1,060,900	$2,121,800

Municipality	Total GBS (Structure Only)	1% of Total	5% of Total	10% of Total
Monroe Township	$105,738,000	$1,057,380	$5,286,900	$10,573,800
Napier Township	$175,388,000	$1,753,880	$8,769,400	$17,538,800
New Paris Borough	$13,119,000	$131,190	$655,950	$1,311,900
Pavia Township	$29,135,000	$291,350	$1,456,750	$2,913,500
Pleasantville Borough	$13,791,000	$137,910	$689,550	$1,379,100
Rainsburg Borough	$9,489,000	$94,890	$474,450	$948,900
Saxton Borough	$94,642,000	$946,420	$4,732,100	$9,464,200
Schellsburg Borough	$25,282,000	$252,820	$1,264,100	$2,528,200
Snake Spring Township	$225,151,000	$2,251,510	$11,257,550	$22,515,100
South Woodbury Township	$146,948,000	$1,469,480	$7,347,400	$14,694,800
Southampton Township	$84,753,000	$847,530	$4,237,650	$8,475,300
St. Clairsville Borough	$6,635,000	$66,350	$331,750	$663,500
West Providence Township	$360,054,000	$3,600,540	$18,002,700	$36,005,400
West Saint Clair Township	$112,576,000	$1,125,760	$5,628,800	$11,257,600
Woodbury Borough	$19,709,000	$197,090	$985,450	$1,970,900
Woodbury Township	$109,958,000	$1,099,580	$5,497,900	$10,995,800
Bedford County (Total)	**$4,536,821,000**	**$45,368,210**	**$226,841,050**	**$453,682,100**

Source: HAZUS-MH 3.1

An area especially vulnerable to the winter storm hazard is the floodplain. At-risk building stock and infrastructure in floodplains are presented in the flood hazard profile (Section 4.3.4). Generally, losses from flooding associated with winter storms should be less than those associated with a 1-percent or 0.2-percent flood. Snow and ice melt can cause both riverine and urban flooding. Estimated losses caused by riverine flooding in the County are discussed in Section 4.3.4.

Impact on Critical Facilities

Full functionality of critical facilities such as police, fire, and medical services is essential for response during and after a winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, these should undergo only minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended for critical facilities and infrastructure.

Impact on the Economy

Infrastructure at risk from the winter storm hazard includes roadways that could be damaged by application of salt, and intermittent freezing and warming conditions that can damage roads over time. Costs of snow and ice removals, as well as repairs of roads undergoing freeze/thaw cycles, can drain local financial resources. Potential secondary impacts from winter storms also impact the local economy, including loss of utilities, interruption of transportation corridors, and loss of business function.

Impact on the Environment

Environmental impacts often include damage to trees and shrubs caused by heavy snow loading, ice build-up, and/or high winds, which can break limbs and down large trees. Indirect effects of winter storms include possible damage to surfaces and contamination of groundwater adjacent to roadway surfaces treated with salt, chemicals, and other de-icing materials (PEMA 2013).

Winter storms have a positive environmental impact: gradual melting of snow and ice recharges groundwater. However, abrupt high temperatures following a heavy snowfall can accelerate snowmelt, leading to rapid surface water runoff and severe flooding (PEMA 2013).

Future Growth and Development

Areas targeted for potential future growth and development within the next 5 to 10 years have been identified across the County at the municipal level, and are further discussed in Section 2.4 of this Plan. Because Bedford County in its entirety has been identified as the hazard area vulnerable to the winter storm hazard, any new development will be exposed to associated risks.

Effect of Climate Change on Vulnerability

Climate is defined not just as average temperature and precipitation, but also by type, frequency, and intensity of weather events. Both globally and at the local level, climate change potentially can alter prevalence and severity of weather extremes such as winter storms. While predicting changes in winter storm events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment.

The climate of Pennsylvania has changed in several ways. Over the past 100 years, annual average temperatures have been rising across the State. Warmer winters have led to decrease in snow cover and earlier arrival of spring. Recent analyses based on the Intergovernmental Panel on Climate Change models suggest a decrease in frequency and an increase in intensity of extra-tropical winter cyclones. However, based on the methodology applied, some models show no significant change in the storm track whereas others indicate a northward displacement of the storm track in the North Atlantic. For the mid-Atlantic region, there is little indication of a change in storm activity or track over Pennsylvania. An overall increase in winter precipitation is anticipated, with decrease in snow and increase in rain during the winter months. Projections regarding future occurrences of extra-tropical cyclones in Pennsylvania are substantially uncertain. Based on available information and projections, winter storms are anticipated to continue to affect Pennsylvania in the future. Future improvements in modeling smaller-scale climatic processes can be expected, and will lead to improved understanding of ways in which changing climate will alter temperature, precipitation, and storm events in Pennsylvania (Shortle and others 2009).

Additional Data and Next Steps

The assessment above identifies vulnerable populations and economic losses associated with the winter storm hazard of concern. Historical data on structural losses to general building stock are not adequate to predict specific losses to this inventory; therefore, the percent of damage assumption methodology was applied. This methodology is based on FEMA How-to Series (FEMA 386-2), Understanding Your Risks, Identifying and Estimating Losses (FEMA 2001), and FEMA's Using HAZUS-MH for Risk Assessment (FEMA 433) (FEMA 2015). Acquisition of additional/actual valuation data regarding general building stock and critical infrastructure losses would further support future estimates of potential exposure of and damage to the general building stock inventory.

4.3.15 Dam Failure

This section provides a profile and vulnerability assessment of the dam failure hazard in Bedford County. A dam is an artificial barrier allowing storage of water, wastewater, or liquid-borne materials for many reasons (flood control, human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, or pollution control). Many dams fulfill a combination of these stated functions (Association of State Dam Safety Officials 2013). They are an important resource in the United States.

Man-made dams can be classified according to type of construction material used, methods applied in construction, slope or cross-section of the dam, how a dam resists forces of water pressure behind it, means used to control seepage, and, occasionally, purpose of the dam. Materials used for construction of dams include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, miscellaneous materials (plastic or rubber), and any combination of these materials (Association of State Dam Safety Officials 2013).

More than a third of the country's dams are 50 or more years old. Approximately 14,000 of those dams pose a significant hazard to life and property if failure occurs. About 2,000 unsafe dams are dispersed throughout the United States, in almost every state.

Dams typically fail when spillway capacity is inadequate and excess flow overtops the dam, or when internal erosion (piping) through the dam or foundation occurs. Complete failure occurs if internal erosion or overtopping results in a complete structural breach, releasing a high-velocity wall of debris-filled water that rushes downstream, damaging or destroying anything in its path (Federal Emergency Management Agency [FEMA] 2015).

Dam failures can result from one or a combination of the following:

- Overtopping caused by floods that exceed capacity of the dam
- Deliberate acts of sabotage
- Structural failure of materials used in dam construction
- Movement or failure of the foundation supporting the dam
- Settling and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate maintenance and upkeep (FEMA 2013a).

Regulatory Oversight of Dams

Potential for catastrophic flooding caused by dam failures led to enactment of the National Dam Safety Act (Public Law 92-367), which for 30 years has protected Americans from dam failures. The National Dam Safety Program (NDSP) is a partnership among states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most dams in the United States (FEMA 2013).

Pennsylvania Department of Environmental Protection

The Pennsylvania Department of Environmental Protection (PADEP) holds responsibility for dam safety. Hazard Potential Category 1 dams are those "where its failure could result in significant loss of life, excessive economic losses, and significant public inconvenience." Hazard Potential Category 2 dams are those "where its failure could result in the loss of a few lives, appreciable property damage, and short-duration public inconvenience" (PADEP 2009). Owners of dams classified as Hazard Categories 1 or 2 ("high-hazard" dams) are required to create an Emergency Action Plan (EAP) that describes the dam, the inundation area if the dam were to catastrophically fail, and procedures for responding to the dam failure (such as notification to the vulnerable population). Bedford County should receive copies of EAPs and inundation maps for high-hazard dams whose failure could impact local residents; however, the County does not currently have copies of the EAPs and inundation maps.

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state's and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety (USACE 2016). The USACE National Inventory of Dams (NID) provides the most recent dates of inspection of the following Bedford County dams:

- Bedford County Sportsmen's Club Lake Dam: May 14, 2014
- Elder Dam: July 16, 2014
- Glade Spring Dam: May 14, 2014
- John C Smith Dam: August 27, 2015
- Kubalak Dam: May 27, 2014
- Lake Gordon Dam: July 22, 2015
- Pence Dam: June 24, 2014
- Shawnee Lake Dam: August 27, 2015
- Thomas W Koon Dam: July 22, 2015
- Todd Spring Reservoir Dam: August 27, 2015
- Trough Creek Reservoir Dam: June 5, 2013.

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) has the largest dam safety program in the United States. FERC cooperates with a large number of federal and state agencies to ensure and promote dam safety and, more recently, homeland security. A total of 3,036 dams are part of regulated hydroelectric projects and are included in the FERC program. Two-thirds of these are more than 50 years old. Concern about their safety and integrity grows as dams age, rendering oversight and regular inspection especially important (FERC 2016). FERC staff inspect hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with terms and conditions of a license (FERC 2016).

Every 5 years, an independent consulting engineer, approved by FERC, must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with total storage capacity of more than 2,000 acre-feet (FERC 2016).

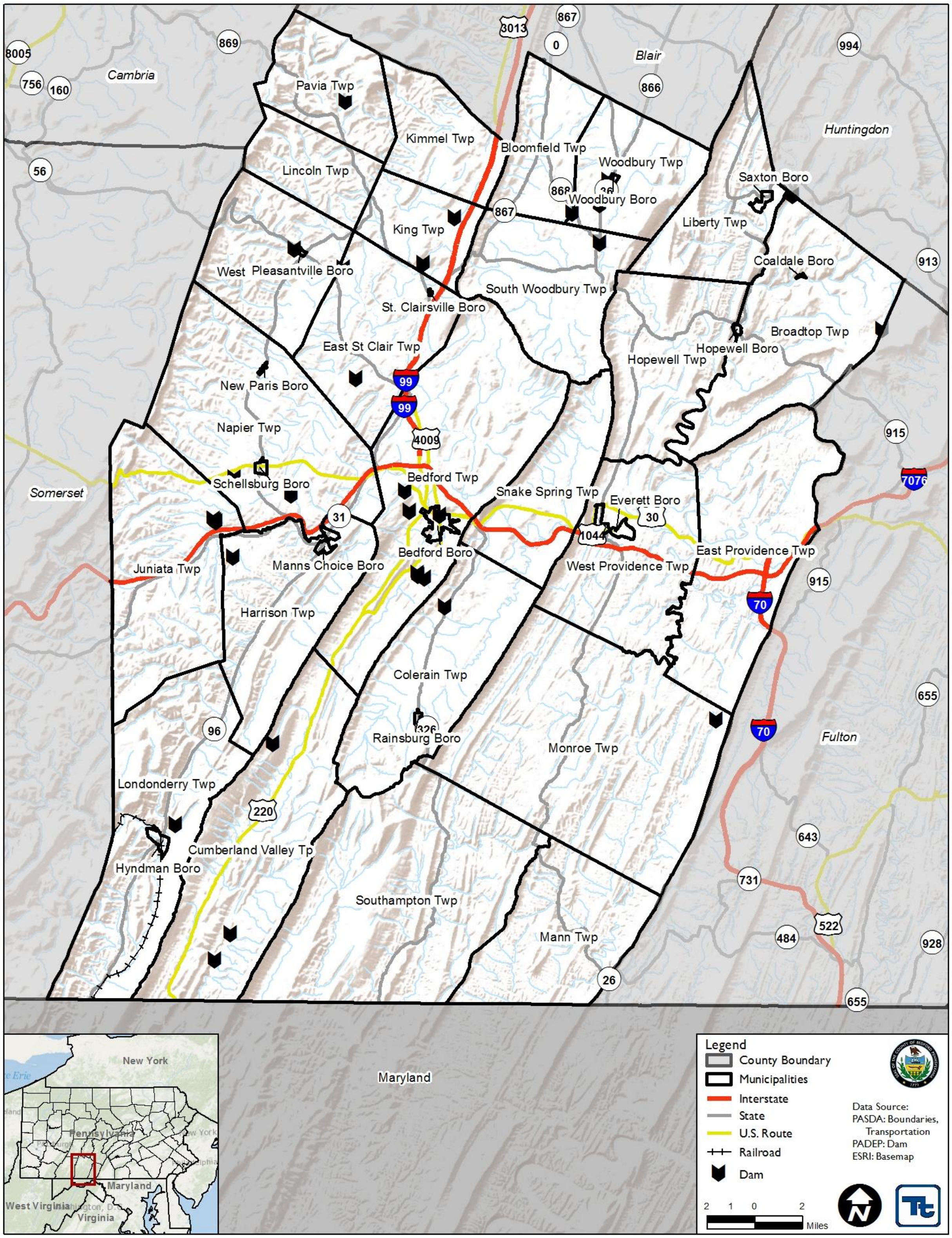
FERC monitors and evaluates seismic research in geographic areas where seismic activity is a concern. This information is applied to investigate and analyze structures of hydroelectric projects within these areas. FERC staff also evaluates effects of potential and actual large floods on safety of dams. FERC staff visit dams and licensed projects during and after floods, assess extents of damage, and direct any studies or remedial measures the licensee must undertake. FERC's *Engineering Guidelines for the Evaluation of Hydropower Projects* guides FERC engineering staff and licensees in evaluations of dam safety. The publication is frequently revised to reflect current information and methodologies (FERC 2016).

FERC requires licensees to prepare EAPs, and conducts training sessions on developing and testing these plans. The plans outline an early warning system in the event of an actual or potential sudden release of water from a dam failure. The plans include operational procedures that may be implemented during regulatory measures, such as reducing reservoir levels and downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that all applicable parties are informed of the proper procedures in emergencies (FERC 2016).

4.3.15.1 Location and Extent

Thirty dams are present throughout Bedford County, as shown on Figure 4.3.15-1. The vast majority of these dams pose little risk; however, five Hazard Category 1 "high-hazard" dams require EAPs. Table 4.3.15-1 lists dam classification definitions. Table 4.3.15-2 is a complete list of dams in Bedford County, "high-hazard" dams listed first.

Figure 4.3.15-1. Dams in Bedford County



Sources: Bedford County; PADEP 2016.

Table 4.3.15-1. Dam Classification Definitions

Size Category		
Category	**Impoundment Storage (Acre feet)**	**Dam Height (Feet)**
A	Equal to or greater than 50,000	Equal to or greater than 100
B	Less than 50,000 but greater than 1,000	Less than 100 but greater than 40
C	Equal to or less than 1,000	Equal to or less than 40
Hazard Potential Category		
Category	**Population at Risk**	**Economic Loss**
1	Substantial (Numerous homes or small businesses or a large business or school)	Excessive, such as extensive residential, commercial, or agricultural damage, or substantial public inconvenience.
2	Few (A small number of homes or small businesses)	Appreciable, such as limited residential, commercial, or agricultural damage, or moderate public inconvenience.
3	None expected (no permanent structures for human habitation or employment)	Significant damage to private or public property and short-duration public inconvenience such as damage to storage facilities or loss of critical stream crossings.
4	None expected (no permanent structures for human habitation or employment)	Minimal damage to private or public property and no significant public inconvenience

Source: Commonwealth of Pennsylvania 2011.

Table 4.3.15-2. Dams in Bedford County

Dam Name	Municipality	Stream	Class	Permittee
High-Hazard Dams				
John C Smith Dam	Bedford Township	Pigeon Run	B-1	Bedford Borough
Lake Gordon Dam	Cumberland Valley Township	Evitts Creek	B-1	City of Cumberland, MD
Shawnee Lake Dam	Napier Township	Tr Raystown Branch Juniata River	B-1	PA DCNR
Thomas W Koon Dam	Cumberland Valley Township	Evitts Creek	B-1	City of Cumberland, MD
Todd Spring Reservoir Dam	Bedford Township	Tr Raystown Branch Juniata River	C-1	Bedford Borough
Other Dams				
Bedford Co. Sportsmen's Club Lake Dam	Colerain Township	Transve Run	C-3	Bedford County Sportsmen's Club, Inc.

Dam Name	Municipality	Stream	Class	Permittee
Glade Spring Dam	Harrison Township	Tr Raystown Branch Juniata River	C-3	Glade Spring Association
Kubalak Dam	East Saint Clair Township	Tr Dunning Creek	C-3	Michael J Kubalak
Barnett Dike No 1 Dam	Juniata Township	Tr Raystown Branch Juniata River	C-4	Mina Barnett
Barnett Dike No 2 Dam	Juniata Township	Tr Raystown Branch Juniata River	C-4	Mina Barnett
Barnett Dike No 3 Dam	Juniata Township	Tr Raystown Branch Juniata River	C-4	Mina Barnett
Blue Knob Park Dam	Union Township	Frost Run	C-4	PA DCNR
Camp Pleasant Dam	East Saint Clair Township	Dunning Creek	C-4	Camp Pleasant Association
Claycomb Dam	Woodbury Township	Potter Creek	C-4	Clyde Claycomb
Distillery Dam	Napier Township	Tr Shawnee Branch	C-4	UCC-Penn West Conference
Elder Dam	Monroe Township	East Br Sideling Hill Creek	C-4	Kerry Richards
F Paul Reighard Dam	Bedford Borough	Raystown Branch Juniata River	C-4	Bedford Borough
Hyndman Water Company Dam	Londonderry Township	Tr Little Wills Creek	C-4	Hyndman Water Company
Keagy Dam	Woodbury Borough	Yellow Creek	C-4	Todd R. Housel
Lake Caledonia Dam	Bedford Township	Tr Shobers Run	C-4	Bruce Corneal
Lower Red Oaks Dam	Bedford Borough	Tr Shobers Run	C-4	Bedford Springs Hotel, Inc.
Pence Dam	Woodbury Township	Yellow Creek	C-4	Jacob C. Miller
Pleasantville Dam	West Saint Clair Township	Barefoot Run	C-4	Pleasantville Borough
Sand Spring Run - Sgl #48 Dam	Cumberland Valley Township	Sand Spring Run	C-4	PA Game Commission
Saxton Water Authority Dam	Broad Top Township	Putts Hollow Run	C-4	Borough of Saxton Water Authority
Snider Dam	King Township	Tr Scrub Grass Run	C-4	Obie Snider
Trough Creek Reservoir Dam	Broad Top Township	Trough Creek	C-4	Wood-Broad Top-Wells Joint Municipal Authority
Upper Dam	Bedford Township	Tr Shobers Run	C-4	Bedford Springs Hotel, Inc.
Whitcomb Dam	King Township	Trout Run	C-4	Ronald and Wanda Whitcomb
Woodside Dam	South Woodbury Township	Yellow Creek	C-4	Waterside Woolen Mills

Source: PADEP Dam Safety 2016

4.3.15.2 Range of Magnitude

Extent or magnitude of a dam failure event can be measured in terms of classification of the dam. FEMA has three classification levels of dam hazard potential: low, significant, and high. The classification levels build on each other. The hazard potential classification system should be used with the understanding that failure of any dam or water-retaining structure could represent a danger to downstream life and property (FEMA 2004). Each FEMA classification level of dam hazard potential is described as follows:

- Low-hazard potential dams are those where failure or misoperation would result in no probable loss of human life and low economic or environmental losses. Losses are principally limited to the owner's property.
- Significant-hazard potential dams are those where failure or misoperation would result in no probable loss of human life but could cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant-hazard potential dams are often located in predominantly rural or agricultural areas.
- High-hazard potential dams are those where failure or misoperation will probably cause loss of human life.

Table 4.3.15-3 lists USACE-developed classifications of hazard potentials of dam failures, based only on potential consequences of a dam failure; this classification does not take into account probability of failure.

Table 4.3.15-3. U.S. Army Corps of Engineers Hazard Potential Classification

Hazard Category[1]	Direct Loss of Life[2]	Lifeline Losses[3]	Property Losses[4]	Environmental Losses[5]
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural location, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

1 Categories are assigned to overall projects, not individual structures at a project.

2 Loss-of-life potential is based on inundation mapping of area downstream of the project. Analysis of loss-of-life potential should take into account the population at risk, time of flood wave travel, and warning time.

3 Lifeline losses include indirect threats to life caused by the interruption of lifeline services from project failure or operational disruption; for example, loss of critical medical facilities or access to them.

4 Property losses include damage to project facilities and downstream property and indirect impact from loss of project services, such as impact from loss of a dam and navigation pool, or impact from loss of water or power supply.

5 Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: USACE 2016

Bedford County's worst-case scenario of dam failures would be failure of Lake Koon or Lake Gordon, which could result in significant property damage and casualties. These dams are adjacent to Route 220 on the sister lakes of Lake Koon and Lake Gordon. Failure of these dams would create a rush of water that would impact nearby residents in Southampton Township. Communities possibly affected include Hazen, MD; Pleasant Valley MD; Cooks Mill, PA; and Stringtown, PA.

4.3.15.3 Past Occurrence

No dam failures or incidents have been recorded in Bedford County.

4.3.15.4 Future Occurrence

Likelihood of a dam failure in Bedford County is difficult to predict. Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, landslides, and excessive rainfall and snowmelt. However, the risk of such an event increases for each dam as the dam's age increases or frequency of maintenance decreases.

"Residual risk" to dams is risk that remains after implementation of safeguards. Residual risk to dams is associated with events beyond those that the facility was designed to withstand. However, probability of any type of dam failure is low in today's dam safety regulatory and oversight environment.

Based on Risk Factor Methodology Probability Criteria (further defined in Section 4.4), and assuming regular maintenance and inspections of the dams in Bedford County, dam failures are considered unlikely in the County.

4.3.15.5 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed and/or vulnerable within the identified hazard area. Regarding the dam failure hazard, the dam failure flood inundation zone of the Shawnee Lake Dam is examined. The following sections evaluate and estimate potential impact of flooding in Bedford County, presenting:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) the economy; and (5) future growth and development
- Effects of climate change on vulnerability.

Overview of Vulnerability

The dam failure hazard is of significance to Bedford County because 30 dams are present across Bedford County, five of which are classified as high-hazard by PADEP. Warning time for dam failure is often limited. These events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather—limiting their predictability and compounding the hazard. Populations without adequate warning of the event are highly vulnerable to this hazard. Direct and indirect losses associated with dam failures include injury and loss of life, damage to structures and infrastructure, agricultural losses, utility failure (power outages), and stress on community resources.

Data and Methodology

Polygons representing dam failure inundation areas (dated April 2008) have been generated by the Pennsylvania Department of Conservation and Natural Resources. Municipalities affected by a failure of the Shawnee Lake Dam are Bedford Borough, Bedford Township, East St. Clair Township, Harrison Township, Juniata Township, Manns Choice Borough, Napier Township, and Snake Spring Township. An exposure analysis was conducted for these municipalities only.

Impact on Life, Health, and Safety

Table 4.3.15-4 lists estimated populations within the dam failure inundation zone by municipality. To estimate populations exposed to the hazard, dam failure inundation boundaries were overlaid upon the 2010 U.S. Census population data in Geographic Information Systems (GIS) (U.S. Census 2010). U.S. Census blocks do not coincide with boundaries of the hazard area. Utilizing the centroid or intersect of the U.S. Census block and the floodplain can grossly overestimate or underestimate exposed population. Limitations of these analyses are recognized, and as such, results are used only to provide a general estimate.

Table 4.3.15-4. Estimated Population Vulnerable to the Dam Failure Inundation Boundary (2010 Census)

Municipality	Total Population	1-Percent Annual Chance Event	
		Population in SFHA	Percent Population in Boundary
Bedford Borough	2,841	1,172	41.3%
Bedford Township	5,395	908	16.8%
East St. Clair Township	3,042	8	0.3%
Harrison Township	978	63	6.4%
Juniata Township	954	0	0.0%
Manns Choice Borough	294	81	27.6%
Napier Township	2,198	28	1.3%
Snake Spring Township	1,639	0	0.0%
Total	**17,341**	**2,260**	**13.0%**

Sources: U.S. Census 2010, Pennsylvania Department of Conservation and Natural Resources (PA DCNR) 2008.

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impact on their families. The population over age 65 is also highly vulnerable because they are more likely to seek or need medical attention that may not be available because of isolation during a flood event, and they may have more difficulty evacuating.

Impact on General Building Stock

Similar to population data, building stock data are presented by Census block. To estimate value of building stock exposed to a hazard event, dam failure inundation boundaries were overlaid upon HAZUS-MH building stock data in GIS. Assuming default general building stock, replacement cost values of Census blocks with centroids in the floodplain were totaled. To estimate the number of structures exposed within the dam failure inundation boundary, the County's spatial layer of structures was overlaid by the 1-percent flood event boundary. Building stock exposures per municipality are listed in Table 4.3.15-5.

Table 4.3.15-5. Estimated General Building Stock Exposure to the Dam Failure Inundation Boundary

Municipality	Total Number of Buildings	Total Replacement Cost Value (RCV)	1% Annual Chance Flood Boundary			
			Number of Buildings	% of Total	RCV	% of Total
Bedford Borough	1,892	$646,059,000	680	35.9%	$280,457,000	43.4%
Bedford Township	5,482	$1,064,751,000	1,169	21.3%	$270,609,000	25.4%
East St. Clair Township	3,216	$370,063,000	33	1.0%	$2,359,000	<1%
Harrison Township	1,664	$163,407,000	450	27.0%	$27,536,000	16.9%

Municipality	Total Number of Buildings	Total Replacement Cost Value (RCV)	1% Annual Chance Flood Boundary			
			Number of Buildings	% of Total	RCV	% of Total
Juniata Township	1,979	$125,361,000	0	0.0%	$0	0.0%
Manns Choice Borough	269	$32,878,000	80	29.7%	$9,698,000	29.5%
Napier Township	3,539	$277,952,000	232	6.6%	$10,201,000	3.7%
Snake Spring Township	1,768	$383,646,000	0	0.0%	$0	0.0%
Total	**19,809**	**$3,064,117,000**	**2,644**	**13.3%**	**$600,860,000**	**19.6%**

Sources: HAZUS-MH 3.1; Bedford County 2016; PA DCNR. 2008

Impact on Critical Facilities

In addition to considering general building stock at risk, risks of flood to critical facilities, utilities, and user-defined facilities were evaluated. Table 4.3.15-6 lists critical facilities and utilities within FEMA flood zones. All transportation infrastructure within the dam failure inundation zone is vulnerable to damage. Damage to this infrastructure could cut off evacuation routes, limit emergency access, and create isolation issues. Utilities such as overhead power, cable, and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation zones.

Table 4.3.15-6 Critical Facilities within the Dam Failure Inundation Boundary

Municipality	Facility Types														
	Correctional	DPW	Government	Hazmat	Major Employer	Municipal Building	Police	Post Office	Potable Facility	Potable Pump	Potable Well	School	Shelter	Wastewater Facility	Wastewater Pump
Bedford Boro	0	0	1	1	0	0	0	0	1	0	0	1	1	0	0
Bedford Twp	1	1	2	5	2	0	1	0	0	5	1	0	0	0	8
Harrison Twp	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Manns Choice Boro	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0

Sources: Bedford County, PADCNR 2008

Impact on the Economy

For more information regarding impacts of dam failure and flooding on the economy, refer to Section 4.3.4 (Flood, Flash Flood, Ice Jams).

Impact on the Environment

Similar to levee failure events, environmental impacts of a dam failure event pose significant water quality and debris disposal issues. Flood waters can cause issues with sanitary sewer systems by inundating wastewater treatment plants and causing raw sewage to flow from the sewer system and contaminate residential and commercial properties. Oil, fertilizers, pesticides, and other chemicals can pollute the waterway and surrounding areas if not located in a secure location. It could take weeks to regain adequate water supply and wastewater treatment capabilities; cleanup and disposal of contaminated and flood-damaged building material and contents would also be necessary once the floodwater subsides. Subsequent removal of contaminated soil would also be required (PEMA 2013).

Future Growth and Development

As discussed in Section 2.4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be impacted by the flood hazard if within identified hazard areas. The County intends to discourage development in vulnerable areas or to encourage higher regulatory standards on the local level.

Effect of Climate Change on Vulnerability

Climate is defined not just as average temperature and precipitation, but also by type, frequency, and intensity of weather events. Both globally and at the local scale, climate change can alter prevalence and severity of extremes such as flood events. While predicting changes of flood events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (U.S. Environmental Protection Agency [EPA] 2006).

Pennsylvania's Department of Environmental Protection (PADEP) was directed by the Climate Change Act (Act 70 of 2008) to initiate a study of potential impacts of global climate change on the Commonwealth. Main findings of the June 2009 Pennsylvania Climate Impact Assessment indicate that Pennsylvania is very likely to undergo increased temperatures in the 21st century. An increase in variability of temperature and precipitation may lead to increased frequency and/or severity of storm events. Summer floods and general stream flow variability are projected to increase due to increased variability in precipitation. Even with the anticipated increase in winter precipitation as rain rather than snow, increased winter temperatures and a reduced snowpack may decrease rain-on-snow events and thus major flooding events in Pennsylvania. This conclusion, however, remains speculative until further studies can validate it. Future improvements in modeling smaller-scale climatic processes are expected, and will lead to improved understanding of how the changing climate will alter temperature, precipitation, storms, and flood events in Pennsylvania (Shortle et al. 2009).

4.3.16 Environmental Hazard

This section provides a profile and vulnerability assessment of the environmental hazard profile for Bedford County. Hazards in this profile include releases of hazardous materials (HazMat) and explosions.

Bedford County is home to 39 identified facilities that utilize, ship, or house chemicals considered hazardous. These facilities have been identified under the Superfund Amendment and Reauthorization Act (SARA) as exceeding the quantity threshold for reporting.

Product release into the local environment can derive from a fixed facility or occur at any location along a route of travel, and may be the result of carelessness, technical failure, external incidents, or an intentional act against the facility or container. Volatility of products stored or transported, along with potential impact on a local community, may increase the risk of intentional acts against a facility or transport vehicle. Release of certain products considered HazMat can immediately and adversely impact the general population, ranging from the inconvenience of evacuations to personal injury and even death. Moreover, any release can compromise the local environment through contamination of soil, groundwater, or local flora and fauna.

4.3.16.1 Location and Extent

The U.S. Department of Transportation (DOT) categorizes HazMat into the following nine classes based on chemical characteristics producing the risk:

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable liquids
- Class 4: Flammable solids
- Class 5: Oxidizers and organic pesticides
- Class 6: Poisons and etiologic materials
- Class 7: Radioactive materials
- Class 8: Corrosives
- Class 9: Miscellaneous.

Based on past occurrences, HazMat releases within Bedford County have been accidental and have not been considered terrorist or criminal acts. While past occurrences have not been deemed intentional, an intentional release of any of these products in large quantity would pose a threat to the local population, economy, and environment resulting in lost revenue, injuries, and deaths.

Bedford County is home to 1,780.8 miles of roadways, including 52.3 miles of interstate highway, 54.6 miles of principal arterials, 73.5 miles of minor arterials, and over 1,200 miles of local roads. With nearly 1,800 miles of roadways linking more-populated areas with rural communities, the grid work of roadways facilitates free movement of HazMat throughout the region. In addition, 10.8 miles of railway traverse the County's southwest corner. The County's mountainous terrain increases its vulnerability to HazMat accidents.

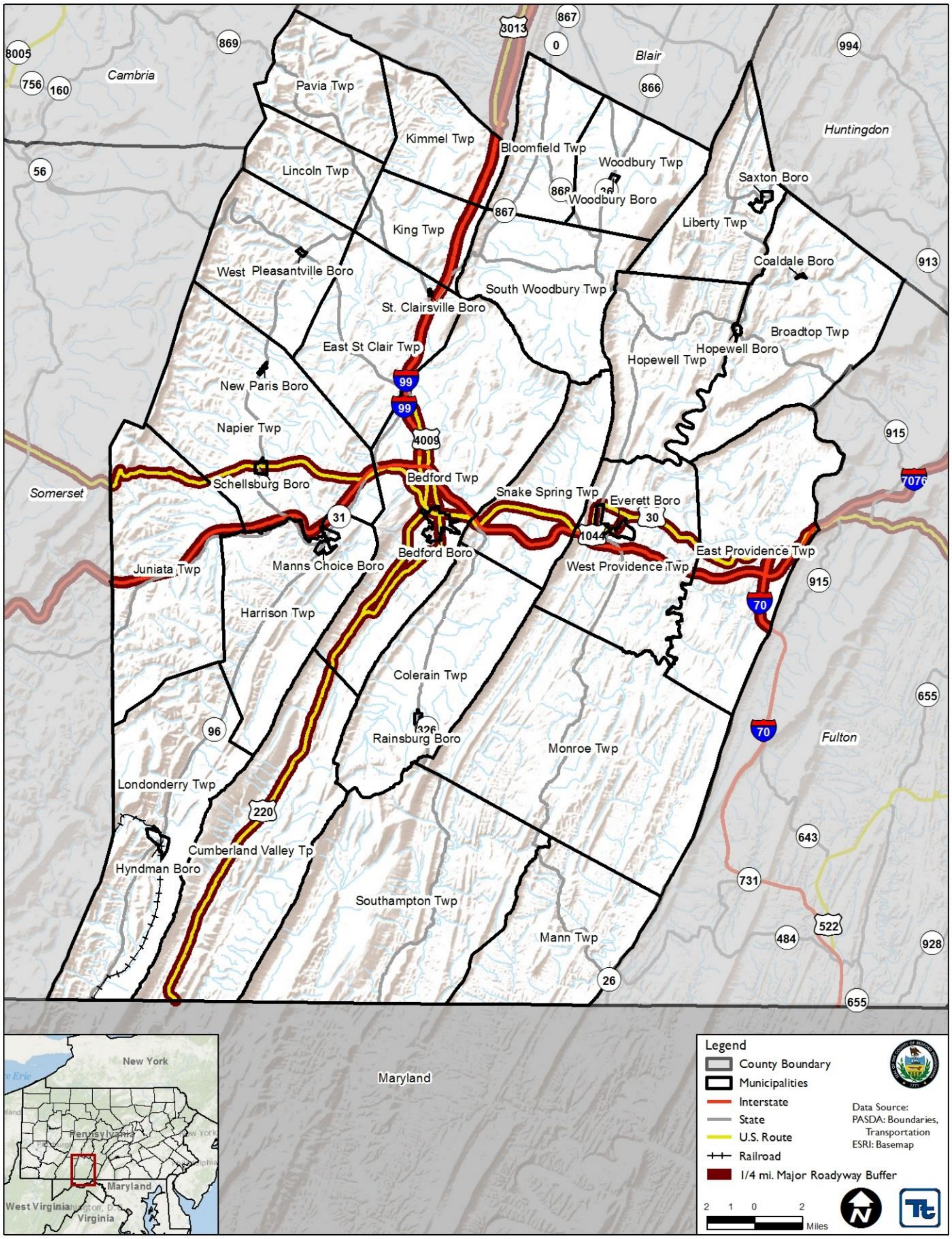
While permitted, identified hazardous substance travel routes are not maintained by the County or regional planning entities. The primary roadways in Bedford County are listed as follows (and shown in red on Figure 4.3.16-1):

- Pennsylvania Turnpike (I-76)
- Interstate 70 (I-70)
- U.S. Highway 220 (US-220)
- U.S. Highway 30 (US-30).

In addition to the major routes of transportation, each fixed facility identified within Bedford County poses a potential threat to the surrounding community.

The U.S. Environmental Protection Agency (EPA) tracks management of over 650 toxic chemicals that pose a threat to human health and the environment through the Toxic Release Inventory (TRI). Facilities in certain industries that use or house these chemicals in respective amounts exceeding specified levels must submit annual reports on how each chemical is managed through recycling, energy recovery, treatment, and releases to the environment. A "release" of a chemical means emission to the air or water, or placement in some type of land disposal. EPA publishes all TRI data in a publicly-accessible database in Envirofacts. In 2016, nine TRI facilities in Bedford County reported to EPA.

Figure 4.3.16-1. Major Roadways Used to Transport Hazardous Materials in Bedford County



Source: Pennsylvania Spatial Data Access (PASDA)

4.3.16.2 Range of Magnitude

Environmental hazard incidents within Bedford County could range from minor petroleum spills to large, facility-based incidents that could lead to loss of life and damage to property, environment, and economy. Additionally, the range of explosion-related incidents within the County could vary from a small incident that affects a residential structure or smaller commercial building to a catastrophic failure leading to loss of life, significant property damage, and negative impacts on the economy. Severity of an incident varies with type of material released, and distance and related response time for emergency response teams. Areas within closest proximity to the releases are generally at greatest risk, yet depending on the agent, a release can travel great distances or persist over a long time (e.g., nuclear radiation), resulting in far-reaching effects on people and the environment.

A HazMat release, whether accidental or intentional, can be exacerbated or mitigated by specific circumstances surrounding the event. Exacerbating conditions are characteristics that can enhance or magnify effects of a hazard. Mitigating conditions, on the other hand, are characteristics of the target and its physical environment that can reduce effects of a hazard. These conditions include:

- Weather conditions – affect how the hazard develops.
- Micro-meteorological effects of buildings and terrain – alter dispersion of materials.
- Shielding in the form of sheltering-in-place – protects people and property from harmful effects.
- Non-compliance with applicable codes (e.g., fire and building codes) and maintenance failures (e.g., fire protection and containment features) – can substantially increase damage to a facility and to surrounding buildings.
- Geographic location of HazMat site – if occurring within a Special Flood Hazard Area (SFHA), a materials release could cause larger scale water contamination during a flood incident, or a flood incident could compromise production and storage of hazardous chemicals. Stormwaters and floodwaters can also move toxic chemicals swiftly across great distances.

The worst-case scenario would be a large, uncontrolled release of a toxic gas within a major urban area. In Bedford County, this could take the form of an accident and major rupture of a tanker hauling a toxic or flammable gas in or near Bedford Borough. While little physical property damage is likely from this type of event, potential for injury and death to residents and visitors up to 0.25 mile from the scene is significant. This event would likely overwhelm the medical care capacity within the County, and possibly the region. The population vulnerable to such a release includes the 2,841 people in Bedford Borough alone. In addition, an event such as this would likely close County offices, causing a major disruption to government operations. The most likely scenario would be a transportation accident resulting in a rupture of a truck's fuel tank, spilling a small quantity of diesel fuel onto the roadway.

4.3.16.3 Past Occurrence

The County has undergone HazMat release accidents at facilities and along roadways. Most incidents have involved spills of petroleum products (59 incidents between January 2002 and 2011 alone); these incidents have easily been contained.

On August 2, 2017, 32 rail cars derailed in Hyndman Borough (DeShong, et al 2017), damaging one house and one garage. No injuries were reported. At least one car that contained liquefied petroleum gas (propane) and one car that contained molten sulfur leaked and caught fire. When molten sulfur burns, it releases hydrogen sulfide gas, which is both toxic and flammable. Propane vapors spread along the ground and are highly combustible. Residents within one mile of the accident were evacuated for three days, though a few residents remained in their homes despite the evacuation order. The car containing propane was allowed to burn until it extinguished, since there was no risk to individuals or structures (DeShong and Smolen 2017). No public water supplies were impacted. The accident closed roads in the surrounding area; see Section 4.3.19 for a description of the traffic impacts of this event.

Local records do not include any other HazMat release accidents or explosions since 2011. However, these statistics are not comprehensive, as years of records were lost when the County changed the Computer Aided Dispatch (CAD) software used in the 911 Center.

4.3.16.4 Future Occurrence

Because of the wide scope of definition of environmental hazards, ranging from a small spill to a large release of a highly volatile or toxic HazMat, incidents can and will happen at any time. Additionally, the County is home to 39 SARA facilities. Although these facilities follow applicable safety and health regulations and best practices, proximities of the facilities to population centers is a concern for the County.

HazMats are also transported along CSX rail line, and I-70, I-76, US 522, and US 30. Transportation of HazMat involves tank cars, and tanker trucks or trailers; not surprisingly, trucks are responsible for the greatest number of HazMat incidents. At several points, these transportation routes cross streams within the watersheds that are part of the County's domestic water supply.

While HazMat release incidents in Bedford County have occurred in the past, they are generally considered difficult to predict. Smaller incidents, such as fuel spills, will affect the County many times each year, most likely along I-99 and U.S. Route 220, or during refilling of home heating oil tanks, and may not be reported. Although the County does not anticipate severe releases on any regular basis, possibility of this should not be discounted. Based on Risk Factor Methodology Probability Criteria, likelihood of future occurrences within Bedford County remains highly likely.

4.3.16.5 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed or vulnerable within the identified hazard area. To assess effects of and risk from environmental hazards, locations of SARA Title III facilities and major transportation networks are examined. The following sections evaluate and estimate potential impacts in Bedford County, presenting specifically:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on (1) life, health, and safety; (2) general building stock, critical facilities, and the economy; and (3) future growth and development.

Overview of Vulnerability

Facilities that produce, use, or ship HazMat within the Commonwealth of Pennsylvania are required to comply with regulations set forth within the federal SARA and the Emergency Planning and Community Right to Know Act (EPCRA), and the Commonwealth of Pennsylvania reporting requirements under the Hazardous Materials Emergency Planning and Response Act (Act 165). The County has 39 SARA Title III facilities.

As stated above, the major roadways in the County include two interstates (I-76 and I-99) and two U.S. Highways (US-30 and US-220). Accidents on these roadways or railways can result in HazMat spills that can contaminate and impact surrounding populations and environment.

Data and Methodology

To determine potential impact on the County, a 0.25-mile buffer was placed around the identified major roadways and rail lines, and the designated vulnerability radius of each SARA Type III facility was used to define the hazard area. Populations and features of the built environment within these areas may be directly or indirectly affected by a potential environmental hazard. The hazard area was overlaid upon the 2010 U.S. Census population data in Geographic Information System (GIS) (U.S. Census 2010). Census blocks do not coincide with these boundaries; blocks with centroids in the hazard area were determined to be affected.

The vulnerability radius for each hazard facility is determined by the County Local Emergency Planning Committee, and each radius is shown in Appendix I.

Impact on Life, Health, and Safety

Environmental hazards exert the greatest impact on the residential population in Bedford County (Table 4.3.16-1 below). Several incidents reported in the County are related to petroleum spills, which may have resulted from motor vehicle incidents.

Table 4.3.16-1. Estimated Bedford County Population Vulnerable to Environmental Hazards

Municipality	Total Population	Population within ¼ mile of railroads	% Population	Population within ¼ mile of major roadways	% Population	Population within vulnerability radii of SARA Facility	% Population
Bedford Borough	2,841	0	0.0%	2,109	74.2%	19	<1%
Bedford Township	5,395	0	0.0%	1,926	35.7%	278	5.2%
Bloomfield Township	1,016	0	0.0%	0	0.0%	0	0.0%
Broad Top Township	1,687	0	0.0%	0	0.0%	23	1.4%
Coaldale Borough	161	0	0.0%	0	0.0%	0	0.0%
Colerain Township	1,195	0	0.0%	0	0.0%	0	0.0%
Cumberland Valley Township	1,597	0	0.0%	292	18.3%	0	0.0%
East Providence Township	1,854	0	0.0%	139	7.5%	244	13.2%
East St. Clair Township	3,042	0	0.0%	104	3.4%	0	0.0%
Everett Borough	1,832	0	0.0%	1,601	87.4%	0	0.0%
Harrison Township	978	0	0.0%	74	7.6%	0	0.0%
Hopewell Borough	230	0	0.0%	0	0.0%	0	0.0%
Hopewell Township	2,010	0	0.0%	0	0.0%	33	1.6%
Hyndman Borough	910	884	97.1%	0	0.0%	0	0.0%
Juniata Township	954	0	0.0%	108	11.3%	0	0.0%
Kimmel Township	1,616	0	0.0%	244	15.1%	0	0.0%
King Township	1,238	0	0.0%	49	4.0%	0	0.0%
Liberty Township	1,418	0	0.0%	0	0.0%	0	0.0%
Lincoln Township	425	0	0.0%	0	0.0%	0	0.0%
Londonderry Township	1,856	304	16.4%	0	0.0%	0	0.0%
Mann Township	500	0	0.0%	0	0.0%	0	0.0%

Municipality	Total Population	Population within ¼ mile of railroads	% Population	Population within ¼ mile of major roadways	% Population	Population within vulnerability radii of SARA Facility	% Population
Manns Choice Borough	294	0	0.0%	0	0.0%	0	0.0%
Monroe Township	1,336	0	0.0%	0	0.0%	0	0.0%
Napier Township	2,198	0	0.0%	215	9.8%	5	<1%
New Paris Borough	186	0	0.0%	0	0.0%	0	0.0%
Pavia Township	295	0	0.0%	0	0.0%	0	0.0%
Pleasantville Borough	198	0	0.0%	0	0.0%	0	0.0%
Rainsburg Borough	133	0	0.0%	0	0.0%	0	0.0%
Saxton Borough	686	0	0.0%	0	0.0%	0	0.0%
Schellsburg Borough	338	0	0.0%	336	99.4%	0	0.0%
Snake Spring Township	1,639	0	0.0%	270	16.5%	0	0.0%
South Woodbury Township	2,155	0	0.0%	0	0.0%	0	0.0%
Southampton Township	976	0	0.0%	0	0.0%	0	0.0%
St. Clairsville Borough	78	0	0.0%	0	0.0%	0	0.0%
West Providence Township	3,212	0	0.0%	1,140	35.5%	509	15.8%
West Saint Clair Township	1,736	0	0.0%	0	0.0%	0	0.0%
Woodbury Borough	284	0	0.0%	0	0.0%	0	0.0%
Woodbury Township	1,263	0	0.0%	0	0.0%	0	0.0%
Bedford County (Total)	**49,762**	**1,188**	**2.4%**	**8,607**	**17.3%**	**1,111**	**2.2%**

Sources: U.S. Census 2010, Bedford County 2016.

Notes:
% Percent
SARA Superfund Amendments and Reauthorization Act

Impact on General Building Stock, Critical Facilities, and Economy

While buildings and critical facilities may be present within the hazard area, estimating direct damage to these structures and facilities would be difficult. However, damages to the surrounding environment can result in indirect impacts, such as temporary loss of function due to hazard response or damage in the area. As for the population, an assessment occurred of exposure of critical facilities within the 0.25-mile buffer surrounding major roadways and railroads, and within specified vulnerability radii of SARA facilities (Table 4.3.16-2 below).

Economic loss from environmental hazards and explosion incidents ranges from non-recordable to losses exceeding millions of dollars. Impact on the local economy from a single incident is almost impossible to measure because of complexities of predicting losses of work, revenue, and future business.

Table 4.3.16-2 Critical Facilities Vulnerable to Environmental Hazards

Municipality	Facility Types																						
	Airport	Day Care	DPW	EMS	Emergency Operation Center	Fire Station	Government	Hazmat	Helipad	Major Employer	Medical	Municipal Building	Police Station	Post Office	Potable Facility	Potable Pump	Potable Tank	School	Senior	Shelter	Substation	Wastewater Facility	Wastewater Pump
Bedford Borough	0	3	0	0	1	0	3	2	0	1	0	0	0	0	0	0	0	2	0	2	0	0	0
Bedford Township	1	3	1	0	0	0	2	11	0	6	0	1	1	0	1	8	2	1	1	1	1	8	0
Bloomfield Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Broad Top Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coaldale Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colerain Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumberland Valley Township	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East Providence Township	0	0	0	0	0	1	1	3	1	1	0	1	0	1	0	0	0	1	0	1	0	0	0
East St. Clair Township	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Everett Borough	0	2	0	1	0	1	0	1	0	1	0	1	1	1	0	0	0	2	1	0	1	0	1
Harrison Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hopewell Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hopewell Township	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Municipality	Facility Types																						
	Airport	Day Care	DPW	EMS	Emergency Operation Center	Fire Station	Government	Hazmat	Helipad	Major Employer	Medical	Municipal Building	Police Station	Post Office	Potable Facility	Potable Pump	Potable Tank	School	Senior	Shelter	Substation	Wastewater Facility	Wastewater Pump
Hyndman Borough	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Juniata Township	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Kimmel Township	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
King Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liberty Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lincoln Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Londonderry Township	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Mann Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manns Choice Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monroe Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Napier Township	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Paris Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pavia Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pleasantville Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rainsburg Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Municipality	Facility Types																						
	Airport	Day Care	DPW	EMS	Emergency Operation Center	Fire Station	Government	Hazmat	Helipad	Major Employer	Medical	Municipal Building	Police Station	Post Office	Potable Facility	Potable Pump	Potable Tank	School	Senior	Shelter	Substation	Wastewater Facility	Wastewater Pump
Saxton Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Schellsburg Borough	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Snake Spring Township	0	0	0	0	0	0	1	3	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0
South Woodbury Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Southampton Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
St. Clairsville Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Providence Township	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1
West Saint Clair Township	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Woodbury Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Woodbury Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bedford County (Total)	**1**	**8**	**2**	**3**	**1**	**5**	**8**	**26**	**2**	**10**	**2**	**8**	**2**	**3**	**3**	**8**	**2**	**8**	**3**	**5**	**2**	**8**	**3**

Source: Bedford County 2016.

Impact on the Environment

As discussed above, environmental hazards and explosion incidents can profoundly affect the surrounding environment. Contamination of soil, surface water, and groundwater can result in many direct impacts on surrounding populations and ecosystems. Local flora and fauna within hazard areas are also at risk.

Future Growth and Development

As discussed in Section 2.4, areas targeted for future growth and development have been identified across the County. Any areas of growth could be impacted by environmental hazards if within identified hazard areas. The County intends to discourage development within vulnerable areas and the SFHA, or to encourage higher regulatory standards on the local level.

4.3.17 Levee Failure

Levees and flood walls are manmade structures designed to protect specific areas within a community from flooding. These structures fail when flood waters exceed the height of the protective levee structure, or when the maximum pressure exerted by the flood waters against the levee or flood wall exceeds its capability.

Levee failures, like dam failures, have the potential to place large numbers of people and great amounts of property at risk. Unlike dams, levees are built parallel to a river or another body of water to protect the population and structures behind it from risks to human health and property damage that could be caused by flooding events (Federal Emergency Management Agency [FEMA] 2008). Levees do not serve a purpose beyond providing flood protection and (less frequently) recreational space for community residents. Dams, on the other hand, can serve to store water or generate energy, in addition to protecting areas from flooding.

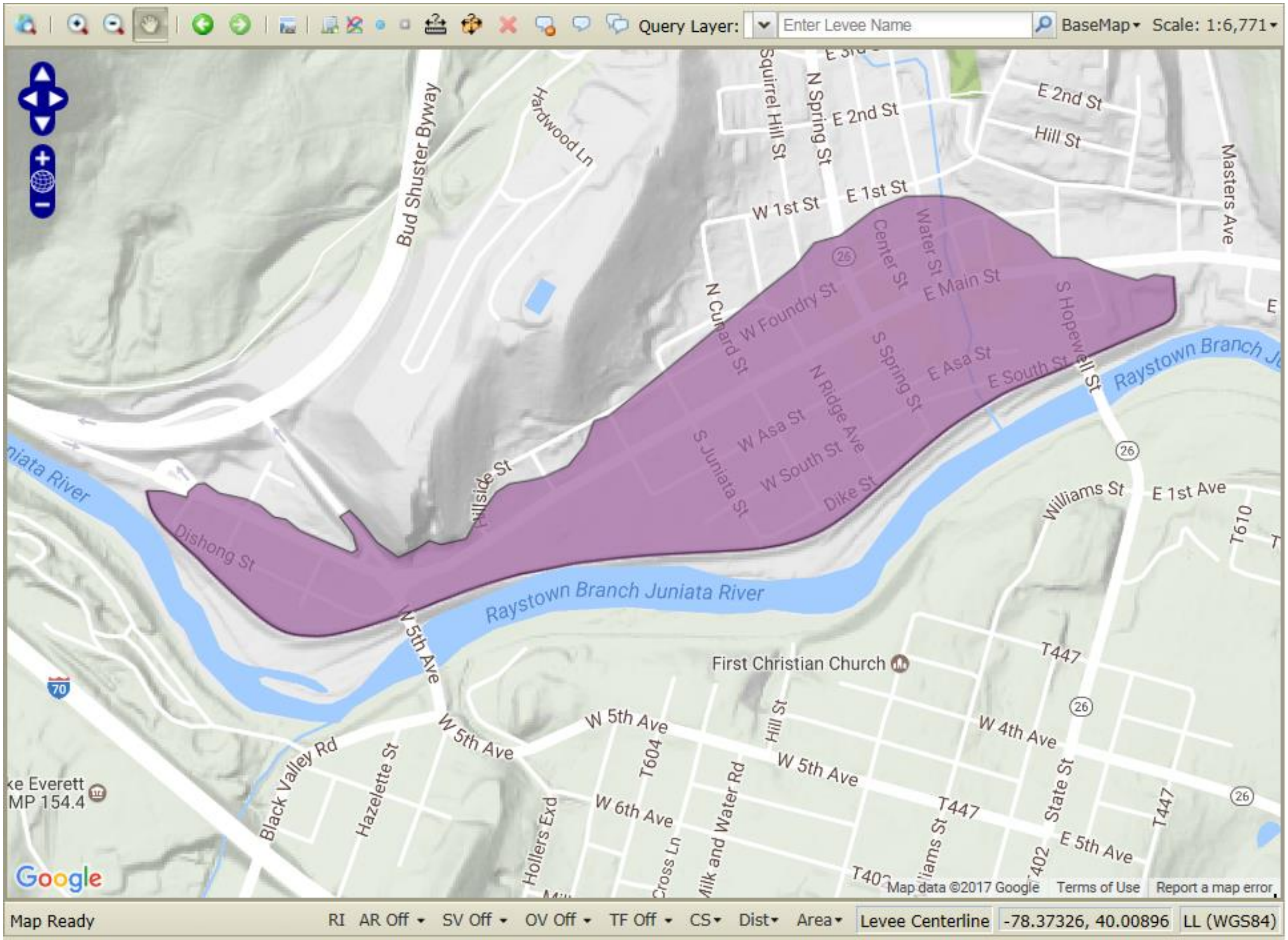
Levee failures can be caused by a number of factors, and can be catastrophic. Damage to the area beyond a failed levee could be more significant than damage caused by the uninhibited flow of flood water (FEMA 2008). Levees are designed to provide a specific level of protection; therefore, excessive water from a flooding event could overtop a levee if the water volume exceeds the levee specifications. Additionally, because levees can fail if they are allowed to decay or deteriorate, regular maintenance is critical.

4.3.17.1 Location and Extent

Bedford County has two levee systems, one located in Everett Borough and one located in Hyndman Borough, as shown below in Figures 4.3.17-1 and 4.3.17-2. The Everett Flood Protection Project was created in 1968 and is owned and operated by Everett Borough (U.S. Army Corps of Engineers [USACE] 2016). According to the National Levee Database (NLD), the Everett Borough levee is 0.96 mile in length (USACE NLD 2015).

The Hyndman Borough levee system consists of two levees: one on Wills Creek that is 0.34 mile long, and one along a back channel that is 0.67 mile long. Both were created in 2008, but are not shown as providing flood protection on the FIRM (USACE 2016).

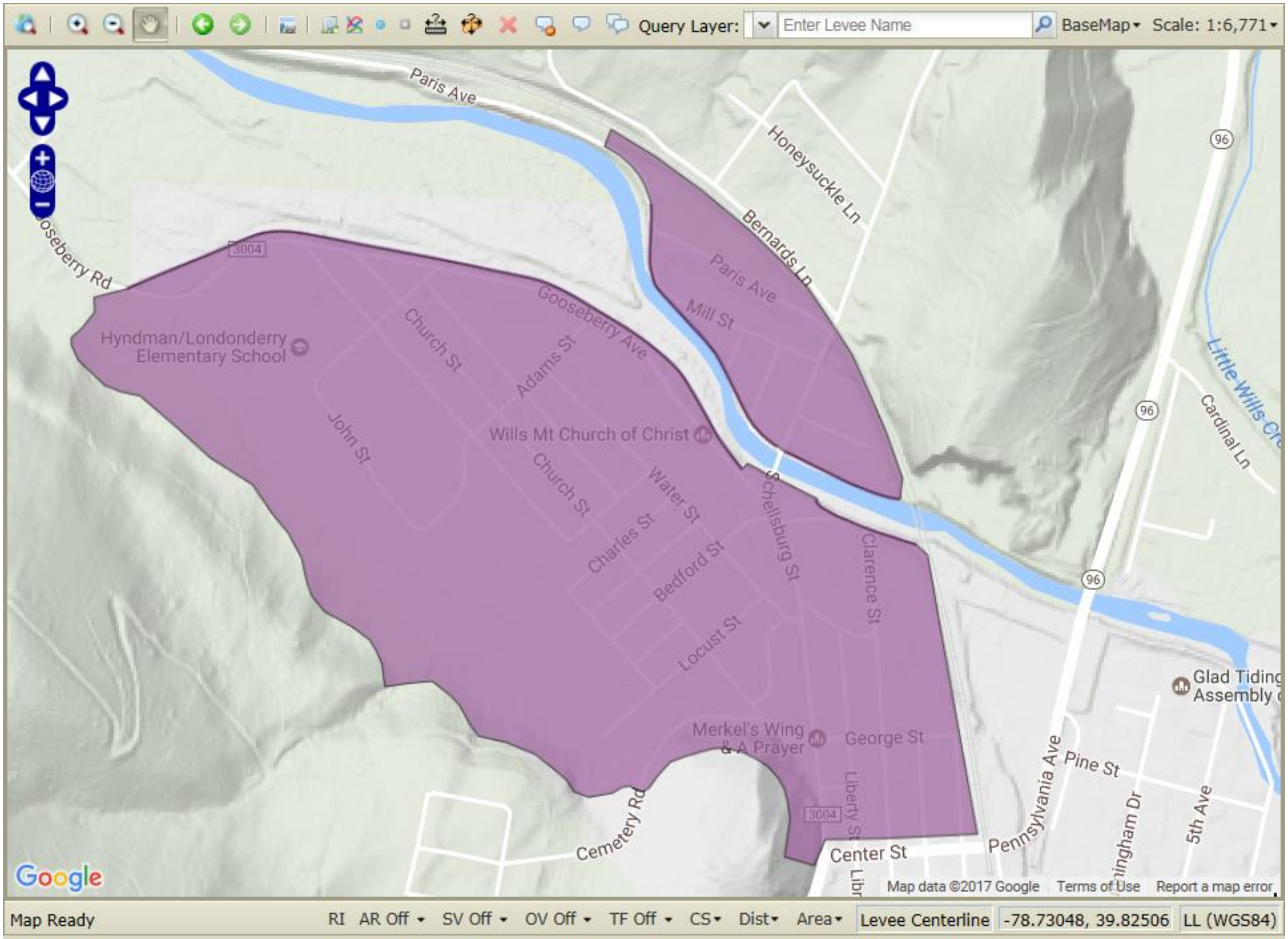
Figure 4.3.17-1. Everett Borough Levee



Source: USACE NLD 2016

Note: Shading indicates the area protected by the levee.

Figure 4.3.17-2. Hyndman Borough Levee



Source: USACE NLD 2016
Note: Shading indicates the area protected by the levee.

4.3.17.2 Range of Magnitude

A levee failure or breach causes flooding in the developed land adjacent to the failed levee structure. The failure of a levee or other flood protection structure could be devastating depending on the level of flooding for which the structure is designed and the amount of land development present. Large volumes of water may be moving at high velocities, potentially causing severe damage to buildings, infrastructure, trees, and other large objects.

The environmental impacts of a levee failure can include significant water-quality and debris-disposal issues. Flood waters can back up sanitary sewer systems and inundate waste water treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and waste water treatment facilities could be off line for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion is likely; such erosion can negatively impact local ecosystems.

The effects of a levee failure are exacerbated when the failure occurs abruptly or with little warning and if it results in deep, fast-moving water through highly developed areas. The worst-case scenario for a levee failure in Bedford County would be the complete failure of the levee systems. If this occurred during a flood with a 1 percent annual chance of occurrence, the failure would lead to effects consistent with those described in Section 4.3.4 (Flood, Flash Flood, and Ice Jams).

4.3.17.3 Past Occurrence

There have been no known levee failures in Bedford County.

4.3.17.4 Future Occurrence

Similarly to dam failures, levee failures can occur at any time given certain circumstances. However, the probability of future occurrence can be reduced through proper design, construction, and maintenance measures. Most levees are designed to meet a specified level of flooding. While FEMA focuses on mapping levees that will reduce the risk of a 1-percent annual chance flood, other levees may be designed to protect against smaller or larger floods. FEMA design specifications provide information regarding the percent annual chance flood that a levee structure is expected to withstand, assuming that the levee has been adequately constructed and maintained. The probability of a levee failure in Bedford County cannot be determined, but based on the Risk Factor Methodology Probability Criteria in Section 4.1, it is considered *unlikely*.

4.3.17.5 Vulnerability Assessment

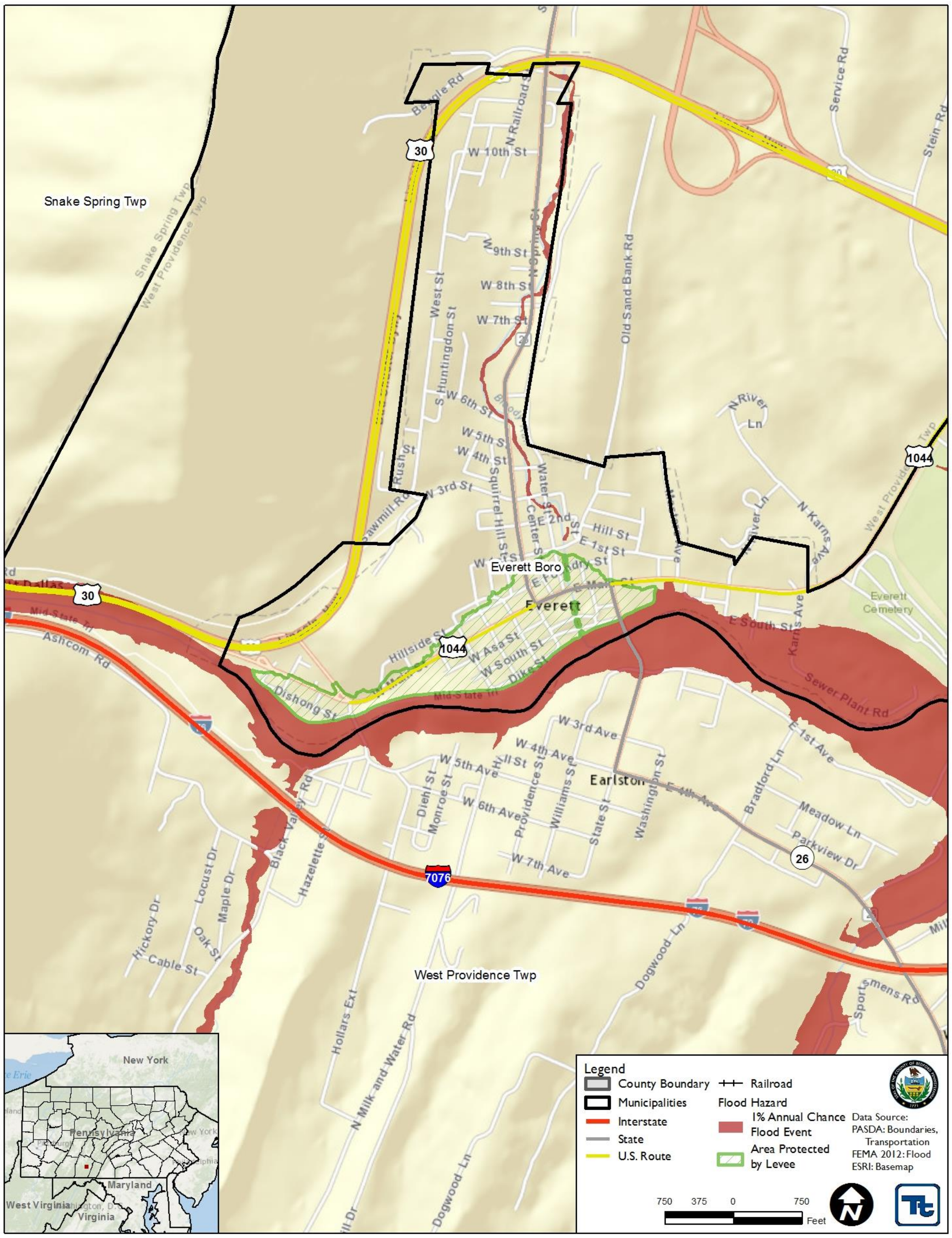
To understand risk, a community must evaluate the assets exposed and/or vulnerable within the identified hazard area. For the levee hazard, the area protected by the Everett Levee, as depicted on the FEMA DFIRM flood maps, is examined. The following sections evaluate and estimate potential impact of flooding in Bedford County presenting specifically:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on (1) life, health, and safety; (2) general building stock; (3) critical facilities; (4) the economy; and (5) future growth and development
- Effects of climate change on vulnerability

Overview of Vulnerability

The Hyndman Levee System is not reflected on the Digital Flood Insurance Rate Maps (DFIRM); therefore, the areas, structures, and population vulnerable to the failure of the levees in this system cannot be determined at this time. Failure of these levees during the 1-percent annual chance flood would result in flood waters reaching the areas shown on the DFIRMs. The area protected by the Everett Levee System is reflected on the DFIRM maps, and is used to estimate exposure to the dam failure hazard. The hazard area is located within Everett Borough (refer to Figure 4.3.17-3).

Figure 4.3.17-3. Everett Borough Areas Protected by Levee



Data and Methodology

Data from the Digital Flood Insurance Rate Map (DFIRM) dated March 2012, including polygons representing the area protected by the levee, were used to estimate exposure. These areas are located adjacent to the floodplain and would otherwise be exposed to the flood hazard if the levee were not present.

Impact on Life, Health, and Safety

Impacts of levee failure on life, health, and safety depend on several factors including severity of the event, protection level of the level, and whether or not adequate warning time is provided to residents. Assumedly, the population living in or near floodplain areas and in the levee protection area could be impacted by a failure event. To estimate the population exposed to the levee failure hazard, the FEMA DFIRM boundaries were overlaid upon the 2010 U.S. Census population data in Geographic Information Systems (GIS) (U.S. Census 2010). The U.S. Census blocks do not follow the boundaries of the DFIRM data. When utilizing the centroids or intersects of the U.S. Census blocks with the levee failure hazard area, the population exposed may be grossly overestimated or underestimated. The limitations of these analyses are recognized, and as such the results are used only to provide a general estimate. For more information on the impact of life, health, and safety, refer to Section 4.3.4 (Flood, Flash Flood, and Ice Jam). According to the analysis, approximately 410 people (22.4% of total borough population) in Everett Borough are located within the levee-protected area.

Impact on General Building Stock

After consideration of the population exposed, the built environment was evaluated. Similar to the population, the building stock data are presented by U.S. Census block. To estimate the value of building stock exposed to the levee failure hazard, the FEMA DFIRM boundaries were overlaid upon the HAZUS-MH building stock data in GIS. Using the default general building stock, the replacement cost values of the Census blocks with their centroids in the area were totaled. Approximately $139 million worth of buildings and their contents are exposed to the hazard area in Everett Borough. This represents approximately 31.7 percent of the borough’s total general building stock replacement value inventory ($439 million). As described above, the U.S. Census blocks do not follow DFIRM boundaries and these estimates should only be used for planning purposes.

To estimate the number of structures exposed to the FEMA DFIRM floodplain boundary, Bedford County’s spatial layer of structures was overlaid by the 1-percent flood event boundary. In total, 266 structures, or 21.8 percent of the Everett Borough’s building stock, are located in the levee protected area.

Impact on Critical Facilities

In addition to considering general building stock at risk, the hazard risk for critical facilities, utilities, and user-defined facilities was evaluated. There are three critical facilities in Everett Borough located within the hazard area. The facilities include one fire station, one police station, and a wastewater pump station.

Impact on the Economy

For more information regarding the impact of levee failure and flooding on the economy, refer to Section 4.3.4 (Flood, Flash Flood, and Ice Jams).

Impact on the Environment

Similar to dam failure events, the environmental impacts of a levee failure event result in significant water quality and debris disposal issues. Flood waters can affect sanitary sewer systems by inundating wastewater treatment plants and causing raw sewage to flow from the sewer system and contaminate residential and commercial properties. Oil, fertilizers, pesticides, and other chemicals are at risk of polluting the waterway and surrounding areas if they are not located in a secure location. It could take weeks to regain adequate water supply and wastewater treatment capabilities; contaminated and flood-damaged building material and contents would also need to be cleaned and disposed of once the floodwater subside. Subsequent contaminated soil would also need to be removed (PA SHMP, 2013).

Future Growth and Development

As discussed in Section 2.4, areas targeted for future growth and development have been identified across the Bedford County. Any areas of growth could be impacted by the flood hazard if within identified hazard areas. The county intends to discourage development in vulnerable areas or to encourage higher regulatory standards on the local level.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change can alter the prevalence and severity of extremes such as flood events. While predicting changes of flood events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (U.S. Environmental Protection Agency [EPA] 2006).

Pennsylvania's Department of Environmental Protection (PADEP) was directed by the Climate Change Act (Act 70 of 2008) to initiate a study of potential impacts of global climate change on the Commonwealth. The June 2009 Pennsylvania Climate Impact Assessment's main findings indicate that Pennsylvania is very likely to undergo increased temperatures in the 21st century. An increase in variability of temperature and precipitation may lead to increased frequency and/or severity of storm events. Summer floods and general stream flow variability are projected to increase due to increased precipitation. Even with the anticipated increase in winter precipitation occurring as rain rather than snow, increased winter temperatures and a reduced snowpack may decrease rain-on-snow events and thus affect major flooding events in Pennsylvania. This conclusion, however, remains speculative until further studies can validate it. Future improvements in modeling smaller-scale climatic processes are expected, and will lead to improved understanding of how the changing climate will alter temperature, precipitation, storms, and flood events in Pennsylvania (Shortle et al. 2009).

4.3.18 Terrorism, Criminal Activity, or Civil Disturbance

Terrorism, criminal activity, and civil disturbance are three types of potential incidents that all relate to malicious human behavior. Bedford County is dedicated to ensuring the continued safety and wellbeing of its residents; to that it end, the county seeks to minimize disruptive and criminal actions under all three of these categories.

Terrorism is defined in the Code of Federal Regulations (CFR) 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" (Title 28 CFR §0.85 2015). Terrorism is less about causing physical damage and injuries (and fatalities) as it is about creating and spreading fear. This fear may result in a change in key policy or cause business operations (such as logging) to cease. Terrorism may include the use of weapons of mass destruction (WMD), including chemical, biological, radiological, nuclear, and high-yield explosive weapons; armed attacks; industrial sabotage; cyber terrorism; and other means. These categories can be further subcategorized and attacks can involve multiple categories, especially when considering the means and purpose behind the event.

Criminal Activity is a very broad hazard category, as defined by the Pennsylvania Standard List of Hazards. It covers all criminality, including enemy attack, disinformation, sabotage, physical or information break of security, work place or school violence, harassment, discrimination, and other crimes (PEMA 2013). Bedford County is aware of the scope of this hazard and has primarily focused its efforts on mitigating terrorist and civil disturbance-related criminal activities. The county, however, maintains an awareness of the potential for illegal activities outside of those two categories and is prepared to focus mitigation and prevention efforts on new areas, should they also arise.

Bedford County supports the rights of persons to exercise their freedom to speak, dissent, and demonstrate, provided that demonstrations are lawful, do not disrupt normal county or municipal activities, and do not infringe upon the rights of others. Most demonstrations are peaceful. People who are not involved in protests should attempt to carry on business as usual if safe to do so. Incidents that are of most concern to the county are those illegal acts that may arise during demonstration-related activities. Civil disturbances consist of incidents that disrupt county operations and require intervention in order to maintain public safety. Typical situations that can lead to such a disturbance include demonstrations against policies, out-of-control rallies or riots, strikes, public nuisances, and criminal activities. Other common terms for civil disturbance include civil unrest and disorderly conduct.

This section provides a profile and vulnerability assessment of the terrorism, criminal activity, and civil disturbance hazard.

4.3.18.1 Location and Extent

Terrorism, criminal activity, and civil disturbances could occur at any location in Bedford County, depending on the perpetrator's agenda. Any facility is vulnerable to terrorism, as terrorists have historically sent chemical or biological agents through the mail. High-risk targets include local, county, state, or federal government facilities; major venues and gathering places; and sites with historic, cultural, or other significance; and key infrastructure. The County Emergency Management Agency maintains a list of vulnerable sites specific to Bedford County.

These sites are also the most likely locations for a civil disturbance because of their intrinsic value to the community or potential roles as key economic drivers. Damage to or disruption of operations at government facilities could have a profound impact on Bedford County's population, even if the incident is a relatively small-scale event. Smaller-scale criminal activity can occur anywhere, particularly at retail locations, restaurants, and other facilities where cash is easily accessible.

4.3.18.2 Range of Magnitude

Acts of terrorism can occur anywhere, at any time of day. The National Terrorism Advisory System (NTAS) communicates information about terrorist threats by providing detailed information to the public, government agencies, first responders, airports and other transportation hubs, and the private sector. When a threat arises, the Secretary of Homeland Security announces an NTAS alert and shares the news with the public. The alert may include specific information about the nature of the threat, including the geographic region, mode of transportation, or critical infrastructure potentially affected; as well as steps that individuals and communities can take to protect themselves and help prevent, mitigate, or respond to the threat. The alert indicates whether the threat is elevated or imminent. Elevated threats are those that include no specific information about the timing or location. Imminent threats are threats believed to be impending, or occurring very soon. The alerts will be posted on-line on multiple government websites (websites vary depending on the threat) and released to the news media for distribution. U.S. Department of Homeland Security (DHS) will also distribute alerts through its social media channels (DHS 2015).

Terrorism refers to the use of WMDs, including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and intentional hazardous materials releases; and "cyber-terrorism." These general categories, however, include many variations. In the area of biological and chemical weapons, there are a wide variety of agents and ways for them to be disseminated. Terrorist methods can take many forms, including:

- Agri-terrorism
- Arson/incendiary attack
- Armed attack
- Biological agent
- Chemical agent
- Cyber-terrorism
- Conventional bomb or bomb threat
- Hazardous material release (intentional)
- Nuclear bomb
- Radiological agent

In Bedford County, terrorist attacks could vary from a mere threat to an individual facility, to the use of a high-yield explosive or other device in a highly populated area.

Civil disorder 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. Generally, two types of large gatherings are associated with disorders: a crowd and a mob. A crowd may be defined as a casual, temporary collection of people without a strong, cohesive relationship. Crowds can be classified into four categories:

- Casual Crowd: A casual crowd is a group of people who happen to be in the same place at the same time. Violent conduct does not occur.
- Cohesive Crowd: A cohesive crowd consists of members who are involved in some type of unified behavior. Members of this group are involved in some type of common activity, such as worshipping, dancing, or watching a sporting event. They require substantial provocation to arouse group action.
- Expressive Crowd: An expressive crowd is one held together by a common commitment or purpose. Although they may not be formally organized, they are assembled as an expression of common sentiment or frustration. Members wish to be seen as a formidable influence. One of the best examples of this crowd type is a group assembled to protest a cause.

- 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 tend to be impulsive and highly emotional, and require only minimal stimulation to arouse them to violence (Blumer 1946).

Terrorism, civil disturbance, and criminal activity events can be minor, such as a peaceful demonstration in Bedford County near the County Courthouse, but they can also significantly disrupt life in the county. The worst-case scenario for Bedford County would be a terrorist incident occurring in a school or hospital, specifically one involving hostage-taking. Because the county does not have identifiable national landmarks, schools and hospitals would be the most likely targets because of the national attention such an incident could provide.

4.3.18.3 Past Occurrence

Bedford County has occasionally experienced domestic terror threats. School bomb threats are the most common, with 17 reported between 2002 and 2016. On September 11, 2001, Bedford County nearly became a target of international terrorism when Flight 93 crashed in Somerset County. Calculations suggest that if Flight 93 had maintained altitude for an additional 15 seconds, it would have crashed just south of Mann's Choice Borough in Bedford County. Since 2002, there have been over 20 terrorism incidents reported in Bedford County. These reported incidents included bomb threats, suspicious packages, and suspicious devices. The appropriate departments and agencies were notified to respond.

4.3.18.4 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 a geographical area such as a floodplain. Thus, planning for the terrorism hazard should be asset-specific, identifying potentially at-risk critical facilities and systems in the community. Although the probability of Bedford County being the target of a direct domestic terrorist attack is greater than being the direct target of an international terrorist attack, the county should be equally prepared for both.

Minor civil disturbances may occur in Bedford County, but it is not possible to accurately predict the probability of future civil disorder events over the long term. 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 at one of the county's high schools may result in gathering of large crowds. Local law enforcement should anticipate these events and be prepared to handle a crowd so that peaceful gatherings are safeguarded from turning into unruly public disturbances. Overall, it is *possible* that Bedford County will be the target of a major terrorism attack or civil disturbance, as defined by the Risk Factor Methodology probability criteria.

4.3.18.5 Vulnerability Assessment

Bedford County does not have facilities, buildings, or landmarks that are more likely to be targeted than other areas in the country. However, several schools and major industries could be considered potential targets for local terrorist activity. These facilities, as well as any of the critical infrastructures in the county, are vulnerable to terrorist attacks. Facility owners and local law enforcement assess the degree of vulnerability at the facility level.

To reduce vulnerability to terrorism hazards, Bedford County belongs to the South Central Mountain Regional Task Force (SCMRTF), which consists of a group of eight counties that collaborate to prevent, protect against, prepare for, respond to, recover from, and mitigate against terrorism and other hazards on a regional level. Like the other regional task forces in Pennsylvania, the SCMRTF is funded by the Pennsylvania Emergency Management Agency (PEMA) using DHS's Homeland Security Grant Program's State Homeland Security Program (SHSP). The counties of the SCMRTF, including Bedford County, use this funding to conduct emergency planning, training, and exercise activities, and to purchase equipment to reduce the region's vulnerability to terrorism.

In general, Bedford County is not particularly vulnerable to civil disorder events. Most civil disorder events, should they occur, would have minimal impact. Sites previously 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 chance of a small assembly of people turning into a significant disturbance.

4.3.19 Transportation Accident

Transportation hazards include hazardous materials in transit, vehicular accidents, aviation accidents, at-grade railroad crossings, and roadways vulnerable to floods. In 2013, the National Transportation Safety Board (NTSB) reported 34,678 transportation-related fatalities. Of those 34,678 fatalities, 32,719 were highway incidents, 819 were rail incidents, 443 were aviation incidents, 10 were pipeline incidents, and 615 were marine incidents (NTSB 2013).

A transportation hazard may be defined as a condition created by movement of anything by common carrier. Transportation hazards can be divided into two categories: hazards created by the material being transported, and hazards created by the transportation medium. Transportation systems available in Bedford County include roadways, railways, one commercial airport, and a few private airstrips. A major road accident in the County is probable; however, aviation or rail accidents are unlikely. All County systems and supporting transportation resources provide services locally, regionally, and nationally. Transportation accidents defined below include incidents involving road, air, and rail travel:

- Vehicular Accidents: A vehicular accident is a road traffic incident that usually involves one vehicle colliding with another vehicle or other road user, such as an animal or a stationary roadside object. A vehicular accident may result in injury, property damage, or possible fatalities. Many factors contribute to vehicular accidents, including equipment failure, poor road conditions, weather, traffic volume, and driver behavior.
- Aviation Accidents: According to the International Civil Aviation Organization, an aviation accident is an occurrence during operation of an aircraft between the time a person boards the aircraft with intent to fly to a destination, to the time the person has disembarked the aircraft. Three different situations qualify as an aviation accident: a person is fatally or seriously injured; the aircraft sustains damage or structural failure; or the aircraft is missing or inaccessible. An aviation incident is an occurrence, other than an accident, associated with operation of an aircraft that affects or could affect the safety of operation (International Civil Aviation Organization 2015). Although Bedford County is home to only a few private airports/airstrips theregy limiting the probability of aviation accidents, airport accidents and incidents have the potential to occur while a plane is flying over County airspace.
- Hazardous Materials (HazMat) in Transit: A HazMat is defined as a substance or material determined capable of posing an unreasonable risk to health, safety, or property when transported. "Unreasonable risk" covers a broad range of health, fire, and environmental considerations. HazMats come in various forms that can cause death; serious injury; long-lasting health effects; and damage to buildings, homes, and other property. HazMat substances include explosives, flammable solids, substances that become dangerous when wet, oxidizing substances, and toxic liquids. An accident involving a vehicle carrying HazMats becomes a HazMat incident if the HazMat leaks; is involved in a fire; or if potential for release, fire, or other hazard exists. Hazards can occur during production, storage, transportation, use, or disposal of HazMats (Illinois Emergency Management Agency 2012; Federal Emergency Management Agency [FEMA] 2015).
- Railway Accidents: Railway accidents involve one or more trains. They can involve a train derailment or one train impacting another train, vehicle, or pedestrian.

HazMats conveyance during transportation is an additional transportation threat to Bedford County. Volatility of products transported, along with potential impact on a local community, may increase risk of intentional acts against a transport vehicle. Release of certain products considered as HazMats can cause immediate and adverse impacts on the general population, ranging from the inconvenience of evacuations to personal injury and even death. Additional effects of a release of HazMats from transportation accidents are addressed in the Environmental Hazard profile (Section 4.3.16).

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the transportation accident hazard for the Bedford County Hazard Mitigation Plan (HMP).

4.3.19.1 Location and Extent

Vehicular Accidents

Bedford County is a main corridor from the Pennsylvania Turnpike (I-76 and I-70) to Interstate 80 to the north via Interstate 99. U.S. Route 220 runs north from the Maryland border and joins Interstate 99. U.S. Route 30 provides toll-free transportation east and west. Interstate 70 provides access to the District of Columbia and the Bay area. State Route 56 serves as a main route to Somerset and Cambria Counties. State Route 26 serves as a route to Huntingdon County and Lake Raystown. Bedford County as a whole is at risk for traffic accidents of all degrees.

There are a total of 2,863 miles of roads in Bedford County. A breakdown of the roads is provided in Table 4.3.19-1. Major roadways in Bedford County include I-70, the Pennsylvania Turnpike – I-76, U.S.-522, and U.S.-30. Bedford County has nearly 1,800 miles of roadways, divided as listed in Table 4.3.19-1, and illustrated on Figure 4.3.19-1 on the following page. Transportation accidents can occur at any point along these roadways, with many occurring at the intersection of two or more roadways.

Table 4.3.19-1. Bedford County Transportation Network

Category	Miles
Interstate Highway	52.3
Freeways/Expressways	3.9
Principal Arterials	54.6
Minor Arterials	73.5
Major Collectors	173.0
Minor Collectors	189.7
Local Roads	1,232.9
Total	**1,780.8**

Source: PennDOT 2015

In response to the collapse of the I-35W Bridge in Minneapolis in August 2007, PennDOT assessed the structural integrity of all bridges in the Commonwealth. Table 4.3.19-2 lists the total number of bridges in Bedford County, as well as the number of those that are structurally deficient (in parentheses). Each structurally deficient bridge poses a risk for transportation accidents.

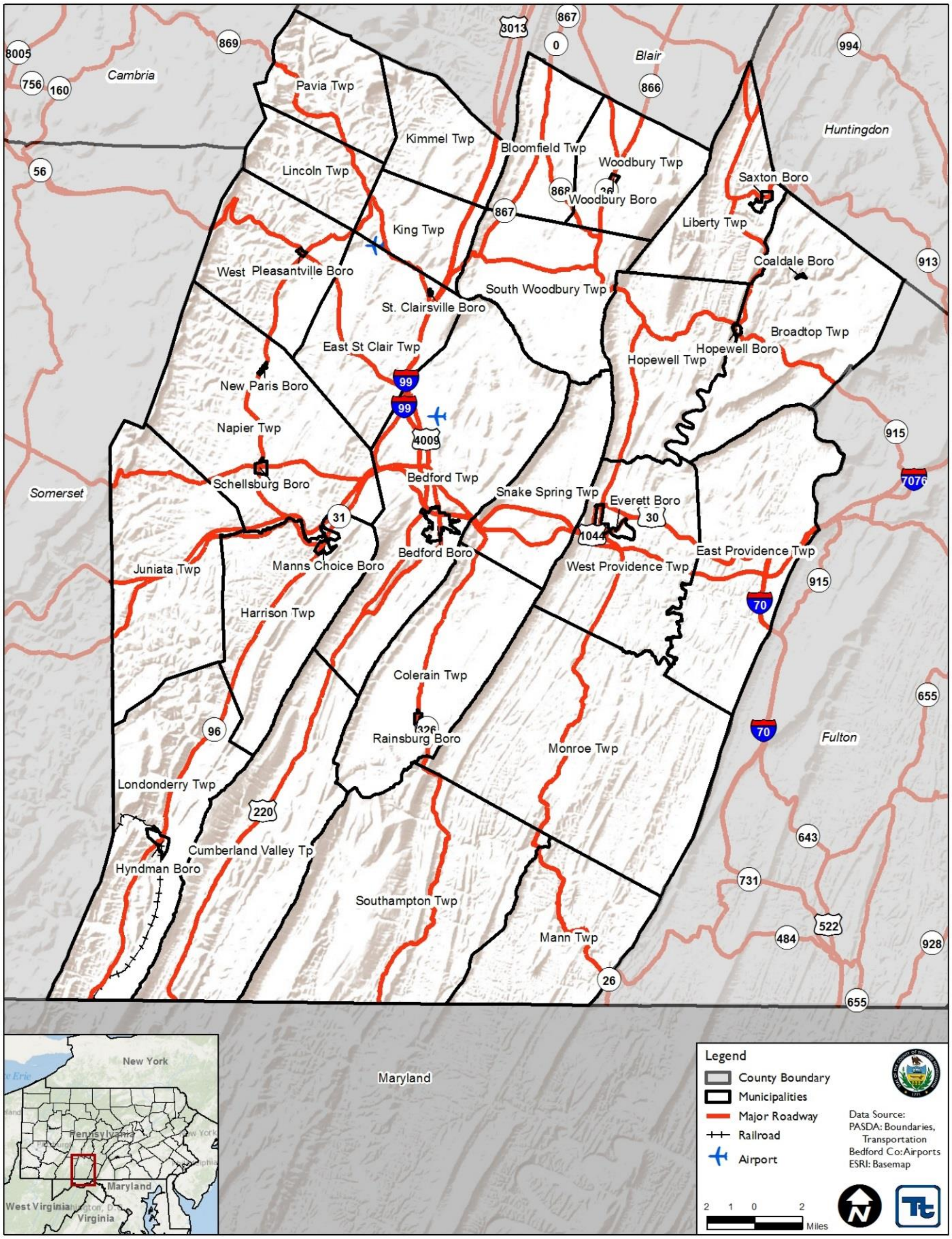
Table 4.3.19-2. Bridges in Bedford County

On State Roads	On Local Roads
457 (66)	88 (29)

Source: PennDOT 2016

There is no warning time for vehicular accidents. Factors contributing to these accidents are typically associated with the driver, vehicle, and the environment. Factors associated with the driver include error, speeding, experience, and blood-alcohol level. Factors associated with the vehicle include type, condition, and center of gravity. Environmental factors include quality of the infrastructure, weather, and obstacles. The majority of vehicular accidents are attributed to the driver. Vehicular accidents can severely affect those directly involved, as well as others not directly involved. Other effects may include severe traffic delays, lost sales to businesses, delayed commodity shipments, and increased insurance costs (Cova and Conger 2004).

Figure 4.3.19-1. Major Transportation Routes in Bedford County



Source: Bedford County 2016

Railway Accidents

Pennsylvania offers freight, passenger, and commuter rail services. The Pennsylvania Bureau of Rail Freight, Ports, and Waterways cites in its 2035 Intercity Passenger and Freight Rail Plan that the freight rail network totals 5,095 miles of track with over 60 railroads, making Pennsylvania the fifth-largest rail network in the nation and the state with the greatest number of railroads. Three railroad systems offer Pennsylvania passenger service: (1) Southeastern Pennsylvania Transportation Authority (SEPTA) – Rapid Transit, Trolley and Light Rail, and Commuter Rail; the Port Authority of Allegheny County (PAAC) – Light Rail; and Amtrak – Intercity Passenger Rail. Amtrak is the only rail service that crosses the entire State.

CSX Transportation, Inc. provides railroad service through the southwest corner of the County. Approximately 30 trains per day travel through Hyndman Borough (Brown 2016).

Rail accidents generally fit into one of three categories (PEMA 2013):

- Derailment – the train leaves the rails
- Collision – a train strikes another train or a vehicle
- Other – including objects on the rails, fires, or explosions.

Aviation Accidents

There is a commercial air facility, the Bedford County Air Park, as well as a handful of private air strips located throughout the County.

Although Bedford County does not maintain any public airports, several Pennsylvania counties near Bedford do. The most notable are the Altoona-Blair County Airport in Blair County, the John Murtha Johnstown-Cambria County Airport in Cambria County, and the Somerset County Airport in Somerset County. In addition, the Harrisburg International Airport is a little more than 100 miles to the east of Bedford, PA, and the Pittsburgh International Airport is only slightly farther away, to the west. These airports may have associated air traffic patterns in the skies above Bedford County that could lead to problems in flight and a crash within the County.

Approximately 80 percent of all aviation accidents occur shortly before or during take-off and landing. Reportedly, most of these accidents are caused by human error. Mid-flight accidents are rare but not unheard of. A survey of 1,843 plane crashes between 1950 and 2006 showed that 53 percent were the result of pilot (human) error, 21 percent were caused by mechanical failure, 11 percent were caused by weather, 8 percent were attributed to other human error (lack of communication or improper maintenance), 6 percent were caused by sabotage and terrorism, and 1 percent resulted from other causes (Krasner 2009).

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

- Pilot or flight crew errors – Pilot error is the number one cause of aviation accidents and accounts for the highest number of fatalities. Pilots have the responsibility to transport passengers safely from one place to another and follow the FAA and NTSB regulations to better ensure passenger safety. If a pilot or flight crew makes an error, an accident may occur.
- Faulty equipment – Faulty aircraft equipment or mechanical features is another common cause of aviation accidents.
- Aircraft design flaws – The manufacturer of an aircraft is responsible for an aviation accident if the structural design is flawed and results in an accident.
- Failure to properly fuel or maintain the aircraft – If any regulations and safety standards set by the FAA or NTSB are violated, an accident may occur.

- Negligence of Federal Air Traffic Controllers – Failure of air traffic controllers to properly monitor the airways is another cause of aviation accidents (*Aviation Law News* n.d.).

4.3.19.2 Range of Magnitude

Roadway accidents in Bedford County range from minor crashes to more serious incidents that involve injuries or fatalities, or result in a release of HazMats (described further in Section 4.3.16).

Rail accidents can vary widely in terms of injuries, fatalities, property damage, and interruption of service, depending on the nature and severity of the accident. One particular issue that Hyndman Borough faces is that when trains break down in the Borough, they block at least one of the three crossings in the Borough, and have blocked all three in the past (Brown 2016). Drivers must take a 30-minute detour through Somerset County, Pennsylvania or Cumberland, Maryland. This detour could be catastrophic for patients travelling in an ambulance or for homeowners whose house is on fire, while firefighters are cut off from responding to the incident. Pit Road serves as a possible detour, but it is a dirt road that is frequently flooded (Kentner 2016a). To use Pit Road, borough staff must manually unlock the gates at each end.

Aircraft accidents can vary from a single-engine aircraft having a "hard landing" and causing damage to the aircraft, to a crash of a small turboprop or jet aircraft, to a crash of a large jet aircraft (such as a Boeing 727). Other aircraft accidents could include helicopter or experimental aircraft crashes. Aviation accidents also can involve radio-controlled or drone aircraft devices, many of which are experimental and not subject to defined regulatory oversight, potentially complicating issues with and for the public that could arise if one of these devices crashes.

The worst-case transportation accident within the County would be overturn of a tractor trailer carrying an extremely hazardous substance (described in Section 4.3.16) resulting in a massive release of its cargo on a major roadway. This incident would block traffic on Bedford County's major transportation routes, and could threaten the health and safety of individuals on the roadways and in surrounding neighborhoods. In addition, a release could necessitate closure of critical facilities in the County. The most likely transportation accident in the County would involve a single vehicle hitting an object and sustaining minimal damage.

4.3.19.3 Past Occurrence

Major roadway accidents (such as multi-vehicle accidents, those that close roads or bridges, or those involving school buses) are reported by Bedford County to PennDOT. Table 4.3.19-3 summarizes these accidents from 2010 to 2015. While this table lists accidents reported to the counties and Commonwealth, significantly more minor accidents are not reported.

Table 4.3.19-3. Summary of Major Roadway Accidents in Bedford County, 2010 to 2015

Year	Vehicle Accidents	Railroad Incidents	Aircraft Accidents
2010	653	0	1
2011	724	0	0
2012	669	0	1
2013	665	0	0
2014	650	0	0
2015	749	0	0
Total	**4,110**	**0**	**2**

Source: PennDOT 2015

Hyndman Borough is divided by a train suffering mechanical failure several times each year (Brown 2016). During the weekend of March 19-20, 2016, two separate malfunctions caused blockages in the Borough (Kentner 2016a). Soon after that, CSX Transportation and Hyndman Borough officials agreed that CSX trains would stop before or after the borough's crossings, barring any mechanical failure beyond control (Kentner 2016b). They also agreed to a contingency plan in which local volunteers would open the gates at either end of Pit Road while a train is blocking the borough's crossings.

On August 2, 2017, 32 rail cars derailed in Hyndman Borough (DeShong, et al 2017), damaging one house and one garage. No injuries were reported. Due to the potential for a release of hazardous materials (see Section 4.3.16 for a description of the hazardous materials aspects of this derailment), residents within one mile of the accident were evacuated for three days. Several area roads were closed, resulting in a long detour for travelers in the area. Route 96 was closed from the Maryland line to the intersection of Brant Hollow Road; Gooseberry Road was closed from the Somerset County line to Route 96; and Route 2019 was closed from the Bedford County line to its intersection with Route 31 in Somerset County (DeShong and Smolen 2017). Temporary flight restrictions were put in place for a three-mile radius, up to 3,000 feet.

4.3.19.4 Future Occurrence

Transportation hazards are impossible to predict accurately; however, areas prone to these hazards can be located, quantified through analysis of historical records, and plotted on county-wide and municipality base maps. Certain characteristics that together cause these hazards or increase vulnerability to these hazards can be identified, and areas that may be prone are identifiable.

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

- Approximately 685 major vehicle accidents. (The actual number of vehicle accidents in Bedford County may be much higher; however, this figure is based on vehicle accidents captured from PennDOT.)
- Zero aircraft incidents
- At least one railroad incident

Based on the Risk Factor Methodology Probability Criteria, the probability of a transportation accident in the categories listed above is considered to be *highly likely* (see Table 4.4-1).

4.3.19.5 Vulnerability Assessment

The entire County has been identified as the hazard area for transportation accidents. This section evaluates and estimates the potential impact of transportation hazards on Bedford County in the following sections:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts on: (1)life, safety, and health; (2) general building stock; (3) critical facilities; (4) the economy; and (5) future growth and development
- Further data collections that will assist in understanding this hazard over time

Overview of Vulnerability

Transportation systems available in the County rely on use of its roadways. Hazards associated with transportation can be natural hazards that affect the roadway, the material being transported, or hazards pertaining to the transportation medium itself. Multiple major roadways (interstates and other major highways) within the County are used by residents and commuters, and these are means for transporting all types of materials, including HazMats. A major accident on any of these major roadways is possible and could affect the County minimally to severely.

Data and Methodology

Regarding this hazard, data were obtained from the County, local officials, and federal data sources. In addition, the Planning Team has identified roadways within the County that are vulnerable to other natural hazards (flood).

Impact on Life, Health, and Safety

Transportation hazards could lead to potential losses in categories of human health and life, property, and natural resources. Vehicular accidents, flooded roadways, and other roadway impairments may result in injury or death to drivers and passengers on the road, the public in the immediate vicinity, and emergency services personnel. Likewise, additional blockages of the rail crossings in Hyndman Borough could result in the delay of emergency services to borough residents. The number of people exposed depends on population density, whether exposure occurs during day or night, and proportions of the population located indoors and outdoors.

The County and its municipalities are prepared to manage and respond to transportation hazards.

Impact on General Building Stock, Critical Facilities, Economy and Future Development

Because of insufficient data, a full loss estimate was not completed for the transportation hazard. Loss of roadway use and public transportation services would affect thousands of commuters, employment, day-to-day operations within the County, and delivery of critical municipal and emergency services. Disruption of one or more of these modes of transportation can lead to congestion of another, and affect both the County and the region as a whole. As discussed in Section 2.4 of this HMP, areas targeted for future growth and development have been identified across Bedford County. Increased development in the County and region will lead to increased road traffic.

Additional Data and Next Steps

Based on limited data regarding the probability and potential impact of this hazard, a quantitative loss estimate was not completed for this HMP. Over time, the County can work with appropriate agencies to collect additional data to support mitigation planning, consideration of potential risks, and prioritization of mitigation measures for this hazard.

Bedford County recognizes it must compile and maintain data regarding specific concerns and past losses from this hazard. These data should include specific information regarding damage or loss of life, property, or infrastructure; and any data pertaining to potential or actual cost and logistics of responding to an event caused by this hazard (locations of road closures, map detours, traffic counts, durations of closures and detours; and costs to respond). These data will be included in future revisions of the HMP, and can be used to support future mitigation grant efforts (benefit cost analysis).

Studying traffic and potential transportation accident patterns could provide information on vulnerability of specific road segments and nearby populations. Increased understanding of the types of HazMats transported through the County will also support mitigation efforts. Maintaining a record of these frequently transported materials can facilitate development of preparatory measures to respond to a release. Predicting costs to respond to a release, remediate the environment, or repair damaged infrastructure would be useful for developing mitigation options.

4.3.20 Utility Interruption

A utility interruption could include power failure, potable water service outage, telecommunications infrastructure failure, or sewer infrastructure failure. For the purpose of this plan, utility interruption focuses on power failure, because no other utility failure has had widespread impacts on the County. A power failure is defined as any interruption or loss of electrical service from disruption of power transmission caused by accident, sabotage, natural hazards, or equipment failure. A significant power failure is defined as any incident of a long duration that would require the involvement of the local or State emergency management organizations to coordinate provision of food, water, heating, cooling, and shelter. Interruptions in other basic utilities (such as data/telecommunications, water, or sewer) can have a detrimental impact on Bedford County. Utilities that employ aboveground wiring (power and data/telecommunications) are vulnerable to the effects of other hazards such as high wind, heavy snow, ice, rain, and vehicular accidents.

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the utility interruption hazard for the Bedford County Hazard Mitigation Plan (HMP).

4.3.20.1 Location and Extent

Utility interruptions occur throughout Bedford County, but are usually of small scale and short duration. Utility interruptions in Bedford County focus primarily on power failures that are often a secondary impact of another hazard event. For example, severe thunderstorms or winter storms could bring down power lines and cause widespread disruptions in electricity service. Strong heat waves may result in rolling blackouts causing loss of power for an extended period. Local outages may be caused by traffic accidents or wind damage.

Local companies—such as Penelec, a FirstEnergy Company that provides electricity to Bedford County—are capable of handling minor interruptions (Section 2 of this plan describes other utilities in the County). Interruptions are possible anywhere utility service has been installed. Some utility facilities are especially vulnerable. For instance, because water intakes and many water control facilities lie in the 1-percent annual chance floodplain, a flood of this magnitude may seriously impair water service. Section 4.3.4 provides more detail on possible flood impacts.

4.3.20.2 Range of Magnitude

Generally speaking, the most severe utility interruptions are regional power outages. Regional loss of power affects lighting; heating, ventilation, and air conditioning (HVAC) and other support equipment; communications; fire and security systems; and refrigerators, which can in turn cause loss of water and sewer service, and food spoilage. These effects are especially severe for individuals with functional needs and the elderly.

At a minimum, power outages can cause short-term disruption in the orderly functioning of businesses, government operations, and private citizen functions and activities. Examples of everyday functions that would be affected by power outages include traffic signals, elevators, and retail sales. A worst-case scenario for utility interruption in Bedford County would be a County-wide power outage during winter months, forcing the evacuation of vulnerable populations.

Sabotage also plays a role in some utility outages. Sabotage may be the direct result of a malicious attack against utilities, or may be the secondary effect of the theft of copper wiring. In a report published in October 2010 titled "An Updated Assessment of Copper Wire Theft from Electric Utilities," the U.S. Department of Energy's (DOE) Office of Electricity Delivery and Energy Reliability reported that United States-based utilities suffer copper thefts costing several million dollars annually (DOE 2010). The estimated minutes of outages experienced by utilities nationwide as a result of copper theft were 456,000 or about 7,600 hours (American Public Power Association [APPA] 2012).

4.3.20.3 Past Occurrence

The nationwide oil embargo of 1973 through 1974, the severe winter of 1976 through 1978, and the national gasoline shortage of 1979 emphasized the vulnerability of all residents in Bedford County to energy emergencies. Minor power outages occur annually. Bedford County has not endured any localized energy emergencies. However, some County residents have experienced individual household emergencies, likely due to aging utility infrastructure. No comprehensive list of utility interruptions exists for the County.

Every year, Bedford County is susceptible to minor utility interruptions either through technological failure or as the result of inclement weather. Table 4.3.20-1 below shows the utility interruptions in the County since 2002.

Table 4.3.20-1: Utility Interruptions from 2007-2016

Dates of Event	Event Type	Losses / Impacts
July 10, 2002	Power Outage	Power outage; no additional information available.
August 3, 2002	Power Outage	Power outage; no additional information available.
April 29, 2003	Power Outage	A power outage occurred in Bedford Township as a result of a transportation accident causing several blown transformers.
July 9, 2003	Power Outage	An unknown number of Allegheny Power customers were without power in the area of Centerville, Cumberland Valley Township.
December 24, 2003	Telephone and Power Outage	Downed trees caused a temporary telephone outage and power outage in Bedford and Cumberland Valley Townships.
March 3, 2004	Telephone Outage	A torn telephone trunk line caused a temporary telephone outage in Liberty Township.
December 27, 2005	Telephone Outage	A telephone outage affected an undetermined number of customers countywide.
December 1, 2006	Power Outage	A power outage affecting an undetermined number of Allegheny Power customers occurred in Bedford Township.
December 3, 2007	Power Outage	A power outage affecting an undetermined number of Allegheny Power customers occurred in Monroe Township.
January 10, 2008	911 outage	A software problem caused a temporary 9-1-1 disruption.
February 10, 2008	Power Outage	A power outage affecting an undetermined number of GPU customers occurred in Bedford Borough.
January 7, 2009	Power Outage	A power outage affecting an undetermined number of Rural Electric Association customers occurred in Harrison Township.
January 21, 2009	Power Outage	A power outage occurred in Breezewood Borough.
February 12, 2009	Power Outage	Power outage; no additional information available.
May 27, 2011	Wires Down	Thunderstorm winds knocked down trees and utility wires in Saxton.
October 29, 2011	Power Outage	Heavy snowfall caused downed trees and power lines. Approximately 520,000 people were without power across the State. No specific details for Bedford County are available.
July 4, 2012	Wires Down	Thunderstorm winds knocked down trees and wires in Buffalo Mills.

Dates of Event	Event Type	Losses / Impacts
October 29, 2012	Power Outage	Superstorm Sandy caused scattered power outages across the County.
March 3, 2013	Power Outage	Heavy snow caused sporadic power outages across the region.
June 28, 2013	Wires Down	Thunderstorm winds knocked down trees and utility wires in Hyndman.
November 1, 2013	Wires Down	Thunderstorm winds knocked down trees and utility wires in Bedford.
November 26, 2013	Power Outage	An ice storm caused power outages across the region.
June 11, 2014	Wires Down	Thunderstorm winds knocked down trees and utility wires along Lower Snake Spring Road near Totesville.
June 12, 2014	Wires Down	Thunderstorm winds knocked down trees and utility wires and snapped a utility pole near Schellsburg.
July 8, 2014	Wires Down	Thunderstorm winds knocked down trees and utility wires across the County.

Sources: Pennsylvania Emergency Incident Reporting System (PEIRS) 2011; National Oceanic and Atmospheric Administration (NOAA)-National Climactic Data Center (NCDC) 2016

4.3.20.4 Future Occurrence

Minor power failure (in other words, short outage events) may occur several times a year for any given area in the County, while major events (long, widespread outage events) take place once every few years. Power failures often occur during severe weather; therefore, they should be expected during those events. Based on the assumption that the County will experience severe weather annually, in addition to outages from other causes, the future occurrence of utility interruptions in Bedford County should be considered *highly likely* as defined by the Risk Factor Methodology probability criteria.

4.3.20.5 Vulnerability Assessment

Utility interruptions most severely affect individuals with access and functional needs (such as children, the elderly, and individuals with special medical needs). Special medical equipment will not function without power. Likewise, a loss of air conditioning during periods of extreme heat or the loss of heating during extreme cold can be especially detrimental to those with medical needs, children, and the elderly. Table 4.3.20-2 shows the demographic change in children and the elderly from 2000 through 2014. Fewer children reside in the County, resulting in lower vulnerability of this population to the effects of a utility interruption. The population over 65 years of age increased by 17.9 percent, somewhat offsetting the decrease in number of vulnerable to utility interruption. Data on individuals with special medical needs was not available.

Table 4.3.20-2: Demographic Trends for Vulnerable Populations

Vulnerable Population	2000 Census	2010 Census	2014 Census Estimate	2000 to 2014 Change
Children under 5 years	3,004	2,627	2,515	-489
Under 18 years	11,774	10,739	7,893	-3,881
65 years and over	8,243	9,476	9,718	1,475

Source: U.S. Census Bureau

All facility infrastructure considered critical are vulnerable to utility interruptions, especially the loss of power. The establishment of reliable backup power at these facilities is extremely important to continue to provide for the health, safety, and well-being of Bedford County's population.

No data regarding economic impacts from utility interruptions in Bedford County are available. However, utility interruptions can cause economic impacts stemming from lost income, spoiled food and other goods, costs to the owners or operators of the utility facilities, and costs to government and community service groups.

4.4 Hazard Risk Ranking

As discussed in Section 4.2, Hazard Identification, a comprehensive range of natural and non-natural hazards that pose significant risk to Bedford County were selected and considered in this plan. However, communities in Bedford County have differing levels of exposure and vulnerability to each of these hazards. It is important for each community participating in this plan to recognize hazards posing greatest risk to their community and direct their attention and resources accordingly to most effectively and efficiently manage risk.

To this end, a relative hazard risk ranking process for the County occurred by application of the Risk Factor (RF) methodology identified in Section 5 and Appendix 9 of Pennsylvania Emergency Management Agency's (PEMA) All-Hazard Planning Standard Operating Guide (PEMA 2013). The guidance states:

> "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 are obtained by assigning varying degrees of risk to five categories for each hazard: *probability, impact, spatial extent, warning time*, and *duration*.
>
> To calculate the RF value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the example equation below:

Example Equation

RF Value = [(Probability x .30) + (Impact x .30) +
(Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]

> Hazards identified as high risk have RFs greater than or equal to 2.5. RFs ranging from 2.0 to 2.4 are considered moderate risk hazards. Hazards with RFs less than 2.0 are considered low risk."

Table 4.4-1 identifies the five risk assessment categories, criteria and associated risk level indices used to quantify each risk, and the suggested weighting factor (weight value) applied to each risk assessment category. Table 4.4-2 lists values of the five risk assessment categories for each Bedford County hazard, and each hazard's RF.

Table 4.4-1. Summary of Risk Factor (RF) Approach

Summary of Risk Factor (RF) Approach				
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 localized or regional?*	**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	
	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**	SELF-DEFINED *(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1	10%
	12 TO 24 HRS	SELF-DEFINED	2	
	6 TO 12 HRS	SELF-DEFINED	3	
	LESS THAN 6 HRS	SELF-DEFINED	4	
DURATION *How long does the hazard event usually last?*	**LESS THAN 6 HRS**	SELF-DEFINED *(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1	10%
	LESS THAN 24 HRS	SELF-DEFINED	2	
	LESS THAN 1 WEEK	SELF-DEFINED	3	
	MORE THAN 1 WEEK	SELF-DEFINED	4	

Source: PEMA 2013

Table 4.4-2. Risk Ranking for Bedford County

HAZARD RISK	NATURAL HAZARDS	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Flood	4	4	3	4	3	3.7
	Environmental Hazards	4	4	2	4	3	3.5
	Wildfires	4	4	2	4	2	3.4
	Invasive Species	4	3	4	1	4	3.4
	Utility Interruptions	4	2	4	4	3	3.3
	Winter Storms	4	3	4	1	3	3.3
	Pandemic Disease	2	4	4	1	4	3.1
	Tornado, Windstorms	3	4	2	4	1	3.0
	Transportation Accidents	4	4	1	4	1	3.1
	Subsidence and Sinkholes	3	3	1	4	1	2.5
MODERATE	Levee Failure	1	4	1	4	3	2.4
	Hailstorm	3	1	4	3	1	2.4
	Radon Exposure	3	1	3	1	4	2.3
	Drought	2	1	4	1	4	2.2
	Earthquake	1	2	4	4	1	2.2
	Dam Failures	1	3	1	4	3	2.1
	Extreme Temperatures	2	1	4	1	2	2.0
LOW	Landslide	1	3	1	4	1	1.9
	Lightning Strike	3	1	1	3	1	1.8
	Terrorism	2	1	1	4	2	1.7

SECTION 5 CAPABILITY ASSESSMENT

The capability assessment evaluates the community's capabilities and resources already in place at the municipal, county, state, and federal levels to reduce hazard risks. The assessment also identifies where improvements can be made to increase disaster resistance in the community.

The first step in organizing hazard mitigation capabilities or resources is to describe the basic approaches available to reduce hazard risks. According to the 2013 Pennsylvania Emergency Management Agency (PEMA) All-Hazard Mitigation Planning Standard Operating Guide (SOG), the following four general approaches may reduce hazard risks: (1) local plans and regulations, (2) structure and infrastructure, (3) natural systems protection, and (4) education and awareness. A brief description of each (according to the PEMA All-Hazard Mitigation Planning SOG) is provided below:

- **Local Plans and Regulations** – These actions include government authorities, policies, or codes that influence the ways land and buildings are developed and built.
- **Structure and Infrastructure** – These actions involve modifying existing structures and infrastructure or constructing new structures to reduce hazard vulnerability.
- **Natural Systems Protection** – These actions minimize damage and losses and also preserve or restore the functions of natural systems.
- **Education and Awareness** – These actions inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them, and may also include participation in national programs.

Capability assessments document the existing resources available to local communities to reduce hazard risks. Resources can be divided into five categories: human, physical, technical, informational, and financial. For each basic capability or approach, one or more of the five resources may be available. A brief description of each resource (according to the PEMA All-Hazard Mitigation Planning SOG 2013) is provided below:

- **Human resources** include local police, fire, ambulance, and emergency management and response personnel; local government services; and electric, gas, and other utility providers that are critical during disasters.
- **Physical resources** include the equipment and vehicles (such as emergency response and recovery equipment and vehicles), public lands, facilities, and buildings available to the community.
- **Technical/technological resources** include early warning systems, weather alert radios, stream-level monitoring gauges, and 9-1-1 communications systems. They also include technical requirements established by law, regulation, or ordinance.
- **Informational resources** include materials about disasters, and hazard mitigation and planning; these are available from a wide variety of sources such as applicable websites, libraries, and state and federal agencies.
- **Financial resources** identify the sources of funding available for hazard mitigation. Most state and federal grant programs require local communities to provide at least part of the necessary project funding in real dollars or through in-kind services. Local communities need to assess their financial capability and resources to implement hazard mitigation action plans.

During this plan update process, Bedford County and all participating municipalities were surveyed to provide an updated assessment of their mitigation planning capabilities. Each municipality was provided with a Capability Assessment Survey, which was created based on the capability assessment survey provided in Appendix 3 of the October 2013 edition of the PEMA All-Hazard Mitigation Planning SOG. The survey was provided to each of the municipal planning points of contact prior to the municipal kick-off meetings, during the kick-off meetings, and throughout the planning process as needed. Capability assessment surveys completed by the municipalities are provided in Appendix D.

This section describes and summarizes the federal, state, county, and local capabilities to address hazard risk in Bedford County.

5.1 UPDATE PROCESS SUMMARY

During the plan update process, Bedford County and all participating municipalities were asked to provide an updated assessment of their mitigation planning capabilities. Each municipality was provided with a Capability Assessment Survey, based on Appendix 3 of the October 2013 edition of the PEMA All-Hazard Mitigation Planning SOG (PEMA SOG 2013). The survey was provided to each of the municipal planning points of contact at the municipal kick-off meeting. Completed capability assessment surveys, whether completed by hand, electronically, or filled in working alongside the planning consultant, are provided in Appendix D.

Bedford County has several resources available to implement hazard mitigation initiatives, including emergency response measures; local planning and regulatory tools; administrative assistance and technical expertise; fiscal capabilities; and participation in local, regional, state, and federal programs. These resources enable community resiliency through actions taken before, during, and after a hazard event. Emergency services, manpower, equipment, and fiscal resources are important tools in addressing hazard potential and mitigation in Bedford County communities.

This section describes and summarizes the federal, state, county, and local capabilities to address hazard risk in Bedford County.

5.2 CAPABILITY ASSESSMENT FINDINGS

A jurisdiction's ability to effectively manage natural hazard risk is directly related to their level of hazard mitigation capabilities. As such, mitigation strategies developed in coordination with Bedford County's municipalities have a direct effect on establishing new capability functions in the community or strengthening existing capabilities.

Bedford County and most of its municipalities updated and completed the Capability Assessment Survey (Appendix D). For municipalities that did not update, or partially updated their capabilities information, the same information provided by those municipalities for the 2011 HMP was carried forward into this plan update.

The following sections further detail the capability assessment findings.

5.2.1 Planning and Regulatory Capability

While municipalities in Pennsylvania must comply with the minimum regulatory requirements established under the Pennsylvania Municipal Planning Code, they otherwise have considerable latitude in adopting ordinances, policies, and programs that can be used to manage natural and non-natural hazard risks. Specifically, municipalities can manage these risks through comprehensive land use planning, hazard-specific ordinances (for example, flood damage prevention, sinkholes, and steep slopes), zoning, site-plan approval, and building code enforcement. When effectively prepared and administered, these regulations can lead to hazard mitigation.

For example, the adoption of the NFIP and the Pennsylvania Flood Plain Management Act (Act 166 of 1978) established minimum floodplain management criteria. A municipality must adopt and enforce these minimum criteria to be eligible for participation in the NFIP. Municipalities have the option of adopting a single-purpose ordinance or incorporating these provisions into their zoning and/or subdivision and land development ordinances, or building codes, thereby mitigating the potential impacts of local flooding.

County and Municipal Planning Capabilities

Bedford County Comprehensive Plan

A comprehensive plan is a policy document that states objectives and guides the future growth and physical development of a municipality. The comprehensive plan is a blueprint for housing, transportation, community facilities, utilities, and land use. It examines how the past led to the present and charts the community's future path. The Pennsylvania Municipalities Planning Code (MPC) Act 247 of 1968, as reauthorized and amended, requires counties to prepare and maintain a comprehensive plan. In addition, the MPC requires counties to update the comprehensive plan every 10 years.

Section 301a.(2) of the MPC requires comprehensive plans to include a plan for land use, which, among other provisions, suggests that the plan should give consideration to floodplains and other areas of special hazards and other similar uses. The MPC also requires comprehensive plans to include a plan for community facilities and services, and recommends giving consideration to storm drainage and floodplain management.

The 2006 Bedford County Comprehensive Plan (Bedford County Planning Commission 2006) grew out of a need to update the previous plan (adopted in 1977) because of changes in technology, demographics, and the economy. This plan recognizes the dynamic nature of the world and region, and is a guidance document for future growth and development in Bedford County. It analyzes the trends, changes, and conditions of the population, economics, housing, environment, infrastructure, and other areas. It then assesses the strengths, weaknesses, opportunities, and threats, and establishes a vision for future growth and formulates goals and strategies to implement that vision.

The purpose of the plan is to define the desired future direction of the County, and to mobilize the public and the private sectors to move toward key goals and priorities. Recommendations in the plan guide development and growth in Bedford County while promoting the preservation of the County's unique heritage and resources. The plan outlines tangible steps to be taken in meeting Bedford County's future needs including to strengthen and diversify the County's economy, improve the County's transportation system, and ensure safe, healthy communities. The plan identifies goals, policies, and a number of action approaches and implementation strategies for a variety of topics including land use, housing/community development, economic development, transportation, community facilities and services, cultural and historic resources, and natural resources.

Although the MPC requires that municipal plans be in accord with the County plan, the code provides no measures for ensuring that this occurs. Several municipalities have adopted their own Comprehensive Plan.

Stormwater Management Planning

In 1978, the Pennsylvania General Assembly passed the Stormwater Management Act (Act 167) of 1978 (Pennsylvania State Data Center 1978). Act 167 requires counties to prepare stormwater management plans on a watershed-by-watershed basis. The plans must be developed in consultation with the affected municipalities. Each new plan is required to provide standards for control of runoff from new development, based on a detailed hydrologic assessment. A key objective of each plan is to coordinate the stormwater management decisions of the watershed municipalities. Implementation of each plan is through mandatory municipal adoption of ordinance provisions consistent with the plan.

Plans prepared under Act 167 will not resolve all drainage issues. A key goal of the planning process is to maintain existing peak runoff rates throughout a watershed as land development continues to take place. While the planning process does not solve existing flooding problems, it aims to prevent these problems from getting worse. Each municipality is responsible for correcting existing flooding problems.

In 2003, the Bedford County Planning Commission published the Bobs Creek and Dunning Creek Watersheds Act 167 Stormwater Management Plan in coordination with Blair County.

The Phase II Act 167 Bobs Creek and Dunning Creek Watersheds Stormwater Management Plan seeks to address the full range of hydrologic and hydraulic impacts from cumulative land development within a watershed in Bedford and Blair Counties. The long-term goals of the plan include protecting public health, safety, and welfare by understanding the influences of future land development and by recommending measures to control accelerated runoff. The plan also enables every municipality in the County to meet the intent of Act 167 through the following aspects:

- Meet legal water quality requirements under state law (including regulations from 25 PA Code, Chapter 93) to protect, maintain, reclaim, and restore the existing and designated uses of the Waters of the Commonwealth.
- Manage accelerated runoff and erosion and sedimentation problems close to their source by regulating activities that cause these problems.
- Preserve the natural drainage systems as much as possible.
- Maintain groundwater recharge to prevent degradation of surface and groundwater quality, and to otherwise protect water resources.
- Maintain existing flows and quality of streams and watercourses.
- Preserve and restore the flood-carrying capacity of streams and prevent scour and erosion of stream banks and streambeds.
- Manage stormwater impacts close to the runoff source, using only minimum structures and a maximum use of natural processes.
- Provide procedures, performance standards, and design criteria for stormwater planning and management.
- Provide proper operations and maintenance protocols for all temporary and permanent stormwater management facilities and Best Management Practices (BMP) that are constructed and implemented.
- Provide standards that are consistent with the National Pollutant Discharge Elimination System (NPDES) permit requirements.

Future planning efforts may differ in several ways from the 2003 plan to reflect changes in the Pennsylvania Department of Environmental Protection (PA DEP)-preferred planning approach. For instance, PA DEP has changed from previously recommending watershed-specific plans to advocating for countywide plans.

Natural Resource Planning

Bedford County has contributed to several documents related to natural resource planning. One such publication is Connections in Our Landscape: The Southern Alleghenies Greenways and Open Space Network Plan (Open Space Plan), which serves as a companion document and additional resource to the Bedford County Comprehensive Plan. The Open Space Plan describes initiatives and issues related to the region's land-use, parks, recreation, and open-space planning efforts. The Southern Alleghenies Planning and Development Commission developed the Open Space Plan on behalf of Blair County, Bedford County, Cambria County, Fulton County, Huntingdon County, and Somerset County.

In addition to the Bedford County Comprehensive Plan and associated documents, the County also completed the Natural Heritage Inventory in 1998. The Natural Heritage Inventory identifies and maps Bedford County's most significant natural places. The study investigated plant and animal species and natural communities unique or uncommon in the County; it also explored areas important for general wildlife habitat and scientific study. While the Inventory did not discuss protecting specific natural resource areas, it provided vital information to those County individuals responsible for making decisions affecting Bedford County's natural assets. The inventory is currently being updated, and should be complete by late 2017 or early 2018.

Finally, the Bedford County Conservation District encourages stewardship and conservation of natural resources. A Board of Directors made up of local citizen volunteers leads the conservation district, studying natural resource issues and making decisions that enhance and protect communities within Bedford County. The Conservation District employs managers and staff personnel to serve clientele from both farm and urban communities reflecting complex and ever changing environmental and land-use issues. The Conservation District provides assistance to citizens, landowners, organizations, agencies and local governments in critical land use decisions (both regulatory and non-regulatory), water quality issues, non-point source pollution abatement, and other resource-related areas. The Conservation District, under delegated authority from the PA DEP and the Pennsylvania Conservation Commission, administered the Erosion and Sediment Pollution Control Program at a Level II authority under the Chapter 102 regulations and the Pennsylvania Clean Streams Law. It also operates the Dirt, Gravel, and Low Volume Road Program, Environmental Stewardship and Watershed Protection Grant Program, Chesapeake Bay Program, Agricultural Land Preservation, and numerous environmental education programs.

Open Space Planning

Bedford County has prepared several plans with the goal of preserving open space in the County for recreational and environmental purposes. These plans include chapters in the Bedford County Comprehensive Plan (Bedford County Planning Commission 2006) and the Connections in Our Landscape Greenways and Open Space Network Plan (The Southern Alleghenies Planning and Development Commission 2007). A greenway is a corridor of open space. The plan identifies regional conservation and cultural, recreational, conservation, and scenic greenways and evaluates ways local ordinances may protect greenways.

The Steering Committee will comment on open space issues identified in these plans during project reviews.

Informational Resources

Bedford County has a variety of informational resources available, and many of the publications discussed previously are available for review by the public on the Bedford County website: http://www.bedfordcountypa.org/Home_Page.html. Bedford County also responds to floodplain information requests from the public. However, any requests for information on the floodplain in Bedford Township are referred to the township, since Bedford Township participates in the CRS Program. The County sponsored a major workshop on floodplain management in 2012. The workshop was led by representatives of FEMA Region III and the Pennsylvania Department of Community and Economic Development (the Commonwealth NFIP Coordinator). The Bedford County Planning Commission has developed and distributed informational handouts and guides. Some of these guides indicate what individuals living in the floodplain can do to protect their property. Other handouts provide information on subdivision and land development, sewage planning; and a checklist for buying/developing land in Bedford County, which includes floodplain, wetland, topography, and soil considerations.

Bedford County and many of its municipalities have identified specific mitigation initiatives in this plan update to help build and enhance mitigation-related planning and regulatory capabilities.

Bedford County Emergency Management

The Bedford County Emergency Management Agency (EMA) is a strong County-level emergency management capability and agency that supports Bedford County. The County operates an emergency 9-1-1 call center, and activates its own emergency operations center (EOC) during emergencies. In addition, the County provides or supports emergency service programs and measures including emergency response, public alert and warning systems, emergency communications systems, hazard event monitoring systems, and public information and outreach programs. Capabilities include the 9-1-1 center, emergency operations center (EOC), emergency service measures, emergency response planning, public information programs, and geographic information system, which are described in the sections below.

9-1-1 Center

9-1-1 is the telephone number used to report emergencies. Citizens use the service in the event of the presence or potential for an immediate threat to life or property, and to request response from police, fire, or emergency medical service agencies. Examples include reporting a crime that has just occurred or is in progress; describing an odor such as gas or reporting a fire; or calling for assistance with a sick or injured person who requires treatment and possibly transportation to a hospital emergency department. The 9-1-1 system is capable of accepting calls from hearing or speech-impaired callers using a Telecommunications Device for the Deaf (TDD). Each county in Pennsylvania operates a 9-1-1 Public Safety Answering Point (PSAP). Personnel at these PSAPs would need to coordinate their efforts in a regional hazard event. Computerized mapping of streets with address information is critical for emergency response purposes. Opportunities exist to streamline the regional 9-1-1 coordination through development of fully integrated, consistent mapping and databases. The 9-1-1 center is also used to alert citizens during an emergency.

Emergency Operations Center (EOC)

In the event of an impending emergency or disaster, Bedford County would activate its EOC. The purpose of the EOC is to manage an emergency response and coordinate the distribution of resources to a disaster incident. When the EOC is activated and becomes operational, it is staffed with highly trained, experienced personnel that have the authority, flexibility, imagination, and initiative needed to take command and make coordinated decisions relative to their field of expertise. EOC staffing includes personnel with skills from the disciplines below, in accordance with the National Response Framework (NRF) and the Commonwealth EOP. Each discipline is assigned a coordinating agency and at least one primary and one support agency. In cases where more than one agency has primary jurisdiction over a discipline, a coordinating agency is designated from among them. Where there is only one agency with primary jurisdiction, that agency is also the coordinating agency. EOC disciplines are listed below:

- Transportation
- Firefighting
- Communications
- Public Works and Engineering
- Emergency Management
- Mass Care/Housing and Human Services
- Logistics Management and Resource Support
- Public Health and Medical Services
- Urban Search and Rescue
- Oil and Hazardous Materials Response
- Energy
- Public Safety and Security
- Long-Term Community Recovery and Mitigation
- Agriculture and Natural Resources
- External Affairs

When activated, the EOC is in constant communication with the 9-1-1 center to ensure coordination of activities.

The Bedford County EMA/9-1-1 capabilities fall under two categories: emergency service measures and public information programs. These capabilities are described below.

Emergency Service Measures

Emergency service measures protect people during and immediately following a disaster. The County monitors several systems that will disseminate emergency information and warnings. These monitoring systems include: Satellite Emergency Voice Alerting Network (SEVAN), Pennsylvania Statewide Telecommunication Alerting and Reporting (PaSTAR), Radio Amateur Civil Emergency Services (RACES), National Oceanic and Atmospheric Administration (NOAA) radios, 800-megahertz (MHz) Statewide radios, and EMNet, which are described below.

- The Satellite Emergency Voice Alerting Network (SEVAN) is the voice component of the satellite warning system. This allows PEMA, Pennsylvania counties, regional offices, and cities to communicate directly in real time regardless of the status of the telephone system. Warning messages are routinely broadcast by PEMA using the system.
- The Pennsylvania Statewide Telecommunication Alerting and Reporting (PaSTAR) Network is a computer network that uses satellite-based technology and the latest computer server and client systems. The network allows data sharing and reporting, and textual and graphics communications to flow

unimpaired between users connected to the system. The core of PaSTAR consists of a commercially available computer server and e-mail software packages.

- The Radio Amateur Civil Emergency Services (RACES) is a group of amateur radio operators who donate their services in times of natural disaster or emergency. They provide communication to fire, police, and other agencies that need assistance. Amateur Radio is a newer resource for Bedford County, and is still in the process of being implemented.
- NOAA Weather Radio All Hazards (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from a nearby National Weather System (NWS) office. NWR broadcasts NWS warnings, watches, forecasts, and other hazard information 24 hours a day. NWR also broadcasts warning and post-event information for all types of hazards, including natural, man-made (such as chemical releases or oil spills), and public safety (such as AMBER alerts or 9-1-1 telephone outages).
- The 800-MHz radio system provides two-way voice and data communications for all Bedford County and State agencies. The primary function of this system is to provide redundant communications between the County and partner agency facilities in the event that the primary means of communication becomes interrupted.
- EMNet is a fast, reliable alert and warning system, with 362 terminals across Pennsylvania over 214 broadcast stations and 62 cable networks. It provides an avenue for text-based messages to be sent among system users.

Emergency Response Planning

Emergency Operations Plan

The Bedford County Emergency Operations Plan (EOP) documents the County's emergency preparedness planning. The EOP includes County-specific emergency response procedures during significant emergency events. Bedford County's EOP complies with NIMS and is updated every 2 years. The updated risk assessment information from this HMP will affect subsequent updates to the EOP. The County's EOP was last updated and adopted in 2015.

Mutual Aid Agreements

Bedford County has mutual aid agreements (formal agreements) with the contiguous Pennsylvania counties as a result of the Pennsylvania Intrastate Mutual Assistance Program. Every county participates in this program. Bedford County is also part of a larger county consortium, the South Central Mountain Counterterrorism Task Force (South Central Mountain Regional Task Force [SCMRTF]), which works together and shares resources during times of emergency. Originally formed in response to the increasing threat of weapons of mass destruction (WMD) and other terroristic activity, the Task Force also provides all-hazards preparedness, mitigation, prevention, response, and recovery services to citizens in its purview. This unprecedented intergovernmental agreement is between the following counties:

- Centre
- Snyder
- Mifflin
- Juniata
- Blair
- Huntingdon
- Bedford
- Fulton

Regional Planning Initiatives

Bedford County also assists in County or regional planning and preparation for the following:

- Local (Municipal) EOPs
- Medical facilities
- Dams
- Airports
- Pandemic
- Mass casualty/fatality incidents
- Counterterrorism preparedness
- Special events, such as concerts, parades, etc.
- School emergency planning
- Day care, group home, and special needs facilities
- Evacuation and Detour Plan
- Superfund Amendments and Reauthorization Act of 1986 (SARA) – The Local Emergency Planning Committee program is based on the SARA of 1986, Title III. This legislation requires local planning by businesses and response agencies (such as fire departments and hazardous materials teams) whenever hazardous materials are involved. SARA also requires the establishment of a system in each community that informs the citizens of chemicals used, manufactured, and stored locally.
- In cooperation with the American Red Cross, the County has designated shelters that may be used during emergencies and disasters.

Local Emergency Management Capabilities

According to Pennsylvania Title 35 (Emergency Management Services Code), Chapter 7500, the following stipulations apply:

- Each political subdivision of this Commonwealth is directed and authorized to establish a local emergency management organization in accordance with the plan and program of PEMA. Each local organization shall have responsibility for emergency response, and recovery within the territorial limits of the political subdivision within which it is organized and, in addition, shall conduct such services outside of its jurisdictional limits as may be required under this part.

- The governing body of a political subdivision may declare a local disaster emergency upon finding a disaster has occurred or is imminent. The effect of a declaration of a local disaster emergency is to activate the response and recovery aspects of any and all applicable local emergency management plans and to authorize the furnishing of aid and assistance.

- Each local organization of emergency management shall have a coordinator who shall be responsible for the planning, administration, and operation of the local organization.

- Each political subdivision shall adopt an Intergovernmental Cooperation agreement with other political subdivisions to accomplish the following:
    - Prepare, maintain, and keep current a disaster emergency management plan for (1) the prevention and minimization of injury and damage caused by a disaster, (2) prompt and effective response to disaster, and (3) disaster emergency relief and recovery consistent with the Pennsylvania Emergency Management Plan.
    - Establish, equip, and staff an EOC (integrated with warning and communication systems) to support government operations in emergencies, and provide other essential facilities and equipment for agencies and activities assigned emergency functions.

    - Provide individual and organizational training programs to ensure prompt, efficient, and effective disaster emergency services.
    - Organize, prepare, and coordinate all locally available manpower, materials, supplies, equipment, facilities, and services necessary for disaster emergency readiness, response, and recovery.
    - Adopt and implement precautionary measures to mitigate the anticipated effects of a disaster. Execute and enforce such rules and orders as the agency shall adopt and promulgate under the authority of this part.
    - Cooperate and coordinate with any public and private agency or entity in achieving any purpose of this part.
    - Have available for inspection at its EOC all emergency management plans, rules, and orders of the Governor and PEMA.
    - Provide prompt and accurate information regarding local disaster emergencies to appropriate Commonwealth and local officials and agencies and the general public.
    - Participate in all tests, drills, and exercises—including remedial drills and exercises—scheduled by the agency or by the federal government.
    - Participate in the program of integrated flood warning systems under Section 7313 (6) (relating to powers and duties).

- Direction of disaster emergency management services is first the responsibility of the lowest level of government affected. When two or more political subdivisions within a county are affected, the county organization shall exercise responsibility for coordination and support to the area of operations. When two or more counties are involved, coordination shall be provided by PEMA or by area organizations established by PEMA.
- When all appropriate locally available forces and resources are fully committed by the affected political subdivision, assistance from a higher level of government shall be provided.
- Local coordinators of emergency management shall develop mutual aid agreements with adjacent political subdivisions for reciprocal emergency assistance. The agreements shall be consistent with the plans and programs of PEMA.

Mutual Aid Agreements

Bedford County has formal mutual aid agreements in place with its municipalities.

Emergency Operations Centers (EOC)

In the event of an impending emergency or disaster, the local EOC may be activated. The purpose of the EOC is to manage the emergency response and coordinate distribution of resources to a disaster incident at the local level.

Emergency Response

Each municipality is responsible for providing emergency response to their municipality consisting of EMS, fire, and police. If a municipality does not have one of these providers in their community, they should have mutual aid agreements with an adjacent political subdivision to respond.

Monitoring Systems

The municipalities may also be equipped with several systems to monitor emergency information and warnings, including RACES, NWS, and Knowledge Center, which have been described previously in Section 5.

Emergency Response Planning

The municipalities may also assist with planning for:

1. Municipal EOPs

2. Medical facilities
3. Dams
4. Counterterrorism preparedness
5. Special events
6. School emergency planning
7. Day care, group homes, and special needs facilities
8. Evacuation

A summary of existing federal, state, regional, and county programs (regulatory and otherwise) to manage specific hazard risks may be found in the hazard profiles in Section 4 of this plan update. While the risk of certain hazards can be addressed at least partially through mitigation, the risks of other hazards (particularly certain non-natural hazards) are primarily managed through the preparedness and response elements of emergency management, or through other regulatory programs at the federal and state levels.

Participation in the National Flood Insurance Program

According to FEMA's 2002 National Flood Insurance Program (NFIP): Program Description, the U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968 (FEMA 2002). The NFIP is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damages.

Participation in the NFIP is based on an agreement between communities and the federal government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction and substantial improvements in floodplains, the federal government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an alternative to disaster assistance and reduce the escalating costs of repairing damage to buildings and their contents caused by floods (FEMA 2002).

NFIP-participating communities in Bedford County are required to adopt a Flood Damage Prevention Ordinance (also sometimes called a Floodplain Ordinance), and update this ordinance whenever the regulatory NFIP Flood Insurance Rate Maps (FIRM) are officially updated. Both the Bedford County Conservation District and the Pennsylvania Department of Community and Economic Development (PA DCED) (Commonwealth-coordinating agency for the NFIP) provide support to municipalities by providing model Flood Damage Prevention Ordinances.

All of the County's municipalities participate in the NFIP. Schellsburg Borough and St. Clairsville Borough are not located within the 1 percent annual chance floodplain and have no identified flood hazard. Bedford County's municipalities currently have a variety of different FIRM effective dates and ordinances ranging from 2006 to 2016. All participating municipalities have adopted a Floodplain Ordinance, and some have adopted a Stormwater Management Ordinance. The municipalities' floodplain administrators enforce the Floodplain Ordinances locally.

NFIP-participating communities in Bedford County are required to make current NFIP FIRMs available to their residents for review, and may provide mapping assistance through their floodplain administrators. Typically this mapping is available at the municipal offices in each community. At the time of this plan update, the Bedford County FEMA Digitized Flood Insurance Rate Maps (DFIRM) (dated March 2012) were used to evaluate exposure and determine potential future losses.

Municipal participation in and compliance with the NFIP is supported at the federal level by FEMA Region III and the Insurance Services Organization (ISO), and at the state level by the Pennsylvania Department of Environmental Protection (PA DEP), PA DCED, and PEMA. Both the County's EMA/9-1-1 and Planning Commission support flood mitigation efforts, associated training, and public education and awareness programs.

Flood hazard risk management in Bedford County is further supported by the County's Phase II Act 167 Bobs Creek and Dunning Creek Watersheds Stormwater Management Plan, which includes stormwater runoff modeling for the Bobs Creek and Dunning Creek watersheds and suggests ways to address the runoff in those watersheds. In turn, this plan will hopefully continue to reduce the effects of flooding in certain areas of the County. Additional information regarding this Phase II project is found in Section 4.3.4 of this document.

Additional information on the NFIP program and its implementation within the County may be found in the flood hazard profile in Section 4.3.5.

Community Rating System (CRS)

In the 1990s, the Flood Insurance Administration (FIA) established the Community Rating System (CRS) to encourage local governments to increase their standards for floodplain development. The goal of the program is to encourage communities, through flood insurance rate adjustments, to implement standards above and beyond the minimum required in order to:

- Reduce losses from floods
- Facilitate accurate insurance ratings
- Promote public awareness of the availability of flood insurance

CRS is a voluntary program designed to reward participating jurisdictions for their efforts to create more disaster-resistant communities using the principles of sustainable development and management. By enrolling in CRS, municipalities can leverage greater flood protection while receiving flood insurance discounts.

There are 10 CRS classes that provide varied reduction in insurance premiums. 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 18 creditable activities that are organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness.

Currently, only Bedford Township participates in the CRS Program. Policyholders for properties in the floodplain receive a 5 percent discount on their flood insurance premiums. Increased participation will be supported by the County, and will be promoted through the local emergency management coordinators as identified in the updated mitigation strategies.

Municipal Capabilities

Participating municipalities in this planning effort were provided a capabilities survey. Table 5-1 summarizes the responses of the municipalities based on planning and regulatory capability, supplemented by information received from the County regarding municipal capabilities. Detailed information regarding Bedford County municipalities' planning and regulatory capabilities can be found in the municipal survey responses provided in Appendix D.

Table 5-1. Planning and Regulatory Capability

Municipality	Hazard Mitigation Plan	EOP	Disaster Recovery Plan	Evacuation Plan	COOP Plan	NFIP	NFIP – CRS	Floodplain Regulations	Floodplain Mgmt. Plan	Zoning Regulations	Subdivision Regulations	Comprehensive Land Use Plan (or General, Master, or Growth Mgmt. Plan)	Open Space Mgmt. Plan	Stormwater Mgmt. Plan/Ordinance	Natural Resource Protection Plan	Capital Improvements Plan	Economic Dev. Plan	Historic Preservation Plan	Farmland Preservation	Building Code	Fire Code	Firewise	Storm Ready	Other
Bedford County	X	X	+	+	+	N/A	N/A	N/A	-	N/A	N/A	X	X	X	X	-	X	+	X	N/A	-	-	X	-
Bedford Borough	X	X	X	X	X	X	-	X	-	X	X	X	X	-	-	-	-	X	-	X	-	-	-	-
Bedford Township	X	-	-	-	-	X	X	X	X	-	X	X	-	X	-	-	X	-	X	X	X	-	-	-
Bloomfield Township	X	-	-	-	-	X	-	-	X	-	X	-	-	-	-	-	-	-	X	X	-	-	-	-
Broad Top Township	X	X	-	-	X	X	-	X	X	-	X	-	-	-	-	-	-	-	-	X	-	-	-	-
Coaldale Borough	X	X	-	-	-	X	-	X	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-
Colerain Township	X	X	-	-	-	X	-	X	X	-	X	-	-	-	-	-	-	-	X	X	-	-	-	-
Cumberland Valley Township	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
East Providence Township	X	-	-	-	-	X	-	X	X	-	X	-	-	-	-	-	-	-	-	X	-	-	-	-
East Saint Clair Township	X	X	-	-	-	X	-	-	X	-	X	-	-	X	-	-	-	-	X	X	-	-	-	-
Everett Borough	X	X	X	X	X	X	-	X	X	-	X	X	-	X	-	-	-	X	-	-	-	-	-	-
Harrison Township	X	-	-	-	-	X	-	-	-	-	X	X	-	-	-	-	-	-	-	X	-	-	-	-
Hopewell Borough	-	-	-	-	-	X	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Hopewell Township	X	X	X	X	-	X	-	X	X	-	X	-	-	X	-	-	-	-	-	X	-	-	-	-
Hyndman Borough	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Juniata Township	X	-	-	-	-	X	-	X	X	-	X	-	-	-	-	-	-	-	-	X	-	-	-	-
Kimmel Township	-	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
King Township	-	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Liberty Township	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	-
Lincoln Township	X	X	-	-	-	X	-	X	-	-	X	-	-	X	-	-	-	-	-	X	-	-	-	-
Londonderry Township	X	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Mann Township	-	X	X	X	X	X	X	X	X	-	X	-	-	-	-	-	-	-	-	X	-	-	-	-

Municipality	Hazard Mitigation Plan	EOP	Disaster Recovery Plan	Evacuation Plan	COOP Plan	NFIP	NFIP – CRS	Floodplain Regulations	Floodplain Mgmt. Plan	Zoning Regulations	Subdivision Regulations	Comprehensive Land Use Plan (or General, Master, or Growth Mgmt. Plan)	Open Space Mgmt. Plan	Stormwater Mgmt. Plan/Ordinance	Natural Resource Protection Plan	Capital Improvements Plan	Economic Dev. Plan	Historic Preservation Plan	Farmland Preservation	Building Code	Fire Code	Firewise	Storm Ready	Other
Manns Choice Borough	X	X	-	-	-	X	-	-	-	-	X	X	-	X	-	-	-	-	-	X	-	-	-	-
Monroe Township	X	X	-	-	-	X	-	-	-	-	X	X	-	-	-	-	-	-	-	X	-	-	-	-
Napier Township	X	X	-	-	-	X	-	-	X	-	X	-	-	X	-	-	-	-	-	X	-	-	X	-
New Paris Borough	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Pavia Township	X	-	-	-	-	X	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Pleasantville Borough	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rainsburg Borough	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Saint Clairsville Borough	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saxton Borough	X	X	X	X	-	X	-	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-
Schellsburg Borough	X	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Snake Spring Township	X	X	-	-	-	X	-	X	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
South Woodbury Township	X	X	-	-	-	X	-	X	-	-	X	X	-	-	-	-	-	-	-	X	-	-	-	X
Southampton Township	X	X	-	-	-	X	-	X	-	-	X	X	-	-	-	-	-	-	-	X	-	-	-	-
West Providence Township	X	X	-	-	-	X	-	X	-	-	X	-	-	-	-	-	-	-	X	X	-	-	-	-
West Saint Clair Township	X	X	-	-	-	X	-	X	-	-	X	-	-	X	-	-	-	-	-	X	-	-	-	-
Woodbury Borough	X	X	-	-	-	X	-	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-	-	-
Woodbury Township	X	X	-	-	-	X	-	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-	-	-

Notes:
"X" indicates that the municipality currently has this capability in place.
"-" indicates no capability is currently in place.
"+" indicates that the capability is under development.
"N/A": Not applicable
Blank space indicates no response was received from the municipality.

5.2.2 Administrative and Technical Capability

Administrative capability is described as the 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.

Municipalities are further supported by county, regional, state, and federal administrative and technical capabilities. For this hazard mitigation plan (HMP), the majority of support agencies and resources have been identified and referenced throughout this plan update.

It is noted that the County and many of its municipalities have identified specific mitigation initiatives described in this plan update, which will help build and enhance mitigation-related administrative and technical capabilities in Bedford County.

Federal and Commonwealth Capabilities

Federal agencies that can provide technical assistance for mitigation activities include, but are not limited to:

- U.S. Army Corp of Engineers
- Department of Housing and Urban Development
- Department of Agriculture
- Economic Development Administration
- Emergency Management Institute
- Environmental Protection Agency
- FEMA
- Small Business Administration

Commonwealth agencies which can provide technical assistance for mitigation activities include, but are not limited:

- Pennsylvania Department of Community and Economic Development
- Pennsylvania Department of Conservation and Natural Resources
- Pennsylvania Department of Environmental Protection
- Pennsylvania Silver Jackets

Municipal Capabilities

Participating municipalities in this planning effort were provided with a capabilities survey. Table 5-2 summarizes the responses of the municipalities based on administrative and technical Capability. Copies of the individual municipal responses are found in Appendix D.

Table 5-2. Administrative and Technical Capability

Municipality	Planners (with land use/land development knowledge)	Planners or Engineers (with natural and/or human caused hazards knowledge)	Engineers or Professionals trained in building and/or infrastructure construction practices	Emergency Manager	NFIP Floodplain Administrator	Land Surveyors	Scientists or Staff familiar with the hazards of the community	Personnel skilled in GIS and/or the FEMA HAZUS program	Grant Writers or Fiscal Staff to handle large/complex grants	Staff with expertise or training in Benefit-Cost Analysis	Other
Bedford County	X	X	-	X	N/A	-	X	X	-	-	-
Bedford Borough	-	-	X	X	X	-	X	-	X	-	-
Bedford Township	X	X	X	X	X	X	X	-	-	-	-
Bloomfield Township	X	-	-	X	X	-	-	-	-	-	-
Broad Top Township	-	-	-	X	X	-	-	-	X	X	-
Coaldale Borough	-	-	-	-	X	-	-	-	-	-	-
Colerain Township	-	-	-	-	X	-	-	-	-	-	-
Cumberland Valley Township	-	-	-	-	X	-	-	-	-	-	-
East Providence Township	X	X	-	X	X	-	-	-	-	-	-
East Saint Clair Township	-	-	-	X	X	-	-	-	-	-	-
Everett Borough	-	X	X	X	X	-	-	-	-	-	-
Harrison Township	-	-	-	X	X	-	-	-	-	-	-
Hopewell Borough	-	-	-	-	X	-	-	-	-	-	-
Hopewell Township	X	X	X	X	X	-	-	-	X	X	-
Hyndman Borough	-	-	-	-	X	-	-	-	-	-	-
Juniata Township	-	-	-	X	X	-	-	-	-	-	-
Kimmel Township	-	-	-	-	X	-	-	-	-	-	-

Municipality	Planners (with land use/land development knowledge)	Planners or Engineers (with natural and/or human caused hazards knowledge)	Engineers or Professionals trained in building and/or infrastructure construction practices	Emergency Manager	NFIP Floodplain Administrator	Land Surveyors	Scientists or Staff familiar with the hazards of the community	Personnel skilled in GIS and/or the FEMA HAZUS program	Grant Writers or Fiscal Staff to handle large/complex grants	Staff with expertise or training in Benefit-Cost Analysis	Other
King Township	-	-	-	-	X	-	-	-	-	-	-
Liberty Township	-	-	-	X	X	-	-	-	-	-	-
Lincoln Township	X	X	X	X	X	-	-	-	-	-	-
Londonderry Township	-	-	-	-	X	-	-	-	-	-	-
Mann Township	X	X	X	X	X	X	-	-	-	-	-
Manns Choice Borough	X	-	X	X	X	-	-	-	-	-	-
Monroe Township	-	-	-	-	X	-	-	-	-	-	-
Napier Township	-	-	-	-	X	-	-	-	-	-	-
New Paris Borough	-	-	-	-	X	-	-	-	-	-	-
Pavia Township	-	-	-	X	X	-	-	-	-	-	-
Pleasantville Borough	-	-	-	-	X	-	-	-	-	-	-
Rainsburg Borough	-	X	X	X	X	-	-	X	-	-	-
Saint Clairsville Borough	-	-	-	-	X	-	-	-	-	-	-
Saxton Borough	-	-	-	X	X	-	-	-	-	-	-
Schellsburg Borough	-	-	-	-	X	-	-	-	-	-	-
Snake Spring Township	-	-	X	X	X	-	-	-	-	-	-
South Woodbury Township	X	X	X	X	X	X	-	X	-	-	-
Southampton Township	X	-	-	X	X	-	-	-	-	-	-

Municipality	Planners (with land use/land development knowledge)	Planners or Engineers (with natural and/or human caused hazards knowledge)	Engineers or Professionals trained in building and/or infrastructure construction practices	Emergency Manager	NFIP Floodplain Administrator	Land Surveyors	Scientists or Staff familiar with the hazards of the community	Personnel skilled in GIS and/or the FEMA HAZUS program	Grant Writers or Fiscal Staff to handle large/complex grants	Staff with expertise or training in Benefit-Cost Analysis	Other
West Providence Township	X	-	X	X	X	X	-	-	-	-	-
West Saint Clair Township	X	X	X	X	X	-	-	-	-	-	-
Woodbury Borough	X	-	-	X	X	-	-	-	-	-	-
Woodbury Township	X	-	-	X	X	-	-	-	-	-	-

Notes:

“X” indicates that the municipality currently has this capability in place.

“-” indicates no capability is currently in place.

Blank space indicates no response was received from the municipality.

5.2.3 Political Capability

For a hazard mitigation project, political capability speaks to a jurisdiction's ability, will, and commitment to support risk management activities and programs within all aspects of their community's governance. This commitment may be evidenced through the adoption and appropriate enforcement of mitigation-related ordinances and plans (zoning, comprehensive planning, site-plan review, building code, higher regulatory standards), appropriate and critical mitigation-related outreach to vulnerable property owners and the public in general, an appropriate dedication of resources (administrative, technical, fiscal) to implement identified priority mitigation projects/actions, and the integration and coordination of the findings and recommendations of this plan update within other complementary and supportive plans and programs.

Strong political capabilities are built over time; they are not necessarily transferred from one elected official to the next. Communities that have had to repeatedly face hazard events and their impacts tend to be those that build and maintain greater mitigation capabilities, and this is certainly the case with political (including public) will. Through this mitigation planning, update, and implementation process, FEMA and Pennsylvania are promoting efforts to build political and popular support to improve the management of hazard risk at the local level.

The capability assessment surveys provided to each jurisdiction for completion included an assessment of local political capability, where the respondent was asked to rate their community's political capability to effect and support hazard mitigation on a scale ranging from "5 – Very Willing" to "0 – Unwilling to Adopt Policies/Programs." Completed capability assessment worksheets returned from communities are provided in Appendix D. By its very nature, an assessment of political capabilities tends to be highly subjective, and any such local assessment provided by a community should not necessarily be considered statistically valid or reflective of the opinions of others in the community. Detailed information regarding municipalities' political capabilities can be found in the municipal survey responses provided in Appendix D.

Municipal Capabilities

Participating municipalities in this planning effort were provided with a capabilities survey. Table 5-3 summarizes the responses of the municipalities based on political capability.

Table 5-3. Political Capability

Municipality	Very Willing	Moderate to Very Willing	Moderately Willing	Unwilling to Moderately Willing	Unwilling
Bedford County				X	
Bedford Borough		X			
Bedford Township	X				
Bloomfield Township					X
Broad Top Township			X		
Coaldale Borough			X		
Colerain Township				X	
Cumberland Valley Township			X		
East Providence Township			X		
East Saint Clair Township			X		
Everett Borough			X		
Harrison Township				X	

Municipality	Very Willing	Moderate to Very Willing	Moderately Willing	Unwilling to Moderately Willing	Unwilling
Hopewell Borough			X		
Hopewell Township			X		
Hyndman Borough			X		
Juniata Township			X		
Kimmel Township					
King Township					
Liberty Township			X		
Lincoln Township			X		
Londonderry Township			X		
Mann Township			X		
Manns Choice Borough					
Monroe Township					X
Napier Township					
New Paris Borough			X		
Pavia Township					X
Pleasantville Borough					
Rainsburg Borough	X				
Saint Clairsville Borough					
Saxton Borough			X		
Schellsburg Borough					
Snake Spring Township			X		
South Woodbury Township			X		
Southampton Township					
West Providence Township			X		
West Saint Clair Township			X		
Woodbury Borough			X		
Woodbury Township			X		

Notes:

“X” indicates the identified municipal political effort currently in place.

Blank space indicates no response was received from the municipality.

5.2.4 Fiscal Capability

Mitigation projects and initiatives are largely or entirely dependent on available funding. As such, it is critical to identify all available sources of funding at the local, county, regional, state, and federal level to support implementation of the mitigation strategies identified in this plan update.

Jurisdictions fund mitigation projects though existing local budgets, local appropriations (including referendums and bonding), and through myriad federal and state loan and grant programs.

Federal mitigation grant funding (Stafford Act 404 and 406) (FEMA 2000) is available to all communities with a current HMP (this plan); however, most of these grants require a "local share" in the range of 10 to 25 percent of the total grant amount.

Federal Hazard Mitigation Funding Opportunities

Hazard Mitigation Grant Program (HMGP)

The HMGP (Stafford Act 404 and 406) is a post-disaster mitigation program made available to states by FEMA after each federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures and can be used to fund cost-effective projects to protect public or private property in an area covered by a federal disaster declaration or that projects to reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard-prone areas, flood proofing, or elevation to reduce future damage, minor structural improvements, and development of state or local standards.

Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved HMP. Applicants who are eligible for the HMGP include state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to PEMA and ranked order for available funding and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available.

Sections 404 and 406 hazard mitigation funding are two distinct criteria associated with mitigation funding. Participation in FEMA 404 HMGP may cover mitigation activities including raising, removing, relocating, or replacing structures within flood hazard areas. FEMA 406 HMGP is applied to parts of a facility that were actually damaged by a disaster, and the mitigation measures that provide protection from subsequent events.

Flood Mitigation Assistance (FMA) Program

FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. FMA is funded annually; no federal disaster declaration is required. Only NFIP-insured homes and businesses are eligible for mitigation in this program. Funding for FMA is limited and, as with the HMGP, individuals cannot apply directly. Applications must come from local governments or other eligible organizations.

The federal government cost share for an FMA project is 75 percent. At least 25 percent of the total eligible costs must be provided by a non-federal source and of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At a minimum, a FEMA-approved local HMP is required before a project can be approved. FMA funds are distributed from FEMA to the Commonwealth. PEMA serves as the grantee and program administrator for FMA.

As of fiscal year 2013, the Severe Repetitive Loss and Repetitive Flood Claims Programs were dismantled and incorporated into the FMA Program. As a result, residential and non-residential properties currently insured with NFIP are eligible to receive FMA funds as long as they meet either the Repetitive Loss Properties (RLP) or Severe Repetitive Loss (SRL) property definitions as described in Section 4.3.5 of this plan.

Pre-Disaster Mitigation (PDM) Program

The PDM program is an annually funded, nationwide, competitive grant program. No disaster declaration is required. Federal funds will cover 75 percent of a project's cost up to $3 million. As with the HMGP and FMA, a FEMA-approved local HMP is required to be approved for funding under the PDM program.

Federal Disaster Assistance Programs

Following a disaster, various types of assistance may be made available by local, state, and federal governments. The types and levels of disaster assistance depend on the severity of the damage and the declarations that result from the disaster event. General types of assistance that may be provided, should the President of the United States declare the event a major disaster, include the following:

- Individual Assistance – provides help for homeowners, renters, businesses, and some non-profit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration. For homeowners and renters, those who suffered uninsured or underinsured losses may be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. Individuals may borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property and an additional 20 percent for mitigation. For businesses, loans may be made to repair or replace disaster damages to property owned by the business, including real estate, machinery and equipment, inventory and supplies. Businesses of any size are eligible. Non-profit organizations such as charities, churches, private universities, etc. are also eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster. These loans are restricted, by law, to small businesses only.
- Public Assistance – provides cost reimbursement aid to local governments (state, county, local, municipal authorities and school districts) and certain non-profit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities, or property used to deliver government-like services. This program is largely funded by FEMA with both local and state matching contributions required.

U.S. HUD Community Development Block Grants (CDBG)

The U.S. HUD CDBGs are federal funds intended to provide low- and moderate-income citizens with decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, planning, and administration. Public improvements may include flood and drainage improvements. In limited instances, and during times of "urgent need" (for example, post disaster) as defined by the CDBG National Objectives, CDBG funding may be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. All municipalities in the County are eligible for CDBG funds through the County.

Additional Federal Resources

Weatherization Assistance Program: Minimizes the adverse effects of high-energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services like heating system modifications and insulation (US DOE, 2011).

Section 108 Loan Guarantee Programs: Provides loan guarantees as security for federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing (HUD, 2011).

U.S. Department of Agriculture: Provides disaster assistance through the following:

- The Emergency Conservation Program provides emergency funding for farmers to rehabilitate farmland damaged by natural disasters and for carrying out emergency water conservation measures during periods of severe drought.
- The Non-insured Crop Disaster Assistance Program provides financial assistance for non-insurable crop losses and planting prevented by disasters.

Emergency Watershed Protection Program: Undertakes emergency measures, including the purchase of floodplain easements for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood, or any other natural occurrence is causing or has caused a sudden impairment of the watershed (NRCS, 2011). It is not necessary for a national emergency to be declared for an area to be eligible for assistance. The program objective is to assist sponsors and individuals in implementing emergency measures to relieve imminent hazards to life and property created by a natural disaster. Activities include providing financial and technical assistance to remove debris from streams, protecting destabilized stream banks, establishing cover on critically eroding lands, repairing conservation practices, and purchasing of floodplain easements. The program is designed for installation of recovery measures.

Commonwealth Hazard Mitigation Funding Opportunities

Commonwealth programs which may provide financial support for mitigation activities include, but are not limited to:

- Community Conservation Partnerships Program
- Community Revitalization Program
- Floodplain Land Use Assistance Program
- Growing Greener Program
- Keystone Grant Program
- Local Government Capital Projects Loan Program
- Land Use Planning and Technical Assistance Program
- Pennsylvania Heritage Areas Program
- Pennsylvania Recreational Trails Program
- Shared Municipal Services
- Technical Assistance Program

Marcellus Shale Legacy Fund - Act 13 of 2012

Watershed Restoration and Protection Program (WRPP) - Act 13 of 2012 establishes the Marcellus Legacy Fund and allocates funds to the Commonwealth Financing Authority for watershed restoration and protection projects. The overall goal of this program is to restore, and maintain restored stream reaches impaired by the uncontrolled discharge of nonpoint source polluted runoff, and ultimately to remove these streams from the PA DEP's Impaired Waters list.

Greenways, Trails and Recreation Program (GTRP) - In addition, Act 13 of 2012 allocates funds to the Commonwealth Financing Authority (the "Authority") for planning, acquisition, development, rehabilitation and repair of greenways, recreational trails, open space, parks and beautification projects. Projects can involve development, rehabilitation and improvements to public parks, recreation areas, greenways, trails, and river conservation.

Flood Mitigation Projects – Finally, Act 13 of 2012 allocates funds to the Commonwealth Financing Authority (the "Authority") for funding statewide initiatives to assist with flood mitigation projects.

While most of the identified fiscal capabilities are available to all of the municipalities in Bedford County, the extent to which communities have leveraged these funding sources varies widely. It is expected that communities familiar with accessing grant programs will continue to pursue those grant sources, as appropriate.

Municipal Capabilities

The implementation of mitigation actions requires time and fiscal resources. While some mitigation actions are less costly than others, it is important that funds are available locally to implement policies and projects. Financial resources are particularly important if jurisdictions are trying to take advantage of Commonwealth or federal mitigation grant funding opportunities that require local-match contributions.

Capital Improvement Planning

Capital improvement plans are often recommended by counties to their municipalities, because these plans help identify specific capital projects to be funded and completed according to a defined schedule. Some of these projects involve improvements to facilities and infrastructure that provide hazard mitigation benefits. As such, during this update process, the County and its municipalities have been encouraged to consider the mitigation benefits associated with their known or anticipated capital projects as a way to help prioritize their execution and to develop awareness that mitigation grants may be available to help fund such projects.

Municipalities participating in this planning effort were provided with a capabilities survey. Table 5-4 summarizes the responses of the municipalities based on fiscal capabilities. Copies of the individual municipal responses are found in Appendix D.

Table 5-4. Fiscal Capability

Municipality	Capital Improvements Program	Community Development Block Grants (CDBG)	Special Purpose Taxes	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation, Revenue, and/or Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements	Other
Bedford County	-	X	-	-	-	-	-	-	X	-
Bedford Borough	X	X	-	-	X	-	X	X	X	-
Bedford Township	X	X	X	-	-	-	X	-	X	-
Bloomfield Township	-	X	-	-	-	-	-	-	-	-
Broad Top Township	-	X	-	-	X	-	-	-	X	-
Coaldale Borough	-	X	-	-	-	-	-	-	-	-
Colerain Township	-	X	-	-	-	-	-	-	-	-
Cumberland Valley Township	X	X	-	-	X	-	-	-	X	-
East Providence Township	-	X	-	-	-	-	-	-	-	-
East Saint Clair Township	-	X	-	-	-	-	-	-	-	-
Everett Borough	-	X	-	-	-	-	-	-	X	-
Harrison Township	-	X	-	-	-	-	-	-	-	-
Hopewell Borough	-	X	-	-	X	-	-	-	-	-
Hopewell Township	-	X	X	-	X	-	-	-	X	-
Hyndman Borough	-	X	-	-	-	-	-	-	-	-

Municipality	Capital Improvements Program	Community Development Block Grants (CDBG)	Special Purpose Taxes	Gas/Electric Utility Fees	Water/Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation, Revenue, and/or Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements	Other
Juniata Township	-	X	-	-	-	-	-	-	-	-
Kimmel Township	-	X	-	-	-	-	-	-	-	-
King Township	-	X	-	-	-	-	-	-	-	-
Liberty Township	-	X	-	-	X	-	-	-	-	-
Lincoln Township	-	X	-	-	-	-	-	-	-	-
Londonderry Township	-	X	-	-	-	-	-	-	-	-
Mann Township	-	X	-	-	-	-	-	-	-	-
Manns Choice Borough	-	X	-	-	-	-	-	-	X	-
Monroe Township	-	X	-	-	-	-	-	-	-	-
Napier Township	-	X	-	-	-	-	-	-	X	-
New Paris Borough	-	X	-	-	-	-	-	-	-	-
Pavia Township	-	X	-	-	-	-	-	-	-	-
Pleasantville Borough	-	X	-	-	-	-	-	-	-	-
Rainsburg Borough	-	X	-	X	X	-	-	-	-	-
Saint Clairsville Borough	-	X	-	-	-	-	-	-	-	-
Saxton Borough	-	X	-	-	X	-	-	-	X	-
Schellsburg Borough	-	X	-	-	-	-	-	-	-	-
Snake Spring Township	-	X	-	-	-	-	-	-	-	-
South Woodbury Township	-	X	-	-	-	-	-	-	-	-
Southampton Township	-	X	-	-	-	-	-	-	X	-
West Providence Township	-	X	-	-	X	-	X	-	-	-
West Saint Clair Township	-	X	-	-	-	-	-	-	-	-
Woodbury Borough	-	X	-	-	-	-	-	-	-	-
Woodbury Township	-	X	-	-	-	-	-	-	-	-

Notes:

"X" indicates that the municipality currently has this capability in place.

"-" indicates no capability is currently in place.

Blank space indicates no response was received from the municipality.

5.2.5 Education and Outreach

Education and outreach programs and methods are used to implement mitigation activities and communicate hazard-related information. Examples include obtaining certification in programs such as Firewise and StormReady; and developing and communicating hazard awareness and safety information to residents.

At the municipal level, education and outreach capabilities vary. Some municipalities have the capability to handle outreach initiatives while others rely on County resources. Several municipal websites post local plans and ordinances, and many municipalities post information regarding hazard-related topics. The local fire departments and emergency managers are active in the schools participating in programs such as fire safety in the fall and attending other community activities to conduct outreach. Appendix D details the outreach and education conducted at the municipal level.

Public Information Programs

Flood Maps

Flood maps and flood data, including new digital maps for Bedford County, are available at the municipal offices and at the offices of both the Bedford County Planning Commission and the Bedford County Conservation District. County and municipality maps, tax maps, and property assessment records are available at the Tax Assessment and Claims Office, and deeds are available at the Register and Recorder's Office.

Library Education Tools

Libraries have educational materials, available upon request, that are used at public speaking events or County meetings, when appropriate. The following educational materials are available, but are not limited to:

- Various types of training videos
- Pennsylvania Emergency Preparedness Guides
- American Red Cross Packets for Flash Flooding, Hurricane, Thunder and Lightning, Tornado, and Winter Storms
- Family Disaster Planning Guides
- Homeland Security Information for Businesses, Family, Individuals, Neighborhoods and Schools
- Pandemic Brochures

South Central Mountain Task Force

Some information about the activities of the South Central Mountain Task Force are provided on the Task Force website (SCMRTF 2016). This information includes meetings and goals for the following:

- Committees
  - Emergency Medical Services Committee
  - Fire, Rescue, Hazardous Materials Committee
  - Health and Medical Committee
  - Information Services Committee
  - Law Enforcement Committee
  - Training and Education Committee
- Teams
  - Incident Management Team
  - Decontamination Strike Team
  - Emergency Medical Services (EMS) Support Team
  - Critical Incident Stress
  - Management Team

Outreach Projects

Several organizations (both public and private sector) have developed outreach projects, educational tools, and training programs. The County promotes both online and traditional in-person programs to appeal to as wide an audience as possible.

- Utility Public Awareness Campaign - The following utility agencies have available safety information accessible to the public:
    - UGI Penn Natural Gas: http://www.ugi.com/portal/page/portal/UGI/Safety
    - Columbia Gas of Pennsylvania: https://www.columbiagaspa.com/stay-safe
- Are You Ready? – This is an in-depth program for citizen preparedness (individual, family, and community) that provides a step-by-step approach to disaster preparedness by walking the participant through steps to get informed about local emergency plans, identify hazards that affect their area, and develop and maintain an emergency communications plan and disaster supply kit. Other topics include evacuation, emergency public shelters, animal handling during disasters, and information specific to people with disabilities. The program includes actions that can be taken before, during, and after each hazard type and provides in-depth information on specific hazards such as the following:
    - Floods
    - Tornadoes
    - Hurricanes
    - Thunderstorms and lightning
    - Winter storms and extreme cold
    - Extreme heat
    - Earthquakes
    - Volcanoes
    - Landslide and debris flows (mudslide)
    - Tsunamis
    - Fires and wildfires
    - Hazardous materials incidents
    - Household chemical emergencies
    - Nuclear power plants
    - Terrorism (explosion, biological, chemical, nuclear, and radiological hazards)
- ReadyPA Campaign – Established by the Commonwealth of Pennsylvania, www.readypa.org is a website that aims to prepare the public for times of disaster by providing education on the risks within Pennsylvania, template emergency plans and kits, and information on ways to get involved with community organizations to help others.
- Community Emergency Response Teams (CERT) – CERT provides training to educate citizens about disaster preparedness and instruction in basic disaster response skills, such as fire suppression, medical operations during disasters, light search and rescue, team organization, disaster psychology, and terrorism awareness. The goal of this program is for emergency personnel to train members of neighborhoods, community organizations, or workplaces in basic response skills. If a disastrous event overwhelms or delays the community's professional response, CERT members can assist others by applying the basic response and organizational skills that they learned during training. These skills can help save and sustain lives following a disaster until help arrives. Although the County does not have a current and active CERT, the County EMA has trained 150 people in CERT concepts.
- Emergency management courses are provided through the County EMA/9-1-1 office to local coordinators and elected officials. The following courses are provided: Duties and Responsibilities of the Local Emergency Management Coordinator (LEMC), Elected Officials Seminar, Initial Damage Assessment, ICS/EOC Interface, NWS Sky Warn certification, and Introduction to ICS.

Local Emergency Planning Committee

The Local Emergency Planning Committee (LEPC) works closely with the business industry community to form a safety net around the chemical industry to protect the general population from the possible outcome of hazardous material incidents. The following features of the LEPC demonstrate the capability of the LEPC to support County emergency management and preparedness initiatives.

- The LEPC shall have a minimum of seven members with at least one representative from each of the following groups:
  - Group 1 – Elected official representing local government within the County
  - Group 2 – Local law enforcement, first aid, health, environmental, hospital, and transportation personnel
  - Group 3 – Firefighting personnel
  - Group 4 – Civil defense and emergency management personnel
  - Group 5 – Broadcast and print media personnel
  - Group 6 – Community groups not affiliated with emergency service groups
  - Group 7 – Owners and operators of facilities subject to the requirements of SARA Title III
- Reporting Facilities – The minimum reporting threshold for which facilities are required to have or prepared a Material Safety Data Sheet is 10,000 pounds of hazardous chemicals. This document provides workers and emergency personnel with procedures for handling or working with hazardous materials in a safe manner. It includes information on the chemicals' physical properties, toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures.
- Planning Facilities – The reporting threshold for Extremely Hazardous Substances (as designated under Section 302 of Title III) is 500 pounds or the threshold planning quantity, whichever is lower. Qualifying facilities are subject to additional reports and accident prevention regulations.

Technical Assistance

The County EMA/9-1-1 office can support local, public, and private entities as needed through coordination and provision of information and equipment resources. These include both existing County capabilities and predetermined private and public resources.

5.2.6 Self-Assessment

Through the capability assessment surveys, all participating jurisdictions were further asked to provide a self-assessment of their jurisdiction's capability in the areas of Planning and Regulatory Capability, Administrative and Technical Capability, Fiscal Capability, Community Political Capability, and Community Resilience Capability. Respondents evaluated their degree of capability in these areas as "Limited", "Moderate" or "High." Table 5-5 provides the summary results from municipalities that completed capability self-assessment worksheets.

Table 5-5. Capability Self-Assessment Matrix

Municipality	Capability Category				
	Planning and Regulatory Capability	Administrative and Technical Capability	Fiscal Capability	Community Political Capability	Community Resiliency Capability
Bedford County	L	L	L	M	M
Bedford Borough	H	M	M	M	M
Bedford Township	M	M	M	M	M
Bloomfield Township	L	L	L	L	L

Municipality	Capability Category				
	Planning and Regulatory Capability	Administrative and Technical Capability	Fiscal Capability	Community Political Capability	Community Resiliency Capability
Broad Top Township	L	M	H	H	H
Coaldale Borough	L	L	L	L	L
Colerain Township	L	L	L	L	L
Cumberland Valley Township	L	L	L	L	L
East Providence Township	L	L	L	L	L
East Saint Clair Township	L	L	L	L	L
Everett Borough	L	L	L	L	L
Harrison Township	L	L	L	L	L
Hopewell Borough	M	M	L	L	L
Hopewell Township	M	H	L	L	L
Hyndman Borough	L	L	L	L	L
Juniata Township	L	L	L	L	L
Kimmel Township	-	-	-	-	-
King Township	-	-	-	-	-
Liberty Township	L	L	L	L	L
Lincoln Township	-	-	-	-	-
Londonderry Township	L	L	M	L	L
Mann Township	L	L	L	L	L
Manns Choice Borough	M	M	M	L	L
Monroe Township	L	L	L	L	L
Napier Township	-	-	-	-	-
New Paris Borough	L	L	L	L	L
Pavia Township	L	L	L	L	L
Pleasantville Borough	-	-	-	-	-
Rainsburg Borough	H	H	H	H	L
Saint Clairsville Borough	-	-	-	-	-
Saxton Borough	L	L	M	M	M
Schellsburg Borough	-	-	-	-	-
Snake Spring Township	M	M	L	L	L
South Woodbury Township	L	L	L	L	L
Southampton Township	-	-	-	-	-
West Providence Township	M	M	L	L	L

Municipality	Capability Category				
	Planning and Regulatory Capability	Administrative and Technical Capability	Fiscal Capability	Community Political Capability	Community Resiliency Capability
West Saint Clair Township	-	-	-	-	-
Woodbury Borough	L	L	L	L	L
Woodbury Township	L	L	L	L	L

Notes:

"-" indicates no capability is currently in place.

Blank space indicates no response was received from the municipality.

Detailed information regarding the municipalities' capabilities self-assessments can be found in the municipal survey responses provided in Appendix D.

5.2.7 Plan Integration

According to FEMA, plan integration is a process where communities look critically at their existing planning framework and align their efforts. Integration of hazard mitigation principles into other local planning mechanisms (comprehensive plans, transportation plans, floodplain ordinances, etc.) and vice versa is vital to build a safer, more resilient community. This two-way exchange of information supports community-wide risk reduction, both before and after disasters occur. Not only will the community's planning efforts be better integrated, but by going through this process there is a higher level of interagency coordination, which is just as important as the planning mechanisms themselves.

Within Bedford County there are many existing plans and programs that support hazard risk management, and thus it is critical that this hazard mitigation plan integrate and coordinate with, and complement, those mechanisms.

The intention of the Planning Team and participating jurisdictions is to incorporate mitigation planning as an integral component of daily government operations. Planning Team members will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (located in Section 8 of this HMP) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Team anticipates the following:

1) Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
2) Hazard mitigation planning will be formally recognized as an integral part of land use policies and mechanisms.
3) The HMP, the comprehensive plans for Bedford County and its municipalities, and County and municipal emergency operations plans (EOP) will become mutually supportive documents that work in concert to meet the goals and needs of County residents.
4) Duplication of effort can be minimized.

In reference to item 3 in the list above, Bedford County is in the process of updating its comprehensive plan concurrently with the hazard mitigation planning process, as part of the six-county Southern Alleghenies region's comprehensive plan development funded by the Pennsylvania Department of Community and Economic Development (PA DCED). The comprehensive plan, focused on being implementable, puts an emphasis on identifying key issues, refining those key issues into a limited number of priorities, and then translating those priorities into realistic action plans. The HMP will play a role in informing the key issues and priorities identified by the plan.

Issues already identified by the planning process that relate to hazard mitigation include:

- **Broadband and cellular communication**: Gaps in the availability and quality of internet and cell phone service have been identified by all six counties as a priority to address. In Bedford County, this has been discussed as both an issue of competitiveness and public safety. The public safety risk is viewed as especially pressing in Hyndman Borough, where geographic isolation, adjacency to a rail line, and very poor cellular coverage present a particularly high risk in the event of a rail-related accidents.
- **Cooperation and Coordination**: Developing closer working relationships between communities has also been identified as a priority in all six counties and is also one of the four planning principles that will shape the contours of the action plans for each county. In Bedford County, the limited capacity of local governments to address pressing needs has been expressed as a concern. Coordination on grant writing -- which may include cooperation in seeking resources to implement hazard mitigation strategies -- has been raised as a potential starting point on this issue. Grant writing capabilities of each jurisdiction in Bedford County is reflected in Section 5.2.2, above.

The HMP in Bedford and the other Southern Alleghenies counties will be highlighted as part of the planning context in the overall regional plan, along with other adopted plans that currently influence strategy and decision-making at local, county, or regional levels.

As noted in Section 6 of this plan, Bedford County has made a concerted effort to reduce their vulnerability to natural and non-natural hazards in its planning and in its daily operations since the Bedford County HMP was last updated in 2011. The County and its jurisdictions have implemented various programs and projects to reduce the impacts of hazards. These projects, programs, and regulations have reduced risk caused by natural and non-natural hazards and support the goals and objectives of this HMP. It is the intent of the County and its participating municipalities to strengthen this focus on mitigation by continuing existing policies, and by further implementing the mitigation policies contained in this HMP.

Implementation actions will include incorporating the goals of the HMP into ongoing planning, zoning, building, and engineering activities. Specifically, the County will urge municipalities to take the following actions:

- Fund hazard mitigation projects or actions in operating budgets to the extent possible
- Notify other municipalities about grant and other funding opportunities as they arise
- Use data and maps from this HMP as supporting documentation in grant applications
- Review mitigation actions when allocating funding for the municipal budgets
- Include hazard mitigation when updating municipal ordinances
- Identify hazard areas in updates of comprehensive plans to identify land use issues
- Review the hazard mitigation plan prior to land use or zoning changes, and permitting or development decisions

The information on hazards, risk, vulnerability, and mitigation contained in this HMP is based on the best science and technology available at the time of the plan's preparation. Additionally, certain plans, including the Act 167 Plan, were incorporated directly into this HMP update. All participating jurisdictions recognize that this information can be invaluable in making decisions under other planning programs, such as comprehensive, capital improvement, and emergency management plans. Figure 5-1 illustrates the interrelationships between the HMP, County Comprehensive Plan, County EOP, and other community planning mechanisms. Existing processes and programs through which the HMP should be implemented are described below.

Plan participants will make every effort to implement the relevant sections and or data contained in the HMP utilizing administrative, budgetary, and regulatory processes as well as partnerships to the maximum extent, as described below.

Administrative

Administrative processes include departmental or organizational work plans, policies, or procedural changes that can be addressed by the following departments:

- Buildings and Grounds
- Planning/Mapping
- Sheriff
- Emergency Management Agency/9-1-1
- Human Services Administration/Services for Children
- South Central Counties Solid Waste Agency

Additional administrative measures may include the creation of paid or unpaid internships to assist in HMP maintenance.

The Bedford County EMA is responsible for preparing and maintaining the County EOP, including a minimum biennial review. Whenever portions of the plan are implemented in an emergency event or training exercise, a review should be performed and changes made where necessary. These changes would then be distributed to the County's 38 municipal Emergency Management Coordinators (EMC). The risk assessment information presented in the 2011 HMP was used to update the hazard Vulnerability Assessment section of the County EOP. The updated risk assessment information will affect subsequent updates to the EOP. Recommended changes to the HMP, based on changes to the EOP, will then be coordinated with the Planning Team.

The Bedford County Planning Commission is responsible for maintaining and updating the County Comprehensive Plan, which covers all 38 municipalities and provides a model subdivision and land use ordinance for use by the municipalities. The Planning Commission meets monthly to review, discuss, and comment on municipal subdivision and land development plans, municipal floodplain ordinances, municipal stormwater management plans and ordinances, and other community planning and development matters. Since the adoption of the original Bedford County HMP and subsequent 2011 update, these reviews have included informal cross-referencing of the planned development or regulatory activity with the provisions of the HMP. It uses this information to identify necessary revisions and to amend the County Comprehensive Plan. The Planning Commission's meetings are open to the public and are advertised according to the Pennsylvania Sunshine Act (65 PA C.S.A.).

The administrative practices described above will continue through the development of subsequent Bedford County Comprehensive Plan updates using the information in this updated HMP. In return, the Bedford County Comprehensive Plan, located on the Bedford County Planning Commission's website, was incorporated into multiple aspects of this HMP. Information from the Comprehensive Plan and other documents was used to formulate the County profile, identify the history of individual hazards, and detail the population projections in Bedford County.

Budgetary Process

In terms of budgetary processes, the County will review capital budgets and, if funding is available, include a line item for mitigation actions. In addition, the County will maximize mitigation aspects of proposed projects, and will encourage municipalities to do likewise.

Regulatory Measures

Regulatory measures—such as the creation of executive orders, ordinances, and other directives—will be considered to support hazard mitigation in the following areas:

- Comprehensive Planning - Institutionalize hazard mitigation for new construction and land use
- Zoning and Ordinances
- Building Codes - Enforcement of codes or higher standard in hazard areas

- Capital Improvements Plan - Ensure that the person responsible for projects under this plan evaluates whether new construction is in a high-hazard area (such as a flood plain) so the construction is designed to mitigate the risk. Revise requirements for this plan to include hazard mitigation in the design of new construction.
- National Flood Insurance Program – Continue participation in this program and explore participation in Community Rating System (CRS) Program
- Stormwater Management – Continue to implement storm water management plans
- HMP Plan Coordination – Prior to formal changes (amendments) to master plans, zoning, ordinances, capital improvement plans, or other mechanisms that control development, all above-mentioned plans must be reviewed to ensure they are consistent with the HMP

Funding

The County and its jurisdictions will consider multiple grant sources to fund eligible projects. These opportunities may include, but are not limited to:

- Federal
    - Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation Program (PDM)
    - FEMA Flood Mitigation Assistance Program (FMA)
    - FEMA Hazard Mitigation Grant Program (HMGP) – Stafford Act, Section 404
    - U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG)
    - U.S. Department of Agriculture (USDA) – USDA Community Facilities
    - Appalachian Regional Commission
    - U.S. Economic Development Administration (EDA) Public Works Program
- Commonwealth
    - Pennsylvania Department of Transportation (PennDOT) Pennsylvania Infrastructure Bank
    - Act 13 Marcellus Shale Legacy Funds – Flood Mitigation Program
- Nonprofit organizations, foundations, and private sources

Other potential federal funding sources include:

- Stafford Act, Section 406 – Public Assistance Program Mitigation Grants
- Federal Highway Administration
- Catalog of Federal Domestic Assistance
- U.S. Fire Administration – Assistance to Firefighter Grants
- U.S. Small Business Administration Pre and Post-Disaster Mitigation Loans
- U.S. Department of Economic Development Administration Grants
- U.S. Army Corps of Engineers
- U.S. Department of Interior, Bureau of Land Management
- Other sources as yet to be defined

Partnerships

The following opportunities for partnerships will be encouraged to provide a broader support and understanding of hazard mitigation:

Existing Committees and Councils

- Local Government Committees:
    - Bedford County Local Emergency Planning Committee
    - Bedford County Public Housing Authority (http://www.hud.gov/offices/pih/pha/contacts/states/pa.cfm)
    - Bedford County Conservation District (http://www.bedfordcountyconservation.com/)

Creative Partnerships for Funding and Incentives

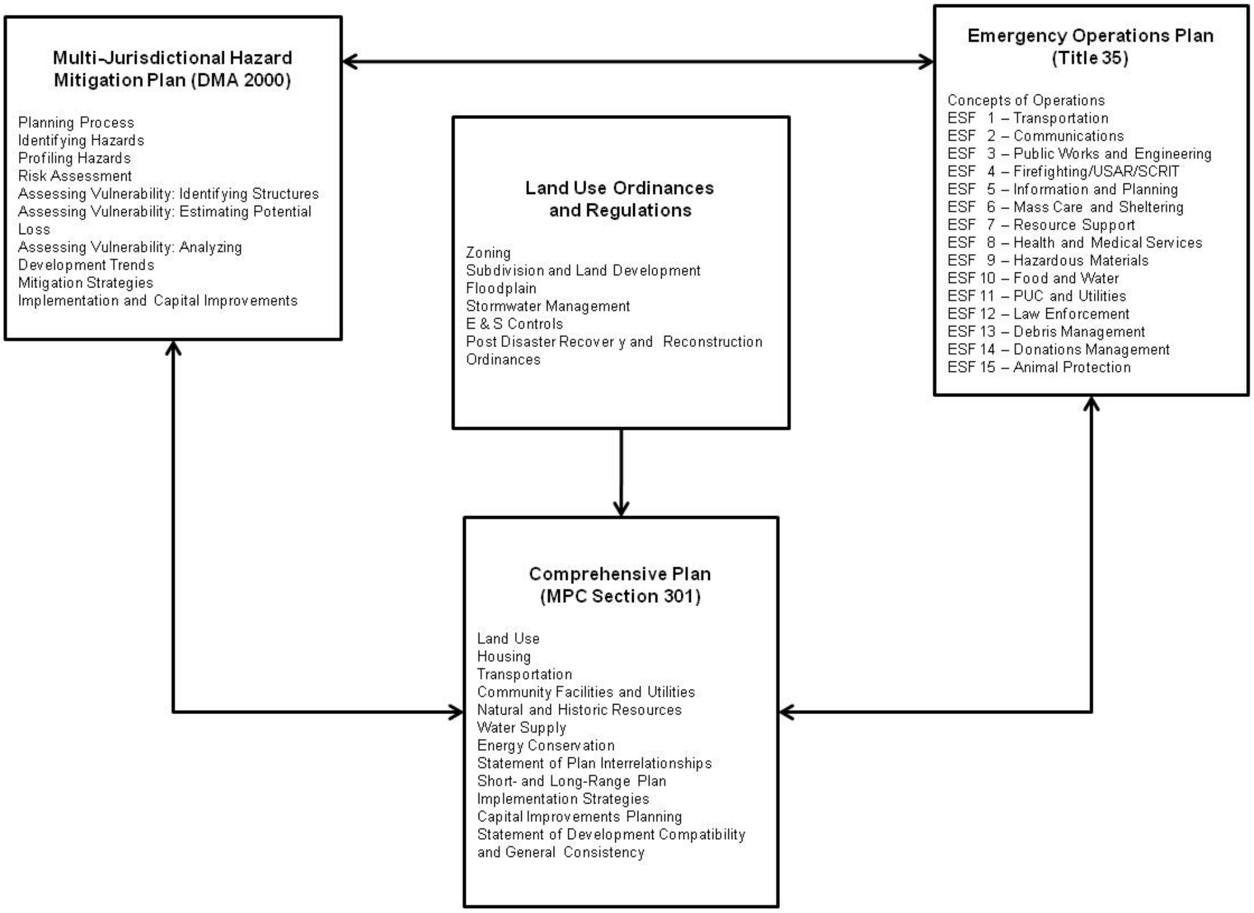
- Public-private partnerships, including utilities and businesses
- State cooperation
- In-kind resources

Working with other Federal, Commonwealth, and Local Agencies

- American Red Cross
- U.S. Army Corps of Engineers (USACE)
- Department of Homeland Security (DHS)
- Federal Emergency Management Agency (FEMA)
- National Oceanic and Atmosphere Administration (NOAA)
- National Weather Service (NWS)
- Pennsylvania Department of Transportation (PennDOT)
- Pennsylvania Department of Environmental Protection (PADEP)
- Pennsylvania State Police (PSP)
- Southern Alleghenies Planning and Development Commission
- United States Department of Agriculture (USDA)
- United States Department of Transportation (USDOT)
- United States Geological Service (USGS)
- Watershed Associations

During the plan evaluation process, the Planning Team will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions, and will include these findings and recommendations in the HMP Progress Report.

Figure 5-1 Plan Interrelationships



Note:

E&S Erosion and Sedimentation
MPC Municipal Planning Code

SECTION 6 MITIGATION STRATEGY

This section describes the process by which the Bedford County (County) Hazard Mitigation Planning Team (Planning Team) will reduce or eliminate potential losses from the natural and non-natural hazards identified in Section 4.2 of this hazard mitigation plan (HMP). The mitigation strategy focuses on existing and potential future mitigation actions to alleviate the effects of hazards on Bedford County's population, economy, and general building stock.

This section provides a summary of the 2017 HMP update process, outlines the mitigation goals and objectives set forth in the 2017 HMP update, describes the process for identifying and analyzing mitigation techniques, and provides the mitigation action plan.

6.1 UPDATE PROCESS SUMMARY

The goals and objectives listed in the Bedford County HMP were first examined through the dispersal of the Mitigation Strategy 5-Year Plan Review Worksheet (Mitigation Review Worksheet). During the 5-year review, the Planning Team members and general public were afforded the opportunity to comment on the goals, objectives, and actions that were listed in the existing HMP. In addition, the HMP was posted on the County's project website (http://bedfordhmp.com/) throughout the course of the plan update process. Correspondence distributed to the municipalities referenced the website and welcomed comments on the HMP to the Planning Team or to Tetra Tech, Inc. (Tetra Tech).

The general mitigation planning approach used to develop this plan is based on (1) the Federal Emergency Management Agency (FEMA) publication entitled *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies*, and (2) the *Pennsylvania All-Hazard Mitigation Planning Standard Operating Guide (SOG)*. The SOG document includes the following four steps, which were used to support mitigation planning for this HMP:

1. **Review of Mitigation Goals and Objectives:** Existing mitigation goals and objectives were examined during the 2017 HMP Mitigation Solutions Workshop and the Mitigation Strategy Meeting, both of which were open to members of the public and County stakeholders. The Planning Team and members of the general public were afforded the opportunity to comment on the goals and objectives that were listed in the existing 2012 HMP through both the Mitigation Solutions Workshop and the Mitigation Review Worksheet. Mitigation goals and objectives were updated using the latest information gathered through the hazard profiles, vulnerability assessments, and the risk assessment; they were also compared to the State HMP goals and objectives.
2. **Develop and Update Mitigation Strategies:** Mitigation actions were identified based on the risk assessment, mitigation goals and objectives, existing policies, and input from the Planning Team and municipal planning partners.
3. **Mitigation Strategy Prioritization and Implementation:** The potential mitigation actions were qualitatively evaluated using the Political, Administrative, Social, Technical, Economic, Environmental, and Legal (PA-STEEL) method, described in more detail in Section 6.4 of this HMP. Mitigation actions were prioritized into three categories: high, medium, and low. High priority and medium priority mitigation actions are recommended for implementation before low priority actions; however, based on County and community-specific needs, cost estimation, and available funding, some low priority mitigation actions may be addressed first.
4. **Document the Mitigation Planning Process:** The entire mitigation planning process is documented throughout this HMP, particularly in Section 3.

This section summarizes past mitigation goals, past mitigation action status and update of mitigation strategies, and additional past mitigation accomplishments.

6.1.1 Review of the Past Mitigation Goals

The mitigation goals identified in the 2011 version of the HMP are listed below:

1. **Goal 1:** Protect lives, property, environmental quality, and natural resources of the County.
2. **Goal 2:** Enhance consistent coordination, collaboration, and communication among stakeholders.
3. **Goal 3:** Provide a framework for active hazard mitigation planning and implementation.
4. **Goal 4:** Build political support and secure funding for mitigation efforts.
5. **Goal 5:** Increase awareness, understanding, and preparedness.

6.1.2 Past Mitigation Action Status and Update of Mitigation Strategies

In the 2012 HMP, Bedford County identified 74 actions and initiatives to support an improved understanding of hazard risk and vulnerability and to enhance mitigation capabilities. Progress on the 2012 County-level mitigation actions was evaluated during the 2017 update process.

Bedford County, via various representatives on the Planning Team, was provided with a Mitigation Review Worksheet identifying all County and municipal actions and initiatives from the 2012 plan. The respondents were asked to indicate the status of each action ("No Progress/Unknown," "In Progress/Not Yet Complete," "Continuous," "Completed," or "Discontinued") and provide review comments on each.

Information from the completed Mitigation Action Plan Review Worksheets is provided in Table 6-1. Projects and initiatives identified as "Complete" and "Discontinued" have been removed from this plan update. The actions that the County has identified as "No Progress/Unknown," "In Progress/Not Yet Complete," or "Continuous" have been carried forward in the updated mitigation strategies identified in Table 6-3 (unless otherwise determined by the County to be a discontinued project). The language in some actions being carried over has been adjusted to reflect changes to County needs and capabilities. Some actions were also merged to reduce redundant efforts on behalf of the County and its municipalities.

Table 6-1. Past Mitigation Action Status

Description	Jurisdiction	Status	Review Comments
1: Disseminate to County residents informational pamphlets that explain the risks of hazards, outline precautionary measures residents can take to help reduce impacts of a disaster to themselves and their property, and emphasize the value of hazard mitigation.	County and all municipalities	In Progress/ Not Yet Complete	• Will be developed for new County website. Pamphlets available in Bedford Borough office. Cumberland Valley Township marked this as in progress. • Bedford Township has this in place for floodplain residents.
2: Develop an informational website with information on hazards that can affect the County, how residents can protect themselves from a disaster, and mitigation actions the County and municipalities are taking to help reduce the risks.	County and all municipalities	In Progress/ Not Yet Complete	• Will be developed for new County website. Cumberland Valley Township and Mann Township marked this as in progress. Bedford Borough website contains an existing ordinance relating to construction in floodplains and FEMA floodplain maps. Bedford Township has this in place.
3: Cooperate with local media to produce regular public service announcements or news releases on hazard risk, safety, and the importance of mitigation.	County and all municipalities	Continuous	• County Emergency Management Agency (EMA) issuing regular public service announcements. Effort will increase with new website. Bedford Borough reports that press releases are issued as situations arise. Juniata Township marked that the township is willing to cooperate with the media.
4: Utilize existing programs for school education programs on hazards, hazard safety, and mitigation.	County and all municipalities	Continuous	• County EMA cooperation with school districts' safe school committees.
5: Disseminate informational pamphlets or mailings on hazard mitigation to property owners in the 1% annual chance floodplain or owners of repetitive-loss structures.	County and all municipalities	In Progress/ Not Yet Complete	• Pamphlets available in Bedford Borough office. Bedford Township disseminates information to its floodplain properties. This is in process in Everett Borough.
6: Develop informational workshops on hazard risks and hazard mitigation for property owners in high-risk areas.	County	No Progress	• Lack of funding and staff resources.
7: Investigate avenues for real estate disclosure for properties in 1% annual chance floodplain.	County and all municipalities	In Progress/ Not Yet Complete	• East Providence Township marked this complete. Everett Borough marked is as continuous. Hopewell Township is marked as completed.
8: Assist municipalities in developing policies and procedures related to hazard mitigation.	County	Continuous	• Assistance provided on a regular basis.
9: Encourage forest and vegetation management policies.	County	In Progress/ Continuous	• County conservation district efforts.
10: Encourage urban forestry and landscape management policies.	County	No Progress	• Lack of funding and staff resources.
11: Encourage best management practices (BMP).	County	In Progress/ Continuous	• Western PA Conservancy and County conservation district projects though BMPs in agricultural areas.
12: Work with state and federal officials to enforce sediment and erosion control regulations.	County	In Progress/ Continuous	• Lincoln Township and West St. Clair Township marked this continuous. • Western PA Conservancy and County conservation district efforts.
13: Work with state and federal officials to enforce stream dumping regulations.	County	Continuous	• Assistance provided as needed. • Lincoln Township marked this continuous.

Description	Jurisdiction	Status	Review Comments
14: Work with state and federal officials to enforce wetlands development regulations.	County	In Progress/ Continuous	• County conservation district efforts.
15: Construct levees or floodwalls to protect communities with repetitive flooding problems.	County and all municipalities	In Progress/ Not Yet Complete	• Everett and Hyndman levees are awaiting FEMA approval.
16: Acquire properties in hazard areas, notably within the 1% annual chance floodplain, to convert them to open space.	County and all municipalities	In Progress/ Not Yet Complete	• East Providence Township and Hopewell Township marked this complete.
17: Elevate structures in hazard areas.	County and all municipalities	In Progress/ Not Yet Complete	• Bedford Township, East Providence Township, and West St. Clair Township marked this continuous. Hopewell Township marked this complete.
18: Regularly inspect and maintain bridges and culverts.	County and all municipalities	In Progress/ Continuous	• This occurs on a regular basis throughout the County. Countywide 5-year Web-based Information System (WBIS) Bridge Safety Inspection Program exists. County engineer and Pennsylvania Department of Transportation (PennDOT) inspections and maintenance.
19: Develop a stream corridor restoration plan.	County and all municipalities	In Progress/ Continuous	• Western PA Conservancy work on stream restoration.
20: Create and maintain a database and map of all critical facilities in the County.	County	In Progress/ Continuous	• Planning Commission Geographic Information System (GIS) and 911 GIS used to maintain the database.
21: Inspect critical facilities regularly to ensure they comply with standard codes and can withstand the impacts of a disaster.	County and all municipalities	Continuous	• In Bedford Borough, completed by BBWA & MABB insurance companies annually. Hopewell Township marked this continuous.
22: Ensure that all critical facilities have updated emergency response plans.	County and all municipalities	Continuous	• This occurs on a regular basis throughout the County. Local Emergency Planning Committee (LEPC) updates of off-site plans for Superfund Amendments and Reauthorization Act (SARA) Tier II facilities.
23: Enforce floodplain development regulations.	County and all municipalities	Continuous	• This occurs on a regular basis throughout the County.
24: Offer technical assistance to municipalities to develop, address, or enforce floodplain zoning, hillside development regulations, subdivision and development regulations, design review standards, and environmental review standards.	County	In Progress/ Not Yet Complete	• County Planning Commission implemented subdivision and land development plans review program on 1/1/2014.
25: Develop stormwater management plans and regulations for those watersheds in the County that do not currently have a plan.	County	Discontinued	• Discontinued after Act 167 funding eliminated.
26: Acquire easements in hazard-prone areas, specifically 1% annual chance floodplains.	County and all municipalities	In Progress/ Not Yet Complete	• Lack of funding and staff resources.

Description	Jurisdiction	Status	Review Comments
27: Promote open space preservation.	County	In Progress/ Continuous	• County Planning Commission promotes open space preservation.
28: Promote natural resource planning.	County	In Progress/ Continuous	• County Planning Commission promotes natural resource planning.
29: Review, evaluate, and discuss designated growth areas in existing County and local plans to ensure development will occur out of hazard-prone areas.	County and all municipalities	Continuous	• This occurs on a regular basis throughout the County. County Planning Commission review of subdivision and land development plans, and sewage planning modules.
30: Review planned infrastructure to ensure that it will be developed outside of hazard-prone areas.	County and all municipalities	Continuous	• This occurs on a regular basis throughout the County. Part of subdivision, land use, and building construction reviews and decision process. County Planning Commission review of land development plans.
31: Recommend, encourage, and assist communities to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).	County	In Progress/ Continuous	• County Planning Commission encourages local municipalities to enroll in CRS.
32: Develop evacuation routes and an evacuation plan to be used in the event of a disaster.	County and all municipalities	In Progress/ Not Yet Complete	• Bedford Borough, Bedford Township, Cumberland Valley Township, East St. Clair Township, and East Providence Township marked this as continuously performed. Everett Borough marked it as in progress. County EMA has the lead on this.
33: Encourage departments responsible for creating and storing data related to parcels, centerlines, buildings, addresses, hydrology, and hazards to develop and enforce data maintenance policies.	County and all municipalities	Continuous	• This occurs on a regular basis throughout the County as part of daily operational activity. New GIS staff at County Planning Commission coordinating with 911 and Tax Assessment staff.
34: Encourage development of data-sharing policies and agreements between departments and organizations responsible for data creation, management, and use.	County and all municipalities	Continuous	• Cumberland Valley Township and Harrison Township marked this as continuously performed. New GIS staff at County Planning Commission coordinating with 911 and Tax Assessment staff.
35: Develop and maintain hazard occurrence databases to record information on hazards such as date and time of occurrence, duration of disaster, amount of damage, number of injuries, etc.	County	In Progress/ Continuous	• County EMA/911 CAD maintains database.
36: Develop detailed databases on parcels and buildings in and out of the 1% annual chance floodplain. The data could include first-floor elevations, number of stories, basements, value of structure, acreage of parcel in floodplain, etc.	County and all municipalities	In Progress/ Not Yet Complete	• Only for historic properties per ongoing PA Historical and Museum Commission Study. Hopewell Township marked this as in progress/not yet complete.
37: Work with the Federal Emergency Management Agency (FEMA) to update current NFIP floodplain maps and determine base flood elevations for the County.	County and all municipalities	Completed	• Maps became effective March 2, 2012.

Description	Jurisdiction	Status	Review Comments
38: Develop and distribute a list of contact persons within each organization who may play a part in emergency response, services, relief, or hazard mitigation.	County	Completed	• County EMA and 911; Hopewell Township marked this complete.
39: Encourage the heads of each department or organization involved in emergency response, services, relief, or hazard mitigation to meet several times a year to discuss hazard mitigation.	County	Continuous	• LEPC, Hazard Mitigation Committee
40: Develop informational workshops or programs on hazard mitigation and available funding for organizations, departments, elected officials, and volunteers.	County	Continuous	• County EMA
41: Disseminate informational brochures among organizations involved in emergency response.	County and all municipalities	Continuous	• This occurs on a regular basis throughout the County. LEPC is developing brochures. Hopewell Township marked this complete.
42: Inventory all available equipment and technology used for emergency response.	County and all municipalities	In Progress/ Not Yet Complete	• Completed in Hopewell Township and South Woodbury Township. Performed continuously in East St. Clair Township and Everett Borough. Also conducted by County EMA and 911.
43: Continue to target and prioritize at-risk structures, and if funding becomes available, perform acquisitions, demolitions, relocations, and/or elevations.	County and all municipalities	In Progress/ Not Yet Complete	• Only for historic properties per ongoing PA Historical and Museum Commission study. Performed continuously in Hopewell Township.
44: Collect Floodplain Management Ordinance-specific information from communities participating in the NFIP, including freeboard requirements; prohibition of identified dangerous materials in the floodway; and prohibition or restriction of hospitals, nursing homes, and jails/prisons.	County	Completed	• Local floodplain maps and ordinances at County Planning Commission office.
Bedford County – Training conference on CSX rail issues scheduled for Bedford and Somerset Counties, covering roughly 80 miles of track.	County	In Progress/ Not Yet Complete	• Cancelled due to snowstorm. EMA attended week-long training at CSX headquarters in Atlanta, GA.
Bedford County – County EMA is conducting a county-wide commodity flow study (CFS) looking at traffic patterns of commercial traffic carrying various hazardous substances.	County	In Progress/ Not Yet Complete	• LEPC will apply for grant to accomplish CFS in 2018.
Bedford Borough – South Side Storm Water Management Project: Stormwater management to reduce flash flooding in the southwestern portion of the Borough of Bedford and adjacent areas of Bedford Township. Install two detention ponds and additional storm sewer pipes & catch basins, and upgrade existing storm sewer pipes & catch basins.	Bedford Borough	In Progress/ Not Yet Complete	• Project engineering and cost estimate are complete. In need of funding.

Description	Jurisdiction	Status	Review Comments
Bedford Borough – Project to remove fill in a section of the Raystown Branch of the Juniata River near the Bedford Township/Bedford Borough line to reduce flood risks to (1) upstream residents and (2) the Bedford Borough Wastewater Treatment Facility adjacent to the fill site.	Bedford Borough	No Progress	• Lack of funding.
Bedford Borough – Water Treatment Plant Generator: Purchase and install a 250-kilowatt (kW) diesel generator with switchgear to serve as a backup power supply to the Water Treatment Plant.	Bedford Borough	Completed	• Purchased and installed June 2012. Generator is inspected semi-annually.
Bedford Township – South Side Stormwater Management Project: Install detention ponds and additional storm sewer pipe and catch basins in the southwest portion of township abutting Bedford Borough and adjacent areas of Bedford Borough. Also upgrade existing storm sewer pipe and catch basins.	Bedford Township	Continuous	• Cut breakers on resident's property to direct water away from homes that are in lower areas, and keep culverts clean.
Bedford Township – Remove fill in a section of the Raystown Branch of the Juniata River near the Bedford Township/Bedford Borough line to reduce flood risks to (1) upstream residents and (2) the Bedford Borough Wastewater Treatment Facility adjacent to the fill site.	Bedford Township	No Progress	• Lack of funding.
Broad Top Township – Coke Oven Bank Protection: Place rip rap along the south bank of Six Mile Run for approximately 500 feet to stabilize.	Broad Top Township	Completed	• Rip rap project to protect the coke ovens was completed in early 2017.
Colerain Township – Improvements to Township Bridges: Clean debris from abutments and piers at Bridge #2 on T-376 over Cove Creek (structure is # 05 7204 0376 4002) and at Bridge #1 on T-373 over Cove Creek (structure is # 05 7204 0373 4001).	Colerain Township	In Progress/ Not Yet Complete	• T-376 Bridge #2 is being replaced.
Cumberland Valley Township – Obtain generator for water treatment plant: Provide generator as a backup power source for the municipal water company that provides water to 40 customers in the Village of Centerville.	Cumberland Valley Township	No Progress	• Lack of funding.
East Providence Township – Brush Creek Camp Ground & Trailer Park: Clean trees and brush from Brush Creek.	East Providence Township	Continuous	• Lack of funding and staff resources.
East Providence Township – Wastewater Treatments Plant: Construct catch basins or sediment ponds to hold water during heavy rains.	East Providence Township	Completed	• New treatment plant to be constructed in 2017.
Everett Borough – Bloody Run Project to reduce flooding and erosion along Bloody Run	Everett Borough	No Progress	• Lack of funding and staff resources.

Description	Jurisdiction	Status	Review Comments
Harrison Township – Dry hydrants: Install dry hydrants at five ponds in the township—two on Milligans Cove Road, one on Route 96 south of Manns Choice, one on Powell Road, and one on Brant Hollow Road.	Harrison Township	No Progress	• Lack of funding and staff resources.
Hyndman Borough –Flood Projection: Levees	Hyndman Borough	In Progress/ Not Yet Complete	• Levees exist but are not certified. Borough is working with its engineering company to address the requirements.
Hyndman Borough – Address problem with trees growing in the middle of Wills Creek near the Dollar General Store in Hyndman. The area creates a narrowing of the stream channel and could significantly decrease effectiveness of high water solutions.	Hyndman Borough	No Progress	• Lack of funding and staff resources.
Juniata Township – Repair/replace/install culverts: Remove debris from stream and install culvert/pipe.	Juniata Township	Continuous	• Lack of funding and staff resources.
Kimmel Township – Emergency Shelter Generator: Purchase generator for community center/emergency shelter in case of power outage.	Kimmel Township	No Progress	• Lack of funding and staff resources.
Kimmel Township – Clear stream banks: Clean stream banks to help reduce debris buildup that can cause flooding.	Kimmel Township	No Progress	• Lack of funding and staff resources.
Mann Township – Stabilize bridge abutments: Install gabian baskets as retaining walls to shore up abutments and prevent water from undermining wingwalls and bridge footers. This is to occur on all bridges in the township. Also place rip rap to stabilize stream banks.	Mann Township	No Progress	• Lack of funding and staff resources.
Manns Choice Borough – Reduce speed limit on Rt. 31 as it crosses through Manns Choice Borough and Harrison Township from 45 to 35 miles per hour (mph).	Manns Choice Borough	No Progress	• Lack of funding and staff resources.
Monroe Township – Road Berm Stabilization: Dig out dirt road berms and replace with blacktop.	Monroe Township	No Progress	• Lack of funding and staff resources.
Pavia Township – Stream Clearing: Clear debris from stream and reinforce streambeds of Bobs Creek.	Pavia Township	No Progress	• Lack of funding and staff resources.
Pleasantville Borough – Community Warning System: Develop a community warning system to notify residents of a potential danger in case of an accident on Rt. 56 involving a tractor trailer hauling hazardous waste.	Pleasantville Borough	No Progress	• Lack of funding and staff resources.
Rainsburg Borough– Sewer Project: Install catch basins or ponds to collect rain waters to reduce flooding during heavy rains that cause sewage backup.	Rainsburg Borough	No Progress	• Lack of funding and staff resources.

Description	Jurisdiction	Status	Review Comments
Southampton Township – Junkyard in floodplain: Acquisition & Conversion—Purchase and clean up junkyard. Remove salvage to recycler. Dig up and dispose of contaminated soil. Dispose of drums of oil and antifreeze. Convert floodplain area to green space/playground.	Southampton Township	No Progress	• Junkyard is no longer in operation. Owner passed away. New renter continues to accumulate vehicles and parts.
St. Clairsville Borough – Main St. Improvement Project: Improve road surfaces on Main Street in St. Clairsville Borough. Improve and install culverts to allow water to drain better.	St. Clairsville Borough	No Progress	• Lack of funding and staff resources.
West Providence Township – Crawford Road: Widen roadway to improve site distance, and reconstruct drainage system.	West Providence Township	In Progress/ Not Yet Complete	• Dirt and gravel in progress, but not widening the road.
West St. Clair Township – Stream/Floodwall Improvement: Improve stream with new flood wall.	West St. Clairsville Borough	No Progress	• Lack of funding and staff resources.
Woodbury Borough – Emergency Alert System: Erect an emergency warning siren.	Woodbury Borough	No Progress	• Lack of funding and staff resources.

On March 2, 2017, the Planning Team hosted a Mitigation Solutions Workshop that was attended by several County and municipal representatives. The purpose of this workshop was to provide another opportunity to review the current goals, objectives, and actions listed in the HMP and to determine possible revised HMP's goals, objectives, and actions. The goals, objectives, and mitigation techniques to be considered in the document were identified. Meeting minutes are provided in Appendix C. The Planning Team then used the outcomes from the workshop to help identify and prioritize the final mitigation actions included further in this section.

The Planning Team determined that most of the actions listed in the 2012 version of the HMP would be continued (i.e., deferred) to the current version of the plan; however, to reflect revised objectives, County capabilities, and long-term needs, the exact wording of the mitigation actions may have changed.

6.1.3 Additional Past Mitigation Accomplishments

Bedford County and its municipalities are dedicated to mitigation activities and comprehensive all-hazards planning. To that end, the County has engaged in mitigation activities beyond those identified in its 2012 HMP. The County and its municipalities have demonstrated a proactive approach, commitment to resiliency, and desire to protect both physical assets and citizens against hazard losses through the following additional accomplishments:

- The County replaced approximately 2,930 feet of water line on the east side of Main Street in Woodbury Borough.
- The County made improvements to the Wood-Broad Top-Wells Joint Municipal Authority's water and sewer plants.

6.2 MITIGATION GOALS AND OBJECTIVES

The Planning Team reviewed the 2012 HMP goals and objectives during the March 2017 Mitigation Solutions Workshop to determine their continuing applicability to County mitigation needs. After careful and deliberate discussion, the Planning Team determined that the goals and objectives would be carried over to the 2017 update with some changes. The 2017 County HMP goals and objectives are in line with State mitigation goals, embody the overarching needs and concerns of the County and participating municipalities, and address both natural and non-natural hazard risk reduction. The 2017 County HMP goals and objectives are listed below:

- **Goal 1: Increase public education and awareness of existing and potential hazards in Bedford County.**
  - Objective 1A: Develop public education and outreach programs on hazards and hazard mitigation.
  - Objective 1B: Educate property owners in hazard risk areas regarding their risks and the precautions they can take.
  - Objective 1C: Encourage residents to implement hazard mitigation and preparedness measures on their properties.
  - Objective 1D: Encourage local participation in the Community Rating System (CRS) Program.
- **Goal 2: Protect the citizens of Bedford County as well as public and private property from the impacts of natural and human-caused hazards.**
  - Objective 2A: Protect existing structures, including critical facilities, from damage that can be caused by hazards.
  - Objective 2B: Promote further local implementation of CRS program for properties in floodplains.
  - Objective 2C: Develop local structural projects to reduce the impacts of natural and human-caused hazards on public and private property.

- Objective 2D: Improve and maintain stormwater management systems to reduce backup and flooding.
- Objective 2E: Acquire, relocate, elevate, and/or retrofit existing structures located in hazard areas.
- Objective 2F: Acquire, relocate, elevate, and/or retrofit repetitive loss properties from flood-prone areas.

- **Goal 3: Prevent injury/death and damage from natural and man-made hazards in Bedford County.**
  - Objective 3A: Develop regulations limiting development in hazard-prone areas.
  - Objective 3B: Lessen impacts on natural resources and open space from natural and human-caused hazards.
  - Objective 3C: Direct new growth away from hazard-prone areas.
  - Objective 3D: Encourage homeowners, renters, and businesses to insure their properties against all hazards, including flood coverage under the National Flood Insurance Program (NFIP).
- **Goal 4: Improve emergency services and capabilities in Bedford County to protect citizens from natural and human-caused hazards.**
  - Objective 4A: Improve coordination and communication between departments.
  - Objective 4B: Ensure adequate training and resources for those involved in emergency response, services, relief, or hazard mitigation.
  - Objective 4C: Ensure adequacy of equipment and technology.
  - Objective 4D: Ensure that residents receive relief and are evacuated as quickly as possible in the event of a disaster.

6.3 IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES

Concerted efforts were made to ensure that the County and its municipalities developed updated mitigation strategies. Updated strategies included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance entitled *Local Mitigation Planning Handbook*. Mitigation action types listed in the FEMA guidance include the following:

1. **Local Plans and Regulations:** These actions include government authorities, policies, or codes that influence the way land and buildings are being developed and built.
2. **Structure and Infrastructure Projects:** These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. These project types could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct man-made structures to reduce the impact of hazards.
3. **Natural Systems Protection:** These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
4. **Education and Awareness Programs:** These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as NFIP and CRS, StormReady (NOAA) and Firewise (National Fire Protection Association [NFPA]) Communities (FEMA 2013).

The participants of the Mitigation Solutions Workshop and the Planning Team identified actions that relate to the techniques listed above. Table 6-2 identifies which mitigation techniques are applicable for the hazards included in the 2017 HMP.

Table 6-2. Mitigation Technique Matrix

Hazard	Local Plans and Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education and Awareness Programs
Drought	X		X	X
Earthquake	X	X	X	X
Extreme Temperatures	X		X	X
Flood, Flash Flood, and Ice Jam	X	X	X	X
Hailstorm	X	X		X
Invasive Species	X		X	X
Landslide	X	X	X	X
Lightning Strike	X	X		X
Pandemic Disease	X			X
Radon Exposure	X	X		X
Subsidence and Sinkholes	X	X	X	X
Tornadoes and Windstorms	X	X		X
Wildfires	X	X	X	X
Winter Storm	X	X		X
Dam Failures	X	X	X	X
Environmental Hazards	X		X	X
Levee Failure	X	X	X	X
Terrorism	X	X		X
Transportation Accidents	X	X		X
Utility Interruption	X	X		X

6.4 MITIGATION ACTION PLAN

Representatives from the County and all participating municipalities selected mitigation strategies and initiatives to pursue until the next plan update. These actions also include some actions identified during the 2012 update that are still relevant or in progress. This section describes 2017 mitigation initiatives, mitigation strategy prioritization and implementation, and prioritization of mitigation actions.

6.4.1 2017 Mitigation Initiatives

Table 6-3 summarizes the updated mitigation strategies identified by the County and all participating municipalities, including the following information:

- Mitigation actions for individual and multiple hazards
- Mitigation action type
- Department or agency primarily responsible for project initiation and/or implementation
- Estimated cost for the mitigation action, and identification of known or potential sources of funding
- Implementation schedule

- Implementation priority

Specific mitigation actions were identified to prevent future losses; however, current funding is not identified for all of these actions at present. The County and participating municipalities have limited resources to take on new responsibilities or projects. The implementation of these mitigation actions is dependent on the approval of the local elected governing body and the ability of the jurisdiction to obtain funding from local or outside sources.

In general, mitigation actions ranked as highest priorities will be addressed first. However, medium priority or low priority mitigation actions will be considered for concurrent implementation. Therefore, the ranking levels should be considered as a preliminary ranking, which will evolve based on prevailing priorities and discretion of local governments, the public, the Pennsylvania Emergency Management Agency (PEMA), and FEMA as the plan update is implemented.

Table 6-3. Hazard Mitigation Strategy

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-1	Disseminate informational pamphlets for County residents that explain the risks of hazards, outline precautionary measures that can be taken to help reduce the impacts of a disaster to themselves and their property, and emphasize the value of hazard mitigation.	New and Existing	All Hazards	1	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Low	EAP
BC-2	Develop an informational Web site with information on the hazards that can affect the County, how residents can protect themselves from a disaster, and mitigation actions the County and municipalities are taking to help reduce the risks.	New and Existing	All Hazards	1	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Two years	Low	EAP
BC-3	Cooperate with local media to produce regular public service announcements or news releases on hazard risk, safety, and the importance of mitigation.	New and Existing	All Hazards	1	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Low	EAP
BC-4	Utilize existing programs for school education programs on hazards, hazard safety, and mitigation.	New and Existing	All Hazards	1	County EMA cooperation with school districts' safe school committees.	Medium	In-House Staff Time	Staff time funded through existing local budgets; Pennsylvania Department of Education	Continuous	Med.	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-5	Disseminate informational pamphlets or mailings on hazard mitigation for property owners in the 1 percent annual chance floodplain or owners of repetitive-loss structures.	Existing	Flood, Flash Flood, and Ice Jams; Dam Failure; Levee Failure	1	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Med.	EAP
BC-6	Develop informational workshops on hazard risks and hazard mitigation for property owners in high-risk areas.	Existing	Flood, Flash Flood, and Ice Jams; Landslides; Subsidence and Sinkholes; Wildfires; Dam Failure; Environmental Hazards; Levee Failure; Transportation Accidents; Terrorism	1	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Low	EAP
BC-7	Investigate avenues for real estate disclosure for properties in 1 percent annual chance floodplain.	Existing	Flood, Flash Flood, and Ice Jams; Dam Failure; Levee Failure	1	Bedford County Planning Commission	Low	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Low	EAP
BC-8	Assist municipalities in developing policies and procedures related to hazard mitigation.	New and Existing	All Hazards	3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets; Pennsylvania Department of Community and Economic Development	Continuous	High	LPR

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-9	Encourage forest and vegetation management policies.	N/A	Extreme Temperature; Wildfires	2	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets; Pennsylvania Department of Community and Economic Development	Continuous	Med.	LPR
BC-10	Encourage urban forestry and landscape management policies.	N/A	Extreme Temperature; Wildfires	3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets; Pennsylvania Department of Community and Economic Development	Continuous	Med.	LPR
BC-11	Encourage best management practices.	New and Existing	All Hazards	3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets; Pennsylvania Department of Community and Economic Development	Continuous	High	LPR

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-12	Work with state and federal officials to enforce sediment and erosion control regulations.	N/A	Flood, Flash Flood, and Ice Jams; Landslides	3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets; Pennsylvania Department of Community and Economic Development; Pennsylvania Department of Environmental Protection	Continuous	Med.	LPR
BC-13	Work with state and federal officials to enforce stream dumping regulations.	N/A	Flood, Flash Flood, and Ice Jams; Dam Failure; Levee Failure	3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets; Pennsylvania Department of Environmental Protection	Continuous	Med.	NSP
BC-14	Work with state and federal officials to enforce wetlands development regulations.	N/A	All Hazards	3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets; Pennsylvania Department of Environmental Protection	Continuous	Med.	NSP
BC-15	Construct levees or floodwalls to protect communities with repetitive flooding problems.	Existing	Flood, Flash Flood, and Ice Jams; Dam Failure; Levee Failure	3	Bedford County Planning Commission	High	High	Pre-disaster Mitigation Grant; Hazard Mitigation Grant Program; U.S. Army Corps of Engineers	Five years	Low	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-16	Acquire properties in hazard areas, notably within the 1% annual chance floodplain, to convert them to open space or demolish and rebuild them.	Existing	Flood, Flash Flood, and Ice Jams; Landslides; Subsidence and Sinkholes; Wildfires; Dam Failure; Environmental Hazards; Levee Failure	2	Bedford County Planning Commission	High	High	Pre-disaster Mitigation Grant; Hazard Mitigation Grant Program; staff time through existing local budgets	Continuous	Low	LPR
BC-17	Elevate structures in hazard areas.	Existing	Flood, Flash Flood, and Ice Jams; Dam Failure; Levee Failure	2	Bedford County Planning Commission	High	High	Pre-disaster Mitigation Grant; Hazard Mitigation Grant Program; staff time through existing local budgets	Continuous	Low	SIP
BC-18	Regularly inspect and maintain bridges and culverts.	Existing	Flood, Flash Flood, and Ice Jams; Transportation Accidents; Terrorism	2	Respective County and Municipal Engineers	High	In-House Staff Time	Staff time funded through existing local budgets	Annually and after each disaster	Med.	SIP
BC-19	Develop a stream corridor restoration plan.	N/A	All Hazards	3	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Two years	Low	LPR
BC-20	Create, update, and maintain the County's GIS database and map of all critical facilities in the County.	New and Existing	All Hazards	2	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Two years	Low	LPR

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-21	Inspect critical facilities regularly to ensure they comply with standard codes and can withstand the impacts of a disaster.	Existing	All Hazards	2	Bedford County LEPC for SARA facilities; respective County and Municipal Engineers for others	High	In-House Staff Time	Staff time funded through existing local budgets	Annually	Med.	LPR
BC-22	Ensure that all critical facilities have updated emergency response plans.		All Hazards	2, 4	Municipal EMAs for municipal facilities; Bedford County EMA for others	High	In-House Staff Time	Staff time funded through existing local budgets; State Homeland Security Program funding through the South Central Mountains Regional Task Force	Continuous	Low	LPR
BC-23	Enforce floodplain development regulations.	New and Existing	Flood, Flash Flood, and Ice Jams	3	Municipal Codes Enforcement Officers	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	High	LPR
BC-24	Offer technical assistance to municipalities to develop, address, or enforce floodplain zoning, hillside development regulations, subdivision and development regulations, design review standards, and environmental review standards.	New and Existing	All Hazards	1, 3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	High	LPR

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-25	Acquire easements in hazard-prone areas, specifically 1 percent annual chance floodplains.	New and Existing	Earthquakes; Flood, Flash Flood, and Ice Jams; Landslides; Subsidence and Sinkholes; Wildfires; Dam Failure; Environmental Hazards; Levee Failure	3	Bedford County Planning Commission	High	Med.	Staff time through existing local budgets; Pennsylvania Department of Agriculture; Pennsylvania Department of Environmental Protection	Three years	Low	NSP
BC-26	Promote open space preservation.	N/A	Flood, Flash Flood, and Ice Jams; Landslides; Subsidence and Sinkholes; Wildfires; Dam Failure; Environmental Hazards; Levee Failure	3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Med.	NSP
BC-27	Promote natural resource planning.	N/A	All Hazards	3	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Med.	NSP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-28	Review, evaluate, and discuss designated growth areas in existing County and local plans to ensure development will occur out of hazard-prone areas.	New	Flood, Flash Flood, and Ice Jams; Landslides; Subsidence and Sinkholes; Wildfires; Dam Failure; Environmental Hazards; Levee Failure; Transportation Accidents	3	Bedford County Planning Commission; Municipal Planning Commissions	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	High	LPR
BC-29	Review planned infrastructure to ensure that it will be developed outside of hazard-prone areas.	New	Flood, Flash Flood, and Ice Jams; Landslides; Subsidence and Sinkholes; Wildfires; Dam Failure; Environmental Hazards; Levee Failure; Transportation Accidents	3	Bedford County Planning Commission; Municipal Planning Commissions	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Med.	LPR
BC-30	Recommend, encourage, and assist communities to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).	New and Existing	Flood, Flash Flood, and Ice Jams; Dam Failure; Levee Failure	1	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	High	LPR

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-31	Develop evacuation routes and an evacuation plan to be used in the event of a disaster.	N/A	Earthquakes; Flood, Flash Flood, and Ice Jams; Landslides; Lightning; Subsidence and Sinkholes; Tornadoes and Wind Storms; Wildfires; Winter Storms; Dam Failure; Environmental Hazards; Levee Failure; Transportation Accidents; Terrorism; Utility Interruptions	4	Bedford County EMA; Municipal EMAs	High	In-House Staff Time	Staff time funded through existing local budgets	Two years	Med.	LPR
BC-32	Encourage departments responsible for creating and storing data related to parcels, centerlines, buildings, addresses, hydrology, and hazards to develop and enforce data maintenance policies.	New and Existing	All Hazards	1	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Low	LPR
BC-33	Encourage the development of data-sharing policies and agreements between departments and organizations responsible for data creation, management, and use.	N/A	All Hazards	4	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Med.	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-34	Develop and maintain hazard occurrence databases to record information on hazards such as date and time of occurrence, duration of disaster, amount of damage, number of injuries, etc.	N/A	All Hazards	4	Bedford County EMA	High	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Low	LPR
BC-35	Develop detailed databases on parcels and buildings in and out of the 1 percent annual chance floodplain. The data could include first-floor elevations, number of stories, basements, value of structure, acreage of parcel in floodplain, etc.	Existing	Flood, Flash Flood, and Ice Jams	4	Bedford County Planning Commission	Medium	In-House Staff Time	Staff time funded through existing local budgets	Three years	Low	LPR
BC-36	Encourage the heads of each department or organization involved in emergency response, services, relief, or hazard mitigation to meet several times a year to discuss hazard mitigation.	N/A	All Hazards	4	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Med.	EAP
BC-37	Develop informational workshops or programs on hazard mitigation and available funding for organizations, departments, elected officials, and volunteers.	N/A	All Hazards	1	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	Two years	Low	EAP
BC-38	Disseminate informational brochures for organizations involved in emergency response.	N/A	All Hazards	1, 4	Bedford County EMA	Medium	In-House Staff Time	Staff time funded through existing local budgets	One year	Low	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-39	Inventory all available equipment and technology used for emergency response.	N/A	All Hazards	4	Bedford County EMA; Municipal EMAs	Medium	In-House Staff Time	Staff time funded through existing local budgets	Continuous	Low	EAP
BC-40	Continue to target and prioritize at-risk structures, and, if funding becomes available, perform acquisitions, demolitions, relocations, and/or elevations.	Existing	All Hazards	2	Bedford County EMA	High	In-House Staff Time	Staff time funded through existing local budgets	Two years	Med.	SIP
BC-41	Training conference on CSX rail issues scheduled for Bedford and Somerset Counties, covering roughly 80 miles of track.	N/A	Earthquake, Hailstorm, Landslide, Lightning Strike, Pandemic Disease, Radon Exposure, Subsidence and Sinkholes, Tornadoes and Windstorms, Wildfire, Winter Storm, Dam Failure, Environmental Hazards (Hazardous Materials), Levee Failure, Terrorism, Transportation Accidents, Utility Interruptions	4	County EMA	Medium	Low	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Short	Med.	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BC-42	Conduct a county-wide commodity flow study (CFS) looking at traffic patterns of commercial traffic carrying various hazardous substances. Apply for grant to accomplish CFS in 2018.	N/A	Environmental Hazards (Hazardous Materials); Terrorism; Transportation Accidents	4	County EMA, LEPC	Medium	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Med.	Med.	EAP
BC-43	Public outreach and education programs about burning trash and yard waste, and for PA Turnpike travelers who are affected by heavy snow. Winter Storm Jonas in 2016 shut down the PA Turnpike, and many people were temporarily sheltered in the Bedford High School.	N/A	Wildfire, Environmental Hazards (Hazardous Materials), Winter Storm	1	Bedford County Emergency Management	Medium	Low	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Short	Low	EAP
BC-44	Install backup generators at all critical facilities and personal care homes.	Existing	Earthquake, Tornadoes and Windstorms, Lightning Strike, Winter Storm, Utility Interruptions	4	Bedford County Emergency Management	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	SIP
BC-45	Conduct education and awareness programs for residents (to be able to identify meth labs and report them to emergency responders), for students, and for emergency responders. Dump sites along roadways are being contaminated by the chemicals used to produce meth.	N/A	Environmental Hazards (Hazardous Materials)	1	Bedford County Emergency Management	Medium	Low	FEMA [HMGP, FMA, PDM], CDBG, PEMA, County Department of Health	Short	Med.	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BB-1	South Side Storm Water Management Project – Stormwater management to reduce flash flooding in the southwestern portion of the Borough of Bedford and adjacent areas of Bedford Township. Install two (2) detention ponds and additional storm sewer pipes & catch basins plus upgrade existing storm sewer pipes & catch basins.	N/A	Flood, Flash Flood, and Ice Jam	2	Borough of Bedford & Bedford Township	Reduce damage to homes & property caused by flash flooding	$1.75 million	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Borough of Bedford & Bedford Township Operating Budgets	DOF	Low	SIP
BB-2	Project to remove fill in a section of the Raystown Branch of the Juniata River near the Bedford Township/Bedford Borough line.	Existing	Flood, Flash Flood, and Ice Jam	2	County, Bedford Borough, Bedford Township	Reduce flood risks of upstream residents as well as the Bedford Borough Wastewater Treatment Facility located adjacent to the fill site.	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	SIP
BF-1	Stormwater Management: Improve road surfaces/reduce run-off. Stabilize streambanks on Potter Creek Road – Rt. 866 to control flooding from stormwater.	Existing	Flood, Flash Flood, and Ice Jam	2	Bloomfield Township Highways/Public Works	Medium	$100K	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BT-1	South Side Stormwater Management Project - Install detention ponds and additional storm sewer pipe and catch basins in the southwest portion of township abutting Bedford Borough and adjacent areas of Bedford Borough. Also upgrade existing storm sewer pipe and catch basins.	New and Existing	Flood, Flash Flood, and Ice Jam	2	Bedford Township	Reduce damage to homes and property caused by flash flooding.	$2 million	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	SIP
BT-2	Remove fill in a section of the Raystown Branch of the Juniata River near the Bedford Township/Bedford Borough line.	Existing	Flood, Flash Flood, and Ice Jam	2	Bedford Township/Bedford Borough DPWs	Reduce flood risks of upstream residents as well as the Bedford Borough Wastewater Treatment Facility located adjacent to the fill site.	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	SIP
BT-3	Reduce vulnerability to flooding at Dutch Corner, located roughly between Business Route 220, and Evitts Mountain to the north and east. SR 220 and Evitts Mountain meet in the south close to Bedford Borough.	Existing	Flood, Flash Flood, and Ice Jam	2	Bedford Township Public Works	Medium	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	SIP
BT-4	Reduce vulnerability to flooding at Camp Sunshine.	Existing	Flood, Flash Flood, and Ice Jam	2	Juniata Township Public Works	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
BT-5	Reduce vulnerability to flooding at Camp Hughes, Briar Valley Rd. (1014) and Whispering Willow Lane. There are three camps, each one on a separate short road next to each other. Camp Hughes is on Leisure lane. Another is on Riverboat lane, and Camp Shaffer is on Whispering Willow Lane.	Existing	Flood, Flash Flood, and Ice Jam	2	Juniata Township Public Works	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	SIP
BT-6	Reduce vulnerability to flooding at Reynoldsdale Rd.(4019) in front of Bedford Reinforced Plastics (264 Reynoldsdale Rd.). The creek runs over in front of the plant and floods the roadway for about one half of a mile at times of heavy rain. 40 06 14.57 N 78 31 49.06 W	Existing	Flood, Flash Flood, and Ice Jam	2	Juniata Township Public Works	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	SIP
BtT-1	Coke Oven Bank Protection: Place rip rap along the south bank of Six Mile Run for approximately 500 feet to stabilize.	N/A	Flood	2	Short	Stabilize bank.	$50,000	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	1 year	Med.	SIP
CT-1	Improvements to Township Bridges: Clean debris from abutments and piers at Bridge #1 on T-373 over Cove Creek – structure is # 05 7204 0373 4001. Removal of the accumulation of foreign material.	Existing	Flood	2	Public Works	Reduce backup and flooding	$20,000	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Township funds	Short	Med.	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
CV-1	Obtain generator for water treatment plant – provide generator as a backup power source for the municipal water company that provides water for 40 customers in the Village of Centerville.	Existing	Earthquake, Tornadoes and Windstorms, Lightning Strike, Winter Storm, Utility Interruptions	4	Municipal Water Company	High	$3,000	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Short	High	SIP
EB-1	Bloody Run Project to reduce flooding and erosion along Bloody Run. 15 step project as outlined by the US Corps of Engineers.	Existing	Flood, Flash Flood, and Ice Jam	2	Borough Public Works; US Corps of Engineers	Reduce flooding and erosion along Bloody Run.	$250K	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	SIP
EB-2	Flood Protection: Address requirements to recertify levee.	Existing	Levee Failure, Flood, Flash Flood, and Ice Jam, Dam Failure	2	Everett Borough Manager	High	$4M+	FEMA [HMGP, FMA, PDM], CDBG, PEMA, USACE, Operating Budget	2 years	High	SIP
EP-1	Brush Creek Camp Ground & Trailer Park – clean trees and brush from Brush Creek.	Existing	Flood, Flash Flood, and Ice Jam	3	Public Works	Reduce flooding of the Crystal Spring Trailer Park.	TBD	Operating Budget	Short	High	NSP
ESC-1	Public Information Program: The Township will assist the County in its hazard mitigation public information program. The public will be educated on the resources available and on ways to help reduce the risk of disasters.	N/A	All Hazards	1	East St. Clair Township, County OEM	Medium	Low	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Short	Low	EAP
ESC-2	Reduce vulnerability to flooding at Salas Hills on State Route 56. Salas Hills is a private development of a few homes located just off of SR 56.	Existing	Flood, Flash Flood, and Ice Jam	2	East St. Clair Township Public Works	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
HB-1	Flood Protection: Certify Levees. Levees exist but are not certified.	Existing	Levee Failure, Flood, Flash Flood, and Ice Jam, Dam Failure	2	Hyndman Borough, PA DEP	High	$4M+	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	High	Low	SIP
HB-2	Address problem with trees growing in the middle of Wills Creek near the Dollar General Store in Hyndman. The area creates a narrowing of the stream channel and could be a big problem in high water solutions.	Existing	Flood	3	Hyndman Borough Public Works	Reduce backup and flooding	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	NSP
HB-3	Develop and implement a multi-faceted strategy to address the problems caused by inoperable trains blocking all crossings in Hyndman Borough. Options include: • Paving Pit Road and protecting it from being washed out when the creek is too high • Replacing the railroad overpass on Pit Road with a larger one • Changing the gate/fence at the sewage treatment plant • Constructing an overpass over the rail lines at the crossing of Schellsburg Street and/or Pennsylvania Avenue	Existing	Transportation Accidents	2, 3, 4	Hyndman Borough Public Works	Improved emergency response	Med.	Norfolk Southern Railroad, CDBG, PEMA, Operating Budget	DOF	High	SIP

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HT-1	Dry hydrants – install dry hydrants at five (5) ponds in the township: 2 on Milligans Cove Road, 1 on Route 96 south of Manns Choice, 1 on Powell Road, and 1 on Brant Hollow Road.	New	Wildfire	4	Township Public Works	Increase availability of water in case of fires.	Med.	Operating budget	DOF	High	SIP
JT-1	Repair/replace/install culverts. Remove debris from stream and install culvert/pipe.	New	Flood, Flash Flood, and Ice Jam	2	Juniata Township Public Works	Reduce debris buildup and flooding	$5,000	Liquid Fuels	Short	Low	SIP
JT-2	Reduce vulnerability to flooding at State Route 31 at the bottom of the mountain below New Baltimore, near the intersection of SR 31 (Allegheny Rd) and New Baltimore Rd. (Rt. 3012). Also, along SR 31 from 3021 to Cider Rd. the creek is very near and during heavy rains sometimes runs over its banks onto the road.	Existing	Flood, Flash Flood, and Ice Jam	2	Juniata Township Public Works	Medium	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	SIP
KT-1	Emergency Shelter Generator: Purchase generator for community center/emergency shelter in case of power outage.	Existing	Earthquake, Tornadoes and Windstorms, Lightning Strike, Winter Storm, Utility Interruptions	4	Kimmel Township	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, County, Township Operating Budget	Short	Med.	SIP
KT-2	Clear stream banks: Clean stream banks to help reduce debris buildup that can cause flooding.	Existing	Flood, Flash Flood, and Ice Jam	3	Kimmel Township Public Works	Reduce debris buildup and flooding	Low	FEMA [HMGP, FMA, PDM], PEMA, Operating Budget	Short	Med.	NSP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
LT-1	Reduce vulnerability to flooding at Creek Road, 2nd Avenue, and Cooks Mill Road (Rt. 3001). There is an area of about two miles where the creek comes close to the road off and on.	Existing	Flood, Flash Flood, and Ice Jam	2	Londonderry Township Public Works	Medium	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	SIP
MC-1	Reduce speed limit on Rt. 31 as it crosses through Manns Choice Borough and Harrison Township from 45 mph to 35 mph.	N/A	Transportation Accidents	3	Manns Choice Borough	Reduce pedestrian and vehicular accidents	Low	Operating Budget	Short	Low	LPR
MrT-1	Road Berm Stabilization: Dig out dirt road berms and replace with blacktop.	Existing	Flood, Flash Flood, and Ice Jam	2	Monroe Township Public Works	High	$100K	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	SIP
MT-1	Stabilize bridge abutments: install gabian baskets as retaining walls to sure up abutments and keep water from undermining wingwalls and bridge footers. This is to be done on all bridges in the township. Also place rip rap to stabilize stream banks.	Existing	Flood, Flash Flood, and Ice Jam	2	Mann Township Highway Department/Department of Public Works	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	SIP
PB-1	Community Warning System: Develop a community warning system to notify residents of a potential danger in case of an accident on Rt. 56 involving a tractor trailer hauling hazardous waste.	N/A	Environmental Hazards (Hazardous Materials), Transportation Accidents	4	Pleasantville Borough	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Long	Low	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
PT-1	Stream Clearing: Clear debris from stream and reinforce streambeds of Bobs Creek. Clearing away fallen trees and other debris from the stream and reinforcing the streambeds will help reduce flooding along Bobs Creek.	Existing	Flood, Flash Flood, and Ice Jam	2	Pavia Township Public Works	Reduce flooding along Bobs Creek	Low	County, Pavia Township Operating Budget	Short	Med.	NSP
RB-1	Sewer Project: Install catch basins or ponds to collect rain waters to reduce flooding during heavy rains that cause sewage backup. Rain water would be contained to reduce flooding during heavy rains that is causing sewage backup.	New	Flood, Flash Flood, and Ice Jam	2	Rainsburg Borough Public Works	Reduce flooding during heavy rains that cause sewage backup	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Short	Low	SIP
SC-1	Main St. Improvement Project: Improve road surfaces on Main Street in St. Clairsville Borough. Improve and install culverts to allow water to drain better. Prevent erosion due to heavy rains.	Existing	Flood, Flash Flood, and Ice Jam	2	St. Clairsville Borough Highways/Public Works	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Short	Med.	SIP
SS-1	Develop and implement traffic control measures at CVS at the King Buffet, US-30 in front of Walmart, and the US-30 Bypass at Sunnyside.	Existing	Transportation Accidents	3	Snake Spring Township Highways/Public Works	Medium	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Med.	LPR

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ST-1	Junkyard in floodplain: Acquisition & Conversion—Purchase and clean up junkyard. Remove salvage to recycler. Dig up and dispose of contaminated soil. Dispose of drums of oil and antifreeze. Turn floodplain area into green space/playground.	Existing	Flood, Flash Flood, and Ice Jam, Environmental Hazards (Hazardous Materials)	2	Southampton Township Supervisors	High	$750K	FEMA [HMGP, FMA, PDM], CDBG, PEMA, General Township Funds	Long	Low	SIP
SW-1	Public Participation Program: Assist Bedford County in a public information program on hazards and hazard mitigation. Educate the citizens of Bedford County about their risks of disasters and measures they can take to try and improve these risks.	N/A	All hazards	1	South Woodbury Township, County OEM	Medium	Low	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Short	Low	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
WB-1	Emergency Alert System – Erect an emergency warning siren. The siren will alert residents of an impending emergency.	New	Flood, Flash Flood, and Ice Jam, Tornadoes and Windstorms, Wildfire, Winter Storm, Dam Failure, Environmental Hazards (Hazardous Materials), Levee Failure, Terrorism, Transportation Accidents, Utility Interruptions	4	Woodbury Borough EMA	High	$10,000	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget/General Fund or loan	Short	Low	EAP
WP-1	Crawford Road: Widen roadway to improve site distance and reconstruct drainage system. Improve the quality of stormwater run-off, reduce silt or sediment amount, and reduce quantity of run-off.	Existing	Flood, Flash Flood, and Ice Jam	2	DPW	High	$20,000	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	DOF	Low	SIP
WP-2	Install backup generators at Township facilities.	Existing	Earthquake, Tornadoes and Windstorms, Lightning Strike, Winter Storm, Utility Interruptions	4	West Providence Township Public Works	High	Med.	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Short	Med.	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead and Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority***	Mitigation Category
WS-1	Stream/Floodwall Improvement – Stream improvement with new floodwall. Cement floodwall placed along stream after 1977 and 1983 flooding is breaking away.	Existing	Flood, Flash Flood, and Ice Jam	2	West St. Clairsville Township/Borough Public Works	High	Med.-High	FEMA [HMGP, FMA, PDM], CDBG, PEMA, Operating Budget	Long	Low	SIP

Notes:
* The letters associated with the initiative number indicate the lead agency (i.e., County or municipality
** Does this mitigation initiative reduce the effects of hazards on new and/or existing buildings and/or infrastructure? Not applicable (N/A) is inserted if this does not apply.
*** Priority indicates the prioritization identified by the lead agency. This may differ from the County prioritization on municipal actions because the municipal priority may be of higher ranking than the PA-STEEL/County priority. Further explanations are provided at the end of this section.

CDBG = Community Development Block Grant
CRS = Community Rating System
EAP = Education and Awareness Program
FEMA = Federal Emergency Management Agency
GIS = Geographic information system
HMA = Hazard Mitigation Assistance
NFIP = National Flood Insurance Program
PDM = Pre-Disaster Mitigation Program
PEMA = Pennsylvania Emergency Management Agency
TBD = To Be Determined

Costs:
These rough estimates should be used where actual project costs cannot reasonably be established at this time:

Low = < $10,000
Medium = $10,000 to $100,000
High = > $100,000

Potential FEMA HMA Funding Sources:
DOF = Depending on funding
FMA = Flood Mitigation Assistance Grant Program
HMGP = Hazard Mitigation Grant Program
PDM = Pre-Disaster Mitigation Grant Program
RFC = Repetitive Flood Claims Grant Program
SRL = Severe Repetitive Loss Grant Program

Timeline:
Short Term = 1 to 5 years. Long-Term = 5 years or greater. OG = Ongoing program.

Priority:
H = High
M = Medium
L = Low

Mitigation Category:
Education and Awareness Programs (EAP) = These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities.
Local Plans and Regulations (LPR) = These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
Natural Systems Protection (NSP) = These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
Structure and Infrastructure Project (SIP) = These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct man-made structures to reduce the impact of hazards.

6.4.2 Mitigation Strategy Prioritization and Implementation

Section 201.6© (3) (iii) of Title 44 Code of Federal Regulations (44 CFR) requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost-benefit review of the proposed projects and their associated costs. This allows the jurisdictions to select the most cost-effective actions for implementation first, not only to use resources efficiently, but also to make a realistic start toward mitigating risks.

Mitigation benefits are defined as future damages and losses that would be eliminated and/or reduced by implementing the proposed mitigation project and include physical damage to structures and infrastructure, loss of service or function, and emergency management costs. Particularly for physical ("shovel-in-the-ground") mitigation projects, jurisdictions were encouraged to estimate project costs as well as to identify the anticipated benefits. Where exact project costs and potential benefits were not available, ranges were identified (high, medium, low) for each, allowing a qualitative evaluation of project cost-effectiveness.

The PA-STEEL methodology is defined in Pennsylvania's All-Hazard Planning SOG (October 2013), pages 36-37 and Appendix 12, "Mitigation Strategy Action Evaluation," as the Political, Administrative, Social, Technical, Economic, Environmental, and Legal (PA-STEEL) opportunities and constraints of implementing a particular mitigation action in a jurisdiction. The PA-STEEL method provides a uniform approach for counties and jurisdictions to use to consider, in a systematic way, the best mitigation strategies for their communities. The following provides a brief discussion of each of the PA-STEEL evaluation criteria, excerpted from the FEMA 386 mitigation planning guidance:

- **Political:** Understanding current opinions of community and state political leadership regarding issues related to the environment, economic development, safety, and emergency management will provide valuable insight into the level of political support offered for mitigation activities and programs. Proposed mitigation objectives sometimes fail because of a lack of political acceptability.
- **Administrative:** Under this part of the evaluation criteria, the Hazard Mitigation Working Group examines the anticipated staffing, funding, and maintenance requirements for the mitigation action to determine whether the jurisdiction has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary.
- **Social:** The public must support the overall implementation strategy and specific mitigation actions. Therefore, the projects have to be evaluated in terms of community acceptance.
- **Technical:** It is important to determine whether the proposed action is technically feasible, will help to reduce losses in the long term, and has minimal secondary impacts. Here, the Hazard Mitigation Working Group determines whether the alternative action is a whole solution, a partial solution, or not a solution at all.
- **Economic:** Every local, state, and tribal government experiences budget constraints at one time or another. Cost-effective mitigation actions that can be funded in current or upcoming budget cycles are much more likely to be implemented than mitigation actions requiring general obligation bonds or other instruments that would incur long-term debt to a community. States and local communities with tight budgets or budget shortfalls may be more willing to undertake a mitigation initiative if it can be funded, at least in part, by outside sources. "Big ticket" mitigation actions, such as large-scale acquisition and relocation, are often considered for implementation in a post-disaster scenario when additional federal and state funding for mitigation is available. Economic considerations must include the present economic base and projected growth.
- **Environmental:** Impact on the environment is an important consideration because of public desire for sustainable and environmentally healthy communities. In addition, many statutory considerations, such as the National Environmental Policy Act (NEPA), should be counted when using federal funds. When implementing mitigation actions, jurisdictions need to evaluate whether the potential negative

consequences to environmental assets such as threatened and endangered species, wetlands, and other protected natural resources are worth the benefit of the actions.

- **Legal:** Without the appropriate legal authority, the action cannot lawfully be undertaken. When considering this criterion, the Hazard Mitigation Working Group determines whether (1) the jurisdiction has the legal authority at the state, tribal, or local level to implement the action or (2) the jurisdiction must pass new laws or regulations. Each level of government operates under a specific source of delegated authority. As a general rule, most local governments operate under enabling legislation that gives them the power to engage in different activities. Jurisdictions should identify the unit of government undertaking the mitigation action and include an analysis of the inter-relationships between local, regional, state, and federal governments. Legal authority is likely to have a significant role later in the process when the state, tribe, or community determines the ways in which mitigation activities can best be carried out and the extent to which mitigation policies and programs can be enforced (PEMA 2013).

Municipal and County-level mitigation actions were evaluated and prioritized primarily using the PA-STEEL methodology. Table 6-4 includes the completed PA-STEEL action evaluation table for the updated mitigation strategies (listed in Table 6-3).

In accordance with the PEMA SOG, the mitigation strategy evaluation through the PA-STEEL methodology also summarizes the feasibility factors for each action and summarizes the factors with benefits and costs weighed more heavily and, therefore given greater priority. Using cost-benefit weighted prioritization, mitigation actions were ranked as high, medium, or low priority actions.

Other factors beyond the PA-STEEL numeric rankings may have to be considered during project prioritization. For example, a project might be designated medium priority because of the uncertainty of a funding source. This priority could be changed to high priority once a funding source (such as a grant) has been identified.

Table 6-4. Analysis of Mitigation Actions

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
BC-1	Disseminate informational pamphlets for County residents that explain the risks of hazards, outline precautionary measures that can be taken to help reduce the impacts of a disaster to themselves and their property, and emphasize the value of hazard mitigation.	+	+	+	-	+	+	+	+	+	+	N	+	+	N	+	N	N	N	N	+	+	+	+	16 (+) 6 (N) 1 (-)	20 (+) 6 (N) 1 (-)
BC-2	Develop an informational Web site with information on the hazards that can affect the County, how residents can protect themselves from a disaster, and mitigation actions the County and municipalities are taking to help reduce the risks.	+	+	+	-	+	+	+	+	+	+	+	+	+	N	+	N	N	N	N	+	N	+	N	15 (+) 7 (N) 1 (-)	19 (+) 7 (N) 1 (-)
BC-3	Cooperate with local media to produce regular public service announcements or news releases on hazard risk, safety, and the importance of mitigation.	+	+	+	-	+	+	+	+	+	+	+	+	-	+	+	N	N	N	N	+	N	+	+	16 (+) 5 (N) 2 (-)	18 (+) 5 (N) 4 (-)
BC-4	Utilize existing programs for school education programs on hazards, hazard safety, and mitigation.	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	N	N	N	N	+	+	+	+	18 (+) 5 (N) 0 (-)	22 (+) 6 (N) 0 (-)
BC-5	Disseminate informational pamphlets or mailings on hazard mitigation for property owners in the 1 percent annual chance floodplain or owners of repetitive-loss structures.	+	+	+	+	+	+	+	+	+	+	N	+	+	N	+	N	N	N	N	+	+	+	+	17 (+) 6 (N) 0 (-)	21 (+) 6 (N) 0 (-)
BC-6	Develop informational workshops on hazard risks and hazard mitigation for property owners in high-risk areas.	+	+	+	-	+	+	+	+	+	+	N	+	+	N	+	N	N	N	N	+	+	+	+	16 (+) 6 (N) 1 (-)	20 (+) 6 (N) 1 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
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BC-7	Investigate avenues for real estate disclosure for properties in 1 percent annual chance floodplain.	+	+	+	-	+	+	+	+	+	+	N	+	+	+	+	N	N	N	N	+	+	+	+	17 (+) 5 (N) 1 (-)	21 (+) 5 (N) 1 (-)
BC-8	Assist municipalities in developing policies and procedures related to hazard mitigation.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	23 (+) 0 (N) 0 (-)	27 (+) 0 (N) 0 (-)
BC-9	Encourage forest and vegetation management policies.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	22 (+) 1 (N) 0 (-)	26 (+) 1 (N) 0 (-)
BC-10	Encourage urban forestry and landscape management policies.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	22 (+) 1 (N) 0 (-)	26 (+) 1 (N) 0 (-)
BC-11	Encourage best management practices.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	23 (+) 0 (N) 0 (-)	27 (+) 0 (N) 0 (-)
BC-12	Work with state and federal officials to enforce sediment and erosion control regulations.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	22 (+) 1 (N) 0 (-)	26 (+) 1 (N) 0 (-)
BC-13	Work with state and federal officials to enforce stream dumping regulations.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	22 (+) 1 (N) 0 (-)	26 (+) 1 (N) 0 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
BC-14	Work with state and federal officials to enforce wetlands development regulations.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	22 (+) 1 (N) 0 (-)	26 (+) 1 (N) 0 (-)
BC-15	Construct levees or floodwalls to protect communities with repetitive flooding problems.	+	+	+	-	-	-	+	+	+	+	+	+	-	+	-	+	N	+	-	+	+	+	+	16 (+) 1 (N) 6 (-)	18 (+) 1 (N) 8 (-)
BC-16	Acquire properties in hazard areas, notably within the 1% annual chance floodplain, to convert them to open space or demolish and rebuild them.	+	+	+	-	-	+	+	+	+	+	+	+	-	+	-	N	N	N	N	+	+	+	+	15 (+) 4 (N) 4 (-)	17 (+) 4 (N) 6 (-)
BC-17	Elevate structures in hazard areas.	+	+	+	-	-	+	+	+	+	+	N	+	-	+	-	N	N	N	N	+	+	+	+	14 (+) 5 (N) 4 (-)	16 (+) 5 (N) 6 (-)
BC-18	Regularly inspect and maintain bridges and culverts.	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	N	N	N	N	+	+	+	+	18 (+) 5 (N) 0 (-)	22 (+) 5 (N) 0 (-)
BC-19	Develop a stream corridor restoration plan.	+	+	+	-	-	+	+	+	+	+	+	+	+	N	-	+	+	N	+	+	+	+	+	18 (+) 2 (N) 3 (-)	22 (+) 2 (N) 3 (-)
BC-20	Create and maintain a database and map of all critical facilities in the County.	+	+	+	+	+	+	+	+	+	+	+	+	+	N	-	N	N	N	N	+	+	+	+	17 (+) 5 (N) 1 (-)	21 (+) 5 (N) 1 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
BC-21	Inspect critical facilities regularly to ensure they comply with standard codes and can withstand the impacts of a disaster.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	N	N	N	+	+	+	+	19 (+) 4 (N) 0 (-)	23 (+) 4 (N) 0 (-)
BC-22	Ensure that all critical facilities have updated emergency response plans.	+	+	+	-	-	+	+	+	+	+	+	+	+	N	-	N	N	N	N	+	+	+	+	15 (+) 5 (N) 3 (-)	19 (+) 5 (N) 3 (-)
BC-23	Enforce floodplain development regulations.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	23 (+) 0 (N) 0 (-)	27 (+) 0 (N) 0 (-)
BC-24	Offer technical assistance to municipalities to develop, address, or enforce floodplain zoning, hillside development regulations, subdivision and development regulations, design review standards, and environmental review standards.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	23 (+) 0 (N) 0 (-)	27 (+) 0 (N) 0 (-)
BC-25	Acquire easements in hazard-prone areas, specifically 1 percent annual chance floodplains.	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	+	+	N	+	+	+	+	+	19 (+) 1 (N) 3 (-)	21 (+) 1 (N) 5 (-)
BC-26	Promote open space preservation.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	22 (+) 1 (N) 0 (-)	26 (+) 1 (N) 0 (-)
BC-27	Promote natural resource planning.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	22 (+) 1 (N) 0 (-)	26 (+) 1 (N) 0 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
BC-28	Review, evaluate, and discuss designated growth areas in existing County and local plans to ensure development will occur out of hazard-prone areas.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	23 (+) 0 (N) 0 (-)	27 (+) 0 (N) 0 (-)
BC-29	Review planned infrastructure to ensure that it will be developed outside of hazard-prone areas.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	N	+	+	+	+	+	+	21 (+) 2 (N) 0 (-)	25 (+) 2 (N) 0 (-)
BC-30	Recommend, encourage, and assist communities to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	23 (+) 0 (N) 0 (-)	27 (+) 0 (N) 0 (-)
BC-31	Develop evacuation routes and an evacuation plan to be used in the event of a disaster.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	N	N	N	+	+	+	+	19 (+) 4 (N) 0 (-)	23 (+) 4 (N) 0 (-)
BC-32	Encourage departments responsible for creating and storing data related to parcels, centerlines, buildings, addresses, hydrology, and hazards to develop and enforce data maintenance policies.	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+	N	N	N	N	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
BC-33	Encourage the development of data-sharing policies and agreements between departments and organizations responsible for data creation, management, and use.	+	+	+	+	+	+	+	+	+	+	+	+	+	N	+	N	N	N	N	+	+	+	+	18 (+) 5 (N) 0 (-)	22 (+) 5 (N) 0 (-)
BC-34	Develop and maintain hazard occurrence databases to record information on hazards such as date and time of occurrence, duration of disaster, amount of damage, number of injuries, etc.	+	+	+	-	+	-	+	+	+	+	+	+	+	+	+	N	N	N	N	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
BC-35	Develop detailed databases on parcels and buildings in and out of the 1 percent annual chance floodplain. The data could	+	+	+	-	-	-	+	+	+	+	+	+	-	+	-	N	N	N	N	+	+	+	+	14 (+) 4 (N)	16 (+) 4 (N)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
	include first-floor elevations, number of stories, basements, value of structure, acreage of parcel in floodplain, etc.																								5 (-)	7 (-)
BC-36	Encourage the heads of each department or organization involved in emergency response, services, relief, or hazard mitigation to meet several times a year to discuss hazard mitigation.	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	N	N	N	N	+	+	+	+	18 (+) 4 (N) 1 (-)	22 (+) 4 (N) 1 (-)
BC-37	Develop informational workshops or programs on hazard mitigation and available funding for organizations, departments, elected officials, and volunteers.	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	N	N	N	N	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
BC-38	Disseminate informational brochures for organizations involved in emergency response.	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	N	N	N	N	+	+	+	+	16 (+) 4 (N) 3 (-)	18 (+) 4 (N) 5 (-)
BC-39	Inventory all available equipment and technology used for emergency response.	+	+	+	-	+	+	+	+	+	+	+	+	+	+	-	N	N	N	N	+	+	+	+	17 (+) 2 (N) 4 (-)	19 (+) 2 (N) 6 (-)
BC-40	Continue to target and prioritize at-risk structures, and, if funding becomes available, perform acquisitions, demolitions, relocations, and/or elevations.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	N	N	+	+	+	+	+	20 (+) 3 (N) 0 (-)	24 (+) 3 (N) 0 (-)
BC-41	Training conference on CSX rail issues scheduled for Bedford and Somerset Counties, covering roughly 80 miles of track.	+	+	+	+	+	+	+	+	+	-	-	+	+	+	N	N	N	+	+	+	+	+	+	18 (+) 3 (N) 2 (-)	22 (+) 3 (N) 2 (-)
BC-42	Conduct a county-wide commodity flow study (CFS) looking at traffic patterns of commercial traffic carrying various hazardous substances. Apply for grant to accomplish CFS in 2018.	+	+	+	-	-	+	+	+	+	+	+	+	+	+	-	+	N	+	+	+	+	+	+	19 (+) 1 (N) 3 (-)	23 (+) 1 (N) 3 (-)

No.	Name	P Political: Political Support	P Political: Local Champion	P Political: Public Support	A Administrative: Staffing	A Administrative: Funding Allocation	A Administrative: Maintenance/Operations	S Social: Community Acceptance	S Social: Effect on Segment of Population	T Technical: Technically Feasible	T Technical: Long-Term Solution	T Technical: Secondary Impacts	E Economic: Benefit of Action (x3)	E Economic: Cost of Action (x3)	E Economic: Contributes to Economic Goals	E Economic: Outside Funding Required	E Environmental: Effect on Land/Water	E Environmental: Effect on Endangered Species	E Environmental: Effect on HazMat/Waste Site	E Environmental: Consistent with Community Environmental Goals	E Environmental: Consistent with Federal Laws	L Legal: State Authority	L Legal: Existing Local Authority	L Legal: Potential Legal Challenge	Results: Summary (Equal Weighing)	Results: Summary (Priority Ranking)
BC-43	Public outreach and education programs about burning trash and yard waste, and for PA Turnpike travelers who are affected by heavy snow. Winter Storm Jonas in 2016 shut down the PA Turnpike, and many people were temporarily sheltered in the Bedford High School.	+	+	+	-	-	+	+	+	+	+	+	+	+	+	-	N	N	N	+	+	N	+	+	16 (+) 4 (N) 3 (-)	20 (+) 4 (N) 3 (-)
BC-44	Install backup generators at all critical facilities and personal care homes.	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-	N	N	N	N	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
BC-45	Conduct education and awareness programs for residents (to be able to identify meth labs and report them to emergency responders), for students, and for emergency responders. Dump sites along roadways are being contaminated by the chemicals used to produce meth.	+	+	+	-	-	-	+	+	+	+	+	+	+	N	+	+	N	+	+	+	+	+	+	18 (+) 2 (N) 3 (-)	22 (+) 2 (N) 3 (-)
BB-1	South Side Storm Water Management Project - Stormwater management to reduce flash flooding in the southwestern portion of the Borough of Bedford and adjacent areas of Bedford Township. Install two (2) detention ponds and additional storm sewer pipes & catch basins plus upgrade existing storm sewer pipes & catch basins. Reduce damage to homes & property caused by flash flooding.	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	+	N	N	+	+	+	+	+	18 (+) 2 (N) 3 (-)	20 (+) 2 (N) 5 (-)
BB-2	Project to remove fill in a section of the Raystown Branch of the Juniata River near the Bedford Township/Bedford Borough line to reduce flood risks of upstream residents as well as the Bedford Borough Wastewater Treatment Facility located adjacent to the fill site.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	N	+	+	+	+	+	+	20 (+) 1 (N) 2 (-)	24 (+) 1 (N) 2 (-)

Mitigation Action — PA-STEEL CRITERIA CONSIDERATIONS: (+) Favorable (-) Less favorable (N) Not Applicable

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
BF-1	Stormwater Management: Improve road surfaces/reduce run-off. Stabilize streambanks on Potter Creek Road – Rt. 866 to control flooding from stormwater.	+	+	+	+	-	+	+	N	+	+	N	+	+	+	-	+	N	N	+	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
BT-1	South Side Stormwater Management Project - Install detention ponds and additional storm sewer pipe and catch basins in the southwest portion of township abutting Bedford Borough and adjacent areas of Bedford Borough. Also upgrade existing storm sewer pipe and catch basins. Reduce damage to homes and property caused by flash flooding.	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	+	N	N	+	+	+	+	+	18 (+) 2 (N) 3 (-)	20 (+) 2 (N) 5 (-)
BT-2	Remove fill in a section of the Raystown Branch of the Juniata River near the Bedford Township/Bedford Borough line to reduce flood risks of upstream residents as well as the Bedford Borough Wastewater Treatment Facility located adjacent to the fill site.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	N	+	+	+	+	+	+	20 (+) 1 (N) 2 (-)	24 (+) 1 (N) 2 (-)
BT-3	Reduce vulnerability to flooding at Dutch Corner, located roughly between Business Route 220, and Evitts Mountain to the north and east. SR 220 and Evitts Mountain meet in the south close to Bedford Borough.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	N	N	+	+	+	+	+	19 (+) 2 (N) 2 (-)	23 (+) 2 (N) 2 (-)
BT-4	Reduce vulnerability to flooding at Camp Sunshine.	+	+	+	+	-	+	-	+	+	+	N	+	+	+	-	N	N	N	N	+	+	+	+	15 (+) 5 (N) 3 (-)	19 (+) 5 (N) 3 (-)
BT-5	Reduce vulnerability to flooding at Camp Hughes, Briar Valley Rd. (1014) and Whispering Willow Lane. There are three camps, each one on a separate short road next to each other. Camp Hughes is on Leisure lane. Another is on Riverboat lane, and Camp Shaffer is on Whispering Willow Lane.	+	+	+	+	-	+	-	+	+	+	N	+	+	+	-	N	N	N	N	+	+	+	+	15 (+) 5 (N) 3 (-)	19 (+) 5 (N) 3 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
BT-6	Reduce vulnerability to flooding at Reynoldsdale Rd.(4019) in front of Bedford Reinforced Plastics (264 Reynoldsdale Rd.). The creek runs over in front of the plant and floods the roadway for about one half of a mile at times of heavy rain. 40 06 14.57 N 78 31 49.06 W.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	N	N	+	+	+	+	+	19 (+) 2 (N) 2 (-)	23 (+) 2 (N) 2 (-)
BtT-1	Coke Oven Bank Protection: Place rip rap along the south bank of Six Mile Run for approximately 500 feet to stabilize.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	N	N	+	+	+	+	+	19 (+) 2 (N) 2 (-)	23 (+) 2 (N) 2 (-)
CT-1	Improvements to Township Bridges: Clean debris from abutments and piers at Bridge #1 on T-373 over Cove Creek – structure is # 05 7204 0373 4001. Removal of the accumulation of foreign material.	+	+	+	+	+	+	+	+	+	+	N	+	+	N	-	N	N	N	+	+	+	+	+	17 (+) 5 (N) 1 (-)	21 (+) 5 (N) 1 (-)
CV-1	Obtain generator for water treatment plant – provide generator as a backup power source for the municipal water company that provides water for 40 customers in the Village of Centerville.	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-	N	N	N	N	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
EB-1	Bloody Run Project to reduce flooding and erosion along Bloody Run. 15 step project as outlined by the US Corps of Engineers to reduce flooding and erosion along Bloody Run.	+	+	+	-	-	+	+	+	+	+	N	+	-	+	-	+	N	N	+	+	+	+	+	16 (+) 3 (N) 4 (-)	18 (+) 3 (N) 6 (-)
EB-2	Flood Protection: Address requirements to recertify levee.	+	+	+	+	-	-	+	+	+	+	-	+	-	+	-	N	N	N	N	+	+	+	+	14 (+) 4 (N) 5 (-)	16 (+) 4 (N) 7 (-)
EP-1	Brush Creek Camp Ground & Trailer Park – clean trees and brush from Brush Creek. Reduce flooding of the Crystal Spring Trailer Park.	+	+	+	+	+	-	+	+	+	+	N	+	+	N	+	+	N	N	+	+	+	+	+	28 (+) 4 (N) 1 (-)	32 (+) 4 (N) 1 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable: P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal			Results	
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
ES C-1	Public Information Program: The Township will assist the County in its hazard mitigation public information program. The public will be educated on the resources available and on ways to help reduce the risk of disasters.	+	+	+	-	+	-	+	+	+	+	N	+	+	N	+	N	N	N	N	+	+	+	+	15 (+) 6 (N) 2 (-)	19 (+) 6 (N) 2 (-)
ES C-2	Reduce vulnerability to flooding at Salas Hills on State Route 56. Salas Hills is a private development of a few homes located just off of SR 56.	+	+	+	+	-	+	-	+	+	+	N	+	+	+	-	N	N	N	N	+	+	+	+	15 (+) 5 (N) 3 (-)	19 (+) 5 (N) 3 (-)
HB-1	Flood Protection: Certify Levees. Levees exist but are not certified.	+	+	+	-	-	-	+	+	+	+	+	+	-	+	-	N	N	N	N	+	+	+	+	14 (+) 4 (N) 5 (-)	16 (+) 4 (N) 7 (-)
HB-2	Address problem with trees growing in the middle of Wills Creek near the Dollar General Store in Hyndman. The area creates a narrowing of the stream channel and could be a big problem in high water solutions.	+	+	+	-	-	-	+	N	+	+	N	+	+	+	-	+	N	N	+	+	+	+	+	15 (+) 4 (N) 4 (-)	19 (+) 4 (N) 4 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
HB-3	Develop and implement a multi-faceted strategy to address the problems caused by inoperable trains blocking all crossings in Hyndman Borough. Options include: • Paving Pit Road and protecting it from being washed out when the creek is too high • Replacing the railroad overpass on Pit Road with a larger one • Changing the gate/fence at the sewage treatment plant • Constructing an overpass over the rail lines at the crossing of Schellsburg Street and/or Pennsylvania Avenue	+	+	+	-	-	+	+	+	+	+	+	+	-	-	-	-	N	N	N	+	+	+	-	13 (+) 3 (N) 5 (-)	15 (+) 3 (N) 7 (-)
HT-1	Dry hydrants – install dry hydrants at five (5) ponds in the township: 2 on Milligans Cove Road, 1 on Route 96 south of Manns Choice, 1 on Powell Road, and 1 on Brant Hollow Road. Increase availability of water in case of fires.	+	+	+	+	-	-	+	+	+	+	N	+	+	+	-	N	N	N	N	+	+	+	+	15 (+) 5 (N) 3 (-)	19 (+) 5 (N) 3 (-)
JT-1	Repair/replace/install culverts – remove debris from stream and install culvert/pipe.	+	+	+	+	+	+	+	N	+	+	N	+	+	+	+	+	N	N	+	+	+	+	+	19 (+) 4 (N) 0 (-)	23 (+) 4 (N) 0 (-)
JT-2	Reduce vulnerability to flooding at State Route 31 at the bottom of the mountain below New Baltimore, near the intersection of SR 31 (Allegheny Rd) and New Baltimore Rd. (Rt. 3012). Also, along SR 31 from 3021 to Cider Rd. the creek is very near and during heavy rains sometimes runs over its banks onto the road.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	N	N	+	+	+	+	+	19 (+) 2 (N) 2 (-)	23 (+) 2 (N) 2 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
KT-1	Emergency Shelter Generator: Purchase generator for community center/emergency shelter in case of power outage.	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-	N	N	N	N	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
KT-2	Clear stream banks: Clean stream banks to help reduce debris buildup that can cause flooding.	+	+	+	+	+	-	+	N	+	+	N	+	+	+	+	+	N	N	+	+	+	+	+	18 (+) 4 (N) 1 (-)	22 (+) 4 (N) 1 (-)
LT-1	Reduce vulnerability to flooding at Creek Road, 2nd Avenue, and Cooks Mill Road (Rt. 3001). There is an area of about two miles where the creek comes close to the road off and on.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	N	N	+	+	+	+	+	19 (+) 2 (N) 2 (-)	23 (+) 2 (N) 2 (-)
MC-1	Reduce speed limit on Rt. 31 as it crosses through Manns Choice Borough and Harrison Township from 45 mph to 35 mph.	+	+	+	N	+	+	+	+	+	+	+	+	+	+	+	N	N	N	N	+	-	-	+	16 (+) 5 (N) 2 (-)	20 (+) 5 (N) 2 (-)
Mr T-1	Road Berm Stabilization: Dig out dirt road berms and replace with blacktop.	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	N	N	N	+	+	+	+	+	17 (+) 3 (N) 3 (-)	21 (+) 3 (N) 5 (-)
MT-1	Stabilize bridge abutments: install gabian baskets as retaining walls to sure up abutments and keep water from undermining wingwalls and bridge footers. This is to be done on all bridges in the township. Also place rip rap to stabilize stream banks.	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	N	N	N	+	+	+	+	+	17 (+) 3 (N) 3 (-)	21 (+) 3 (N) 5 (-)
PB-1	Community Warning System: Develop a community warning system to notify residents of a potential danger in case of an accident on Rt. 56 involving a tractor trailer hauling hazardous waste.	+	+	+	+	-	-	+	+	+	+	N	+	+	N	-	N	N	N	N	+	+	+	+	14 (+) 6 (N) 3 (-)	18 (+) 6 (N) 3 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	**Summary (Equal Weighing)**	**Summary (Priority Ranking)**
PT-1	Stream Clearing: Clear debris from stream and reinforce streambeds of Bobs Creek. Clearing away fallen trees and other debris from the stream and reinforcing the streambeds will help reduce flooding along Bobs Creek.	+	+	+	+	+	+	+	N	+	+	N	+	+	+	+	+	N	N	+	+	+	+	+	19 (+) 4 (N) 0 (-)	23 (+) 4 (N) 0 (-)
RB-1	Sewer Project: Install catch basins or ponds to collect rain waters to reduce flooding during heavy rains that cause sewage backup. Rain water would be contained to reduce flooding during heavy rains that is causing sewage backup.	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	+	N	N	+	+	+	+	+	18 (+) 2 (N) 3 (-)	20 (+) 2 (N) 5 (-)
SC-1	Main St. Improvement Project: Improve road surfaces on Main Street in St. Clairsville Borough. Improve and install culverts to allow water to drain better. Prevent erosion due to heavy rains.	+	+	+	+	-	+	+	N	+	+	N	+	+	+	-	+	N	N	+	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
SS-1	Develop and implement traffic control measures at CVS at the King Buffet, US-30 in front of Walmart, and the US-30 Bypass at Sunnyside.	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	N	N	N	N	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
ST-1	Junkyard in floodplain: Acquisition & Conversion—Purchase and clean up junkyard. Remove salvage to recycler. Dig up and dispose of contaminated soil. Dispose of drums of oil and antifreeze. Turn floodplain area into green space/playground.	+	+	+	+	-	-	+	+	+	+	+	+	+	+	-	+	N	+	+	+	+	-	-	17 (+) 1 (N) 5 (-)	21 (+) 1 (N) 5 (-)
SW-1	Public Participation Program: Assist Bedford County in a public information program on hazards and hazard mitigation. Educate the citizens of Bedford County about their risks of disasters and measures they can take to try and improve these risks.	+	+	+	-	+	-	+	+	+	+	N	+	+	N	+	N	N	N	N	+	+	+	+	15 (+) 6 (N) 2 (-)	19 (+) 6 (N) 2 (-)
WB-1	Emergency Alert System - Erect an emergency warning siren. The siren will alert residents of an impending emergency.	+	+	+	+	-	+	+	+	+	+	N	+	+	N	-	N	N	N	N	+	+	+	+	15 (+) 6 (N) 2 (-)	19 (+) 6 (N) 2 (-)

Mitigation Action		PA-STEEL CRITERIA CONSIDERATIONS (+) Favorable (-) Less favorable (N) Not Applicable																							Results	
		P Politi-cal			A Admin-istrative			S Social		T Technical			E Economic				E Environmental					L Legal				
No.	Name	Political Support	Local Champion	Public Support	Staffing	Funding Allocation	Maintenance/Operations	Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Benefit of Action (x3)	Cost of Action (x3)	Contributes to Economic Goals	Outside Funding Required	Effect on Land/Water	Effect on Endangered Species	Effect on HazMat/Waste Site	Consistent with Community Environmental Goals	Consistent with Federal Laws	State Authority	Existing Local Authority	Potential Legal Challenge	Summary (Equal Weighing)	Summary (Priority Ranking)
WP -1	Crawford Road: Widen roadway to improve site distance and reconstruct drainage system. Improve the quality of stormwater run-off, reduce silt or sediment amount, and reduce quantity of run-off.	+	+	+	+	-	+	+	N	+	+	+	+	+	+	-	+	N	N	+	+	+	+	+	18 (+) 3 (N) 2 (-)	22 (+) 3 (N) 2 (-)
WP - 2	Install backup generators at Township facilities.	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-	N	N	N	N	+	+	+	+	17 (+) 4 (N) 2 (-)	21 (+) 4 (N) 2 (-)
WS -1	Stream/Floodwall Improvement - Stream improvement with new floodwall. Cement floodwall placed along stream after 1977 and 1983 flooding is breaking away.	-	+	+	+	-	+	+	+	+	+	+	+	-	+	-	+	N	N	+	-	+	-	+	15 (+) 6 (N) 2 (-)	17 (+) 6 (N) 4 (-)

Notes:
CDBG = Community Development Block Grant
CRS = Community Rating System
EAP = Education and Awareness Program
FEMA = Federal Emergency Management Agency
GIS = Geographic information system
HMA = Hazard Mitigation Assistance
NFIP = National Flood Insurance Program
PDM = Pre-Disaster Mitigation Program
PEMA = Pennsylvania Emergency Management Agency
TBD = To Be Determined
+ = Favorable
- = Less Favorable
N = Not Applicable

6.4.3 Prioritization of Mitigation Actions

Once the mitigation actions were evaluated, the Planning Team set about prioritizing them to create an implementation strategy. FEMA mitigation planning requirements indicate that any prioritization system used shall include a special emphasis on the extent to which benefits are maximized according to a cost-benefit review of the proposed projects. Though the PA-STEEL values for each action are somewhat qualitative, all of the actions listed as having an economic impact indicated that that impact would be beneficial to the community. Whether the actions had associated costs or not, those mitigation actions could not be ruled out based on the benefit or cost values in the PA-STEEL evaluation. Implementation of any project will be based on a benefit-cost analysis as described in *FEMA 386-5: Using Benefit-Cost Review in Mitigation Planning* (FEMA 2007). The specific economic benefits and costs will be determined prior to application for funding of the mitigation project.

Participants in the 2017 HMP update process provided comments that allowed for the prioritization of the mitigation actions listed in Table 6-4 using the seven PA-STEEL criteria. To evaluate and prioritize the mitigation actions, the County identified *favorable* and *less favorable* factors for each action. Table 6-4 summarizes the evaluation methodology and provides the results of this evaluation for all 83 mitigation actions (45 County actions and 38 municipal actions) in two columns. The first results column includes a summary of the feasibility factors, placing equal weight on all factors. The second results column reflects feasibility scores with benefits and costs weighted more heavily; and therefore, given greater priority. A weighting factor of 3 was used for each benefit and cost element. Therefore, a "+" benefit factor rating equals three pluses, and a "-" benefit factor rating equals three minuses in the total prioritization score.

The results of the weighted PA-STEEL matrix were examined to prioritize the mitigation actions. The number of unfavorable ratings was subtracted from the number of favorable ratings to determine each action's score. The average score was 19.2, with a standard deviation of 5.0. Actions that received more than 24 points (one standard deviation above the average) were assigned high priority. Actions that received scores of 19 to 24, inclusive, were assigned medium priority. Other actions were assigned low priority. Officials then updated the priority of some actions based on their needs.

The actions identified in Table 6-5 are listed in order of priority, with the high priority actions first. This list of actions is the result of the planning effort led by the Planning Team and represents what the County and municipalities consider most important. Any actions, including projects, to be implemented will have benefits outweighing their associated costs (i.e., the benefit-cost ratio would be greater than 1).

Table 6-5. Prioritized Mitigation Actions

	Mitigation Action	Score
	High Priority	
EP-1	Brush Creek Camp Ground & Trailer Park – clean trees and brush from Brush Creek. Reduce flooding of the Crystal Spring Trailer Park.	31
BC-8	Assist municipalities in developing policies and procedures related to hazard mitigation.	27
BC-11	Encourage best management practices.	27
BC-23	Enforce floodplain development regulations.	27
BC-24	Offer technical assistance to municipalities to develop, address, or enforce floodplain zoning, hillside development regulations, subdivision and development regulations, design review standards, and environmental review standards.	27
BC-28	Review, evaluate, and discuss designated growth areas in existing County and local plans to ensure development will occur out of hazard-prone areas.	27
BC-30	Recommend, encourage, and assist communities to participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS).	27
BC-9	Encourage forest and vegetation management policies.	26
BC-10	Encourage urban forestry and landscape management policies.	26
BC-12	Work with state and federal officials to enforce sediment and erosion control regulations.	26
BC-13	Work with state and federal officials to enforce stream dumping regulations.	26
BC-14	Work with state and federal officials to enforce wetlands development regulations.	26
BC-26	Promote open space preservation.	26
BC-27	Promote natural resource planning.	26
BC-29	Review planned infrastructure to ensure that it will be developed outside of hazard-prone areas.	25
HT-1	Dry hydrants – install dry hydrants at five (5) ponds in the township: 2 on Milligans Cove Road, 1 on Route 96 south of Manns Choice, 1 on Powell Road, and 1 on Brant Hollow Road. Increase availability of water in case of fires.	16
EB-2	Flood Protection: Address requirements to recertify levee.	9
HB-1	Flood Protection: Certify Levees. Levees exist but are not certified.	9
HB-3	Develop and implement a multi-faceted strategy to address the problems caused by inoperable trains blocking all crossings in Hyndman Borough. Options include: • Paving Pit Road and protecting it from being washed out when the creek is too high • Replacing the railroad overpass on Pit Road with a larger one • Changing the gate/fence at the sewage treatment plant • Constructing an overpass over the rail lines at the crossing of Schellsburg Street and/or Pennsylvania Avenue	8
	Medium Priority	
BC-40	Continue to target and prioritize at-risk structures, and, if funding becomes available, perform acquisitions, demolitions, relocations, and/or elevations.	24
BC-21	Inspect critical facilities regularly to ensure they comply with standard codes and can withstand the impacts of a disaster.	23
BC-31	Develop evacuation routes and an evacuation plan to be used in the event of a disaster.	23
PT-1	Stream Clearing: Clear debris from stream and reinforce streambeds of Bobs Creek. Clearing away fallen trees and other debris from the stream and reinforcing the streambeds will help reduce flooding along Bobs Creek.	23
BC-4	Utilize existing programs for school education programs on hazards, hazard safety, and mitigation.	22
BC-18	Regularly inspect and maintain bridges and culverts.	22
BC-33	Encourage the development of data-sharing policies and agreements between departments and organizations responsible for data creation, management, and use.	22

	Mitigation Action	Score
BB-2	Project to remove fill in a section of the Raystown Branch of the Juniata River near the Bedford Township/Bedford Borough line to reduce flood risks of upstream residents as well as the Bedford Borough Wastewater Treatment Facility located adjacent to the fill site.	22
BT-2	Remove fill in a section of the Raystown Branch of the Juniata River near the Bedford Township/Bedford Borough line to reduce flood risks of upstream residents as well as the Bedford Borough Wastewater Treatment Facility located adjacent to the fill site.	22
BC-5	Disseminate informational pamphlets or mailings on hazard mitigation for property owners in the 1 percent annual chance floodplain or owners of repetitive-loss structures.	21
BC-36	Encourage the heads of each department or organization involved in emergency response, services, relief, or hazard mitigation to meet several times a year to discuss hazard mitigation.	21
BtT-1	Coke Oven Bank Protection: Place rip rap along the south bank of Six Mile Run for approximately 500 feet to stabilize.	21
KT-2	Clear stream banks: Clean stream banks to help reduce debris buildup that can cause flooding.	21
LT-1	Reduce vulnerability to flooding at Creek Road, 2nd Avenue, and Cooks Mill Road (Rt. 3001). There is an area of about two miles where the creek comes close to the road off and on.	21
JT-2	Reduce vulnerability to flooding at State Route 31 at the bottom of the mountain below New Baltimore, near the intersection of SR 31 (Allegheny Rd) and New Baltimore Rd. (Rt. 3012). Also, along SR 31 from 3021 to Cider Rd. the creek is very near and during heavy rains sometimes runs over its banks onto the road.	21
BT-3	Reduce vulnerability to flooding at Dutch Corner, located roughly between Business Route 220, and Evitts Mountain to the north and east. SR 220 and Evitts Mountain meet in the south close to Bedford Borough.	21
BT-6	Reduce vulnerability to flooding at Reynoldsdale Rd. (4019) in front of Bedford Reinforced Plastics (264 Reynoldsdale Rd.). The creek runs over in front of the plant and floods the roadway for about one half of a mile at times of heavy rain. 40 06 14.57 N 78 31 49.06 W	21
BC-45	Conduct education and awareness programs for residents (to be able to identify meth labs and report them to emergency responders), for students, and for emergency responders. Dump sites along roadways are being contaminated by the chemicals used to produce meth.	21
BC-7	Investigate avenues for real estate disclosure for properties in 1 percent annual chance floodplain.	20
BC-20	Create and maintain a database and map of all critical facilities in the County.	20
BC-41	Training conference on CSX rail issues scheduled for Bedford and Somerset Counties, covering roughly 80 miles of track.	20
BC-42	Conduct a county-wide commodity flow study (CFS) looking at traffic patterns of commercial traffic carrying various hazardous substances. Apply for grant to accomplish CFS in 2018.	20
CT-1	Improvements to Township Bridges: Clean debris from abutments and piers at Bridge #1 on T-373 over Cove Creek – structure is # 05 7204 0373 4001. Removal of the accumulation of foreign material.	20
WP-1	Crawford Road: Widen roadway to improve site distance and reconstruct drainage system. Improve the quality of stormwater run-off, reduce silt or sediment amount, and reduce quantity of run-off.	20
BC-1	Disseminate informational pamphlets for County residents that explain the risks of hazards, outline precautionary measures that can be taken to help reduce the impacts of a disaster to themselves and their property, and emphasize the value of hazard mitigation.	19
BC-6	Develop informational workshops on hazard risks and hazard mitigation for property owners in high-risk areas.	19
BC-19	Develop a stream corridor restoration plan.	19
BC-32	Encourage departments responsible for creating and storing data related to parcels, centerlines, buildings, addresses, hydrology, and hazards to develop and enforce data maintenance policies.	19
BC-34	Develop and maintain hazard occurrence databases to record information on hazards such as date and time of occurrence, duration of disaster, amount of damage, number of injuries, etc.	19
BC-37	Develop informational workshops or programs on hazard mitigation and available funding for organizations, departments, elected officials, and volunteers.	19
CV-1	Obtain generator for water treatment plant – provide generator as a backup power source for the municipal water company that provides water for 40 customers in the Village of Centerville.	19
KT-1	Emergency Shelter Generator: Purchase generator for community center/emergency shelter in case of power outage.	19
SC-1	Main St. Improvement Project: Improve road surfaces on Main Street in St. Clairsville Borough. Improve and install culverts to allow water to drain better. Prevent erosion due to heavy rains.	19

	Mitigation Action	Score
BF-1	Stormwater Management: Improve road surfaces/reduce run-off. Stabilize streambanks on Potter Creek Road – Rt. 866 to control flooding from stormwater.	19
BC-44	Install backup generators at all critical facilities and personal care homes.	19
WP- 2	Install backup generators at Township facilities.	19
SS-1	Develop and implement traffic control measures at CVS at the King Buffet, US-30 in front of Walmart, and the US-30 Bypass at Sunnyside.	19
	Low Priority	
BC-2	Develop an informational Web site with information on the hazards that can affect the County, how residents can protect themselves from a disaster, and mitigation actions the County and municipalities are taking to help reduce the risks.	18
MC-1	Reduce speed limit on Rt. 31 as it crosses through Manns Choice Borough and Harrison Township from 45 mph to 35 mph.	18
WB-1	Emergency Alert System - Erect an emergency warning siren. The siren will alert residents of an impending emergency.	17
ESC-1	Public Information Program: The Township will assist the County in its hazard mitigation public information program. The public will be educated on the resources available and on ways to help reduce the risk of disasters.	17
SW-1	Public Participation Program: Assist Bedford County in a public information program on hazards and hazard mitigation. Educate the citizens of Bedford County about their risks of disasters and measures they can take to try and improve these risks.	17
BC-43	Public outreach and education programs about burning trash and yard waste, and for PA Turnpike travelers who are affected by heavy snow. Winter Storm Jonas in 2016 shut down the PA Turnpike, and many people were temporarily sheltered in the Bedford High School.	17
BC-22	Ensure that all critical facilities have updated emergency response plans.	16
BC-25	Acquire easements in hazard-prone areas, specifically 1 percent annual chance floodplains.	16
MT-1	Stabilize bridge abutments: install gabian baskets as retaining walls to sure up abutments and keep water from undermining wingwalls and bridge footers. This is to be done on all bridges in the township. Also place rip rap to stabilize stream banks.	16
MrT-1	Road Berm Stabilization: Dig out dirt road berms and replace with blacktop.	16
ST-1	Junkyard in floodplain: Acquisition & Conversion—Purchase and clean up junkyard. Remove salvage to recycler. Dig up and dispose of contaminated soil. Dispose of drums of oil and antifreeze. Turn floodplain area into green space/playground.	16
ESC-2	Reduce vulnerability to flooding at Salas Hills on State Route 56. Salas Hills is a private development of a few homes located just off of SR 56.	16
BT-4	Reduce vulnerability to flooding at Camp Sunshine.	16
BT-5	Reduce vulnerability to flooding at Camp Hughes, Briar Valley Rd. (1014) and Whispering Willow Lane. There are three camps, each one on a separate short road next to each other. Camp Hughes is on Leisure lane. Another is on Riverboat lane, and Camp Shaffer is on Whispering Willow Lane.	16
BB-1	South Side Storm Water Management Project - Stormwater management to reduce flash flooding in the southwestern portion of the Borough of Bedford and adjacent areas of Bedford Township. Install two (2) detention ponds and additional storm sewer pipes & catch basins plus upgrade existing storm sewer pipes & catch basins. Reduce damage to homes & property caused by flash flooding.	15
BT-1	South Side Stormwater Management Project - Install detention ponds and additional storm sewer pipe and catch basins in the southwest portion of township abutting Bedford Borough and adjacent areas of Bedford Borough. Also upgrade existing storm sewer pipe and catch basins. Reduce damage to homes and property caused by flash flooding.	15
HB-2	Address problem with trees growing in the middle of Wills Creek near the Dollar General Store in Hyndman. The area creates a narrowing of the stream channel and could be a big problem in high water solutions.	15
JT-1	Repair/replace/install culverts – remove debris from stream and install culvert/pipe.	15
PB-1	Community Warning System: Develop a community warning system to notify residents of a potential danger in case of an accident on Rt. 56 involving a tractor trailer hauling hazardous waste.	15

	Mitigation Action	Score
RB-1	Sewer Project: Install catch basins or ponds to collect rain waters to reduce flooding during heavy rains that cause sewage backup. Rain water would be contained to reduce flooding during heavy rains that is causing sewage backup.	15
BC-3	Cooperate with local media to produce regular public service announcements or news releases on hazard risk, safety, and the importance of mitigation.	14
BC-38	Disseminate informational brochures for organizations involved in emergency response.	13
BC-39	Inventory all available equipment and technology used for emergency response.	13
WS-1	Stream/Floodwall Improvement - Stream improvement with new floodwall. Cement floodwall placed along stream after 1977 and 1983 flooding is breaking away.	13
EB-1	Bloody Run Project to reduce flooding and erosion along Bloody Run. 15 step project as outlined by the US Corps of Engineers to reduce flooding and erosion along Bloody Run	12
BC-16	Acquire properties in hazard areas, notably within the 1% annual chance floodplain, to convert them to open space or demolish and rebuild them.	11
BC-15	Construct levees or floodwalls to protect communities with repetitive flooding problems.	10
BC-17	Elevate structures in hazard areas.	10
BC-35	Develop detailed databases on parcels and buildings in and out of the 1 percent annual chance floodplain. The data could include first-floor elevations, number of stories, basements, value of structure, acreage of parcel in floodplain, etc.	9

Notes:
CDBG = Community Development Block Grant
CRS = Community Rating System
EAP = Education and Awareness Program
FEMA = Federal Emergency Management Agency
GIS = Geographic information system
HMA = Hazard Mitigation Assistance
NFIP = National Flood Insurance Program
PDM = Pre-Disaster Mitigation Program
PEMA = Pennsylvania Emergency Management Agency
TBD = To Be Determined

Mitigation Action Worksheets were developed for each project included in the HMP. Where possible, the prioritization of municipal actions corresponds with the information and requested prioritization received from the community. However, the prioritization provided in the PA-STEEL table is based on County ranking and may differ slightly from the municipal ranking. For instance, a municipality may have submitted a Mitigation Action Worksheet where the project was designated as high priority; however, the County (PA-STEEL) prioritization considers it a medium priority. The only impact any difference in prioritization will have on implementation is that these actions may require more immediate attention by the sponsoring municipality due to competing priorities and limited available timeframes, staffing, and funding.

A blank Mitigation Action Worksheet template is included in Appendix G. The set of completed Mitigation Action Worksheets and a table summarizing the worksheets by jurisdiction are presented in Appendix H.

SECTION 7: PLAN MAINTENANCE PROCEDURES

This section describes how the plan was updated since 2011 (Section 7.1), the system that Bedford County and all participating jurisdictions have established to monitor, evaluate, and update the Hazard Mitigation Plan (HMP) (Section 7.2), and continued public involvement for plan maintenance (Section 7.3).

7.1 UPDATE PROCESS SUMMARY

Monitoring, evaluating and updating the HMP is critical to maintaining its value and success in Bedford 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.

The Bedford County Planning Commission, in partnership with the county Emergency Management Agency, convened an annual group of stakeholders since the 2011 HMP adoption to solicit input regarding the status and accuracy of the HMP, and the status of any new, ongoing, or completed mitigation projects. Notice of the meetings was distributed to the 13 boroughs and 25 townships participating in the plan, and included information about the HMP and copies of the Hazard Mitigation Project Opportunity Form to be completed and submitted for any new mitigation projects. Each year the meetings were attended by between six to eight participants representing participating municipalities, emergency responders, and county agencies. Documentation of the meetings, including reports of the mitigation actions accomplished during this period and reported during the meetings, are included in Appendix D. Key issues discussed at the meeting are described below.

Bedford Township's Community Rating System (CRS) application was discussed at the 2012 meeting. The application was approved and Bedford Township has been actively participating in the CRS Program since 2013. The County is interested in expanding CRS participation to other municipalities, and is working with the Southern Alleghenies Planning and Development Commission (SAPDC), which has received funding to support a staff member on implementing CRS in rural municipalities. It is likely that an initial meeting between the County and SAPDC to determine a project scope will occur by late 2017. Encouraging other municipalities to join the CRS Program is reflected in objectives and actions listed in Section 6.

The issue of CSX trains blocking all three access points (crossings) to Hyndman Borough (as described in Section 4.3.19) was discussed at the 2014 and 2015 meetings. This resulted in numerous contacts with CSX, as well as with state and federal elected officials. There appeared to be some improvement in the frequency of the blockages in 2016 and 2017, but unfortunately a major accident occurred in Hyndman in August 2017. It is likely that there will be continued attempts at coordination with CSX to reduce the hazards associated with the blocking of the railroad crossings. Information about the train blockages was incorporated into the Transportation Accidents hazard profile (Section 4.3.19).

The Steering Committee reviewed the 2011 plan maintenance procedures and carried them forward to the HMP update, as described in the sections below. In addition, the plan will continue to be available on the Bedford County Planning website. The 2017 plan maintenance procedures also elaborate on how this plan may be integrated into other planning mechanisms in the County.

7.2 MONITORING, EVALUATING, AND UPDATING THE PLAN

The Bedford County Planning Team intends to remain intact as the organization responsible for monitoring, evaluating, and updating this plan. The Director of the Bedford County Planning Commission shall continue to serve as HMP Coordinator for the Planning Team. Each participating jurisdiction is expected to retain a municipal hazard mitigation representative to support the jurisdiction's input to the monitoring, evaluating, and updating responsibilities identified in this section.

Table 7-1 identifies the members of the Hazard Mitigation Planning Team as of the date of this plan update.

Table 7-1. Hazard Mitigation Planning Team

Name	Title	Department / Agency
Don Schwartz	Director	Bedford County Planning Commission
Dave Cubbison	Director	Bedford County EMA
John Fulton	Coordinator	King Township EMA
Dave Hershberger	Coordinator	Harrison Township and Manns Choice Borough EMA
Gillian Leach	Executive Director	Bedford County Historical Society
Guy Stottlemyer	Watershed Specialist	Bedford County Conservation District
Mark Pennabaker	Director of Buildings, Grounds, and Transportation	Bedford Area School District
Fred Tempke	Member	Bedford County Planning Commission

Notes:

EMA Emergency Management Agency

Understanding that individual commitments change over time, each jurisdiction and its representatives are responsible for informing the Bedford County HMP Coordinator of any changes in representation by formal letter. The HMP Coordinator will strive to keep the Planning Team makeup as a uniform representation of planning partners and stakeholders within the planning area. The HMP Coordinator shall maintain the current membership of the Planning Team on the Bedford County Planning Commission website (http://www.bedfordcountypa.org/Planning.html) or in publicly accessible County records.

The following sections describe the monitoring, evaluating, and updating processes and protocols for the Bedford County HMP.

7.2.1 Monitoring

The Planning Team shall be responsible for monitoring progress on, and evaluating the effectiveness of, the HMP, and documenting this progress in a progress report. Prior to Planning Team progress meetings (detailed below), Planning Team representatives may collect information from departments, agencies, and organizations involved with the mitigation activities identified in Section 6 of this plan. The representatives will make phone calls and conduct meetings with persons responsible for initiating and/or overseeing the mitigation projects to obtain progress information. Copies of any grant applications filed on behalf of any of the participating jurisdictions shall be provided to the Planning Team. Further, the representatives shall obtain from their municipal supervisor, mayor, or councilperson any public comments made on the plan, and provide them to the Planning Team for inclusion in the progress report.

The Planning Team representatives shall be expected to document the following, as needed and as appropriate:

- Hazard events and losses occurring in their jurisdiction including their nature and extent, and the effects that hazard mitigation actions have had on impacts and losses
- Progress on the implementation of mitigation actions, including efforts to obtain outside funding for mitigation actions
- Any obstacles or impediments to the implementation of actions
- Additional mitigation actions believed to be appropriate and feasible
- Public and stakeholder input and comments on the plan

Local Planning Team representatives may use the progress reporting forms (Worksheets #1 and #3 in the Federal Emergency Management Agency (FEMA) 386-4 guidance document) to facilitate collection of progress data and information on specific mitigation actions.

7.2.2 Evaluating

The evaluation of the HMP is an assessment of whether (1) the planning process and actions have been effective, (2) the plan's goals are being reached, and (3) changes are needed. The plan will be evaluated on an annual basis to determine the effectiveness of the programs, and to reflect changes that may affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at a plan review meeting of the Hazard Mitigation Planning Team. At least 1 month before the progress plan review meeting, the Bedford County HMP Coordinator will advise Planning Team members of the meeting date, agenda, and expectations of the members. The Bedford County HMP Coordinator may also distribute additional flood mitigation survey and mitigation project opportunity forms for jurisdictions that may have new information or did not participate in the update process.

The Bedford County HMP Coordinator will be responsible for calling and coordinating the progress plan review meeting, and assessing progress toward achieving plan goals and objectives. These evaluations will assess whether:

- Goals and objectives address current and expected conditions
- The nature or magnitude of the risks has changed
- The HMP has been implemented into land use processes on the County and municipal levels
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available
- Actions are cost effective
- Schedules and budgets are feasible
- Implementation problems exist—such as technical, political, legal, or coordination issues with other agencies
- Outcomes have occurred as expected
- Changes in County or municipal resources have impacted plan implementation (for example, funding, personnel, and equipment)
- New agencies, departments, or staff should be included, including other local governments as defined under 44 *Code of Federal Regulations* (CFR), Section 201.6
- Documentation has been completed for any hazards that occurred during the last year

Specifically, the Planning Team will review the mitigation goals, objectives, activities, and projects using the following performance-based indicators:

- New agencies/departments created that have authority to implement mitigation actions or are required to meet goals, objectives, and actions
- Project evaluation based on current needs of the mitigation plan
- Project completion regarding progress of proposed or ongoing actions
- Under/over spending regarding proposed mitigation action budgets
- Achievement of the goals and objectives
- Resource allocation to note if resources are required to implement mitigation activities
- Timeframe comments on whether proposed schedules are sufficient to address actions
- Budget notes (in other words, if budget basis should be changed or is sufficient)
- Lead or support agency commitment notes (if there is a lack of commitment on the part of lead or support agencies)

- Resource comments regarding whether resources are available to implement actions
- Feasibility comments regarding whether certain goals, objectives, or actions prove to be unfeasible

Finally, the Planning Team will evaluate the ways other programs and policies have conflicted or augmented planned or implemented measures, and shall identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions (described further under the "Implementation of Mitigation Plan through Existing Programs" subsection presented later in this section). Other programs and policies can include those that address the following:

- Economic development
- Environmental preservation and permitting
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use and zoning
- Public education and outreach
- Transportation

The Planning Team may refer to the evaluation forms, Worksheets #2 and #4 in the FEMA 386-4 guidance document, to assist in the evaluation process.

The Bedford County HMP Coordinator shall be responsible for preparing an HMP progress report based on the local progress reports provided by each jurisdiction, information presented at the Planning Team meeting, and other information as appropriate and relevant. These reports will provide data for the 5-year update of this HMP and will assist in pinpointing implementation challenges. By monitoring the implementation of the plan, the Planning Team will be able to assess which projects are completed, are no longer feasible, or may require additional funding.

This progress report shall apply to all planning partners who have provided input, and as such, shall be developed according to an agreed-upon format and with adequate allowance for input and comment of each planning partner prior to completion and submission to the State Hazard Mitigation Officer. Each planning partner will be responsible for providing this report to its governing body for their review.

During the Planning Team meeting, the planning partners shall establish a schedule for the draft development, review, comment, amendment, and submission of the HMP progress report to the State Hazard Mitigation Officer.

The plan will also be evaluated and revised following any major disasters to determine whether the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damages or if data listed in the Section 4.3 (Hazard Profiles) of this plan have been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

7.2.3 Updating

Section 44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval to remain eligible for benefits awarded under the Disaster Mitigation Act of 2000 (DMA 2000). The Bedford County Hazard Mitigation Planning Team updates this plan on a 5-year cycle from the date of plan adoption.

To facilitate the update process, the Bedford County HMP Coordinator, with support from the Planning Team, shall hold a meeting 3 years from the date of plan approval to develop and commence with the implementation of a detailed plan update program. The Bedford County HMP Coordinator shall invite representatives from the

Pennsylvania Emergency Management Agency (PEMA) to this meeting to provide guidance on plan update procedures. This program shall, at a minimum, establish (1) the parties responsible for managing and completing the plan update effort, (2) features needed to be included in the updated plan, and (3) a detailed timeline with milestones to ensure that the update is completed according to regulatory requirements.

At this meeting, the Planning Team shall determine the resources needed to complete the update. The Bedford County HMP Coordinator shall be responsible for ensuring that needed resources are secured.

Following each 5-year update of the HMP, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all Planning Team members, special-purpose district participants, and the Pennsylvania State Hazard Mitigation Officer.

Bedford County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. Therefore, the plan will be posted on the Bedford County Planning Commission website (http://www.bedfordcountypa.org/Planning.html), and copies of the plan will be made available for review during normal business hours at the Bedford County Planning Commission's main office. Bedford County will make electronic copies of the plan available for local municipalies to provide public access.

The Bedford County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan at the review meeting for the HMP and during the 5-year plan update. Bedford County will maintain an active link on the Bedford County Planning Commission's website to collect public comments.

The Bedford County HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the 5-year plan update, as appropriate. Additional meetings may also be held as deemed necessary by the Planning Team. The purpose of these meetings would be to provide an opportunity for the public to express concerns, opinions, and ideas about the HMP.

The Planning Team representatives are responsible for ensuring the following:

- Public comment and input on the HMP (and hazard mitigation in general) are recorded and addressed, as appropriate. An opportunity to comment on the plan will be provided directly on the project website, and provisions for public comment, in writing, will also be made. All public comments shall be addressed to:

  Donald Schwartz, Director
  Bedford County Planning Commission
  200 South Juliana Street
  Bedford, PA 15522

- Copies of the latest approved version of the plan are available for review at the municipal buildings along with instructions to facilitate public input and comment on the plan.
- Appropriate links to the Bedford County HMP website (http://www.bedfordhmp.com/) will be maintained. The website will be monitored throughout the course of the HMP update process, and a draft copy of the plan will be posted for public comment. Upon conclusion of the update, appropriate links to the County HMP will be maintained on the County Planning Commission's website (http://www.bedfordcountypa.org/Planning.html).
- Public notices will be made, as appropriate, to inform the public of the availability of the plan, particularly during plan update cycles.

The Bedford County HMP Coordinator shall ensure the following:

- Public comment and input on the HMP (and hazard mitigation in general) are recorded and addressed, as appropriate
- The Bedford County Planning Commission's website is maintained and updated, as appropriate

- All public and stakeholder comments received are documented and maintained
- Copies of the latest approved plan are available for review at the County Planning Commission office, along with instructions to facilitate public input and comment on the plan
- Public notices, including media releases, are made, as appropriate, to inform the public of the availability of the plan, particularly during plan update cycles

SECTION 8 PLAN ADOPTION

Resolutions reflecting formal adoption of this Hazard Mitigation Plan (HMP) by Bedford County and participating municipalities can be found in Appendix F. The template resolutions used by the County and municipalities are shown on the following pages.

Bedford County Hazard Mitigation Plan

County Adoption Resolution

Resolution No. ___________________

Bedford County, Pennsylvania

WHEREAS, the municipalities of Bedford County, Pennsylvania, are most vulnerable to natural and human-made 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, Bedford County acknowledges the requirement 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 Bedford County Hazard Mitigation Plan has been developed by the Bedford County Planning Commission in cooperation with other County departments, local municipal officials, and the citizens of Bedford County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Bedford County Hazard Mitigation Plan, and

WHEREAS, the Bedford County Hazard Mitigation Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-made hazards that face the County and its municipal governments,

NOW THEREFORE BE IT RESOLVED by the governing body for the County of Bedford that:

- The 2017 Bedford County Hazard Mitigation Plan 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 2017 Bedford County Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _________ day of ________________, 2017

ATTEST:

____

BEDFORD COUNTY COMMISSIONERS

By _______________________________

By _______________________________

By _______________________________

Bedford County Hazard Mitigation Plan

Municipal Adoption Resolution

Resolution No. ___________________

< Municipality Name>, Bedford County, Pennsylvania

WHEREAS, the <*Municipality Name*>, Bedford County, Pennsylvania, is most vulnerable to natural and human-made 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 <*Municipality Name*> acknowledges the requirement 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 Bedford County Hazard Mitigation Plan has been developed by the Bedford County Planning Commission in cooperation with other County departments, and officials and citizens of <*Municipality Name*>, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Bedford County Hazard Mitigation Plan, and

WHEREAS, the Bedford County Hazard Mitigation Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-made hazards that face the County and its municipal governments,

NOW THEREFORE BE IT RESOLVED by the governing body for the <*Municipality Name*>:

- The 2017 Bedford County Hazard Mitigation Plan is hereby adopted as the official Hazard Mitigation Plan of the <*Municipality Name*>, and
- The respective officials and agencies identified in the implementation strategy of the 2017 Bedford County Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this _________ day of ________________, 2017

ATTEST:

____

< MUNICIPALITY NAME>

By ________________________________

By ________________________________

By ________________________________